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INDEX
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VOL. XL—JANUARY—JUNE, 1911.

E.—Editorial Comment. Q.—Question Department. I.—Current Information.
M.—Machinery and Trade. W.—From Workers in the Field.

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Municipal Engineering

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Sewage Disposal Plans of Atlanta, Ga.

By W. T. Waters, Atlanta, Ga.

ATLANTA, GA., a rapidly growing city of 155,000 people, ranking second to New Orleans among the largest cities of the cotton-growing states, has just begun the installation of its first sewage disposal system. Over 16,000,000 gallons daily flow of sewage, now dumped in its raw state into several small streams flowing away from the center of the city in all directions, will be treated by this process. Atlanta is six miles from the Chattahoochee river, a non-navigable stream at this point. All the sewage finds it way into that river, which constitutes the sole water supply of several cities and towns below Atlanta toward the gulf.

The process which Atlanta will install embodies the Imhoff tank, of which little is known in this country. The Imhoff tank has been installed at Batavia, N. Y. Atlanta is the first large city in America to use it. The Cameron Septic Tank Company have notified the city that the proposed plants constitute an infringement of their own plant. They have ignored the Imhoff patent. They claim their usual royalty. Atlanta is therefore in the role of a pioneer in two fields—first, the demonstration of the Imhoff patent, and also the defense of that patent as valid and independent of the Cameron process.

Atlanta's proposed sewage disposal system will be necessarily, because of the topography of the city, divided into three widely separated plants, into each of which the flow of several trunk sewers will be directed, intercepting sewers being used to extend the flow of those trunks from their present mouths to the plants beyond the outskirts of the city. Each of the disposal plants will use the same principle of treatment.

The money for the construction of these disposal plants is part of a $3,000,000 bond issue which the city voted in February, 1910. The issue was won after a hard campaign under the Georgia law, which requires the favor of two-thirds of those who cast their ballots. In it provision was made for the extension of the city water system, for new school equipment, for a hospital addition, for crematories, and for sewers. Each of these issues was voted upon separately, and all passed. The sewers' share was $1,350,000, divided as follows: $528,900 for three purification works; $545,230 for ten intercepting sewers; $100,000 for thirteen lateral trunk sewers (to relieve congestion on main trunk lines now existing); $175,870 for contingencies and engineering, and $100,000 for an auxiliary trunk sewer.

At the date of the bond election, there were 239 miles of streets in Atlanta without house sewers, and 11,600 homes without sewer facilities. The city had just taken in a great deal of contiguous territory and had thereby more than doubled its area to 26 miles. The old territory was bad enough, but the new territory added just so much more to the undeveloped portion of the city. Atlanta had already outgrown herself before the annexation. The rapidity of her growth theretofore and the fact that her tax is $1.25 (reduced from $1.50 in 1896) on a 60 per cent. valuation, the lowest in a long list of large cities, were together responsible for the condition which the annexation made worse.

Till the bond issue was voted, Atlanta had made no provision whatever for the treatment of her sewage. Always the raw matter had been dumped into the streams radiating from the central crown of the city. In the late '70's a few private sewer systems were put in by companies owning downtown hotels and buildings. The first public system was not begun till the middle '80s, when Rudolph Hering. of New York, still the city's consulting engineer, laid out the system which has been followed since. The first departure from that system is being made under the new work now in progress. The existing sewer system is on the combination plan, carrying sewage and surface drainage. All extensions of it are on the separate system, one sewer for surface drainage and another for sewage. The drainage water will be discharged directly into the streams at the most convenient points. The house sewage will flow into the trunk sewers from such territory as lies above the ends of those and into the intercepting sewers from the territory beyond the outlets. The prohibitive cost of further extending the ten main trunk sewers, which are of brick construction and beyond the outfalls of which the city has long since grown, was a potential argument for the decision to cease the construction of combination sewers.

After the present projected plants and connections are completed, all of the small streams now used will carry surface water at all times, and will carry the diluted sewage emptied into the main trunks in time of heavy rain. The treated sewage below the disposal plants will still go into the Chattahoochee river.

The three disposal plants are designated locally as the Peachtree plant, serving the northern portion of the city; the Proctor creek plant, serving the western and southwestern portions, and the Intrenchment creek plant, serving the southeastern portion. It has been found practicable to convey the discharge of all save one of the present trunk sewers to their respective disposal plants. The one exception is called the McDaniel street outfall, which will have to be pumped to either the Proctor creek plant or the Intrenchment creek plant. There is a possibility that the city may investigate the electrolytic process for separately treating the discharge at this outfall. The extreme northeastern portion of the city, built in the sump of a plateau, is another problem still unsolved, which confronts the city authorities. A separate system and disposal plant may be necessary for this section. In all other respects than these mentioned, the plans for the city's new sewage system are clear cut and definite. They were drawn up under the supervision of Rudolph Hering, the same engineer who laid out the original system of sewage removal.

The discharge from three outfalls (and possibly four, if the McDaniel street outfall is included) will be conveyed to the Proctor creek plant at a cost of $107,990 for the three. The McDaniel street outfall was included in the group of four outfalls directed to the Intrenchment creek plant in the bond issue estimates, the four to cost $163,240 for the necessary intercepting sewers. And the discharge of three outfalls will be conveyed to the Peachtree plant at a cost of $274,000.

There has been some little difficulty encountered by the city authorities in securing right of way for the intercepting sewers to the Peachtree plant, but this opposition has been practically overcome by tactful and diplomatic dealing with the interposing landowners. Some slight similar opposition was met in the securing of rights of way to the other plants, but amounted to even less. No drastic action in any case has been found necessary as yet.

On December 12 bids had just been opened for the construction of the Peachtree plant, but the ensuing computations became so involved and complicated that three days after the inspection of the bids the successful contractor had not yet been announced.

Bids for the Proctor creek plant were opened on November 22, and the contract was awarded to the Municipal Engineering and Construction Company, of Chattanooga, Tenn., for $95,686. This amount came under the bond issue appropriation for the plant, which was $103,255. Earlier bids had been rejected because they all exceeded the bond estimate, and these later bids were received on alternative propositions, the alternative on which the successful bid was made omitting half an acre of the acre and a half of sprinkling beds contemplated in the original plans. The omitted half acre will be built by the county convict forces for the city.

Space would forbid the separate detailing of the three disposal plants, which are planned to be substantially similar in the important particulars. The Proctor creek plant is typical of the two others, and a description of it will be sufficient here. Detailed plans and specifications of the other plants may be obtained from the city engineer of Atlanta.

Inasmuch as the Proctor creek plant has just been begun, any description of it is necessarily based on what it will be, under the specifications.

Atlanta's process will be, throughout

the three plants, to subject the raw sewage to sedimentation, the solids sinking through the Imhoff patent bottom to a decomposition chamber below, and the liquids passing on to the sprinkling filter beds. Periodically, at such intervals as experimentation with local conditions will determine, the sludge from the bottom of the decomposition chamber, that which has been in there longest, will be blown out to the sludge drying beds.

The system, in short, separates liquids and solids, and subjects the one to aerobic action and the other to anaerobic action. Seemingly, it attains the ideal toward which sanitarians have been striving, for it permits the treatment of each under the best conditions and without interference by the other.

In detail, the Proctor creek plant is to consist of a grit chamber of concrete, 17x18 feet, with a set of steel bar screens near the inlet end; a concrete preliminary settling tank of the Emscher type, consisting of a combination of 12 units; a revolving mechanical fine screen; two concrete dosing tanks; two broken-stone sprinkling filters, one of an acre and the other of half an acre superficial area; a broken-stone dyring bed, and a laboratory building.

The grit chamber consists of a screening compartment, three channels for the sedimentation of sewage, and a by-pass channel, the flow through which is controlled by means of stop planks; and an overflow chamber of brick masonry. The bottoms of the three channels are provided with drains of 6-inch vitrified tile. The screen is placed in a sloping position, the upper end being inclined inward.

The preliminary settling tanks, 12 in 1 unit, are of reinforced concrete, and are of the Emscher type(which embodies the Imhoff patent bottom). They are provided with channels through which the sewage can be passed in either direction through the upper portions, which form the settling chambers. The flow of sewage is through three tanks in a row, and the provision for its reversal is obviously wise, the purpose of that provision being to work all the tanks equally. The bottom partitions, which form the sludge chambers, are circular wells with conical bottoms. The heavier sewage drops down to the inclined bottom of the settling chamber, one lap of the bottom underlapping the other, and passes through the slot that this underlaps to the sludge chamber. The inclined and underlapped bottom of the settling tank is the essence of the Imhoff patent. The underlap closes the sludge chamber to all upward exit of gas bubbles, carrying sludge particles through the settling chamber to the top of the flow, and thus eliminates one of the greatest objections voted against the accepted form of so-called septic tanks. A gas vent pipe is provided to conduct the gases beyond the top of the upper flow.

It is in these settling tanks that the solids are separated from the liquids. The solids remain where they have settled, in the sludge chamber. The period of their stay there will be determined when the plants are put in operation. There they are subjected, without disturbance, light, or air, to anaerobic action. At the expiration of the proper interval a valve in the sludge exit is opened, and so much of the sludge on the bottom of the mass as has been there the required time will be forced out by the pressure above it.

Leaving the sludge chamber, the treated sludge goes to a sludge drying bed of 10,000 square feet area, where it is spread upon a bed of ¼-inch sand overlying 2 inches of broken stone. The stone is laid in three layers; 1 to 2½ inch size, 5 inches deep on bottom; ¼ to ¾ -inch for the next 5 inches, and the upper 2 inches of a size finer than ¼-inch and coarser than 1-16 inch. Upon this the sand is spread uniformly. Underdrains of 3-inch vitrified pipe, with an 8-inch pipe for the main underdrain, are provided. With this whole goes a sludge removal railway, 24-inch gauge, on steel cross ties within the banks of the slduge bed, and on wood ones beyond.

To return to the point where the liquid passes from the settling tanks: The liquid passes next to a mechanical self-cleaning fine screen, enclosed in a concrete chamber with a brick superstructure under a timber and slate roof. The screen is to be of a heavy and durable construction, equal in efficiency to the Weand cylindrical type. The screen cloth will have not less than 36 meshes per lineal inch, will be supported by a heavier screen, and will have a whole surface of not less than 150 square feet. The screen will be revolved by electric motors, the power being furnished by the local company that furnishes public power. The screen will be automatically cleaned, and the screenings will be discharged into a chamber provided. Stop planks are provided so that the sewage may be diverted into a by-pass pipe at will.

Beyond the screen, the liquid passes to two concrete dosing tanks, operated separately, and each capable of dosing an acre of filter surface. The tanks are of the taper pattern, each with a reinforced concrete roof. In each there is a Miller or Merritt automatic 24-inch siphon, set so as to discharge the tanks under a head of 9 feet to 2½ inches above the sprinkling filter nozzles. Each is equipped with an automatic counter, numbering 10,000, to show the number of doses applied.

Next come the sprinkling filters, each of 1-acre area. They may be enlarged in number, as the needs of the plant demand, as may also the settling tanks. Only half of the second unit will be constructed for the present at the Proctor creek plant.

The walls of the sprinkling filter are of dry rubble masonry. The stones are to be squared roughly with a hammer to not less than 4 inches in thickness or 10 inches in either of the horizontal directions, and are to be laid so as to break joints and avoid spalls. The bottom is drained by ridges and valleys, and is ventilated through a false bottom and rising pipes equipped with revolving ventilators (like those on ships) and weather vanes at the top. Lateral distributers come into the filter underneath, of 6-inch vitrified pipe, laid carefully to grade in a bed of concrete and surrounded by concrete. The risers from tees in these lateral distributers are of lightweight cast-iron pipe. At the top of each riser is the sprinkler nozzle, of the Taylor or Weand type, discharging a spray or film of uniform intensity. The nozzles are 13 feet 6 inches apart in the lateral lines, and alternate on lines 11 feet 8 inches apart in longitudinal measurement.

This, briefiy, is what the Proctor creek disposal plant is to be. The city engineer's estimate, based on present conditions, is that 3,185,568 gallons of sewage per 24 hours will flow into this plant. The Peachtree plant will be built to take care of 8,317,728 gallons daily flow immediately, and the Intrenchment creek plant will treat 5,077,096 gallons daily.

On November 25 the city attorney of Atlanta received from Dr. Karl Imhoff, patentee of the Emscher type of settling tank, a release from all claims for royalty. The release had been drawn up by the attorney, sent to Germany by Rudolph Hering, and returned through that gentleman. It was on Mr. Hering's word that he would secure the release that Atlanta proceeded with all her plans. The reason behind the release is said to be Dr. Imhoff's desire to see his patent demonstrated in America by a city of some size. The Cameron Septic Tank Company claims, however, that the city's proposed plants will infringe their patent, and have notified the city that it must either pay royalty or allow the plants to be built by them. On June 10, 1910, shortly after the plans for the city's disposal plants were made public, the mayor of Atlanta received from H. D. Wyllie, general manager of the Cameron Company at Chicago, a letter which read in part as follows: "We learn that the city of Atlanta is contemplating the construction of a sewage disposal plant that will involve an infringement of letters patent No. 624,423, issued Ooctober 3, 1899, to Donald Cameron and his fellow patentees." General Manager Wyllie proceeded to insist that the rights of the company's patent must be respected. "We are assured that the parties who are designing your plant,' he continued, know of the risk that you are incurring, and we therefore surmise that these parties have very probably offered you some sort of assurance of alleged protection." He minimized the value of those assurances. He stated the company's contention that its American patent is independent of the British patent, and does not expire till October 13, 1916.

The mayor was out of the city when this letter was received, and his secretary submitted the communication to the city engineer, who stated his opinion that the claim of infringement had no foundation. The secretary then inquired by letter of Hering and Fuller, New York, concerning the matter, and received the following reply, signed with the firm name: "Replying to your query of the 13th instant, addressed to Mr.. Hering, who is at present in Europe, we would say that if sewage disposal plants are constructed for the city of Atlanta in accordance with the plans and report submitted by Mr. Hering recently, there will be no infringement whatever of the Cameron patents. The use of the septic process is not contemplated in any of the designs which have recently been made in this office for any city." The secretary informed the Cameron Septic Tank Company that both the city engineer and Hering & Fuller decried its claims of infringement, and said "it is hardly to be credited that he (Mr. Hering) would recommend to the city of Atlanta the adoption of a system covered by patents without having the city secure the patents right from the proper authority." On July 26 the mayor received a copy of the circular letter which the Cameron Company sent out, setting forth their claim that the life of their patent endures till 1916.

That was as far as the matter went until a citizen of Atlanta, who is interested in having the electrolytic process installed here, wrote to the Cameron Company as follows: "Atlanta is putting in a settling tank system of sewage disposal. It was first called 'septic tank' and afterward the name was changed to 'settling tanks.' The patentee is Dr. Imhoff, of Germany, and he offers to charge no royalty to the city of Atlanta. I beg leave to inquire if the settling and septic tanks are the same thing and both covered by your patents." This and the reply were given to the press. The reply, in part, was as follows: "The process claims of our patents cover any system of tanks in which putrefaction is systematicaly developed for the liquefaction of sewage solids, and notwithstanding Mr. Rudolph Hering's statements to the contrary, we are satisfied that the system proposed for the city of Atlanta clearly infringes our patent, and the city authorities have been so advised. * * * While Mr. Hering's firm does not hesitate to criticize the court's decision on purely legal questions, they would be the first to resent any criticism by the court of any decision of theirs involving engineering problems. Yours very truly, Cameron Septic Company. (Signed), H. D. Wyllie, General Manager."

That is as far as the matter of infringement has gone. The city authorities do not appear to be disturbed about it. They are relying wholly upon Mr. Hering, none of them having studied the question. They are busier building the plants than they are worrying over possibilities.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Principles of Design of Plant

THE United States Geological Survey department has gradually perfected a system of river flow measurements which now covers every river of any importance, and practically all those which represent water power opportunities. These operations are carried on along practical and not purely scientific lines and yield results which may be safely accepted as reflecting the true hydrographic conditions as near as they can be ascertained. River height gauges have now been established at several thousand stations; they are read twice daily by instructed observers and flow measurements are made at each station for different river heights during the year. From these gauge records and measurements the flow rating for the stream at the respective station is developed, which covers the entire range of its fluctuations. On all large rivers several such stations are maintained.

This system has now been in perfect condition since 1907, and since the last four years has contained an abnormally dry year for every section of the country, the required data to make a daily flow analysis of any river during a dry year are now available. If the point of the projected development is some distance up or downstream from one of these stations, the rating for the nearest may be taken and applied in ratio of the drainage area under consideration; and if no government observations have been made on the stream in question one is likely to be found in the same drainage basin on some other river, and the rating of this may be utilized with satisfactory results.

Parties who control water power sites would do well to establish a river gauge at some point where it will be safe against interference from floatage and arrange with some person to have the readings noted continuously every morning and night. These data will prove of great value when the engineering of the project is taken up.

The daily flow of the stream during a low precipitation year is tabulated as per the following partial record:

No. of Days	Gauge Height	Flow in c. f. s.	Aggregate of Days	Flow	Mean
8	1.2	550	8	4,400	550
12	1.35	600	20	11,600	580
20	1.60	650	40	24,600	601
45	1.75	700	85	56,100	660
60	2.30	850	145	107,100	738

From this it appears that 550 c. f s. was the lowest daily flow, and it prevailed during 8 days; 600 was the next during 12 days; 650 next for 20 days, and so forth. It shows the accumulated and mean flow for the daily units, and the completed table would give the total and mean for the entire year.

From such an analysis two basic facts regarding the available potential flow are deduced.

First, that the absolute continuous maximum is the daily mean of the annual total. This requires no argument, because it is a fact that two or more low precipitation years occur in sequence.

Second, that the feasible continuous maximum is the lowest daily mean plus any supplemental flow secured from storage or the equivalent of some auxiliary power supply.

The storage unit is the acre-foot. The acre equals 43,560 square feet; 24 hours contain 86,400 seconds, or about double the area, therefore one acre-foot (one foot deep) of water represents a continuous 24-hour flow of half a cubic second foot.

To supplement the low daily flow of 550 to that of the next higher of 600 requires a storage supplement from 50x8x2, or 800 acre feet, which may be a reservoir of any area and depth representing this total in acre feet of water. To raise the potential flow to the next higher daily calls for storage supply from 50x20x2, or 2,000 acre feet plus the previous 800, or of 2,800 acre feet, and so on. It requires about 13 c. f. s. to produce one electric horse power with one foot fall. If the potential fall is 50 feet, the difference between the lowest and next higher daily flow of 50 c. f. s. represents an output of 50/13x50, or 192 horse power; and that between the second and third lowest a similar quantity or a total of 384 horse power, which calls for a steam plant of about 425 horse power capacity. In this manner the daily flow table is analyzed until the output is reached which can be remuneratively marketed.

But the determination as to the potential flow basis for the development is yet far off, as the question of cost must make the final decision. How much storage can be secured, what is the cost of the needed land and reservoir works, how do the aggregate, fixed and operating charges of the storage investment compare with those of an auxiliary plant; these are the questions to be first settled. And settled they should be before the development is planned. If left to the future the enterprise need not be expected to represent the most resourceful utilization of the power source. Much more can be said of the flow determination, but space will not allow.

The available fall is not always found to lie on the surface. Many water power opportunities are capable of being developed by various programs which may conserve or waste this power factor, every foot of which is of great import to the final result. This is especially true of the low fall sources, which today represent the large majority of those yet undeveloped. The best solution of this problem must often consider the feasibility and promise of several different development programs in their final financial results of earning capacity. This requires a thorough engineering investigation, determining not only the fall in a given reach but also the slope upstream of it and the development of the future ponded areas, and a careful study of the influences of higher and flood stages by any of the proposed fall accumulations; also the preliminary designing of the required restraining and diversion works in order to clearly establish their influence upon the future regimen and control of the river's flow and the effective utilization of the greatest possible fall. While the flow determination calls for a careful analysis of existing data, that of the fall requires the matured judgment gained from varied experience in devising and applying the most resourceful of several feasible programs of developing the power.

When these potential factors of the power source have been wisely chosen, much remains to be done and every step taken brings opportunities to waste capital investment and earning capacity. If the development is to show the highest possible net annual surplus, the maintenance and operating charges must be the lowest obtainable. Shortsighted economy may reduce the first cost, but is likely to increase the charges beyond the interest item which the saving represents. And on the other hand, the economies of present day structural material and designs are most likely to insure the best final financial results.

The flow and fall determination practically fixes the outline of the development program and its scope, because the former must be decided to lead to a conclusive adoption of the latter, and it is rather the exception than rule that developments can be completed for a given scope progressively. At any rate the restraining works, dam, spillway, waste sluices, etc., are pertinent to even a partial first development; they are, or should be, designed to answer all future needs. In these safety with greatest economy is a rudimentary consideration; but others, such as flood and ice control, preventing sediment accumulations, accessibility for needed repairs, automatic in place of hand operations for controlling head and flow, disposal of floatage, etc., which are not always given proper attention and which will have a great final influence upon the economic efficiency of the plant. Many a Northern plant closes down yearly for a few days to weeks on account of ice interferences; in others silt accumulates in the upper pool, intake and diversion conduits, whereby their capacities are much reduced, and some find their operating head drowned out by high water. It is not presumed to state that all of these might be prevented, but it is a fact that provisions could often be made to guard against them, or at least greatly diminish their damaging effects.

The design of the dam must adapt itself to the characteristics of the stream as well as to those of the site. Much can be gained for the control of flood flow, ice, silt, etc., by the open dam type, in which the greatest portion of the natural channel area remains available during such periods, while their cost need not exceed that of the required solid masonry structure. Dam failures are chiefly due to two causes, insufficient foundation and non-adaptation to flood conditions, and both of these problems are much simplified in the open dam type. If diversion of the potential flow is a part of the program, the method chosen must be proven to be the most economical and efficient. Whether open conduit, flume or pipe line is the most favorable depends upon volume to be diverted, distance, location and climatic conditions. Many a pipe line is wasteful of head and expensive in maintenance cost. Canals on the other hand often cause a considerable loss to the flow.

The power station is the culmination of the development. Its proper location is all important. It should secure the freest influx and exit of the water, be easily accessible and be protected from flood rises, ice and floatage. In dimensions it should be ample for the moving in and out of any of the equipment, repair facilities and the safe separation of electric control apparatus and transformer installation from all other machinery. It should be fireproof and dry. For a direct development, when diversion is not a part of the program, the station location problem is the most troublesome. When at end of dam the storm overflow is likely to retard the tail water outflow and thus reduce the effective head, the advisability of creating some intake leading downstream from the dam should be thoroughly canvassed.

In many such cases the problem is most advantageously solved by the erection of a hollow concrete-steel gravity dam and placing the power station in its interior. This realizes the greatest obtainable ouput from the available power source and economizes in first cost of the plant. If the dam is safe the station in its interior is likewise so. Dampness may be entirely avoided by surrounding the interior station walls by an ample air space, and access and egress may be arranged for as conveniently as in a separate structure. Several of these spillway stations have now been erected and are fully coming up to all the advantages claimed for this type.

The generating equipment may be the means of turning an otherwise well planned development into financial failure. The engineer plans for eighty per cent. turbine efficiency, but how frequently is this realized? There are many water power installations yielding seventy and less, nor are these only of the old timers' class. Unfortunately the equipment question is not generally given the careful treatment which it should have. The unit selection should conform to the service to be rendered and, with this condition satisfied, should be chosen to yield the highest practicable speed. Head fluctuations should and can be met by the turbine design. Exciter units should, where feasible, be operated independently of the generator lines. There is much less difficulty with the electric than the hydraulic equipment, as the modern apparatus is of uniformly high standard and efficiency.

This completes the hydro-electric generating plant. When plans and estimates are properly prepared the power output and its generating cost will be known and the value of the output, and therefore of the development, can then be determined. The capital investment covers the cost of the development, lands, franchises, legal and engineering services, interest to be paid during construction period and the discount in placing securities. Fixed charges are interest on investment, depreciation, and taxes. Operating charges are hire of personnel, maintenance and administration. The cost of the output follows by dividing the aggregate of all charges by the annual kilowatt hour yield. Any higher revenue than this represents surplus earned.

A normally conditioned water power opportunity can be developed to put the product on the market for half a cent and less per kilowatt hour, which for 300 days at 20 hours amounts to $30.00 per kilowatt, or $20.00 per horse power electric. There is no steam plant now in commission in this country which produces current at a lower cost, nor is this likely to be the case in the future, as the costs of steam plant and fuel are sure to advance constantly. A few large steam plants, of twenty thousand and larger output, produce seven-eighths of a cent current, while the best of five thousand kilowatt output do not produce current for less than one cent per kilowatt hour.

In closing this article of my series on hydro-electric topics, I quote the following Associated Press dispatch of recent date:

"Standing on a public platform in Berlin (Ontario) this afternoon, surrounded by members of his cabinet and facing an assemblage of about 8,000 people, Sir James P. Whitney, premier of Ontario, applied pressure to the ordinary electric button in a small piece of board. Instantly the twilight gloom of the building was transformed to the brightness of day by the light of tier upon tier of incandescent bulbs and arc lamps, fed by electric energy from the water of Niagara Falls, more than 100 miles away.

"Simultaneously there leaped to life in the streets of Berlin, in business places and private homes of the city, thousands of other bulbs fed from the same inexhaustible source.

"Simple as was the act of Ontario's premier, it marked the opening of the most important epoch in the history of the province, an epoch of increased industrial development. In pressing the button he formally inaugurated the supply of Niagara power to western Ontario under the present scheme of joint municipal ownership and government operation."

The significance of the advent of cheap electric current herein expressed for the industrial future welfare of our Northern neighbor is the same for many sections of our own country, especially for the Southern States, so bountifully blessed with economical hydro-power resources.

Comparison of Des Moines and Indianapolis Forms of Municipal Government

By Augustus Lynch Mason, Indianapolis, Ind.

THE so-called commission form of government is now under discussion in the city of Indianapolis. The charter of that city has long been a model, but, like all forms of city government which permit the use of the offices of the city to pay political debts, it is not altogether satisfactory when political manipulators are in control. Mr. Augustus L. Mason, who put the original Indianapolis charter into the form which it has retained through considerable change in detail, seldom for the better, comes to the defense of the Indianapolis form in a series of articles in a daily paper, from which the following extracts are made.—[Editor.

We may quickly state the fundamental difference between the charters of Indianapolis and Des Moines. It lies in a nut shell. The Indianapolis charter separates the legislative and executive powers, placing them in the hands of different officials. The Des Moines charter vests both executive and legislative power in the same officials. With us the council possesses the legislative power to pass ordinances, levy taxes and appropriate money. The mayor and his subordinates can spend the money thus appropriated only for the specific purposes determined by the council. The five commissioners at Des Moines do all these things. They decide upon the tax levy and appropriations and they expend the public revenues. They exercise all the powers of our council, mayor, controller, boards of public works, safety, health and parks.

This difference is the heart of the whole question. There are many other things, such as nonpartisan elections, civil service rules, the referendum, the recall, etc. These things may be good or bad. We can take them or leave them. They can all be used with our present plan of government. The only thing which is vital and fundamental is the union or separation of the taxing power and the spending power. Under our plan, the council holds the purse strings, and acts as a check upon the executive. Under the Des Moines plan the executive holds the purse strings. We have two keys to the public treasury. Des Moines has one. Which is the better? The answer can not be made absolutely as a matter of theory. It must also be sought in experience.

The practical question is, has our council, under the present charter, levied taxes which were too low? Has it appropriated too little money? Has the council held the purse strings too tightly? If so, then we have surrounded the taxing power with too many checks, and it should be placed, as at Des Moines, in the hands of the same men who spend the moneys raised by taxation.

Most taxpayers will be surprised to learn that this is exactly what is behind much of the present discontent with our city charter. The fact is that the executive side of our city government has complained for years of the restraints placed upon it by the city legislature. Not only have our city executives been impatient because of delay and reluctance in council appropriations, but in the no less important matter of borrowing money through the sale of bonds. Our mayors have had a hard time to get what they wanted from the council.

Almost as soon as the present charter became law, various interests began to show their belief that the council would not levy enough taxes nor appropriate enough money. First came the firemen's pension law, in which the state legislature required the council to levy a specific tax for firemen's pensions. Then came a similar law for police pensions. I believe the sinking fund law came next. The park law also required the council to make certain levies for park purposes, and the legislature from time to time made increases in the required amount of park tax levy. The argument made for the park boulevard law, with its system of local assessments, was that the council would not appropriate enough money for boulevards.

This displeasure with the restraints on the executive side of the government is characteristic of our times. One article in Mr. Roosevelt's new nationalism is "an impatience of legislative restrains on the executive." President Taft seemed to have the same feeling. At the convention of governors of the various states, President Taft, apparently having in view his troubles with congress, addressed them as, "My fellow-sufferers."

For my part, I distrust this tendency to break down the legislative side of government. I believe that it is a bad theory, and will prove bad in practice, if we revert to the old principle of city government, which was tried here for fifty years, before the adoption of the present charter. Those of us who were here then know that it worked disastrously. Each man of the council could get his own desired appropriation by voting for what the other fellows wanted. As the council committees spent the money, they did just what Judge Cardwell says the commissioners at Des Moines are doing, i. e., they practice the "I tickle you and you tickle me" policy.

Another illustration of the same body of officials exercising both legislative and executive powers is our board of county commissioners. The system worked well when the population was small, but is has proved expensive, inefficient and often corrupt in counties of large population and wealth. So disgraceful was the condition of finances in our larger counties that, a dozen years ago, it was found necessary to take from county commissioners the power of levying taxes and appropriating money, and to vest it in a separate body, the county council, as a check on the commissioners. At the same time a law drafted by A. C. Harris, to check the state-wide scandals in township business, was passed, taking the taxing power from township trustees and vesting it in township advisory boards. Of course, all this machinery would be unnecessary if only good, able, honest business men were elected to office. Such men need few checks. But it is a sound principle that power is always liable to abuse. Laws must be framed in the expectation that incompetent and dishonest men will sometimes get into office. The separation of the taxing from the spending power is the greatest instrument that I know of for calling public attention to the conduct of public business. The very friction between two sides of government advises the people what is going on. It lays the basis for uncovering extravagance and rascality. To unite these two government powers in the hands of the same persons is to encourage secrecy, keep the people in the dark and take their attention off of public affairs. The very agitation and public discussion of city affairs under our present charter, so far from condemning it, is one of its chief merits. It has done much to encourage the citizen to be critical of the conduct of public officials, and to keep the citizen posted on city affairs.

The school board does, indeed, exercise both the taxing power, including the sale of bonds, and the spending power. The public approval which it has earned is due not to the safeguards of law, but the safeguards of character. It is the high grade of men chosen for the school board which has protected us from wrongdoing.

Last year the revisers of the Boston charter considered and rejected the commission plan of government, and adopted the federal plan of city government, such as we now have in Indianapolis. The Boston finance commission made the most thorough study of municipal government which has been made in this country. It issued 127 reports. Its expert engineers made seventy-seven reports. That part of the report on the subject of commission government is so important that I quote it here at length, as applicable in almost every point to the situation in Indianapolis. It is as follows:

"The 'Elective Commission' Plan—The commission has given careful consideration to the plan recently adopted by a few relatively small cities, including some in this state, of vesting their entire government of the city in the hands of a small elective board or commission.

"An elective commision would be a return to the principle of the charter of 1822, in so far as that instrument withheld executive power and responsibility from the mayor.

"If the electorate will choose a bad mayor, a majority, or possibly all, of the officials elected under the commission plan would probably be men of the same character. The city would then be at the mercy of three or five bad men instead of one, and each could avoid responsibility by throwing it on the others.

"For small cities suffering under the rule of committee government, the 'elective commission' plan presents many advantages, and to such cities the plan has so far been confined. It is, however, too early to draw conclusions from these experiments. None of them is yet fairly in operation, except in Galveston, where the conditions of the suffrage are very different from those which obtain in the cities of the North. Even if ultimately successful in smaller cities, this is no assurance that the plan would work when applied to a city like Boston, with a population exceeding 600,000, spending $25,000,000 a year, and presenting political and municipal conditions and problems different not only in degree but in kind.

"The experience of the city under the school committee law of 1905 is not necessarily in point; for the opportunities for politics, patronage, corruption and waste in the management of the public schools are slight in comparison with those which are offered by the city government as a whole. Under the law of 1901 establishing the school house department, the school committee was purposely deprived of the power to buy land, and construct, repair and furnish school buildings; and this power was not restored to the school committee when reconstructed in 1905. The new plan has been in operation only three years, and its permanent value has not yet been demonstrated.

"The school committee system furnishes no more of an argument for an elective commission than the success of the state in recent years in the management of the police and license problems is an argument for putting the entire government in the hands of commissions appointed by the governor.

"A closer analogy is presented by the boards of county commissioners. The general opinion seems to be that these boards have not proved a success.

"All large and successful corporations are practically managed by one man under the supervision of the directors. If there is any defect in this system it is the frequent failure of the directors to supervise, not their failure to manage the executive part of the company's business.

"There is at the present time a lively interest in municipal reform in all large cities of the country; but in none of them does there appear to be any desire for an elective commission. No one with experience in the city government of Boston has favored its adoption for this city."

The criticism of commission government made by such eminent authority as the Boston finance commission should have great weight, in my judgment. To sum up, commission government may be suited to small cities, but Indianapolis is much too large a place for it.

The Des Moines charter vests in the mayor and the four councilmen all the powers now exercised by our mayor, city council, board of public works, board of parks, board of safety, board of health and city controller. The law leaves the commission free to run the city finances as it pleases. It works smoothly, because there are only five men to harmonize. It is frictionless. It throws the rein on the horse's neck.

Against this view is urged that the referendum and recall are sufficient protection. The referendum means that if 25 per cent. of the lawful voters sign a written petition, the people may review the action of the council at an election. The same kind of a petition will secure an election to decide on ousting a member of the council. These provisions might work well in a small place, but what are we to think of a written petition in Indianapolis, with the names of one-fourth of the voters? It simply means that the acts of the council would go unchallenged in a city so large as this.

Proofs are not wanting. The Anti-Saloon League found that written remonstrances would work in small territories, like a ward, but were unworkable for an entire county, especially with the population of Marion county. Yet they were able to have a power of attorney for all remonstrances, and the question could only come up once a year. Council ordinances under the commission plan would be passed constantly, so that the referendum would break down at once, owing to the time, trouble and expense of petitions and elections.

Again in several places where the recall is in use, as at Haverhill, Mass., a commission town, and at Los Angeles, the defeated candidate has used it to get another chance to win the office, by having a new trial. It is a dangerous instrument, unless surrounded by conditions which make its use almost impossible in a city the size of Indianapolis. Again, in the case of a corporation franchise, such as a street railway, which goes to a popular vote as a matter of course without petition, we have high authority against it. Judge Lindsey, of Denver, Colo., a man of national reputation, on account of his connection with the juvenile court, has stated that in Denver it cost the city $10,000,000. The city government inserted provisions in the street railway franchise highly favorable to the company, because the city government felt the responsibility rested, not on it but on the people. The government could not be blamed if the people adopted the franchise, nor even if they rejected it. The franchise was adopted after a campaign which Judge Lindsey says was a disgrace to Denver. The people, in the mass, were unable to inform themselves concerning the complicated provisions of a corporation franchise, while corporation money and the use of able speakers did the rest.

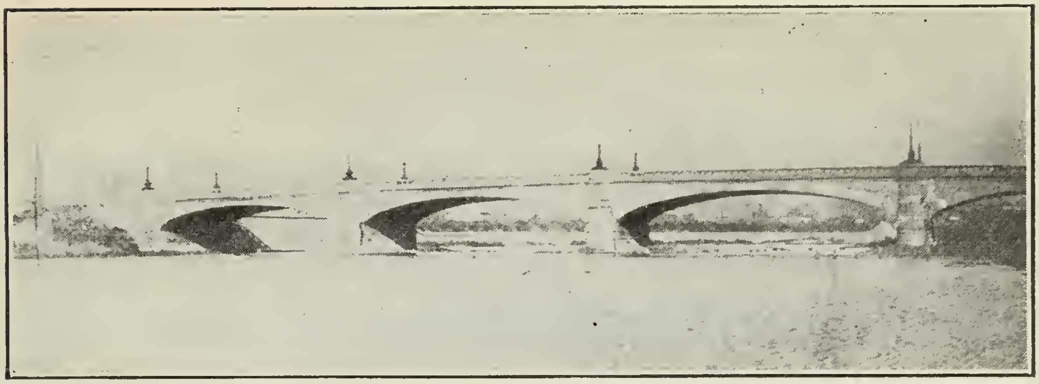
At any rate, in a city the size of Indianapolis, the referendum and recall are not sufficient checks upon a council of five members with unlimited power. Private trust funds are not managed by the trustee alone. A guardian, administrator or receiver must have the approval of a second authority for expending or investing trust funds. He must apply to the court and secure its approval. Why should not public trust funds, amounting to more than a million dollars a year, be safeguarded with the same care? No good reason has been shown for vesting the power to raise money by taxation or by the sale of city bonds, the power to appropriate it for special public purposes and the power to spend it in the hands of the same set of men. The fact is, we need more checks rather than fewer ones. If the referendum and recall are good, let us add them as additional safeguards, but let no man be deceived by thinking that they will take the place of our present system, which separates the legislative from the executive power. Let us also have non-partisan elections and a stringent civil service law. Many of these things are good as amendments and additions to our present system. But the commission plan itself has nothing to do with these things. They are separate devices, used in various places where the commission plan is not in force. Is our memory so short that we have forgotten the experience of Indianapolis, when the council had exclusive power to raise money and spend it? Have we forgotten why the board of aldermen was created? It was because the people's money could not be trusted to the council alone. A second chamber was created as a check on the waste of public money. Shall we now ignore the lessons of our own past and trust to a single body of five men the disposition of our great revenues? We must assume bad men will get into office, and that the corporations will spare no effort to get their agents in such a small and powerful body. It is a short and easy road to the pockets of the people. It will be frictionless, silent, but it will be effective. It is nevertheless true that good government is at bottom a question of men. With good men the Des Moines plan is all right, but if we elect bad mayors, who do wrong in spite of publicity and discussion and criticism under our present system, what reason is there to believe that we will not be just as apt to elect bad commissioners? The difference is, that at present we have some checks on the tax eaters. Under the commission plan we shall have none. Let the friends of good government turn their attention away from the notion of breaking down the most effective restraint which has yet been devised for protection against bad men in office, in nation or state, in county or city. I mean, of course, the separation of legislative and executive power.

The White River Bridges in Indianapolis, Ind.

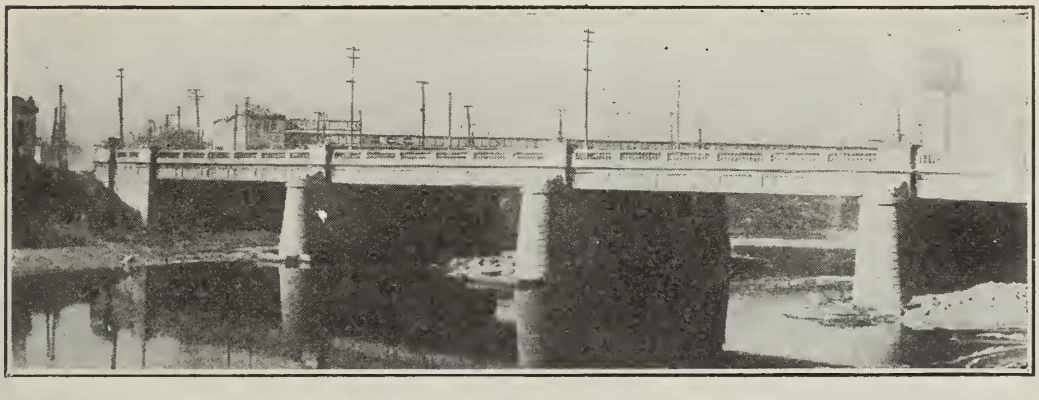
INDIANAPOLIS, the Hoosier capital, far famed as the locus of literary lights, has until recent years had little to boast of in the line of aesthetic civic improvements, particularly of the nature of river improvements. Fortunately for all concerned, two floods within a period of two months in the spring of 1904 effectually removed almost the entire list of inartistic and unstable bridges which spanned the streams within the city. This made possible the adoption of a plan for river and stream improvement, which was brought about in a rather peculiar manner.

The law allowed the city to call upon the county to construct the bridges, very properly, because the city of Indianapolis pays about ninety per cent. of the county taxes. The county commissioners therefore asked the county council at a special meeting to appropriate the sum of $750,000 for the purpose of replacing the bridges. It was necessary in order to appropriate money at any but the regular September meeting, that a two-thirds vote of the council be obtained. Through political reasons this necessary two-thirds vote was not forthcoming, so the movement was blocked. This brought the matter to the attention of the Indianapolis Commercial Club, a very efficient organization, where the welfare of the city is under consideration. The question of a thorough river and stream improvement along with the matter of the replacing of the bridges led to the suggestion of an improvement commission. A meeting was therefore called, in which the park, city and county officials were included; and it was developed that the County Council would be willing to appropriate the necessary funds, provided that the commission were given the supervision of preparation of plans and of letting contracts for construction. The directors of the Commercial Club thereupon proceeded to appoint a Bridge and Stream Improvement Commission, consisting of B. J. T. Jeup, city engineer; Harry W. Klausman, county engineer; J. Clyde Power, park engineer; and four citizens, namely, Medford B. Wilson, a banker; Ferd L. Mayer, a retail merchant; Edwin A. Hendrickson, a wholesale merchant, and Charles Carroll Brown, a consulting civil engineer, the last named being chairman. This commission secured from the County Council an appropriation of $830,000 with which to replace the missing bridges. With this, by the careful management of the county engineer in charge and the attention given to details of design, etc., by the commission, bridges were built at Morris street, River avenue, West Michigan street, Emrichsville, and almost enough funds were left to build a bridge at Thirtieth street, over White river.

White river holds an almost due



I. MORRIS STREET BRIDGE, INDIANAPOLIS, IND.



II. RIVER AVENUE BRIDGE, INDIANAPOLIS, IND.

III. WASHINGTON STREET BRIDGE, INDIANAPOLIS, IND.

north and south course through the western portion of the city, and consequently is crossed by a number of cross-town car lines, as well as a great many east and west thoroughfares. This necessitated a rather heavy type of construction as well as one that would meet the standards of beauty set by the commission. The Melan arch, or more properly the von Emperger arch, was adopted for all except one of the river bridges. This type of construction was chosen on account of its beauty and general adaptability to ornamentation and by reason of its strength and solidity. The arch ribs were of latticed steel, made to conform to the outline of the arch and set at a distance of three feet or less apart on each of the bridges. The stresses were computed for a maximum live load consisting of a 100-ton car. The following are descriptions of the bridges taken in order from the south.

Morris Street. Photograph I shows the details of this bridge. It consists of two 90-foot spans, two 100-foot spans and the center span of 110 feet. The roadway is 38 feet wide and a 6-foot sidewalk is next the rail on either side. The photograph does not do justice to the appearance of the stone finish, which is of rock faced Bedford limestone, consistent in every detail even to the railing along the sides of the roadway.

River Avenue. The River avenue bridge, shown in the second photograph, is unique in several respects. Two of the spans shown are 85 feet in length, while the other three are of 86 feet. A 40-foot roadway and two car tracks are supported on two plate girders of standard construction. The 8-foot sidewalks on either side are supported by concrete girders, which are divided and set on rollers at each of the panel points to allow of free expansion and contraction. The ornamental work on the panels, and forming the posts and railings, is all of molded concrete and of particularly good workmanship. The excellence of detail and the fact that no attempt was made to disguise concrete as stone is certainly worthy of commendation. The structure, with its consistent adherence to straight line effect, has received much praise from competent critics.

West Washington Street. This bridge, shown in the third photograph, was constructed before the regime of the commission, and was not damaged by the flood, and is perhaps the least satisfactory of the river bridges. The roadway and street car tracks are supported, as in the case of the River avenue bridge, on deck plate-girders, and the sidewalks on latticed girders; but the entire absence of any ornamentation other than a fancy railing along the sides of the bridge gives a sort of undressed effect which is not entirely pleasant. The number and length of spans are the same as in the case of the River avenue bridge.

West Michigan Street. The West Michigan street bridge is of the same general design as the Morris street bridge, as will be noted from photograph IV. It consists of two 110-foot spans and one 120-foot span, supporting a 40-foot roadway and two 10-foot walks. The facing is of buff Bedford limestone, finished in a panel effect as shown. Although the photographs do not admit of a very satisfactory comparison, the effect attained in the rock faced finish on the Morris street bridge is more pleasing than the smooth finish of the West Michigan street bridge. The discoloration on the first mentioned bridge, from efflorescence, causes an unsightliness which will not allow an appreciation of the beauty of the rock finish.

Emrichsville. This bridge, shown in the fifth photograph, is the most highly ornamental of the river bridges. It is placed on what is known as the Crawfordsville road, a pike very popular with automobilists. This road is also at the south end of Indianapolis' largest park, Riverside. An attempt was therefore made to make the bridge an ornamental gateway to this park. The park it at the right of the picture, as shown, so that the towers and gateway are on the inner end of the bridge. This was made necessary owing to the fact that the approach on the opposite was blocked by a steep bluff and a turn in the road. The bridge consists of two 94-foot spans and one 104-foot span. The roadway is 25 feet in width with an 8-foot walk on either side. The facing is of buff Bedford limestone dressed and ornamented with panels and carvings. The towers and arch at the end, with the railed steps leading down into the park, make a very artistic appearance, as seen from the boulevard along the river bank and from the Crawfordsville road. From that side the sea shell and dolphin carvings on the piers make a much more pleasing appearance than from the angle at which this photograph was taken.

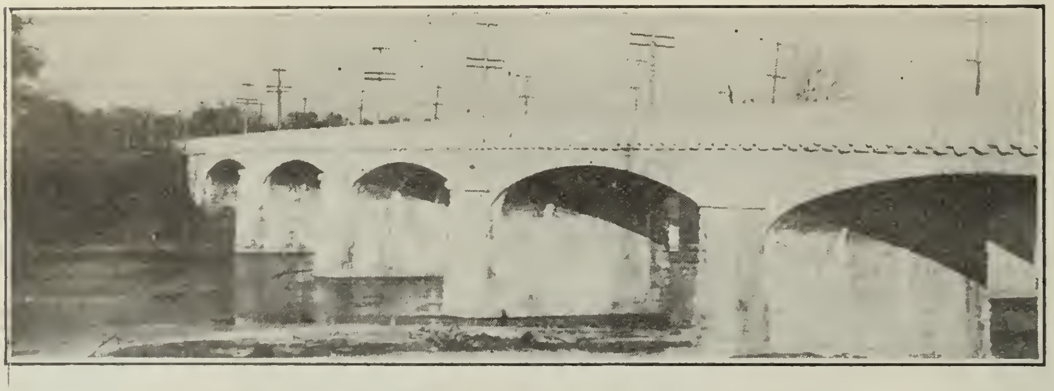
IV. WEST MICHIGAN STREET BRIDGE, INDIANAPOLIS, IND.

V. EMRICHSVILLE BRIDGE, INDIANAPOLIS, IND.

VI. THIRTIETH STREET BRIDGE, INDIANAPOLIS, IND.

Riverside. The Riverside bridge, or more properly the Thirtieth street bridge, shown in photograph VI, is the most beautiful structure of the entire list. It has a massiveness without heaviness which the width of the roadway, the thickness of the arch ring at the crown and the treatment of the approaches makes distinctive. This effect is consistently aided by the use of rock faced stone in the facing and ornamentations, which are in entire accord with the design of the structure. The two end spans are 94 feet in length, while the center span is 104 feet. A 50-foot roadway and two 10-foot walks give ample space in which to carry out the effect of a continuation of the boulevard straight across the bridge. On both sides of the river, on the upstream side, platforms and steps are built in such a manner that the lowest platform may be used as a boat landing. These platforms are walled and given the same general treatment as the main portions of the bridge, so that they appear as a part of the whole structure. The fact that this bridge was the last of those constructed under the supervision of the Commission, being partly paid out of money saved from the construction of previous bridges, would seem to be indicative of the development through experience, and a promise for the future. It is an example of good taste and excellent construction rare among municipal bridges.

Broad Ripple. The seventh photograph shows a small bridge recently completed in Broad Ripple, a suburb of Indianapolis. It consists of five 66-foot spans carrying only a 26-foot roadway. The facing is of rock faced stratified limestone, laid in severely plain designs. The bridge, while not particularly pleasing in appearance, is an example of stable and permanent construction seldom found in semi-municipal structures. It is outside the city and was built after the Bridge and Stream Improvement Commission had completed the work for which it was appointed, so that it did not have the criticism of that organization.



VII. BROAD RIPPLE BRIDGE, INDIANAPOLIS, IND.

The foregoing description will serve as an indication of the tendency towards beauty of design and detail, as well as utility in municipal bridge building. The movement towards civic improvement in all lines should make itself felt on future bridge construction in Indianapolis, and the present structures will furnish a good foundation upon which to build a system of municipal bridges second to none.

Buffalo's Plans to Transform Bird Island

By H. G. Anderson, Buffalo, N. Y.

BUFFALO, like all other progressive cities, realizes that it cannot provide too many breathing spots for its citizens. Our parks attest our city's timeliness in that respect. Yet, our public recreation places, almost without exception, are not up to their possibilities, in that they are inland. Buffalo's location, on lake and river, is a great factor in the city's attractiveness. Yet, municipally, we have not taken advantage of our water front and its possibilities for pleasure purposes.

The most popular point of departure in the city for the pleasure seekers is the foot of Ferry street. The Niagara river is the city's play ground. The variety of aquatic enjoyments and scenic splendor that it offers is well-nigh unrivaled. Bird Island Pier is the key to the waterway's attraction; it is the automobile gateway to Canada. Yet, there is hardly a section of the city so dilapidated, so unsanitary and so repulsive as the foot of Ferry street in its present condition.

To remedy this, and to take advantage of an unusual opportunity, the West Side Business Men's Association has instituted a project that is well worth the consideration of our taxpayers throughout the city. If the plan is fulfilled, Ferry street will be transformed from an unsightly lane into a broad, well graded thoroughfare, and Bird Island Pier, from an unkempt cluster of squatters' premises, into a spacious park. By furnishing dockage for excursion craft, the property would furnish sufficient revenue to offset the original cost within a few decades.

The property to be acquired runs from the foot of Albany street on the south to the head of Squaw Island, near the foot of West Delevan, on the north. According to the reports of the United States engineers, this contains 2,991 lineal feet, of which ten tenants, with revocable leases, occupy 1,041 feet, twenty-one squatters occupy 659 feet, and 1,291 feet are vacant. This land can be acquired by the city at little expense by cession from the state and federal governments.

The necessary preliminary to the improvements on the pier proper is the widening and grading of Ferry street from Niagara street to the new Black Rock Harbor. The plan calls for a width of sixty-six feet, with wide concrete sidewalks on both sides. This part of the improvement is practically assured. Already a notice of intention has been prepared for that purpose by Alderman Staples and the city engineering department. A bascule bridge, spanning the new harbor and fully as wide as the improved Ferry street, will be erected by the federal government.

The bird's-eye illustration of the plan in detail shows the magnitude of the improvement that would be effected. On the new Black Rock Harbor there would be a frontage of 2,500 feet, available for boats of all draughts, bound either up through the harbor, out to the lake, or down through the new federal lock at Black Rock out into the river. On the river side there would be another 2,500 foot frontage, with dockage facilities. The north end, at the head of Squaw Island, would be 410 feet in length, and the south end, at Albany street, about 100 feet.

Excursion dockage is provided for in the proposed plan. But little motor craft that swarm the river have not been neglected, as the project calls for a small lock between the pier and Squaw Island for the transit of small boats to and from the river. This would obviate the inconvenience of using the mammoth lock at Amherst street. The small lock could be operated by one tender, and at a slight expense.

To the huge triangular park, a great deal of filling-in would be necessary —work which would ordinarily involve great expense. Circumstances, however, make it possible to get this done at practically no cost, in that the dredgings from the strip that now separates the canal from the harbor from Ferry street north can be dumped to advantage both to the government and the city on the Bird Island property. The federal government will probably let the contract for this work some time next spring. Negotiations should be entered into at once looking toward the utilization of this property as a dumping ground for the dredgings.

The estimated initial expense involved in the improvements as proposed, would be only $350,000. The revenue that would accrue from excursion boats, ferries, etc., would more than pay all interest, and would provide a sinking fund sufficient to pay the bonds in full at maturity. It would be an improvement to be enjoyed by generations to come. To put it through now would be economy Later, the expense would be many times greater.

It is far from a sectional project. The whole city reaps the joys of Niagara river, and Bird Island Pier is the gateway. No better proof of the city-wide character of the plan could be adduced than the sentiment of the taxpayers. Over fourteen business men's organizations throughout the city have already heartily endorsed it, and have appointed committees of three to co-operate with the West Side organization to push the plan through when the time is ripe for action.

The project has passed the speculative stage. The details have been worked out and approved by Col. Ward and Captain Norton of the City Engineering department, Engineer Jones of the Federal corps and Col. Alexander. The co-operation of the Federal Government seems assured. The plan awaits the verdict of Buffalo. In view of the desirability of the improvement, and its economy as a business proposition, the verdict cannot but be favorable.

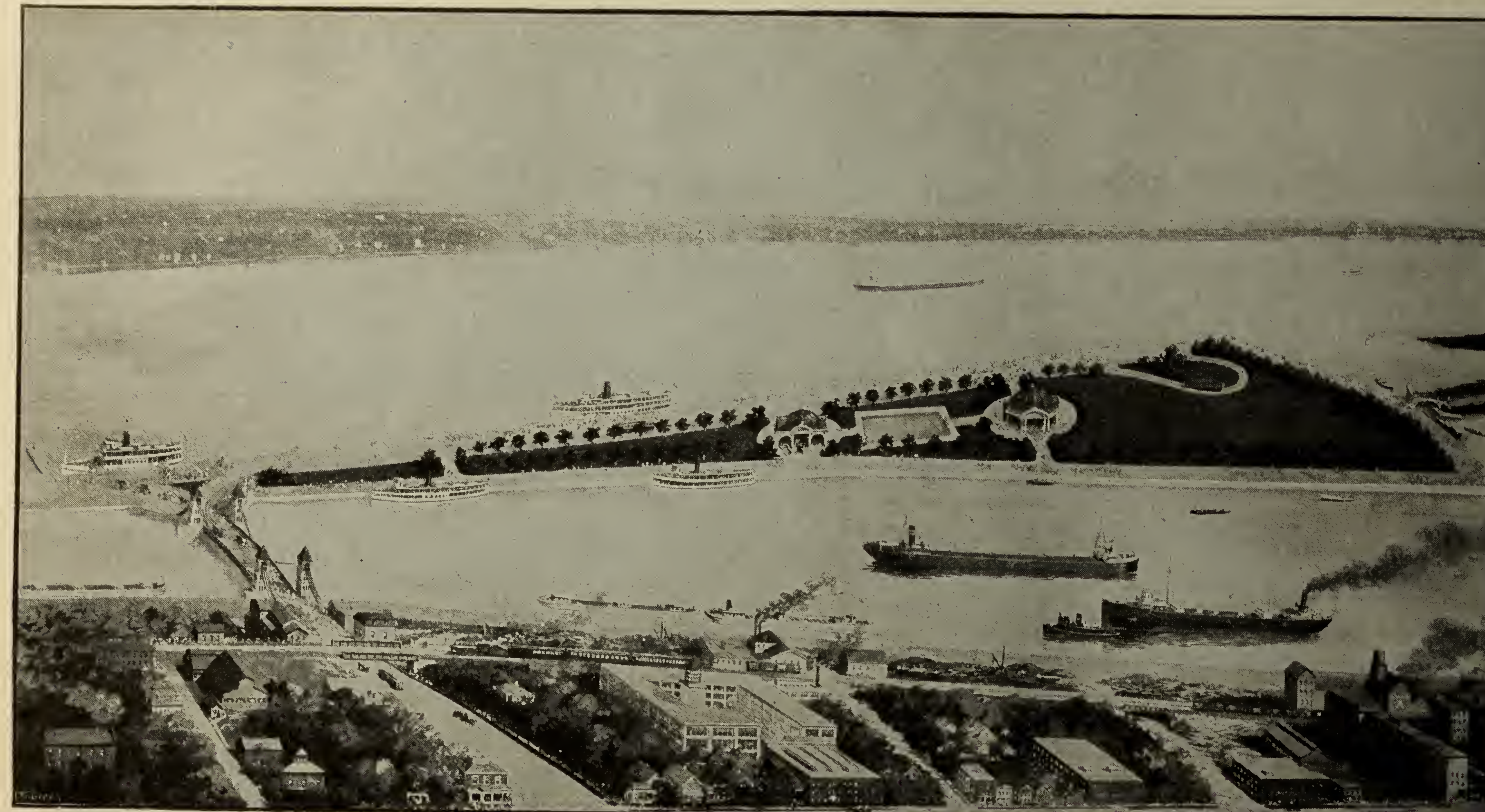
It is not often that such a great opportunity is offered to a great city. It would mean the acquisition of eighteen acres and the establishment of a park, comprising excursion dockage, swimming pool and garage, conveniently located on the banks of a majestic river. To take advantage of this opportunity will add one more to the factors that make Buffalo the Ideal City.

Apparatus for Efficient Fire Fighting

BY the time the fire engines arrived the building was a mass of flames, and adjacent houses were catching fire from the intense heat. This sentence or one very similar may be found in the description of almost any of the large fires of which we read. In "The Burning of Chelsea," a book giving a vivid description of the destruction of that Boston suburb, in April, 1908, it is stated that when the heavy apparatus arrived at the point where the fire started, "the flames were licking up the inflammable building and sending a shower of sparks, blown by a forty-mile gale, towards the heart of the city." In connection with this statement a picture is given of the horse-drawn fire engine responding to the first alarm. The picture was taken at a point where the horses were apparently not going faster than eight miles per hour over a street paved with rough cobble stones. This is just one of the many examples which prove true the assertion that " a minute at the start of a large fire means the saving of hours in subduing it."

It is this initial time-saving element more than any other which is bringing about the general adoption of the motor fire apparatus. The plunging horses drawing the heavy apparatus through crowded streets clanging and clattering over the pavement, have been thrillingly described by writers of fiction and in the daily papers. But no one saw fit to comment on the fact that for all the noise and appearance of speed, the horses with their plunging, rocking chair motion were not going faster than from 8 to 12 miles an hour, and even at that speed they possessed an inertia such that it was difficult to check their progress to avoid an accident or upon coming to the fire. Contrast a run of this horse-drawn apparatus with the more modern motor-propelled type. In the latter case the apparatus is driven safely through the streets at a speed of 25 or more miles per hour, always under perfect control and capable of being brought to a sudden stop in case of need. Within a radius of one mile, motor-driven apparatus will save at least one-third of the time; while outside this limit it saves from one-half the time upwards, depending on the distance. Due to this fact an auto-engine can cover the territory of two or three horse-drawn engines and do it more quickly.

The expense of up-keep is naturally one of the first questions asked



PLAN FOR IMPROVEMENT OF BIRD ISLAND, BUFFALO, N. Y.

relative to the automobile fire machines, and the arguments advanced by the opponents of the more advanced apparatus are usually very similar to the following, clipped from an Eastern paper.

"It is argued that the auto-machines would be cheaper than the present apparatus, because with the former in service there would be no horses to keep and employ a veterinary for. But what of that? The autos would always be in need of repair. An automachine is not a horse and it will not eat, but it will swallow money, just the same. An auto needs repairs occasionally, just the same as a bicycle or a horse."

It is difficult to conceive of the class of repairs necessary on a horse, but otherwise the writer states a very general misunderstanding. This sort of argument is entirely disapproved by the statement of fire chiefs who have had the supervision of motor apparatus in active service. In a paper by J. H. Carlisle, chief of fire department, Vancouver, B. C., the following comparison is offered between the relative cost of maintenance for one year between a horse-drawn hose wagon and an auto hose wagon, the latter having been in service for two years.

Hose capacity, horse-drawn, ft.	1,000
Hose capacity, auto, ft........	2,000
Alarms responded to, horse-drawn	41
Alarms responded to, auto.....	146
Miles traveled, horse-drawn...	98
Miles traveled, auto..........	288
Cost of maintenance, one horse-drawn hose wagon..........	$866.00
Cost of maintenance, one auto hose wagon.................	$201.50

As will be noted, the auto apparatus carried double the amount of hose, responded to 105 more alarms and traveled 190 miles farther than the horse-drawn equipment. Chief Carlisle offers a further comparison between two stations, each built to accommodate three pieces of apparatus, one being equipped with auto and the other with horse-propelled apparatus. This comparison shows a great saving in the favor of the motor equipment.

In a paper given before the International Association of Fire Engineers, Charles F. Allen, chief of the fire department of Trenton, N. J., offered a comparison of cost of the two types of apparatus. Both were engine companies, the auto company numbering seven men in its crew and the steam engine apparatus requiring nine men. Both were in the same district and did the same work, and the following table gives the results of the comparison.

Cost of maintenance of engine company one year.........	$885.41
Cost of maintenance of auto company one year.........	151.60
Total saving of............	$733.81
Salaries paid to engine company, nine men............	$8,129.80
Salaries paid to auto company, 7 men...............	5,770.00
Total saving in salary.....	$2,359.80
Total cost of engine company.	$9,015.21
Total cost of auto company..	5,921.60
Saving in comparative cost of maintenance	$3,093.61

At the same convention W. H. Loller, chief of the fire department of Youngstown, Ohio, gave an account of the maintenance expense on an auto fire engine, which had traveled over 1,200 miles at a cost of $98.00. Other reports were offered at the same place, telling of the economy of operation of motor equipment, and in no case was it shown the horse-drawn apparatus could be maintained within twice the cost of that auto-propelled.

The adaptation of the gasoline engine to the purposes of practical fire fighting is receiving a great deal of attention at present, and a number of firms manufacturing motor fire apparatus are supplying motor-driven fire engines, the pumps of which are gasoline operated. Mr. George W. Booth, chief engineer, committee on fire prevention, of the National Board of Fire Underwriters, supervised a series of tests, the results of which are given in the proceedings of the International Association of Fire Engineers. No comment whatsoever is made on the results of these tests other than to recommend the following provisions for the automobile fire engine:

"That the engine and pump shall be able to deliver the rated capacity of the pump at 120 pounds net pressure, and at least 50 per cent. of its rated capacity at 200 pounds net pressure. A 20 or a 30-minute run under each of the above conditions will usually suffice to determine the ability of the engine, but it would be well to specify an endurance run of 2 or 3 hours if such a test appeared desirable."

The results of these and other tests seem to indicate that only a very little development is needed along the lines of pressure and capacity to make the motor pumping engine the superior of the steam engine. At present any points in favor of the latter type are more than equaled by the rapidity with which the motor equipment can get into action; by the fact that full rated pressure is attained at the moment of starting, and for the reason that an amount of fuel capable of operating it continuously for several hours, is self-contained within the apparatus.

The auto engine is furthermore capable of being propelled through roads and over grades which are entirely inaccessible to the horse-drawn steamers. In Trenton, N. J., an automobile engine of only 30 horse power was driven through snow, which was two feet deep on the level and drifted in places to four to six feet in depth. After arriving at the fire at the outer edge of the city, the engine pumped steadily for almost five hours.

In Birmingham, Ala., an automobile engine is in constant service in a district where in places the street grades are 13 per cent. Other instances are recorded in Seattle, Washington, Lansing, Mich., and a number of other cities, which show conclusively that the auto engine will overcome road difficulties which would block the heavy horse-drawn steamers. As for the cost of maintenance of the two types, the following comparison is taken from two pieces of apparatus under similar service.

Annual cost of maintaining five horses in fire department station.

Horse feed, at $150	$750	
Shoeing	180	
Veterinary and medicine	100	
Harness repairs and replacements	75	
Stable equipment — blankets, brushes, stall repairs, manure hauling, etc.	175	
Total maintenance, five horses		$1,280
Cost of operating fire engine.		
Coke heater for maintaining steam under boiler	$190	
One-fifth cost of maintaining fuel wagon	260	
Fuel	90	
Rags, polish, oil, grease	20	
Wages of engineer, stoker, 1 engine driver, 1 hose wagon driver	3,780	
Total		$4,340
Total cost of operating one steam fire engine		$5,620

Annual cost of maintaining motor fire engine.		
Tire replacement	$200	
Gasoline and oil	50	
Kerosene for lamps	4	
Battery charging	3	
Rags and polish	15	
One operator	1,200	
Total		$1,472
Saving in favor of motor equipment		$4,148

Disregarding the cost of maintenance and granting that the present steam fire engine can, after it gets into service, throw a greater volume of water than the present motor engine, the latter must be held superior in the following particulars. Suppose a specific instance in which an alarm is turned in at a distance of one mile from the engine house, the run being made over paved streets. The motor engine will easily cover the distance and have a stream of from 400 to 700 gallons per minute on the fire inside of 2½ minutes. Of the seven men forming the engine crew, only one is required to look after the apparatus, the other six being free for active fire fighting. The apparatus may be placed as closely as desired to the fire without fear of falling sparks, etc. At the end of five minutes the horse-drawn steamer will be on the ground and inside of perhaps ten minutes will have worked up to maximum discharge. Of the engine crew of nine men, at least two are needed to look after the engine and hose wagon horses. Two more are necessary to look after the engine in the capacities of engineer and stoker. This leaves but five men for active service. In event of a long, continuous pumping, the problem of obtaining fuel for the steamer is one that must be considered, while the auto carries with it sufficient fuel for an hour's run and more may be procured without the aid of a team and wagon. Finally there is the possibility of a number of alarms in succession from the same district, in which event the horses are soon exhausted; but the motor apparatus remains as speedy as before.

More than 100 cities of the United States have adopted and have motor equipment in active service at this time, and among these cities old style horse-drawn apparatus is being replaced by new types until some of them have only the latter in service. The duplication of motor equipment after a thorough trial is the best recommendation that can be given for the more efficient fire-fighting machines.

George Washington's Surveying Outfit*

By T. Hugh Boorman, New York City

I AM indebted to the Hon. Andrew S. Draper, Commissioner of Education of the State of New York, for the accompanying photograph of all the surveying instruments of George Washington in the possession of that department of the Empire State. This is accompanied by a copy of a pen-written statement pasted inside of cover of instrument box.

"The instruments contained in this box, together with a case of protracting instruments in a shagreen case, two surveyors' chains and the wooden pins used with the same, were the property of General Washington, and used by him when a very young man.

"These instruments descended to my father Colonel William A. Washington (the General's oldest nephew), and from him to me, and by me presented to my son, Lewis W. Washington, February 10th, 1854.

Signed, "G. C. WASHINGTON."
Georgetown, D. C., Feb'y 10, 1854.

The instruments photographed consist of

1. Pocket Protracting Instruments. —A case of mathematical instruments covered with silver hinge and hasp, the same in form as is still sold for students.

2. Box of Surveying Instruments.— This oaken box, 14½ inches long by 7½ inches wide and 4 inches deep, contained, besides a compass, various instruments, all of brass, such as a scale of parts, parallel ruler, spirit-level, etc. Washington commenced his studies in surveying when he was 14 years of age, as appears from a manuscript volume of his "Book of Surveys, 1746," now at Cornell University. Lord Fairfax appointed him surveyor for his own lands, with a compensation of $3.50 a day, when he had just entered his sixteenth year, and he became public surveyor of the province, after two years' service with Lord Fairfax, for the three following years.

3. This compass, which was contained in the box above mentioned, has engraved on its face, "D. Rittenhouse, Philadelphia." Its maker, David Rittenhouse, was the distinguished astronomer, who became president of the American Philosophical Society and was a commissioner to define the boundary between Pennsylvania, New Jersey and New York in 1769-70. He was born in the same year as Washington, and was engaged in the manufacture of mathematical instruments and clocks at as early a period as the former commenced surveying. It is impossible to say whether this compass was manufactured by him before he opened an establishment in Philadelphia in 1770, as there is no date upon it. His first shop was opened in Norriton, near that city, in 1751.

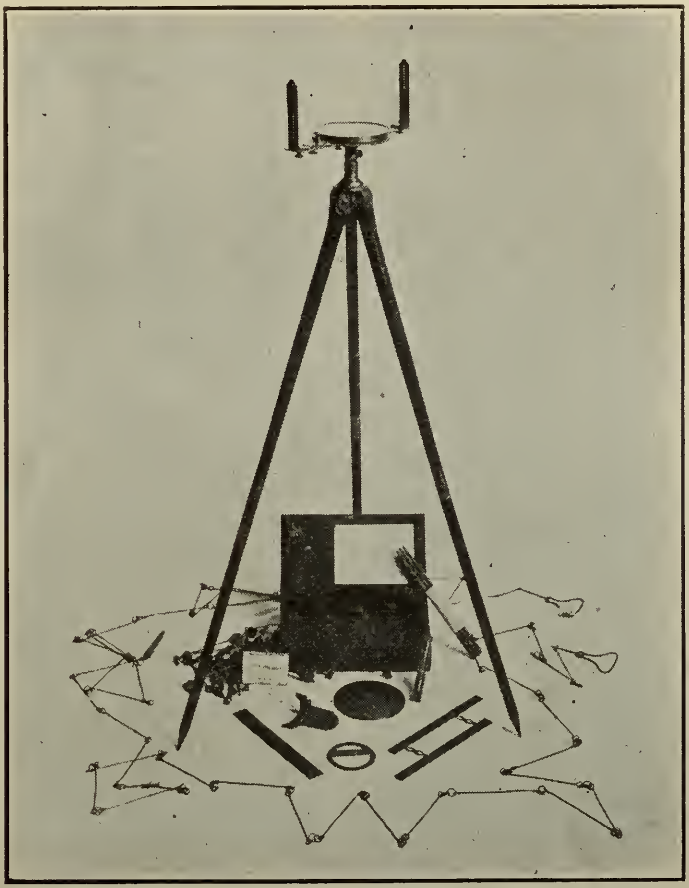
4. Surveyor's Tripod.—This is made of oak, mounted with brass. The three legs are each in two sections, with brass screws to unite them, for the purpose of easy transportation on horseback. In the original inventory it was described as "Jacob's staff."

Measuring iron chains, the large sized one, 33 feet 2 inches long; the small size, 30 feet long. This is the first used by him, and probably some of the links have rusted off. Also, six wooden marking pins, of ash.

Dr. H. Leffman claimed that "Washington was not a college man." This does not agree with the positive statement of Henry M. Wilson, C. E., in his address before the American Society of Civil Engineers at their semi-centenary in 1902, when he called attention to the fact that Washington is reported to have evinced marked

*From a paper before the Congress of Good Roads at Indianapolis, December 6-9, 1910.

aptitude for mathematics at the early age of 11. He took a course of surveying and navigation at Dr. Williams' school in Westmoreland County, Virginia, and became so interested in these branches that later he served a special apprenticeship in practical work under William James Genn, a learned surveyor.



GEORGE WASHINGTON'S SURVEYING OUTFIT.

In the clerk's office of Culpepper Court House is recorded the following:

"The 20th July, 1749 (O. S.), George Washington, Gent., produced a commission from the president and master of William and Mary's College, appointing him to be surveyor of this county, which was read and thereupon he took the usual oaths."

Washington was not only the first to map out and recommend the general route of the great highways called the National pike and the Chesapeake and Ohio canal, which latter, in truth, became, to quote him, "The channels of conveyance of the versatile and valuable trade of a rising empire," but he was also the first to commend and predict the commercial success of that route through the Mohawk valley which was afterward taken by the Erie canal and the New York Central railroad.

The National pike, the route of which was practically located by him and the construction of which he planned from the Great Falls of the Potomac to Pittsburg, was, and still is considered to be one of the best aligned, best graded and best macadamized roads in America.

It is a matter of record that while Major L'Enfant is to be credited with working out the details embodied in the plans of Washington City, it was President Washington who, as a consulting engineer, directed the work of L'Enfant.

To What Extent Do Automobiles Destroy Our Roads? *

By Logan Waller Page, Director, U. S. Office of Public Roads, Washington, D. C.

THIS question and its immediate sequel, "What shall we do to prevent this destruction?" are the summing up of the most serious problem with which road builders have now to wrestle, and with all the discussions as to "cause" and "remedy" which have taken place in recent years, we cannot yet feel that we are any more than fairly started on the way to a solution of the problems.

In considering the injurious effect of motor traffic on our roads, I shall confine myself to a consideration of what has always been considered our highest type of construction, the broken-stone road, as first specified by the eminent French engineer, Tresaguet, in 1775, and later improved upon by Telford and Macadam. The principles involved in their methods of road building really depended upon the wear of traffic for the preservation of their roads. They had to contend only with horse-drawn vehicles, and the dust which was constantly being worn from the stone acted as a filler in the road surface, and under the action of moisture formed a cementing medium between the stones. Therefore, in a well-constructed macadam road, where the selection of stone was suited to the volume and character of traffic, the fine dust resulting from wear was just sufficient to replace that carried away by wind and water; the action of water caused this remaining dust to re-cement and the surface was thus automatically rebonded. Moreover, the road surface remained practically impervious to water and the foundation was protected.

The advent of the automobile has, however, completely changed conditions, and the seriousness of the problem becomes more impressive when we consider the rapid advance in the production of motor-propelled vehicles. It was estimated that on November 1, 1908, there were in the United States about 150,000 automobiles. The output in 1908 was 55,000 cars, for 1909, about 80,000, and it is anticipated that the close of the current year will hace seen a year's production approaching the 200,000 mark. And, whereas the early output went largely to the large centers of wealth and were looked upon as a rich man's latest luxury, we now find the automobile in common use throughout the length and breadth of our country, not a luxury, but a necessary means of daily travel for the business man and the farmer, who is the better enabled to cover his often widely distributed property. It has, therefore, come about that the smallest community is face to face with the problem of meeting the new conditions brought about by these changes in the character of traffic passing over their local highways.

There has been much discussion from time to time as to the reasons for the destructive action of automobile traffic, but I think the series of experiments conducted by the Office of Public Roads has given some most interesting and conclusive results, which, although previously published, will bear repetition in the present instance. A 60-horse-power car stripped for racing and weighing with driver and mechanism about 2,800 pounds, was driven over a stretch of level, broken-stone road, first at five miles an hour, with increasing rates of five miles an hour until a speed of sixty miles was attained. The road was a section of government road which had been resurfaced two years previous to the test and was in good condition. Photographers were stationed at a point on the road designated for the proper speed and photographs were taken of the effect produced during the passage of the car. It was evident from a consideration of these photographs that up to fifteen miles an hour little or no effect was produced on the road, and even at twenty miles an hour the observers concluded that no serious damage was done. From twenty miles an hour on, however, the effect was decidedly noticeable with each increase of speed, and the dust is often lifted from the road by the severe shearing stress of the driving wheels, which I have compared to the action of a circular saw going through a board. Once lifted from the road, this fine material is subjected to the

*Read before the Southern Appalachian Good Roads Association.

effect of air currents generated by the car body and subsequently by the wind. Thus, large quantities of the very material that is essential for bonding the road together are rapidly carried away, the wearing stones are soon left bare and loose, and subject to displacement, water finds its way into the body of the road and a general deterioration rapidly sets in. It is therefore evident that the most serious damage to our roads as a result of increased motor traffic is due to the shearing stress of the rear wheels on the road surface when the machine exceeds a speed of twenty miles an hour.

There is another source of injury, which is not so serious, for the reason that it is confined to rather sharp curves and easily overcome. This is the tangential stress or tendency of the car to skid in rapidly rounding a curve, thus shifting the crown of the road tangentially to the gutter. This difficulty may be obviated by raising the outer side of the road.

But while the automobile is continually lifting the valuable binding material from our roads, and causing injury to crops, property values, and even the health of the neighboring communities, it is doing absolutely nothing toward replacing the dust so distributed. The principles of Macadam and his predecessors are set at naught, for whereas the iron-tired, horse-drawn vehicles of other days caused a continual replenishing of dust, the motor-driven car, with its pneumatic tire, is practically without any wearing effect on the road stone. As motor traffic increases, a point is reached where the type of road has to be changed, and this point varies with the volume of horse traffic and the volume and speed of motor traffic, a condition in part brought about by a failure of the motor vehicle to produce sufficient wear on the road surface.

It is those who have the building and maintenance of our rural highways who are most seriously affected by this great problem. It is comparatively easy to control the speed of motor traffic through our larger towns and over the park systems of our cities, and it is admitted that at low rates of speed the motor vehicle is no more injurious to the road than ordinary traffic. But, in the open country, where we have the grinding action of the iron tire and heavy load followed by the high-speed automobile throwing up and distributing the products of wear, we are confronted with the necessity of providing a new and more durable form of road.

For several years past, highway engineers and chemists have been uniting their efforts in attempts to solve this problem, and, generally speaking, have experimented along two lines, either to add some palliative to the surface of the road, in order to hold the dust, or else to construct the road with the use of some binding material that will hold the stone in place. Water was the original dust layer, but its continual application is costly, especially on long stretches of open highway where facilities are not always at hand for securing water. The addition of hygroscopic salts to the sprinkling water was then tried with the object of having the salt retain the water in the road surface, and in this respect calcium chloride has proven fairly successful, although even this very hygroscopic salt has a tendency to dry out unless the climate is quite humid. The lighter residual oils and tars have been used in holding down the dust with varying success dependent on the quality of the material, its method of application and adaptability to the character of the road in question. And right here it may be said, that while I do not think a fully satisfactory solution of our great problem has been reached, it is an unquestionable fact that a large percentage of the failures to date has been due to the application of inferior materials, deficient in certain well-known necessary characteristics or to the use of good products in conditions to which they are not adapted. There has been a too general acceptance of the fact that any oil or tar is a good dust preventive or road-building material, and that whatever the eager salesman guarantees (?) must be good and fulfill all the claims he makes for it.

While results from surface treatment can only be regarded as temporary, lasting, perhaps, in the case of proper oils or tars, throughout a season, more permanent results have been secured through the application of some of the heavier bitumens during construction. These may be applied either by heating and mixing with the upper coarse of stone before spreading, known as the mixing method, or by pouring the hot bitumen into the upper course of stone after it has been shaped, known as the penetration or grouting method. The former is the better way, in that a more uniform distribution of the binder is secured, but the method involves considerable expense, as well as time, especially where a proper plant is not available and the mixing has to be done by hand.

By working along those lines we have certainly bettered conditions and produced a highway better fitted to resist the ravages of modern traffic, but there is much work ahead of us before we can say that we have wholly solved our problem. Automobile production is increasing with rapid strides, the distribution of cars is becoming daily more general, and whereas almost the entire output of cars has until now been largely for passenger transportation, I believe the next ten years will witness a great development in freight transportation. In England large quantities of food are transported to the city of London in trains of cars drawn by traction engines, and these trains return to the farms with supplies. The value and economy of motor transportation for freight in cities has been demonstrated and the ecenomy of building roads over which it can travel in the country will become more and more evident to taxpayers in rural districts. And while there is a tendency on the part of many severely to arraign the automobile for its destructive action on our public highways, they should not lose sight of the other phase of the subject which is worthy of serious thought. The application of mechanical arts to our daily convenience and comfort must necessarily introduce new problems which require long and patient experimenting for their solution, but, when solved, are apt to produce a betterment of conditions that might otherwise not have been reached. So the motor vehicle, while tending to destroy our broken-stone roads, has had an improving influence, not only in the building of many miles of better highways, but in rendering most urgent the study of road improvement and preservation. The dust nuisance antedated the automobile by many years; if our experimental work leads to success, it will demonstrate the really beneficial effect to ourselves and posterity that motor traffic has had upon the development of the art of road building.

State Regulation of a Massachusetts Telephone Company

In these days of increasing agitation in favor of the control or supervision of public service corporations and of large companies many new problems are developing in regard to the methods of managing and valuing such concerns. It seems that the ultimate end most desirable in all lines of industry is combination to effect economy of operation and public control to prevent the pooling of prices or unfair rate making.

An example of public regulation that is a model in its accuracy, soundness and fairness is that recently accomplished in Massachusetts by the State Highway Commission and the telephone companies. A record of this investigation contains valuable information for the investor, for the telephone user and for the telephone operating company.

The specific charge against the New England Telephone and Telegraph Company, which was brought in September, 1906, was over-capitalization and excessive and inequitable rates. The commission's handling of the charge of over-capitalization involves the straightening out of a tangled situation that is typical in these days of properties formed by a progressive consolidation of small companies. The New England Telephone Company is the result of a combination of a good many smaller companies, each of which had certain records of construction outlay, operating expense, etc. It was found, however, that the accounts of the final company were entirely inadequate as a basis for valuation. The commission, therefore, had their engineers make a detailed inventory of all the company's physical property in the six New England states. Every pole, every foot of wire, every instrument, the exchanges and their equipment, lands, buildings and property of every sort was properly inventoried and valued.

From this inventory it was found that the telephone company had actual property amounting to $100 for every $84 worth of securities issued. To this valuation was added what was considered a just value of intangible or overhead charges, including cost of engineering, salaries, interest, etc., during construction operations. In telephone construction the total charge that should be made against capital account over and above the actual expenditures for physical property has been determined as about 20 per cent., being apportioned as follows: 10 per cent. for preliminary engineering expenses and engineering supervision during construction, 4 to 6 per cent. for taxes, 1 to 2 per cent. for insurance, and from 5 to 10 per cent. for the cost of selling the securities.

The readjustment of the telephone rates might seem at first sight to concern only the telephone using public, but it was clearly demonstrated by investigation of the Massachusetts commission that this readjustment of rates was of vital interest to the holder or intending investor in public service securities.

The principles upon which the commission proceeded in fixing the telephone rates were those first applied by Prof. Jackson in his study of the Chicago telephone problem in that city. The whole idea of this system is to make each branch of telephone service stand on its own legs. It developed in the course of the investigation that the actual cost in Boston and vicinity, of handling each call was in the neighborhood of 2½ cents. It was further shown that not infrequently large users of telephones secured their service at rates as low even as ½ cent a call, the loss to the company being, of course, made up by the small users. Up to the time of this investigation the system of accounting of the telephone company was such that it could only tell in a lump sum the amount of its income and the amount of its expenses.

One of the most important recommendations from the point of view of the investor, which was made by the commission and adopted by the telephone company, was the installation of a system of accounting devised by Prof. Jackson and a firm of expert accountants in the Chicago investigation, by which the necessary facts could be obtained to show the exact expense and income of each class of service.

The danger of not knowing where the leaks are occurring is of vital interest to parties holding securities of any corporation. On the extension of the non-paying systems of service the company would immediately commence losing money without being aware of how it was going. This point was very clearly illustrated by the fact that the New England company installed a new system of accounting as recommended by Prof. Jackson and made a year's trial run, ending in March, 1910. The new accounts show that the company was furnishing certain classes of telephone service at a heavy loss, and that the classes of service upon which it was making a profit did not return sufficient to overbalance the losses. Although the company has been paying 8 per cent. dividends upon its stock, together with the interest upon its bonds, it was found that in order to do this the company had neglected to set aside proper reserves for depreciation, and obsolescence of its plant. In other words, as the company had been conducting its business it was approaching the time when it must face the expenditure of millions of dollars for renewal of plant without having any reserves provided to meet these expenditures. It is evident that it was headed straight for trouble.

The investigation of the highway commission has established the company's accounting system upon a sound, adequate basis, has made the owners of its securities feel more secure, has removed the probability of mischievous legislative interference and has established a system of rates which will undoubtedly greatly increase the business of the telephone company, much to the advantage of the user of every telephone, owing to the extension of this service. Probably no more sound judicial and scientific investigation of the sort has ever been carried through in this country, and from every point of view it would seem to be a model deserving of close study and of imitation by other communities.

One of the most striking features of this entire investigation has been the spirit of co-operation exhibited between the telephone company on one hand and the commission and their engineers on the other. The entire expense of the commission during the investigation was borne by the telephone company by means of a special tax; but this was only a portion of the total expenses borne by the telephone company during this investigation.

EDITORIAL COMMENT

A National Good Roads Association—The Des Moines, Indianapolis and Boston Plans of City Government

A NATIONAL GOOD ROADS ASSOCIATION.

Those who pay a little, and but little, attention to the good roads movement may very easily become confused in the number of national associations devoting their attention to this subject. There are the National Good Roads Association, the National Good Roads Congress of the American Automobile Association, the American Road Builders' Association, and, latest of organizations, the American Association for Highway Improvement. There is a vast field in which to work, and there may be room for so many associations, but the movement for good roads is still in its youth and to the observer there is every indication of duplication of effort or else of special interest which may be served by the exploitation of an association.

Municipal Engineering has had some opportunity of late to gather information about the various organizations and their conventions, and finds the serving of special interests too prevalent for pleasure or comfort. There can be no serious objection to such handling of the associations if the facts are known and those who attend their conventions and congresses are informed concerning them.

The recent convention of the first named association is reported to have been rather small and not well carried through so that this one may possibly be put out of consideration with the organizer and promoter.

The American Automobile Association is directly interested in the question of good roads and has been active in the promotion of the cause. It has done much good work and can do much more. The interested attendant of its good roads congress notes, however, a disappointingly small attendance and wonders whether its efforts in this direction would not be better placed if used in encouraging attendance at conventions and congresses of truly national and of state and district organizations.

The American Road Builders' Association mentioned has a considerable membership among state highway commissioners and state and national engineers and by its constitution seems to be sufficiently inclusive to cover the field, but practically the association itself is a rather close corporation showing no particular desire to extend its membership and operating its conventions as congresses, with delegates appointed with great prodigality who have no voice in the conduct of the association or of the congress.

The congress held in Indianapolis by this association is reported elsewhere in this number of Municipal Engineering. It is said to have had a registry of something like 1600 delegates, but this report was not verified, access to the list not being permitted to those directly interested in the Indiana portion of the list, admittedly for the benefit of the special periodical interest represented by the secretary. Other reported occurrences confirm the opinion that this association is too largely in the hands of the special interest.

The facts do not detract from the value of the congress, which was addressed by a large number of those who are in the official organizations who have the construction and repair of state and county highways in their charge. The size of the delegation to the congress was largely due to the efforts of the Indiana Good Roads Association and others who are preparing to present to the Indiana legislature bills which, if passed, will put that state in the line of progress in good roads. The proceedings of the congress were of much interest and value to these Indiana delegates as well as to those from other states, and created much enthusiasm for the cause in Indiana. Some of the criticisms above suggested must have reached the managers of the association, for, in a private session of "a few of the prominent members" there was some discussion of methods of extending its field. The most evident course of procedure would seem to be a divorce from the special interest and an active campaign for new members who would have an opportunity to exercise their rights of membership and would not be subject wholly to the dictation of star chamber sessions of a few members of the association or of the board of directors.

The last named association is but just formed and has not had an opportunity to demonstrate its principles. They are stated as follows by the newly elected president, Logan Waller Page, director of the U. S. Bureau of Roads, Department of Agriculture:

"The primary object of this association is to aid and promote every practical movement looking toward the improvement of public roads. There are already a number of county, state and general organizations which are doing good work along various lines, and I am glad to say that representatives of several such organizations are with us today. It is our hope that this organization will harmonize and correlate the work of all existing organizations.

"We shall supplement this work of correlation by endeavoring to bring about the organization of practical, working county clubs, which will turn their attention and their energies to improving county road administration, maintenance and construction; to uphold and strengthen the work of state associations for road improvement, and aid them in their efforts to secure wise and adequate legislation and competent and skilled supervision.

"The need of the day in road work is to take the administration of the roads away from the influence of politics; to insist upon skilled supervision of all road work; to remedy the evils of too much localization and to substitute uniformity and system for the confusion incident to pure localism as we now find it in some of the States.

"We hope to make the headquarters of this organization a clearing house wherein every movement of practical improvement will have a sympathetic hearing and earnest and helpful cooperation."

The character of the force back of this organization is shown by the names in the following list of officers and directors: President, Logan Waller Page; vice-president, W. C. Brown; treasurer, Lee McClung; secretary, J. R. Pennybaker, Jr.; organizer, W. D. Brown; directors—L. Hill, chairman; James McCrea, H. W. Finley, B. F. Yoakum, L. W. Page, Dr. E. J. James, E. D. Chapin, Bryan Lathrop, John Goodell, Melville E. Stone, Walter Page, Alfred Noble, Leonard Tufts, Lafayette Young, N. C. Brown, Joseph W. Jones, John A. Stewart, Leo McClung, James S. Harlan, Robert P. Hooper, George C. Diehl, A. G. Spalding, C. S. Barrett, Clarence Wilson, J. E. Pennybaker, Jr.

There is possibly room for a small technical organization of the state highway commissioners such as the American Road Builders' Association is in fact, but the plan of the new organization is so inclusive, and its efforts to correlate the efforts of the national and local organizations working in the same field is so helpful that, assuming the competence which the membership of the board of directors would seem to guarantee, it will become the truly national organization for which search has so long been made. Entangling alliances are particularly tabooed.

THE DES MOINES, INDIANAPOLIS AND BOSTON PLANS OF CITY GOVERNMENT.

As stated in the editorial note introducing the article on the commission and Indianapolis plans of city government, to be found on a preceding page, the new form of municipal government called the commission plan is under discussion in Indianapolis. The lack of understanding of what constitutes the commission form and the difficulty of separating from it the features which have been borrowed from other plans of city and state government, even by the best informed of the attorneys and others advocating a complete change in the form of government of the city, suggest the thought that others may not recognize the true relations of the various provisions which have been added to the original form of commission government, as well as those which, while included therein, were taken from other forms and are equally well appliable to any form likely to be devised.

The comparison of the Indianapolis and the commission forms is so well made by Mr. Mason in the article referred to that it will not be repeated here. Mr. Mason is an expert in city charters and shows his knowledge and judgment in the article.

Some of the points made by the chief exponent in Indianapolis of the commission form of government, Mr. Lewis A. Coleman, may be considered without too much repetition, however, and their relations to the plan as a whole may be demonstrated.

Mr. Coleman sets out five points in the commission form of government which, he thinks, make it a decided departure from the so-called federal plan, more properly the Indianapolis plan, since it was developed most completely in that city under the guidance of Mr. Mason and his associates in the work, and is the business plan and only incidentally resembles a federal plan.

The first point mentioned by Mr. Coleman is the complete abandonment of the nomination of candidates for office by political parties. This was not a feature of the first commission plan in Galveston, which provided for three commissioners appointed by the Governor of the state and two elected by the city. Election of all commissioners by the city was adopted because the first method was decided to be unconstitutional. The full development of non-partisan nominations was not reached until the Des Moines charter was formulated. It was one of the additions to the commission form of government, made first by the constitutional necessities of the case and second to eliminate partisan nominations as nearly as possible. That the principle can be applied independently of the commission plan is shown in the Boston charter. Indianapolis made a half-hearted attempt to diminish the force of partisanship by insuring that one-third of the council shall be of a party in the minority. That city can easily take the next step and apply fully the principle of non-partisan nominations, if it is willing to abandon the organizations of the political parties. The double election is a still further development in the same line which may be an advance and is applicable to the present Indianapolis form with equal ease.

The second point made is the abandonment of ward lines. This was a necessary feature of the original Galveston plan for a commission partly appointive, and of the subsequent desire to elect those who had been so appointed when their method of appointment was declared illegal. It was an accident, therefore, rather than a design, and may well be successful in a small or a compact city when it would not be in a large one, especially if scattered and made up of more or less disconnected districts. The experience of Boston in this line will be of interest.

The third point made is the merging of the legislature and executive functions in a commission. Many of the objections to this feature, which is the only distinctive feature of the commission form of government, are set forth in Mr. Mason's article on a preceding page. This is the only provision which should be discussed under the title "Commission Form of Government." All other propositions are either borrowed from other sources or are developed to meet some difficulty in that plan, seen or feared. For lack of space no attempt is made here to present either side of the case regarding this particular proposition.

The fourth point presented by Mr. Coleman is the right of recall and the fifth covers the initiative and the referendum. These were of foreign birth and were discussed and tested long before the so-called commission plan was adopted by Galveston, and they were, in fact, engrafted upon the commission plan later, that the people might have some control of the commission, which, under the original plan, had very autocratic powers.

There are several other features that have been added to the original commission form, derived from various sources, such as separate election of mayor, instead of election of five commissioners who would select one of their number for mayor; separate nomination and election of each commissioner for his particular position on the commission; compulsory reference of franchises or contracts with public service corporations to vote of the people; publication of itemized statements of financial transactions and audit of all city accounts; separation of terms so that part of the commission changes each year; separation of schools and of parks from the commission proper, etc., which may quite as well be considered elements of the commission plan as the first, second, fourth, and fifth elements named by Mr. Coleman. They are no more essential to the commission form and differ only in being later developments and some of them in being less important. Whether they are better or worse is open to discussion.

It is not the purpose here to discuss the value of any of these numerous provisions nor their applicability in any particular case. That is reserved for the future. This article will have served its purpose if it has shown that but one of the provisions discussed, Mr. Coleman's third, can in any true sense be considered to be or to appertain to the commission plan of city government alone; that all the others are equally applicable to almost any other American form of city government, or can be incorporated therein by some modification of existing provisions, and that, therefore, it is not necessary to adopt the commission form of government in order to secure the benefits which the adoption of any of these other provisions may confer.

The fact is that, whatever the form of government, it is good in the hands of good people and bad in the hands of bad people. The majority of our municipal governments are in the hands of neither expert good people nor expert bad people, and their forms are so inefficient that the inefficient officers elected under them are, almost in spite of themselves, made more inefficient, if not even criminal.

The elements necessary to the average American municipal government seem to be home rule, so far as the adoption of plans for development, improvement and self-government are concerned; complete publicity, not merely by publication of thousands of agate lines of reports of proceedings, financial or otherwise, but through such expert investigations of conditions as are made by such an independent body as the finance commission provided for in the Boston charter; expert control, mainly through publicity, of technical operations, such as handling the public service industries, whether under public or private ownership, municipal accounting, etc., as now exercised through certain state commissioners; better methods of selecting competent men for expert technical services in the lines mentioned, probably to be developed through the demands of such state commissions for better service and the adoption of better salaries; more secure tenure of office of such employes, undoubtedly a consequence of the adoption of the preceding suggestions and of the short ballot, whereby the executive and legislative officer or officers are elected and all administrative officers are appointed under reasonable civil service regulations. Again the independent civil service commission provided in the Boston charter, is worthy of study. It exercises a minimum of authority over the appointing officers at the same time that it comes very near always providing competent persons from which they may select their employes.

Each city has quite as good government as its citizens deserve. All that the best charter can do is to make it as easy as possible for the people to assume control when they so desire, and as difficult as possible for the forces opposed to good government to cover their tracks and shift the responsibility for their acts. In almost any community publicity is almost the only necessity. This requirement was omitted from the Indianapolis charter and most of the complaints made of its municipal officials would have had no ground if those officials had known in advance that all ther acts and the consequences thereof would be recorded and the records thrown open for all to see.

THE QUESTION DEPARTMENT

Cost and Efficiency of Street Cleaning Methods.

Can you refer me to a good book of recent publication, or other reliable source of information regarding the comparative cost and efficiency of different street cleaning methods, particularly with reference to machine flushing?

E. W., City Engineer, ———, Mich.

The only book on the subject is Soper's "Modern Methods of Street Cleaning" ($3 net), which describes the methods in use in European cities and in New York. The figures for cost are nearly all very general in their nature, so that they are not of much value for application to any other locality, particularly under the different conditions in the smaller cities.

Some figures of cost of flushing streets in New York City, under high pressure, will be found in MUNICIPAL ENGINEERING, vol. xxxix, p. 316. This article states that 2 gallons of water were used per square yard of pavement cleaned, at 9 cents per 1,000 gallons, and the figures of cost are based on this statement. Another test made in three districts with street flushing machines and hand hose showed the following results, the figures for each type of machine being the average of two machines of that type. The first machine, the Connelly, used 0.343, 0.327, and 0.571 gallon per square yard of pavement flushed in each of the three districts respectively in which the experiment was tried. The second machine, the Sanitary, used 0.504, 0.588, and 0.642 gallon per square yard, respectively. The fire hose operated by hand by a gang of three men used 1.500, 1.795, and 1.699 gallons per square yard, respectively. The test on each district occupied 5 days in August. Meters were used in determining the amount of water used in the third district. These figures for use of water would reduce somewhat the estimate of cost made in the above named article.

The following data are drawn from various sources:

CHICAGO, ILL.

A Chicago citizens' bureau carried on street cleaning for a time, some four to six years ago, and stated that the cost of cleaning by hand sweeping was 86.7 cents per 1,000 square yards per day for granite blocks and 60.5 cents per 1,000 square yards per day for asphalt. The area was swept 2½ times each week day and once on Sunday, or an average of 2.3 times per day, so that the cost for each sweeping would be 37.7 cents per 1,000 yards each time for granite and 26.3 for asphalt. An interesting development is that the number of men required for sweeping varies directly as the tonnage of traffic. Cost of removal and disposal of street sweepings is not included in the Chicago figures.

DAYTON, O.

The special report of the U. S. Bureau of the Census on statistics of cities for 1907, gives figures of average cost of street cleaning and details of amounts cleaned by hand sweeping, machines and flushing, classified by cleanings per week. All the 44 cities given, but Dayton, O., use two or more methods of cleaning, so that the cost of different methods of cleaning can not be compared. The cost for machine cleaning in Dayton is 56.5 cents per 1,000 square yards, each cleaning.

ST. LOUIS, MO.

J. C. Travilla, street commissioner of St. Louis, Mo., supplies the following:

The average cost of cleaning streets per 1,000 square yards each cleaning is as follows, no charge being made for water:

Flushing	$1.00
Squeegees	0.45
Machine sweeping	0.81
Hand sweeping	1.58
Patrol system	0.25

For cleaning alleys the figures are:

Flushing	$1.94
Hand sweeping	1.70

The flushing system is used on granite block, vitrified brick and sheet pavements. There are eight crews made up as follows:

4 flushers at $7	$28.00
12 laborers at $1.50	18.00
4 mud wagons at $4	16.00
2 inspectors at $3	6.00
Total cost per day	$68.00

Two inspectors are required. One is in charge of the 4 flushers and 4 laborers, 2 of whom keep the sewer inlets screened and free from rubbish and 2 follow the flushers, brooming the water down the gutters and off the street crossings. The other inspector has charge of 8 laborers and the 4 mud wagons. Flushing on sheet pavements costs but little more than cleaning with the squeegees.

The squeegees are used only on sheet pavements. There are 2 crews made up as follows:

1 sprinkler at $5	$ 5.00
2 squeegees at $7	14.00
2 pick-up wagons at $4	8.00
4 laborers at $1.50	6.00
1 inspector at $3	3.00
Total cost per day	$36.00

Machine sweeping is done by 4 crews made up as follows:

1 sprinkler at $5	$ 5.00
2 machine brooms at $5	10.00
12 laborers at $1.50	18.00
6 pick-up wagons at $4	24.00
2 inspectors at $3	6.00
Total cost per day	$63.00

One of the inspectors is in charge of the sprinklers and machine brooms and the other looks after the laborers and pick-up wagons.

There are 8 crews doing hand sweeping and scraping, consisting of the following:

12 laborers at $1.50	$18.00
2 pick-up wagons at $4	8.00
1 inspector at $3	3.00
Total cost per day	$29.00

Under the patrol or "white wings" system there are an average each of 309 patrolmen employed per day at $1.50 each, with 1 inspector at $3.50 a day to every 19 patrolmen, and 1 pick-up wagon at $4 a day for every 6 patrolmen. The minimum area given 1 patrolman is 2,000 square yards, the maximum 11,000, and the average 6,000.

Alley flushing requires 6 crews made up of:

2 flushers at $7	$14.00
6 laborers at $1.50	9.00
2 mud wagons at $4	8.00
1 inspector at $3	3.00
Total cost per day	$34.00

The city is divided into 4 cleaning districts in charge of district superintendents at $85 a month, who report to a general superintendent, at $150 a month, in charge of all the work. A man is in the general superintendent's office at all times to receive the reports of superintendents and inspectors, which are telephoned in twice a day, and to take care of the daily written reports of inspectors as to force employed, etc.

The lengths and areas of streets cleaned are as follows:

	Miles.	Sq.Yds.
Asphalt	59.46	1,245,332
Bitulithic	38.69	807,249
Granite block	70.02	1,334,318
Wood blocks	3.26	61,901
Vitrified brick	142.02	2,742,450
Totals	313.45	6,191,250

The alleys amount to the following:

	Miles.	Sq.Yds.
Granite blocks	8.89	85,325
Vitrified brick	113.58	1,085,555
Granitoid	1.31	11,528
Limestone	60.92	537,022
Totals	184.70	1,719,430

Pavements in the business districts are cleaned twice a week at night and in the residential districts once a week, alleys about twice a month, some machines running day and night. These facts must be considered in comparing the cost per square yard of cleansing streets and alleys and in making comparisons with other cities.

In winter 11 snow traps or dumps, cost averaging $365 each, are installed over large sewers, providing short hauls for snow removal. In the central retail business district 25 stations are established as centers for report of inspectors, laborers and teams after each fall of snow, so as to reduce the time of snow removal to a minimum. The cost of this removal is about 16 cents a cubic yard.

ALBANY, N. Y.

Streets are swept twice a week by machine for 8 months of the year at a total daily cost of $153.40, not including cost of dirt removal, or 42 cents per 1,000 square yards. The cost of dirt removal, done by contract, increases the cost, apparently, to about 55.5 cents per 1,000 square yards.

CLEVELAND, O.

Average cost for street flushing by machine by city's machines 44 cents per 1,000 square yards in 1908.

SCRANTON, PA.

Annual report of department of public works for 1908 states that hand cleaning cost 30.7 cents per 1,000 square yards, machine sweeping cost 18.2 cents, and flushing cost 20 cents, all these figures including labor of cleaning only.

NEW YORK CITY.

The special commission appointed to investigate cost of street cleaning made detailed estimates of cost of street cleaning, the final result of which is a statement that hand sweeping should cost 28.1 cents per 1,000 square yards, machine sweeping 31.7 cents, flushing by hose with special nozzle 25.1 cents, flushing by hose with ordinary nozzle 31.9 cents, and flushing by machine 72.1 cents, being the figure given in the article on p. 316, vol. xxxix. These figures seem to have been those of 1907, in which is also included the cost of cleaning with squeegee as 20 cents per 1,000 square yards.

AVERAGE COSTS.

A paper before the American Society of Municipal Improvements in 1906 gave the average costs in 13 American cities as 75.3 cents per 1,000 square yards for machine cleaning, 24.5 cents for hand cleaning and 31.8 cents for flushing.

BOSTON, MASS.

The report of the street department for 1909 shows that the cost per 1,000 square yards cleaned once is 32.6 cents for flushing; 43.1 cents for machine sweeping of paved streets; $1,199 for gutters, or an average of 49.8 cents for streets and gutters combined.

Additional data with figures for contract work in Indianapolis, New York, Washington, Hartford and other cities using various methods will be found in MUNICIPAL ENGINEERING, vol. xxxviii, p. 193, with references to many previous articles on the subject, giving further details, which give more information than can be obtained from any other one source.

Railways and Snow Removal.

Will you kindly inform me what street car companies are usually required to do toward taking care of snow on city streets? The electric railway here has been using a snow plow which shoves the snow to the side of the street a sufficient distance to leave a narrow driveway each side of the track. This driveway is so narrow, however, that there is barely room for a team or vehicle to pass between the banked snow and a passing car, and there is considerable worriment among teamsters and others on their account.

I presume this is a question on which the laws of different states would differ, and it would also probably be affected by the form of franchise, but no doubt you can at least tell me what is the usual condition.

Any information along this line will be very much appreciated.

E. R. W., Port Huron, Mich.

If the franchise granted the company is silent on this point, it can probably be controlled by city ordinances exercising the police powers of the city. Custom is quite variable in this respect. Too many street railway franchises are silent upon this subject, even in the northern cities, where snow removal is a serious problem.

Elgin, Ill., provides that "in removing snow from its tracks the said company shall distribute it so that it will not impede public travel on the streets occupied by its tracks."

The Moline, Ill., ordinance provides that the street railway company "shall keep their roadways free and clear from snow and dirt, so much as may be occupied by its said tracks and right-of-way and turnouts, and shall cause the snow and dirt or street cleaning to be removed, so as in no wise to interfere with the free use of the avenues or streets by the public in all cases."

The Hammond, Ind., ordinance provides that "in the event that the said company shall at any time cause the snow to be removed from its tracks, it shall be disposed of in such manner as not to interfere with travel by private conveyance."

The corresponding provision of the Dayton, O., franchise governs street cleaning and may possibly be construed to cover snow removal also. It is as follows: "Said company shall keep clean and free from dirt so much of said part of such streets and intersections adjoining as lies between the parallel lines drawn and extending eighteen inches outside of its tracks, and, in case said part of such track shall be paved, said transit company, its assigns or mortgagees, shall cause the dirt and street sweepings to be removed along the line of said road and place the same in heaps, and to so remove the same as not to interfere with the free use of such street by the public; or the city of Dayton, at its option, may clean and remove the dirt from said part of such streets from the space between the rails and tracks and for eighteen inches outside the outer rails, and in case the city shall do such cleaning and removal of dirt, said company shall pay to the city the reasonable cost thereof, provided such cost shall not exceed that of cleaning and removing the dirt from the rest of the street; and while said part of such street remains unpaved, said company shall pile and remove the dirt and street sweepings from along its said tracks in the same manner as is provided above in the event of paving. Said company shall pay the cost of sprinkling the space between lines parallel to and eighteen inches outside of its outside rails on said part of such street and intersections adjoining."

Such provisions as the following from Rome, N. Y., may be made to cover the case in absence of anything more definite: "The said company, its grantees, lessees, assigns, successor or successors, shall and will at all times indemnify and well and truly save, keep and bear harmless the city of Rome, of and from all harm, let, trouble, damages, costs, suits, actions, judgments and executions that shall or may at any time arise, come or be brought against or by any person, persons or corporation, for or by reason of any neglect, want of care or skill, negligence of omission or commission in the construction, maintenance, management, repair or operation of said road or its equipment or the repair of the streets aforesaid in any form or manner, either by said company, its agents or servants, or its grantees, lessees, assigns, successor or successors."

Lacking any ordinance, it is probable that the police powers of the city could be invoked in case of serious interference with traffic or danger to persons or property.

The following from the superintendent of a New York state street and interurban railway, for which snow is as great a problem as it is for Port Huron, will give some ideas on the subject for use on streets where it is not necessary to haul all the snow off the street:

Many roads, having an average passenger car headway of seven and one-half minutes to ten minutes, do not often have the number of plows or sweepers required to maintain over the system a headway of even sixty minutes. This fact, together with climatic conditions, renders the problem of snow removal in our smaller cities and towns, and also in all cities and towns of Northern and Western New York, one of serious importance.

With us it is a question of ways and means; a question of number and types of plows, of capacity of rotaries, of strength of sweeper brooms, of means of throwing the snow over banks, from five feet to fifteen feet high, and of providing electric power to operate both plows and cars.

In our towns we cannot haul all the snow off the streets, because there is too much to possibly handle; we, therefore, confine our efforts in this respect to the business centers, crosswalks and junction points. Along the remainder of the lines the snow is piled up between curb and walk, or spread between track and curb, as the locations warrant. The snow we do remove is hauled away in sleighs, and sometimes on flat cars.

In considering our snow-fighting equipment we find that all types of machines for removing snow are useful. We even require horse-plows or walkaways for leveling back banks of snow thrown out by the plows and for cutting down drifts and opening gutters—work which cannot always be readily done by a track-plow.

In localities where winter commences early in December and lasts until April, where storm follows storm, and where a "thaw" means a rise in temperature slightly above 32 degrees, and closely followed by more snowstorms, severe cold and usually high winds, the accumulation of snow from one storm almost never disappears before it is buried beneath another. In the outskirts of the cities and on the suburban lines, the high winds continuing for days are the cause of most of the trouble, as huge drifts of hard sandy snow are formed as rapidly as removed, and successfully defy ordinary snow-plow apparatus.

To combat our local conditions we have drifted away from rattan brooms and followed, more or less intelligently, modern steam road practice. First, we dragged a board along the track; but finding this little better than our sweepers, we placed the board ahead and shoved it along. The board soon changed its form from a vertical plank, placed diagonally across the track, to a warped-surface shear, tending to cut, lift and then roll a mass of snow along its length.

Finding this snow-plow ineffective in banks over five feet or six feet high, an ingenious friend produced an electrically-driven boring machine, and called it a rotary track cleaner. With this machine we are able to cut our way slowly but surely through banks of snow of almost any depth and of any condition, short of hard ice.

We have, also, placed upon all our passenger cars track cleaners or scrapers, which will, without difficulty, remove snow from the rails to the depth of four inches, unless the snow has been packed down to this depth by the street traffic; and it may be well to say that scrapers which will remove even hard-packed snow are in use in Toronto and elsewhere.

Each type of plow has its place and cannot economically be used in any service for which it is not adapted. It is as improper to attempt to remove six inches of snow with a rotary as to attempt to cut through two feet of snow with a rattan sweeper. In either case the feat may be accomplished, but in neither case with the greatest economy.

Considering the removal of snow in cities, it may be said that experience in Western New York has shown that, with the equipment at hand, the work should be performed about as follows:

On the appearance of a snowstorm, when the streets are free from snow, light plows and sweepers should be gotten in readiness and should commence work when not more than about two inches have fallen. If the storm continues and the snow falls so rapidly that there is a probability that the accumulation between trips of the plows and sweepers will exceed three inches, the heavy shear-plows are sent out. When the ridges formed by the plows and levelers approach twenty-four inches in depth, walkaways are used to level off the same, and shovelers are sent out to clean all crosswalks. At the commencement of a storm a force of trackmen are sent out to clean switches.

In storms of recent years, when snow has fallen to depths of over thirty inches, it has been found impossible to depend upon the light plows and sweepers to do more than follow after the heavy plows, and to clean the street to the pavement. The work of the rotary commences when the banks of snow on either side of the tracks become so high that the plows can no longer shove them back.

The rotary is a slow-moving machine, because of the power limitations of the ordinary street car motor, but its work is positive and effective. As our storms are usually accompanied or followed by high winds, the new-fallen snow is soon piled in drifts in the thinly settled portions of the city. The snow thrown out by the rotary is spread over a large surface and does not materially add to the height of the bank until the snow has become wind-packed and sandy, and then, for the reason stated, the height of the bank is only slightly increased. Teams and shovelers commence the removal of snow at junction points as soon as it accumulates. When the storm is over the work of removing the banks of snow in the business section, thrown up by the plows and from the sidewalks, is undertaken by the railway and city forces jointly.

When the storm ceases our work has just fairly begun. Although there remains little to be done in the centers of the city, drifts are being rapidly formed in the outskirts, and plows and rotaries must remain in constant operation for days tc keep the lines open.

The Rochester snow-plow equipment consists of eight antiquated sprocket-driven mold-board plows, equipped with Westinghouse No. 3 motors, three combined rattan sweepers, one double track four-motor Wason nose plow, one double-end tin fan rotary, two single truck shear-plows and six walkaway or horse-plows. With this equipment was kept open, throughout the severe storms of last winter, 100 miles of track, including twenty-five miles of side or boulevard track, placed between rows of trees on one side, with less than ten feet betwen the two. This peculiar location of tracks renders the use of wings or levelers impossible, and the snow is therefore soon piled up close to the tracks and the cars are operated in a cut, the width of the car body. Under these conditions the removal of snow is made difficult and expensive, and because of the narrow space between rails and sidewalk the number of shovelers and the expense of snow is greatly increased. The cost of removal of snow and ice for the winter of 1901-1902 in Rochester was $90 per mile, a large percentage of which may be attributed to the twenty-five miles of boulevard tracks.

When the average life of a rattan-filled broom is considered, as with its extreme flexibility, the additional cost of a steel broom, properly reinforced by steel plates, is more than made up. Those who have operated steel brooms, driven by fifty-horse power motors, know that they will cut through drifts of moderate depth and sweep the track clean, with no apparent injury to the brooms. For comparison it may be well to state that the steel brushes cost $42 per set, and last from two to five years with ordinary care. A sweeper thus equipped will readily go through two feet of loose snow and at good speed, and will cut all packed snow to the pavement, when properly operated.

Reduction of Garbage.

I am seeking information regarding processes of converting garbage into fertilizer.

In August *Pearsons*, page 159, mention is made of Paul Bruet, a German, in London, who began burning garbage in large vertical cylinders, surrounded by steam jackets, and evaporated the 75 per cent of water in the garbage. The fatty substances were dissolved, and as a result of the process a fertilizer worth $15.00 per ton.

The incinerator built for this city was a failure for the teams drove up an incline and dumped load down chute. After a few loads everything was choked up, no heat could reach the interior of all those slushy loads, and now the garbage is fed to pigs outside of city limits. The approximate quantity is 400 tons per day.

Every one is dissatisfied with past and present means of disposing of this matter, and if I can start up a business to use this matter at a profit I intend to do so, and any information you can give me will be received gratefully.

Considering the large number of days here when the sun is on the job, I believe a long building with a moving platform and glass sun reflectors overhead would be both successful and economical for sunshiny days of spring, summer and fall. But I do not intend to experiment until I get experienced, practical advice.

M., Los Angeles, Cal.

This is too large a problem to be attacked at long range, and in the limited space available in this department.

The description of the London experiment is very imperfect and incorrect, but indicates that Mr. Bruet is trying a process in England, where destruction of garbage has long been almost the only method of disposing of it, which is very similar to some of the methods of reduction of garbage which have been developed in this country, where the reduction plan has been quite popular, especially in the larger cities. Reduction processes extract the grease from the garbage, more or less completely, and produce a comparatively dry "tankage," which is used as the base for making fertilizers. Almost none of the operators of such plants claim profits. In fact, they have almost always combined the collection and reduction of garbage in a single contract, and have required a considerable payment from the city for the double work on the statement that otherwise they could not make a profit. Two cities now collect and reduce their own garbage—Cleveland and Columbus, O.—and we may soon know more of the facts in the case. Both now claim profits from the reduction, not including the collection, but their claims have not yet been substantiated to the satisfaction of all the expert observers. There is a reasonably good profit in the reduction of dead animals, and one developer of reduction plants of long and varied experience makes the definite statement that there is no chance for profit in a reduction plant unless all the "good" garbage, including that from hotels, and all the dead animals are delivered to the plant.

In any particular city the quality of the garbage, the method of collection, the proportion of grease, the number of dead animals and the local influences on cost of operation must be known in order to make any estimate of the returns and the profits.

The description of the operation of the incinerator would indicate that the trouble with the incinerator was not so much with the plant as with the operation of it. Very probably it was seriously overloaded, and there is no worse failure imaginable than that of an overloaded garbage destructor. There is some chance for an overloaded steam plant to stagger through for a while, but none whatever for a garbage plant. There are several very satisfactory incinerators and destructors in operation in this country, and many more in England. The reported bad management of the garbage delivery station to an outsider is a suggestion of ignorance or incompetence in manage of the whole garbage problem in Los Angeles.

The writer is not at all sure that feeding to pigs is not the best solution of the problem for Los Angeles, provided the matter is in the hands of large operators, and is not distributed about among small farmers and irresponsible herders. Denver reports the best of success under this plan, due largely to the close supervision and competent care of the matter by the Board of Health and the contractors, the concentration of the business, and even more largely to the climate, which makes it so much easier to get the garbage to the feeding places in good condition.

The drying of the garbage which seems to be proposed in the later sentences would not prepare it for use as fertilizer. It would make the material easier to burn, and, if the fumes were properly consumed, or the plant were far enough from habitations would not, perhaps, become too serious a nuisance in the dry season at Los Angeles, and possibly not at any season.

The quickest way to dispose of the garbage is to bury it, and in the climate of the Mississippi Valley it then becomes an indistinguishable part of the soil in about two years. Whether the dryer climate of Los Angeles would change this action the writer could not say without further information.

It is hoped that enough has been said to demonstrate the difficulty of the problem and the necessity of expert study of the special conditions of the locality, before selecting any method of garbage disposal.

The intimate relation of city refuse collection and garbage disposal is shown in an editorial in the October number of MUNICIPAL ENGINEERING, vol. xxxix, p. 286.

Specifications for Electric Lighting Contract.

This city is contemplating the letting of a contract for street and commercial electric lighting, and if you could refer me to articles or books dealing with specifications for such electric lighting, they would be very useful to me in drafting our specifications.

W., ———, Ind.

There are now many systems of electric lighting and their efficiencies and economies depend to a considerable extent upon the work to be done, so that specifications which will apply to one city will not apply to another. The advancement in electric lighting is so rapid that no book can be kept fully up to date. MUNICIPAL ENGINEERING has discussed most of the provisions of such a contract, and reference should be made to the following articles:

"Some Provisions in Modern Franchises for Municipal Service Utilities" in vol. xxxix, p. 456, gives some important provisions for such a contract, particularly those providing for future modification of rates. This provision is already made use of under one of the franchises or contracts mentioned in the article.

"Number and Cost of Electric Lights," vol. xxxix, p. 37, gives a list of many previous articles which will be of great value in comparing prices for electric lights of various kinds and for various services in many cities. Several of these articles are in vol. xxxviii, on pp. 107, 186, 169, 186, 187, 249, 330, and are directly to the point.

The contract for ornamental lighting of the business streets of Indianapolis is given in vol. xxxix, p. 50, and may be of interest in this connection.

Other articles in vol. xxxviii of direct application are "Co-operative Franchises for Municipal Public Service Corporations," p. 335; "Factors That Should be Considered in Making Street Lighting Contracts," p. 393; "Cost of Operating Street Lighting System," and "Excessive Rates for Water and Electric Light," p. 417; "Street Lighting," p. 15; "Arc and Other Electric Lights," p. 44; "Distribution of Charges for Electric Power," p. 108; "Cost and Efficiency of Electric Power," p. 266; "Expediency of a Municipal Electric Light Plant," p. 416.

If further investigation is desired, some of the above-named articles give references to articles in previous volumes.

Electric Light Franchise.

Can the twenty-fifth annual report of the Illinois Society of Engineers and Surveyors be obtained, and from whom?

I would like to get a copy of a good progressive electric light franchise, one containing the whole ordinance. I read the articles with interest in MUNICIPAL ENGINEERING on municipal subjects, and have a copy of Wilcox's "Municipal

Franchises." I have also read the article mentioning the Taylorville light ordinance.
B., Bowling Green, O.

The proceedings of the Illinois Society of Engineers and Surveyors can probably be obtained from E. E. R. Tratman, secretary, Monadnock building, Chicago, Ill., at a cost of 50 cents.

No one form of franchise will suit the conditions of two towns in different states and even slightly different physical conditions. There are so many points of difference in customs, requirements, demands, forms of doing business, legal restrictions, and many others, that each franchise must be built for its particular duties. The best procedure, therefore, is to take such articles as "Factors That Should be Considered in Making Street Lighting Contracts," in MUNICIPAL ENGINEERING, vol. xxxviii, p. 393; "Co-operative Franchises for Municipal Public Service Corporations," p. 335; "Some Provisions in Modern Franchises for Municipal Public Service Utilities," vol. xxxix, p. 456, and others referred to therein, and develop a franchise which will suit the local conditions. If there is one already in existence it may be necessary to use that one as the basis for the new one. A franchise for another city can be taken only as an example of what that city has been able to do under its peculiar conditions. A second franchise for another public service corporation is now being put in shape in Taylorville, Ill., which is more comprehensive than the one referred to by our correspondent, because it covers electricity, gas and heat, and when it is completed it will be printed. Meantime can any of our Ohio readers, or those from other states, send copies of their electric light contracts or franchises with comments as to the provisions they think bad as well as those which are good?

The preparation of a franchise or contract with a public service corporation is the most important act of a city council, and should not be undertaken without the fullest and most public discussion and all the expert aid which can be made available.

Gas Processes and Rates.

Will you kindly give me such information as you can as to what is an average or fair rate to be paid to manufacturers of gas, or to be reserved to the manufacturers in a franchise to be granted by a city of this size, viz., 5,000 people?

An exclusive franchise is asked and the right to charge certain rates, to both private consumers and the city, is to be reserved to the manufacturers under the franchise.

I will appreciate any information you can give me along the lines as to what is a fair rate.

Please quote both ways, where the gas is to be manufactured from coal and from crude oil. P. G. E., City Attorney,
————, Colo.

This is a question which requires detailed study in order to give a reply which will be just to both company and consumers. The cost of the plant is an important item, and this will depend upon the process chosen, the probable capacity required, the density of the population using the gas, which may be expressed in cubic feet of gas consumed per day or year, per mile of mains, etc. Judgment as to probable rate of increase in patronage, number of consumers per mile, whether gas will be used for both lighting and fuel or for both, etc., must be exercised carefully if a single rate is fixed.

Cost of coal or oil, wages, cost of management, interest on cost of plant, allowance for depreciation, must all come into the daily cost of maintenance and operation.

Under expert state supervision of public service corporations it is possible to fix rates which will be fair to both sides. If they are not right at any time, on account of errors in first determination or on account of changes in conditions, the state commission can call for the accounts of the company, take evidence on both sides of the case and fix the rate accordingly.

Where there is no such state commission it has not been customary to require a company to show its books to the local authorities, although, in making a contract, the council has the right to insert such a provision. In some cases, such as those mentioned in the article on another page on "Some Provisions in Modern Franchises for Public Service Utilities," this examination of books is put in the hands of an expert commission appointed in such manner as to be independent and unbiased.

Another method of fixing rates would be to compute for an assumed small beginning consumption of gas the proper rate to give the company a just return on the capital invested, including all items of construction, working capital and legitimate expense. Then compute the rates for assumed larger consumptions and insert in the franchise a proviso that the rate shall be a fixed amount until the consumption reaches a certain figure, when it shall be reduced to a given rate, such reductions being made according to a schedule fixed in the franchise as the consumption increases. To secure rates which will be at all times fair to both manufacturer and consumer, the advice of one experienced in this line should be sought.

The writer would not venture to suggest a rate without full knowledge of the local conditions. One small city may be able to secure a rate of, say $1.25, when another city of like size would put its company into bankruptcy by reducing the oven processes produce gas the cheapest, but where the consumption is small and even the smallest practicable plant can not be operated all the time, the water rate below, say $1.75.

It is probable that water gas would be the cheapest for a city of this size and location, although a large consumption of gas for fuel or a low price for coal might reverse the statement. In large quantities, and where the residuals of manufacture can be disposed of advantageously, the coal gas and some coke gas process has an advantage even without residuals to sell as by-products. In many cases of cities somewhat larger than that of our correspondent a combination of the two processes produces the best financial results.

Some of these problems have been discussed in MUNICIPAL ENGINEERING in such articles as the following:

In vol. xxxxix: "A Bill to Control Gas Companies in the District of Columbia," p. 51; "Enlargement of Municipal Gas Plant at Westfield, Mass.," p. 132; "Investigation of Washington Gas Cost," p. 133; "Determining Minimum Charge for Gas," p. 222; "Flow of Gas in Pipes," p. 310. The various processes of making gas and their applicability to a city of somewhat larger size than the above are discussed on p. 389.

In vol. xxxviii: A list of books on gas making is given on p. 107, also one of a few articles on gas. Another list will be found on p. 188. The principles underlying some proposed new franchises are discussed on p. 315, and they may be applied to a gas franchise although none of those mentioned are for gas or lighting companies.

In vol. xxxvii: An article on "Municipal Gas Plant Experiences" on p. 315 gives pointers of some value.

In vol. xxxvi: "Quality of Gas," p. 286.

In vol. xxxv: "Books on Gas Manufacture," p. 35; "Principles Underlying a Street Lighting Contract," p. 96. "A Modern Municipal Franchise," p. 306, gives the provisions in the latest contract in Indianapolis with a gas company, which is able to make money on a 60-cent rate.

In vol. xxxxiv: A list of previous articles on gas rates and costs, p. 29; "Effects of a Reduction in the Price of Gas," p. 144; "Ownership of Gas Meters and Service Pipes," p. 370.

The following list of gas rates in cities of about 5,000 to 10,000 population will show the variations but not the full reasons for them:

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
ALABAMA.						
Anniston, coal	$2.20	....	$1.50	$1.40	$1.10	$1.00
Eufaula, coal	3.20	....	1.75	1.58	1.50	1.35
Florence, coal	3.00	....	1.65	1.50	1.65	1.50
*Talladega, coal	2.25	....	1.50	1.25	1.50	1.25
ARIZONA.						
Douglas, Beale crude oil	....	3.928	....	1.50	....	1.50
ARKANSAS.						
Helena, coal	3.37	....	2.50	2.00	....	1.25
CALIFORNIA.						
Anaheim, Beal crude oil	....	5.5	1.50	1.25	1.50	1.25
Bakersfield, Lowe crude oil	....	$1†	2.00	1.50	2.00	1.50
Chico, Lowe crude oil	....	2.5	....	1.50	....	1.50
Covina, Western oil	....	90†	1.50	....	1.50	....
Grass Valley, Lowe crude oil	....	3.6	....	1.50	....	1.50
Hanford, W. C. Con. Co. oil	....	2.15	2.00	1.75	2.00	1.75
Long Beach, New Lowe crude oil	..	....	1.25	1.00	1.25	1.00
Marysville, Lowe crude oil	....	2.4	....	1.50	....	1.50
Modesto, New Lowe crude oil	....	$1.05†	2.00	1.90	1.50	1.40
Monrovia, Lowe crude oil	....	....	1.50	1.35	1.50	1.35
Napa, Lowe crude oil	....	2.4	....	1.50	....	1.50
Oroville, Lowe crude oil	....	....	2.50	2.00	2.00	1.50
Oxnard, Lowe crude oil	....	1.55	....	1.25	....	1.25
Palo Alto, Lowe crude oil	....	....	....	1.50	....	1.50
Pomona, Lowe crude oil	....	....	1.10	1.00	1.10	1.00
Redding, Lowe crude oil	....	....	....	1.50	....	1.50
San Pedro, Lowe crude oil	....	....	1.50	1.35	1.50	1.35
San Rafael, Lowe crude oil	....	2.4	....	1.50	....	1.50
Santa Ana, Lowe crude oil	....	....	....	1.00	....	1.00
Santa Clara, Lowe crude oil	....	2.38	1.50	1.25	1.50	1.00
Visalia, W. G. C. Co. oil	....	2.5	2.00	1.50	2.00	1.50
Watsonville, Lowe crude oil	....	....	....	1.50	....	1.50
Whittier, Lowe crude oil	....	....	1.50	1.35	1.50	1.35
COLORADO.						
Canon City, Lowe crude oil	4.45‡	3.5	2.00	1.50	1.25	1.25
Ft. Collins, P. English oil	3.25	4	....	1.50	....	1.00
Grand Junction, coal	3.10	....	1.60	1.52	1.60	1.52
Greeley, coal	4.55	....	1.75	1.50	1.75	1.00

*Municipal plant.
†Per bbl.
‡Price of coke per ton.

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Net.	Fuel. Gross.	Net.
CONNECTICUT.						
Bristol, Lowe	5.85	....	1.60	1.50	1.60	1.00
Putnam, Lowe	6.10	3.8	2.00	1.65	1.35	1.25
Rockville, Lowe	....	....	1.60	1.30	1.60	1.30
Wallingford, Lowe	....	5	....	1.50	....	1.50
West Winsted, Lowe	6.75	....	1.60	1.50	1.60	1.50
FLORIDA.						
Gainesville, Sutherland	6.00	4	2.25	2.00	2.00	1.80
Miami, Logan & Janeway	....	4.5	....	1.50	....	1.50
Ocala, Lowe	7.60	3.67	2.00	1.90	1.50	1.40
Orlando, coal and Lowe-Granger	4.75	3.75	....	2.00	....	1.60
St. Augustine, Lowe	....	....	1.60	1.50	1.60	1.50
GEORGIA.						
Brunswick, coal	....	....	2.00	....	1.50	....
Cartersville, coal	2.50	....	....	1.25	....	1.25
Dalton, coal	2.25	....	....	1.00	....	1.00
Valdosta, coal	....	....	2.00	1.50	2.00	1.50
IDAHO.						
Lewiston, coal	5.70	....	2.25	2.00	2.25	2.00
ILLINOIS.						
Beardstown, coal	4.50	....	1.50	1.35	1.50	1.35
Belvidere, Lowe improved	5.15‡	2.85	....	1.20	....	1.20
Canton, coal	4.10	....	2.00	1.25	1.50	0.90
Clinton, coal	3.89	....	1.25	1.25	1.25	1.25
Dixon, coal	4.25	....	1.25	1.15	1.25	1.15
Du Quoin, coal	1.50	....	1.50	1.25	1.50	1.25
Galena, coal	....	....	....	2.00	....	2.00
Litchfield, Kendall oil	....	2.5	2.00	1.50	1.50	1.35
Macomb, Lowe	5.95‡	3.125	1.50	1.25	1.50	1.00
Mendota, coal	5.00	....	1.40	1.25	1.40	1.25
Morris, Lowe and Sutherland	5.00‡	2.85	1.50	1.50	1.50	1.50
Mt. Carmel, Lowe	....	2.65	1.10	1.00	1.10	1.00
Murphysboro, Lowe	....	....	1.50	1.25	1.50	1.25
Pontiac, coal	....	....	1.25	1.19	1.25	1.19
Princeton, coal	4.10	....	1.50	1.25	1.50	1.25
Taylorville, Lowe	....	....	2.00	to		1.25
INDIANA.						
Aurora, coal	2.00	....	1.50	1.25	1.50	1.00
Bedford, coal	....	....	....	1.00	....	1.00
Connersville, coal	3.00	....	1.50	1.15	1.50	1.15
Crawfordsville, coal and Lowe	3.45	....	1.50	1.20	1.50	1.20
Franklin, coal	....	....	....	1.10	....	1.10
Goshen, coal	2.85	....	1.25	1.00	1.25	1.00
Huntington, coal	....	....	....	1.25	....	....
Lawrenceburg, coal	3.00	....	....	1.25	....	1.25
Madison, coal	3.05	....	1.65	1.50	1.10	1.00
Martinsville, Lowe	4.00‡	3.4	1.35	1.00	....	....
Plymouth, Lowe	2.65‡	3	1.35	1.25	1.35	1.25
Rochester, coal	3.15	....	1.35	1.25	1.35	1.25
Rushville, oil	....	....	1.60	1.50	....	....
Seymour, coal	....	....	1.50	1.25	1.50	1.25
Valparaiso, coal and Lowe	3.25	3.5	1.50	1.25	1.50	1.00
Warsaw, coal	3.15	....	....	1.00	....	1.00

Rails for Street Car Tracks.

Will you kindly give me some information as to the relative merits of Tee rails vs. the Trilby rails and also a list of cities in which the Trilby rails are used?

P., City Engineer, ———, Cal.

It seems to be generally conceded now that for permanence of construction a depth of rail of some 7 inches is necessary. Nine-inch rails have been used successfully in some cities, but if heavy interurban cars are run over them they must be so heavy that they are unduly expensive, otherwise there may be the complaint reported from Indianapolis that the web was so light that a lateral motion was apparent under the heavy cars.

This, or its equivalent, conceded, the question becomes one of the form of the surface of the rail and the laying of the pavement against it. There are many differences of opinion as to which is the best, probably because not all consider at the same time the relations of the form of rail surface to the form of paving adopted.

The T-rail is used to greater or less extent in such cities as Dayton, O., Davenport, Iowa, Delaware, O., Denver, Col., Erie, Pa., Indianapolis, Ind., Kansas City, Mo., Milwaukee, Wis., Minneapolis, Minn., New Haven, Conn., St. Paul, Minn., Schenectady, N. Y., Scranton, Pa., Tacoma, Wash., Terre Haute, Ind., Amsterdam, N. Y.

The girder rail is used in such cities as Syracuse, N. Y., Baltimore, Md., Brooklyn, N. Y., Buffalo, N. Y., Cambridge, Mass., Cleveland, O., Detroit, Mich., Louisville, Ky., New York, N. Y., Richmond, Va., Rochester, N. Y., Springfield, Mass., Washington, D. C., Waterbury, Conn., Worcester, Mass., Columbus, O., Chicago, Ill., as well as most of the cities in the former list. Many of these cities use grooved rails, but some use a flat tread.

Track construction in Indianapolis for some of the interurban service with 7 and 9-inch T-rails and brick pavement along the tracks, is described in articles in MUNICIPAL ENGINEERING, vol. xxxviii, p. 133; vol. xxv, p. 342, and vol. xxxii, p. 327. Rails less than 7 inches deep are not stiff enough for street work. A new method of track construction is described in vol. xxxii, p. 38, and vol. xxxiv, p. 40.

In vol. xxxiii, p. 425, is a brief description of El Paso, Tex., tracks using 9-inch, 90-pound, grooved rail. Other brief articles giving valuable information are, "Paving Street with Street Railway Tracks," vol. xxxii, p. 319; "T-Rails in Paved Streets," vol. xxxii, p. 320; "Street Railway Track in Macadam Streets," vol. xxxi, p. 282, stating the conclusions which lead to the selection of the T-rail for such work, and giving reference to earlier detailed articles, giving various points of view; "Form of Rail for Paved Streets," vol. xxx, p. 354.

Iron and Brick Paving Blocks for T-Rail Street Railway Construction.

I noticed in your publication some time ago an advertisement of a metal block, which was intended for the purpose of converting a T-rail into a grooved rail. This block was intended to serve the same purpose as the special brick made by the brick people for placing on the inside of T-rails and was somewhat of the same shape, although it was made of metal instead of clay or shale. If you would give me the address of the manufacturer of this metal block I would appreciate it very much.

H. L. S., Lynchburg, Va.

The only such block known to the writer is the Buckland paving block. It is described in MUNICIPAL ENGINEERING, vol. xxiii, p. 136, and is said to have been used in Springfield, Mass., Hartford, Conn., Norfolk, Va., Atlanta, Ga., and elsewhere. The name of the manufacturer is not given. Either this block was not successful or was not properly advertised, for nothing further has been heard of it.

A brick block for use with T-rails is described in vol. xxviii, p. 265. It was invented by W. H. Arthur, Stamford, Conn., and is sold by him and the Mack Manufacturing Company, Philadelphia, Pa. Other special forms of brick for such use are described in vol. x, p. 154, and vol. xxxii, p. 327, which can be made by any paving brick manufacturer.

Information About Calcium Chloride.

I find on page 392, November MUNICIPAL ENGINEERING a letter in regard to advantages of calcium chloride in highway construction. I should like to know where I can secure more information about this material and where it can be purchased in quantity.

G. E. S., New Haven, Conn.

Hubbard's "Dust Preventives and Road Binders" ($3) and Judson's "Road Preservation and Dust Prevention" ($1.50) give reports regarding the use of calcium chloride in reducing the dust nuisance. The former book gives the fuller treatment of the subject. Our correspondent, who is a new subscriber, is referred to the following articles on the use of calcium chloride in the last volume, xxxix, of MUNICIPAL ENGINEERING: "Calcium Chloride as a Dust Layer," p. 30, with references to previous articles on the subject; "Calcium Chloride and Its Action on Road Surfaces," p. 122, being a report of English practice and results; "Calcium Chloride for Dust-Laying and Road Maintaining Purposes," p. 214, being another letter from Mr. Howe; "Relative Action of Calcium Chloride and Oil on Stone and Gravel Roads," p. 292, the article referred to by our correspondent.

There are a number of manufacturers of calcium chloride. Those nearest our correspondent are Merrimac Chemical Co., Boston, Mass.; Eimer & Amend, 205 3d ave., Roessler & Hasslacher Chemical Co., 100 William st., Wm. H. Scheel, 159 Maiden Lane, Chas. E. Sholes Co., 164 Front st., New York City; Solvay Process Co., Syracuse, N. Y.

Books on Bituminous Road Construction.

Can you tell me if there has yet been published any reliable work setting forth all the bituminous binders now recognized as good in road and street work?

Also, can I find any publication dealing with all the methods of reducing or eliminating dust by surface applications?

A. T., Jackson, Tenn.

New processes are presented to the trade so frequently that no book can keep up with them. The volumes of MUNICIPAL ENGINEERING are the freshest and most complete source of information.

Judson's "Road Preservation and Dust Prevention" ($1.50), gives brief descriptions of the character and use of each of the processes of dust control and prevention, under the classification of moisture, oil emulsions, oils, coal-tar preparations, with fuller descriptions of machines and of methods of construction of more permanent tar-macadam roads.

Hubbard's "Dust Preventives and Road Binders" ($3) is a larger book which goes into more detail, and is probably the book nearest what our correspondent desires.

Smith's "Dustless Roads and Tar-Macadam" ($3.50) is an English book devoted particularly to tar binders and tar spraying, and is the most complete book on this material, giving the excellent English practice. All these are reviewed in MUNICIPAL ENGINEERING, vol. xxxix, pp. 320 and 321.

As an example of what is presented in MUNICIPAL ENGINEERING the following titles of articles in vol. xxxix, just completed, are given: "Calcium Chloride as a Dust Layer," p. 30; "Books on Macadam Country Roads," p. 34; "Specifications for the Bitu-Mass Pavement," p. 64; "Supplying Individual Demands for Asphaltoilene,' p. 67; "The Modern Problem of the Road, p. 109; "Cost of Asphalt and Bitulithic Pavements,' p. 113; "Calcium Chloride and Its Action on Road Surfaces," p. 122; "The International Good Roads Congress," p. 171; "Bituminous Roads, Mixed and Poured," p. 178; "Calcium Chloride for Dust-Laying and Road Maintaining Purposes," p. 214; "How to Lay Bitu-Mass," p. 242; "Work Preliminary to Road Construction and Street Pavement Maintenance," p. 270; "Tar Macadam Test Road," p. 295; "Bitulithic Pavement in Oklahoma," p. 332; "Bituminous Pavements, Patented and Otherwise," p. 358; "The Economics of Modern Highway Engineering," p. 374; "Relatives Action of Calcium Chloride and Oil on Stone and Gravel Roads," p. 392; "The Ohio Experiments on Road Binding Materials," p. 401; "A Pressure Road Oil Machine," p. 407; "A Portable Asphalt Plant," p. 410; "Road Surfaces to Suit the Traffic," p. 466; "Asphalt, Asphalt Macadam and Bitulithic Pavements," p. 475; "The Application of Oil to Highways," p. 490.

Oiling Highways.

I would like to see the subject of crude petroleum for highways discussed, methods, results, specifications.

B. S. R., ———, Okla.

Good discussions of this subject will be found in Judson's "Road Preservation and Dust Prevention" ($1.50) and Hubbard's "Dust Preventives and Road Binders," ($3).

The general conclusions reached are that the best results are obtained from crude petroleums having asphaltum base and that those having paraffine base are much less effective. Residual oils from the asphaltic oils are also used.

Mr. Hubbard says that specifications for oils or tars with which to treat roads must be made to suit the local requirements but suggests the following as a statement of what may well be required:

1.. The oil shall have a specific gravity not greater than 1.05 and not less than 0.98 at 25 deg. C., unless the residue obtained from the volatilization test (in clause 5) has a specific gravity of not less than 0.985.

2. It shall be soluble in -. p. carbon bisulphide at air temperature to at least 99 per cent. and shall contain not over 0.3 per cent. organic matter insoluble.

3. It shall contain not less than 12 per cent. nor more than 25 per cent. of bitumen insoluble in 86 deg. B., paraffin naphtha at air temperature.

4. When tested for 5 seconds at 25 deg. C, with a standard No. 2 needle weighted with 100 grains, it shall show a penetration of not less than 15.0 mm., nor greater than 25.0 mm., unless the residue obtained from the volatilization test (in clause 5) shows a penetration of not over 20.0 mm. when tested in the manner above described.

5. When 20 grams of the material is heated for 5 hours in a cylindrical tin dish approximately 2½ inches in diameter by 1 inch high at a constant temperature of 13 deg. C., the loss in weight by volatilization shall not exceed 20 per cent. The residue remaining shall show a penetration of not less than 10.0 mm., nor greater than 20.0 mm. when tested in the manner hereinbefore described.

6. Its fixed carbon shall not be less than 6 per cent. nor greater than 20 per cent.

7. The oil shall be free from water upon delivery.

These specifications eliminate some materials which it may be desirable to allow in some cases. In such cases the specifications may be modified, so as, for example, to admit preparations of Trinidad asphalt, tar products, or solid native bitumens. The true paraffin materials are eliminated and the oil will not be too hard under service conditions nor too volatile.

Specifications for applying oils to roads depend upon the material of which the road is made, whether earth, gravel or macadam, loose or compacted, and upon whether the oil is to be used by the penetration method to lay the dust and keep it down, or is to be mixed with the road material as it is laid and compacted, the oil thus becoming more or less a binder for the road materials as well as controlling the dust.

Information from various standpoints will be found in the following articles in MUNICIPAL ENGINEERING: In vol. xxxix: "Relative Action of Calcium Chloride and Oil on Stone and Gravel Roads," p. 392; "The Ohio Experiments on Road Binding Materials," p. 401, not including oil; "Road Surfaces to Suit the Traffic," p. 406. In vol. xxxviii: "Comparative Road Tests at Cornell University," p. 92. In vol. xxxvii: "Materials for Tarring Macadam Roads," p. 18; "Methods of Examination of Bituminous Materials for Use on Roads and Streets," p. 20; "Some Consideration of the Necessary Changes in Construction to Adapt Macadam Roads for the New Traffic," p. 109; "The Cost of Adapting Macadam Roads to Automobile Traffic," p. 143; "Dust Abatement by Surface Applications," p. 236, gives clear descriptions of methods of application of materials, which may be used as the basis for specifications covering the workmanship; "Specifications for Bituminous Macadam Pavements," p. 254, gives general terms of specifications and references to many specific sources of information and details of specifications, as well as references to previous articles in MUNICIPAL ENGINEERING; "Tar in the Surface Treatment of Roads," p. 297, also treats of the use of oil to some extent; "Three Years of Experience with Oiling Roads," p. 381. These may be used, when conditions are compared with those of the locality, to aid in the preparation of specifications. Other articles on the subject will appear from time to time in future numbers, on all the surface treatments of roads for dust abatement.

Street and Sewer Designs for New City.

1. With regard to our streets I may say they have never been properly made at all, but consist of loose gravel dumped on top of the black loam soil. They will have to be plowed up to a certain depth. My idea is that for a 66-foot street the construction might be as follows: 8.5 ft. sidewalk on each side, 3-ft. boulevard on each side, to have easy access to drain laid under it at any time, 1.5 ft. for surface water drainage on each side, 40 ft. for actual road. What do you think of this plan? In rocking the road what sizes would you have for the crushed rock? If there are three layers, what proportion of each size should be used, and what rise should be made?

2. I should be glad to have your opinion upon combined surface water and sewerage system. Can this be carried out in perfect safety? Would it be a practical idea to have drain as in the road description above where any gases in the sewage drain would be sealed by traps in the connections by which the surface drainage reaches the drains?

G. W. N., Chilliwack, B. C.

1. The layout suggested is apparently for a residence street. In such case the sidewalk is wider than is necessary and so is the street. A width of 5 or 6 feet for sidewalk is generally considered sufficient under such circumstances, and there is no necessity for a street wider than 27 to 30 feet, including surface drainage gutter. This would leave 12 to 15 feet for each lawn or "boulevard," as it is termed by our correspondent. Except for ease in turning vehicles at any place, the width of the roadway may be made materially less than 27 feet. The drains, if intended to carry drainage water only, may be laid under the lawns as described, but trees will undoubtedly be planted in the lawns, and their roots will give trouble by finding their way through the joints into the inside of the drains, and it will be desirable to put the drains as far from the trees and as near the gutter as possible. If the gutter is not paved the drain might even be directly under it. Specifications for the road construction should be fitted to the local circumstances, physical and financial. Roads vary from 4 to 16 inches in thickness, according to the amount and weight of traffic, 6 to 8 inches being common for ordinary light traffic on residence streets. Sizes of stone vary also according to traffic and thickness of layer and quality of stone from 2 to 4 inches for the lower layers, and ½ to 2 inches for top layer, not including the binding material used, which is made up of smaller sizes and dust. The thickness of each layer should be at least equal to the largest dimension of the stone used, and two or three layers are used according to the size of stone used, the total thickness of the macadam, and the character of the construction for the traffic to be carried. These suggestions are as definite as should be given without full knowledge of the local conditions. The amount of crown or "rise" varies according to the width of road, amount of traffic, promptness with which repairs are made, longitudinal slope, etc. The extreme limits are about 1 in 12 and 1 in 30. That is, in a road 30 feet wide the center would be 6 to 15 inches higher than the sides of the road. Probably 7 to 9 inches would be considered most common in a residence street. Among many articles in MUNICIPAL ENGINEERING of direct application, reference may be made to one in vol. xxxviii, p. 306, for interesting information on cross section of highway.

2. The choice of the separate or the combined system of sewerage and drainage is one which could be made only after a careful study of the local conditions. Both are in successful use. The writer has used both systems, selecting the one to be used, first, from sanitary conditions, and second, from considerations of economy. No two cities are alike in this regard, and what is right for one may be quite the reverse for another. The question has been discussed at some length in several articles in MUNICIPAL ENGINEERING, some of which are the following: "Exposed Sewers at Leavenworth, Kan.," vol. xxxix, p. 347; "Sewerage and Drainage of Clinton, Iowa," vol. xxxvi, pp. 163, 220, 300; "Ordinance Controlling Tree Location and Roots in Sewers," vol. xxxvi, p. 236, giving references to earlier articles on the same subject; "Problems in Street Paving and Drainage," vol. xxxv, p. 105; "Tight Joints in Pipe Sewers," vol. xxxv, p. 356; "Roots in Sewer Pipe," vol. xxxiv, p. 239; "Notes on Sewer Design," vol. xxx, p. 329; "Rainfall and Runoff in Sewer Design," vol. xxix, p. 161; "Sewerage and Sewage Disposal at Bedford, Ind.," vol. xxvi, p. 109; "Best Plan for Sewerage for Small City," vol. xxiv, p. 276; "The Separate System of Sewers of Brantford, Can.," vol. xxii, p. 70; "Sewer Systems for Small Cities," vol. xxii, p. 303; "Sewer Systems of Small Cities," vol. xxi, p. 25; "Comparative Merits of Separate and Combined Systems of Sewerage," vol. xviii, p. 170; "Merits of Combined and Separate Systems of Sewerage," vol. xv, p. 306.

Literature from the Cement Industry.

Can you give me the names of any manufacturers of cement who publish literature containing illustrations of the cement industry? The information will be greatly appreciated.

MARY J. BOOTH,
Librarian, State Normal School,
Charleston, Ill.

The Atlas Portland Cement Co., Dept. N., 30 Broad street, New York, publishes the most elaborate books of this kind. The Indianapolis, Ind., office of the Lehigh Portland Cement Co., F. E. Paulson, general sales agent, publishes a monthly leaflet largely devoted to pictures of work in which their cement has been used. The Universal Portland Cement Co., Chicago, Ill., publishes a similar monthly "Farm Cement News." There are others. Letters to the cement manufacturers listed in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the heading "Cement," will bring their catalogs and other literature of the nature desired.

Another Dealer in Crushed Granite.

In the Question Department of MUNICIPAL ENGINEERING, vol. xxxix, p. 35, we note your answer to same, giving names of different companies in the north and south, but you did not mention us. We are in a position to furnish red granite, crushed granite and crushed quartz.

ST. LOUIS CRUSHED QUARTZ CO.,
Roe Building, St. Louis, Mo.

Lime in Portland Cement Mortar.

Can you tell me the effect of mixing lime with Portland cement for concrete and for mortar? I have read that one neutralizes the other, and that such a mixture is weaker than if either the lime or cement had been left out.

R. H. P., Kelowna, B. C.

If the lime is dry and hydrated it can be mixed with the Portland cement without injury. In fact, the lime acts to make waterproof the mortar and the concrete made with the mortar, if the right proportions of ingredients are used, because the fine lime powder closes the voids in the materials, thus preventing the passage of moisture. By the same filling of the voids in the mortar, even up to 15 or 20 per cent admixture of hydrated lime, seems to increase the tensile strength of the mortar. In general, therefore, it may be said that the use of the right proportion of hydrated lime in Portland cement is advantageous.

This subject is discussed in MUNICIPAL ENGINEERING in the following articles: In vol. xxxix: "The Effect of Waterproofing Compounds on the Permeability and Tensile Strength of Concrete," p. 225; "Hydrated Lime, p. 94. In vol. xxxviii: "Hydrated Lime Makes Concrete Waterproof," p. 129. In vol. xxxiii, "Hydrated Lime in Concrete," p. 342, showing the good results of using it and giving references to a number of earlier articles giving details on the same subject.

Such books as Sabin's "Cement and Concrete" ($5) and Taylor & Thompson's "Concrete, Plain and Reinforced" ($5), give results of tests and experience, practically all of which are favorable to the proper use of hydrated lime in Portland cement mortar.

Concrete Silos.

As a reader of your magazine I would like some information in regard to cement silos, either of concrete or cement blocks, and both.

First, I would like to know if either gives satisfaction as to keeping of the silage, and which is the best and cheapest.

Second, some kind of specifications and prices for both; also names and addresses of parties having built or had them built.

Third, whether or not it is better to, or not to, have a continuous door from the bottom to top.

Fourth, parties' names that make molds for blocks, or forms for silos, and any thing of interest in this line.

J. D. B., Cedar Rapids, Iowa.

The increasing number of concrete silos is evidence that they are satisfactory for keeping ensilage. The only complaints known to the writer are that if the inside of the wall is rough the ensilage will settle unevenly, on account of uneven friction on the walls, and the ensilage about the small air spaces thus formed will become moldy and must be thrown away. There is a similar effect if the inner surface of the wall is porous, for it will then absorb moisture from the adjacent ensilage, causing "dry firing" to a certain extent. The walls should also be air-tight to prevent excessive fermentation. It is claimed that well constructed concrete silos are better in all these respects than those built of any other material. There does not seem to be any material difference between the various methods of building silos, as regards satisfactory keeping of the ensilage, provided the construction is the best of its kind. This may be modified in cold climates by the desirability of the hollow wall, monolithic or block construction, to prevent freezing during the severe winter weather. The question of cost seems to depend upon local conditions, neither form being the cheapest everywhere.

2. Probably the most complete specifications, or rather descriptions of methods, will be found in a booklet "The Modern Farmer," published at the Indianapolis, Ind., office of the Lehigh Portland Cement Co. Other specifications will be found in the Atlas Portland Cement Co.'s booklet on "Concrete Construction About the Home and On the Farm." These specifications are also printed in MUNICIPAL ENGINEERING, vol. xxxv, p. 103. The Universal Portland Cement Co., Chicago, publishes "The Farm Cement News," which also considers the subject. The following addresses of those having concrete silos are taken from these various sources: U. S. Soldiers' Home, Washington, D. C.; Gedney Farms, White Plains, N. Y.; Blue Label Cheese Co., Winslow, Ill.; F. J. Bosler, Georgia, Ind.; Wilrus Stock Farm, Wausau, Wis.; A. O. Fox, Oregon, Wis.

3. Provided the door planks are so constructed as to be water and air tight

and the steel reinforcement is properly carried across the opening, the continuous door may be used. Some excellent silos use the continuous door with an exterior chute built around it and into the silo wall each side. The structure would seem to be somewhat more stable when empty if the openings are in sections and not all run into one continuous opening.

4. Any of the standard cement block machines may be used for making the blocks, provided, first, that the circular arc required for the size of silo to be built can be supplied in the forms, that the blocks can be made of sufficiently wet mixture to insure that they are water tight and practically air tight. The specifications referred to describe method of making and handling forms for the monolithic and hollow monolithic concrete walls.

For names of makers of molds, machines and forms for block and concrete, reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Chimneys," "Concrete Blocks," "Concrete Block Machines," "Concrete Chimneys."

Real Estate Registry.

Will you kindly give me information concerning kind of records to be kept for real estate registry. We are about to establish a real estate registry, and would like to have the best system that can be had for a city of 12,000.

J. M. S., ———, Pa.

Will our readers favor this correspondent with their suggestions?

In some Indiana counties maps are made by order of the county commissioners at intervals of several years upon which the real estate transactions are entered from the county recorder's books, and these maps are the basis of the work of the township and county assesnors. They are on a large scale, and changes in ownership and descriptions of property are entered upon them until they pass the readable stage, when a new and revised copy is made. This may possibly answer the purposes of our correspondent as a real estate registry.

Commission and Other Forms of City Government.

I am a reader of MUNICIPAL ENGINEERING and would like to have some information on the commission and recall form of government for cities.

Could you advise me as to the objections being made to the new form and in what way the ward system is preferable to the new form, and vice versa? I would greatly appreciate any information on this subject, or reference to any authority on this subject.

E. H. S., Ottawa, Kan.

There is much misconception of what constitutes the commision form of government and the arguments for and against it are many of them misapplied on that account. Non-partisan nominations, elections at large and not by districts, initiative and referendum, the recall, are all ideas which were developed and applied long before the commission form of government, so-called, was instituted and they are applicable to most if not all, other forms of city and state government. They have been applied, some of them, to the so-called federal form of government in the new Boston charter, a form which is not truly federal, but is a business-like organization having some resemblances to the federal form, but really based on another principle. The Galveston plan has come to be called the commission plan, and was successful under the peculiar conditions there existing, and it differs from others in electing five persons to be equally responsible or irresponsible, in the municipal government. It is a reversion to the old council form of government, which has long been discredited in this country, though far more successful in England, whose municipal voters are in this respect more democratic and more interested in good government for themselves. But it lacks the salutary veto power of the mayor. Besides the circumstances of the case, the adoption of the non-partisan nomination of candidates and the selection of candidates for merit account for the early success of the plan.

No other city has adopted the Galveston plan entirely. Each city or state adopting the plan has made its addition of safeguards, which are the really valuable features of their plans. They succeed in spite of the strictly commission feature.

The city of Indianapolis, the originator of the Indianapolis plan, misnamed the federal plan, is now discussing the commission plan, but has not yet separated the commission feature from the other features named, and is floundering in the fog of misunderstanding and misconception of the two plans, and does not yet see that the good features of the plan they are calling the commission plan, can be applied equally well to the Indianapolis plan, thus improving that plan and escaping the dangers existing in the one feature which is, strictly speaking, the only feature properly bearing the name "commission plan."

Articles elsewhere in this number of MUNICIPAL ENGINEERING give further details regarding the discussion.

On p. 36 of vol. xxxix, is an article on charter for small city, which refers also to one in vol. xxxviii on the commission form in Memphis, really the first city in the country to use the form; one in vol. xxxviii, p. 345, compares the commission and federal forms; one in vol. xxxviii, p. 404, describes the Indianapolis form, etc. There is a brief outline of the Illinois law in vol. xxxix, p. 219. In earlier volumes are more or less extended descriptions of the forms in use in Galveston, Des Moines, and elsewhere.

Influence of Indeterminate Franchises on Sales of Bonds of Public Service Corporations.

Will you kindly send me such data and information as you have at your command in regard to the sale of bonds of public utility corporations operating under long-term franchises, as compared to the sale of bonds of corporations operating under indeterminate franchises? Our local public utility corporations have made the argument that if their franchise was made an indeterminate one, that they could not extend their lines because they could not dispose of the bonds readily. They wish to have their franchise extended from twenty-five to fifty years. This proposition will be submitted to the voters of this city in the form of a charter amenment. We wish to offer an alternative proposition along the lines of granting an indeterminate franchise. In order to be perfectly fair to all, we wish to have as much information upon the subject as we can obtain.

Your kindness in this matter will be greatly appreciated.

PERCIVAL E. WOODS,
Supt. Dept. of Finance, Ways and Means, San Diego, Cal.

It will be impossible to answer this question definitely. Legislation and court decisions have been so generally opposed to long-term franchises that the arguments against fifty-year franchises have crystallized very definitely, and the effect of reducing the length of franchises to twenty-five years or thereabouts, has been so discounted that, especially in states where these shorter terms are the only ones available, the bond market for the securities of public service corporations is reasonably steady, and apparently not much more difficult than that for the longer franchise terms. Indeed, twenty-five to thirty years is now generally accepted in most parts of the United States as a reasonable limit for franchises granted by municipalities.

Of late years there has been a strong tendency to scrutinize the securities of public service corporations much more closely than in the past. This has come about because of the criminally careless management of some, the equally criminal manipulation of others, and the real instability, as shown by experience, of long-term franchises if they are not equitable, or have been outgrown by the city granting them or the companies operating under them. The shortening of the franchise term is even considered an advantage by some investors, as it has a tendency to keep the feet of the managers a little nearer to solid earth.

This demand of stockholders for more efficient service by the managers of their companies is met, without trouble or expense to them, by the supervision of the companies by state commissioners. The Wisconsin law proceeds frankly on the principle that this supervision is as advantageous to the companies as it is to the cities interested, and offers the benefits of the law to all companies who will give up their term franchises, long or short, and accept the regulation of the state commission, and franchises of indefinite length, i. e., continuing during good behavior. The commission has demonstrated the propriety of this assumption and most of the public service corporations have acknowledged its validity by accepting the indeterminate franchises and state regulation. There is no pronounced complaint of objectionable effect upon bond sales. Indeed, the far greater safety of investments in companies so supervised is coming into recognition and the securities of public service corporations are rapidly assuming the stability of other high-class investments and the rates of interest demanded are reducing as a consequence.

In a state without a public service commission the supervisory feature is not available, but it is possible so to hedge issue of securities, ill-considered actions of council, and other matters of controversy and of danger to investors, that very nearly the same result is secured. This may be done, for example, in the manner described in the articles in MUNICIPAL ENGINEERING referred to in the article in this department on "Specifications for Electric Lighting Contract."

A very valuable discussion of this subject, with references to actual practice, is given under the heading "Rate of Return for Interest and Profits" in the decision of the Railroad Commission of Wisconsin in the case of the State Journal Printing Co., et al., vs. Madison Gas and Electric Co., made March 8, 1910, and probably obtainable from the commission at Madison, Wis.

List of Water Works Superintendents.

Where can a list of water works superintendents in the United States be secured, and how much will it cost?

E. M., Chicago, Ill.

The writer knows of no comprehensive lists of names of water works superintendents issued since the last edition of the "Manual of American Water Works ($1.50) of 1897, and the "Municipal Year Book" ($1.50) of 1902. A list of names of water companies, municipal and private, in cities of 10,000 or more, will be found in the "Engineering Directory" for 1910, published by *Domestic Engineering*, Chicago. ($5.)

Books on Bridge and Building Foundations.

Kindly advise me of the best book issued dealing with ordinary bridge and building foundations.

A. J. S., Winnipeg, Man.

Probably the best book for our correspondent's purpose is Fowler's "Ordinary Foundations" ($3.50), Freitag's "Architectural Engineering" ($3.50) has a good chapter of nearly 90 pages on foundations for buildings; Ketchum's "Design of Highway Bridges" ($4) has a chapter on the design of abutments and piers, which devotes some space to their foundations.

Patton's "Foundations" ($5.00) is a practical treatise covering the ground quite fully. Cooper's "General Specifications for Foundations and Substructures of Highway and Electric Railway Bridges" ($1) is prepared by an expert. So is Corthell's "Allowable Pressure on Deep Foundations" ($1.25).

There are good chapters on foundations in such hand-books as "Kidder's "Architects' and Builders' Pocket Book" ($5), and there are more or less extended chapters in general books on civil engineering, bridge design, etc.

The construction of concrete foundations is described in such books as the "Handbook for Cement Users" ($3), Buel & Hill's "Reinforced Concrete" ($5), and Taylor & Thompson's "Concrete, Plain and Reinforced" ($5).

A New York city foundation is described in MUNICIPAL ENGINEERING, vol. xxxii, p. 150.

Disposal of Brewery Waste.

Where can I obtain Naylor's "Trades Wastes," referred to in the October number of MUNICIPAL ENGINEERING, or anything else on the subject of the treatment of brewery waste

J. S. R., Monongahela, Pa.

Naylor's "Trades Wastes" ($6.50) can be supplied by the business department of MUNICIPAL ENGINEERING on receipt of price. The American trade is supplied by J. B. Lippincott Co., Philadelphia, Pa.

There is not much which is definitely satisfactory as yet regarding the disposal of brewery waste, which is still the subject of experiment.

The city of Reading, Pa., has made a careful study of the various trades waste and divided them into three classes: Wastes which may be discharged directly into the canal or river; wastes which can not be discharged into the canal or river or allowed in the city's sanitary sewers without purification; and wastes which can not be discharged into the canal or river directly, but may be discharged into the city sanitary sewers. It classes brewery wastes in the third of the above classes.

A paper by Mr. Wm. Naylor, author of the book on "Trades Wastes," above referred to, states that brewery wastes are received into the sewers without giving rise to abnormal developments at Blackburn, England, but at Shepton Mallet, with much greater ratio of waste to sewage, the consequences are disadvantageous. Strong brewery waste may become sour, and in such case it impairs the usefulness of the sewage filter; but the introduction of competitive and more active organisms, such as the anaerobic bacteria of putrid sewage has the effect of preventing the souring almost completely of liquors containing starch or starch products. This is the reason for the process which he recommends in his book for the treatment of brewery wastes which are strong enough to affect deleteriously the purification of the sewage. Brewery waste can be treated with difficulty, if at all, in bacterial filters, owing to the formation of acids, unless it has a mixture of sewage.

At the Hook Norton Brewery Company's brewery, Hook Norton, Banbury, England, a settling tank and continuous flow sand and gravel filter was used, but with little success, during the six years, ending 1898. It was then tried intermittently with no better result, and on the suggestion of the author the plant was remodeled in 1900. The flow is reduced, by eliminating all clear water, to about 12,000 imperial gallons of strong liquor per day. This is impounded in a settling tank for not less than 24 hours in contact with putrid sludge from sewage, or 5 per cent. of domestic sewage is admitted to the tank, and when the putridity has once been established, sewage-sludge is no longer necessary. The contents of this tank, which may be termed an "anti-souring" rather than a septic tank, and pumped continually by a pulsometer delivering into the hopper of the sprinkler over the filter. After two years' use the filter was in better condition than when it was started.

The filtering medium is coal, screened and graduated in size from about 1-inch cubes at the bottom to ¼-inch cubes at the top. The company, being well provided with steam, were prepared (under threat of legal proceedings from two sources) to pump the first filtrate on to a second filter for further purification, but this was not found necessary. The little suspended matter present after the first filtration is intercepted by shallow sand filters, and the effluent is clear, neutral, colorless, sweet, contains nitrates, and liberates albuminoid ammonia to the extent of about 0.1 part per 100,000. The diminution of dissolved oxygen after saturation is less than 30 per cent.

Large Fire Fighting Machine for Billings, Montana.

Billings has recently purchased and installed one of the largest fire-fighting machines ever built. It is a triple combination automobile, weighing in excess of five tons and capable of attaining a speed of forty miles per hour. The apparatus was manufactured by the Robinson Fire Apparatus Manufacturing Company, of St. Louis.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Construction Difficulties in Nebraska.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The job, construction of a small power plant on a stream flowing sixty to eighty second-feet, is not of sufficient importance to merit mention, but some things were done that I have never seen described and which may be of interest. The water wheel was placed in the concrete part of the dam, which also served as foundation for the wooden superstructure. It was in the sand hill district of northwest Nebraska. These hills are composed of a fine white silicious sand, free from vegetable matter. When dry, the sand drifts before the wind like frozen snow, and when sufficient water is present it behaves, in most respects, like quicksand.

The present stream is fed entirely by springs. Its bed is of quicksand, interspersed with sand and gravel washed by rains from the adjacent uplands, and at some period antedating the sand hills a river had strewn a mantle of Rocky Mountain gravel over the plain. At all points in the valley corresponding with the level of the stream, water and quicksand are encountered, making foundation work "wet work," and making it useless to cut a channel for the stream around the site during construction.

The site was located where the stream was underlaid with a stratum of soft magnesian sand stone (solidified quicksand). Good concreting sand was to be had in the bluff about a mile distant, but gravel, free from adhering quicksand and magnesian mud, was not to be found. So the gravel was taken from the channel at the lower site.

To separate the sand and gravel we constructed a sort of dredge, consisting of a bottomless chute 14 feet long, 4 feet wide at the discharge end and 8 feet at the up-stream end, where panels were fastened at an angle and of sufficient length to confine the flow of the stream and cause a strong current through the chute. This washed the quicksand from the heavier gravel, moving from twenty to fifty yards of sand to uncover a yard of gravel. In this way deep holes were dug, with the gravel piled up below and the quicksand washed on downstream.

The attempt to make the dredge move forward automatically did not prove a success. This dredging was continued on downstream below the magnesian bottom and served to materially lower the water at the site. As soon as a continuous surface of gravel was presented, erosion stopped. We first, with rakes, gathered the film of gravel into piles, exposing a new surface on which the water could act. But as soon as the gravel was piled from the swift current it was again buried in quicksand. So we devised a cradle 18 inches wide and 2 feet long, with 2x6 sides and screen on the bottom and one end, cross-slats being added to give sufficient strength. About one-third of the way from the closed end legs extending downward about 6 inches were securely nailed. This cradle was held in the current with the open end upstream and the gravel was raked in. The man in charge of this work soon found a large grain scoop with a long handle was the thing to use. Holding the cradle in place with his shins, the long handle over his shoulder, and grasping it above the blade, he was able, aided by the force of the water, to fill the cradle at a single stroke. Then, following a few rockings of the cradle, balanced on its legs, to remove the remaining sand, the clean washed gravel was deposited in the wagon by lifting the "cradle." By this method gravel cost about $1.20 per yard. In this water screening a smaller screen can be used than in dry work.

Following the removal of most of the gravel, as described above, there still remained 2 to 3 feet of material to be cleaned off before the rock bottom was exposed. The surface of this rock was so rough that it was impossible to clean with the scraper, so the rock was washed clean.

Cement sacks were filled with gravel and laid in the channel so as to force the water into a narrow swift current. By starting this current at one side of the channel, and, as it cleaned to the bottom, rearranging the sacks so it would cut laterally back and forth across the stream, it was an easy matter to remove large gravel from holes 2 to 3 feet deep, and to cut away all of the softer surface rock and lay the harder rock entirely bare. As soon as a sufficient area was cleaned, the sacks were laid so as to inclose it, laying the sacks in a double row to the required height, separated about 6 inches, and tying each alternate pair together with wire. This double row of sacks formed the inclosing walls of the coffer dam and the space was filled with the water-excluding material. As clay, loam, dirt or any of the commonly used water-excluding materials were not to be found in the vicinity, this filling did not appear to be a simple matter. We located what had apparently, at some time past, been a pond or slough where rushes had grown and fallen into partial decay, leaving a material much resembling peat or turf. This we used as packing, making a water-tight joint. Owing to accommodating the flow of the creek, the work was done in two parts. Instead of using sacks for the second coffer dam, we found a springy place where the sod grew rank and used the sod from here. A removal of from 4 to 8 inches of sod exposed pure sand. In many respects I prefer a coffer dam built of sod to one of sacks. Before the water-tight packing of the second coffer dam was completed our material was exhausted. So we resorted to the second breaming of sod. Chopping this fine and mixing it with magnesian muck, we succeeded in making a good anti-leak compound. For, with a double sod wall, three sods thick each, and a foot of packing between a 6-foot head of water was completely shut out. As with the sacks, it is necessary to tie the sod walls together.

H. A. MARK, Morrill, Neb.

Where Can the Specified Oil for Treating Wood Paving Blocks be Obtained?

To the Editor of MUNICIPAL ENGINEERING:

Sir—In your December number, under the caption "Where can oil fulfilling the standard wood block paving specifications be obtained?" is published a letter signed "M., New York," commenting on the report of the wood block paving specifications committee of the American Society of Municipal Improvements made to that society at their convention at Erie, Pa. This letter states that the writer wrote to several members of the committee, and then gives a partial copy of the letter sent.

This letter was received by my office on November 1st, but did not come into my hands until two weeks later, owing to absence from town. On receiving it an investigation was taken up to ascertain who would guarantee to furnish an oil complying with these specifications, and several parties were found willing to supply it provided their orders were sufficiently large.

After corresponding with the other members of the committee, however, we decided as a whole that it was hardly the place of the committee to hunt up oil refiners for wood block manufacturers so long as there did not appear to be any discrimination in the selling of this oil. We thereupon wrote an answer as follows:

"We might say, to start with, that the assertion in the report of the committee of the American Society of Municipal Improvements on the subject of wood block paving specifications that 'investigation on our part had shown that the oil recommended was not controlled by one company' was made in reference to wood block manufacturers only and did not relate to oil manufacturers. We would, of course, have answered you as regards the wood block manufacturers at an earlier date, but as you desired to know the names of manufacturers of oil in the country who could deliver such a material, we have delayed writing in hopes that we could ascertain the names of a few of such parties. While not as successful up to the present time in this as we had hoped to be, yet we have decided not to further delay in answering you.

"Our reason for believing that this oil is not controlled by one company is, first: the statement made in Bulletin No. 4 of the Bureau of Municipal Research in the paving report on wood paving block in Cincinnati, Ohio, page 8:

" 'Two kinds of coal tar oils are in common use for treating wood paving blocks—one, a coal tar creosote of a gravity approximately between 1.03 and 1.08 at 68 degrees F., with practically no free carbon; the other, generally produced as a mixture of this creosote with coal tar or pitch, the gravity being 1.10 or higher at 68 degrees F. and containing small percentage of free carbon up to 5 per cent.

" 'Both of these are commercially feasible—i. e., they are readily obtainable in large quantities, at prices from 6 to 8 cents per gallon.'

"Second: It is readily understood and appreciated by everyone acquainted with the tar industry that any coal tar can be filtered so as to produce a tar sufficiently free from carbon that when mixed with a proper creosote oil will produce a product such as called for in these specifications. The by-product coke oven tars produced in Nova Scotia are well adapted to the manufacture of such an oil.

"It is also reported by one of our inspectors that the Ayer-Lord Tie Company buy this oil from two different sources that are entirely independent of each other. One of these is the Barrett Manufacturing Company, and the other we have been unable to ascertain as yet.

"Our belief and assertions in this matter are entirely agreed with by Dr. Gellert Alleman, Professor of Chemistry, Swarthmore College. The following is a quotation from a letter which we have just received from him in this matter:

" 'I have no hesitation in stating that any dealer in tar can fulfill the specifications to which you refer by either filtering the tar and adding a certain proportion of creosote oil to it, or in some cases by adding creosote oil to the unfiltered tar. There are a number of coke oven tars now made in this country which contain less than 8 per cent of free carbon, and, at the same time possess a gravity of about 1.15. Such tars, unfiltered, when reduced with creosote oil, will yield the material you require. There are two Philadelphia oil firms which could supply this material, but would be unwilling to do so unless the orders were quite large. I suggest that the F. J. Lewis Mfg. Co., Chicago, might also be in position to do likewise.'

"I know that Dr. Alleman will be only too pleased to put you in touch with manufacturers of this product. I have also been informed that you can procure this oil from the very same parties who are now furnishing you with the lighter creosote oil which you are now using. There is no evidence to prove that oil of the kind called for by these specifications is not being supplied to a very considerable number of wood block manufacturers and that there is any discrimination against any one manufacturer in the matter of price. For these reasons we do not believe it is the province of this committee to hunt up the names of oil manufacturers for contractors."

I beg to correct a statement in the editorial comments on the above communication in which is stated "The above sub-committee report was prepared by a single member of the committee after arrival at the convention and was presented as such." This is not correct, as a report was written several weeks before the meeting of the society and was discussed by two members of the committee before attending the convention at Erie. At the convention the committee had several meetings at which the preliminary report tentatively prepared by two members of the committee was revised at least three times.

A. W. Dow,
Chairman of Sub-committee on Wood Block Paving Specifications of A. S. M. I.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I note in your issue of December, 1910, on page 474, a communication from M., New York, in regard to oil for filling the standard wood block specifications proposed by a sub-committee of the American Society for Municipal Improvements.

If you will put me in touch with him, I should be glad to show him that it would be impossible for any competitor of (a company named) to obtain oil of this kind in America, as the supply is practically controlled by that company.

CLIFFORD RICHARDSON,
Consulting Engineer, New York City.

The question raised by Mr. Covell about the specific gravity of creosote oil for the treatment of wood block pavements was very thoroughly discussed at a convention of municipal engineers held in Chicago about a year ago, for the purpose of standardizing paving specifications. The committee charged with the preparation of specifications for creosoted wood block pavements held a conference with representatives of some of the creosoting companies and listened to their side of the argument relative to the proper value of the specific gravity of this creosote oil. The question was given very careful consideration and this committee had the assistance and advice of some of the best chemists that could be obtained, and after a very careful review of the data, recommended a specific gravity for this creosote oil of 1.10.

During the past year this committee, of which the writer is a member, has been subjected to considerable criticism by certain companies and individuals on account of the limiting value of the specific gravity of the creosote oil adopted by this convention. Certain of the companies in this country engaged in the treatment of wood block for pavements alleged that creosote oil having a gravity of 1.10 could not be obtained except from one corporation, in other words, the product was controlled by one company.

The American Society of Municipal Improvements recently appointed a committee to prepare standard specifications for creosoted wood block pavements. As the time allowed this committee for the preparation of a report was so limited the committee decided to adopt tentatively the Chicago specifications with some slight modifications. This committee felt, in view of the recent criticism, that the matter of the value assigned to the specific gravity of the creosote oil should be investigated, with a view of determining whether or not the statements made by certain of the creosoting companies, to the effect that the product was controlled by one company, was true. Mr. A. W. Dow, of the firm of Dow & Smith, of New York, a member of the American Institute of Chemical Engineers, and chairman of this committee, reported, after making many searching inquiries, that creosote oil having a specific gravity of 1.10 could be obtained by any one having the necessary capital. As this part of the report was left in the hands of the chairman of the committee I personally did not inquire into the matter and endorsed the report of the committee. Today I received a letter from a company, asking me for information as to where they could obtain 200,000 gallons of creosote oil having a specific gravity of 1.10.

In view of the foregoing, it appears that the question relating to the proper value of the specific gravity of creosote oil for the treatment of wood block pavements is worthy of further consideration.

In my opinion, the quantity of preservative treatment for timber should be determined by the character of the wood to be treated and the uses for which it is intended. For example, in the case of wood block pavements the quantity of preservative used should be determined by the amount of traffic to which the pavement would be subjected, rather than by an arbitrary fixed amount. The wood block pavement subjected to heavy traffic requires a less amount of preservative than a wood block pavement laid on a residence street or alley where the traffic is light and is used for only local needs. The treated block in the first instance will wear out before it will rot out, while in the latter case the wood will decay before it wears out, and therefore a larger percentage of preservative should be used in treating the wood.

With respect to the quantity of treatment for railroad ties and lumber used for structural purposes, it appears that a preservative treatment of ten to twelve pounds of oil per cubic foot prolongs the life of this material several years. Would it not be economy to use a larger percentage of preservative at a relatively small additional cost and thus prolong the life of the wood a few years more?

N. S. Sprague,

Superintendent Bureau of Construction, Department of Public Works, Pittsburg, Pa., in the *Proceedings of the Engineers' Society of Western Pennsylvania.*

These communications and statements are printed as received during the past month except that such personal allusions as are not pertinent to the matter have been omitted. They are presented for the information of our readers without comment, other than a further request that the definite information suggested in Mr. Dow's letter and its enclosure as obtainable, be sent to us for publication with any other information which our readers may have on the subject.

Particular attention is called to Mr. Dow's correction of the editor's statement regarding the preparation of the committee's report with regret that misinformation or misunderstanding of information received should have caused the error referred to.

A Winter's Use for Stove Ash and Furnace Cinders.

To the Editor of Municipal Engineering:

Sir—With the rapid development of fast-moving and heavily-laden vehicles has come a road problem that calls for a quick and practical solution.

In the evolution of heating and power plants that marks this early part of the twentieth century comes a troublesome waste in ash and cinders during the winter season. With this ash and cinder accumulation comes a period under present prevailing methods when practically all repair work on roads and pavements ceases. With this cessation of work bad, rutty conditions develop.

The ordinary hard and soft coal stove ash has not body enough in it to make a surface or wearing composition; but it will pack and make a bottom almost as firm as cement concrete if saturated with water. The top three or four inches, however, should be filled with a furnace cinder having a sufficient clinker in it to give it a body, binding and wearing substance. When depressions are shallow, as for instance in brick, block or asphalt pavements, the fine cinder may be used as a filler with very satisfactory results, and this filling is the proverbial "stitch in that that saves nine." To get satisfactory and staying results from the cinder and surface filler, it must be mixed with some substance that will cause it to pack and hold its place; yet one which will not become hard and brittle enough to crumble and break up. Calcium chloride furnishes such a flux or binder. The chemical and cinder are mixed about as a dry concrete batch is mixed, after which this combination is filled into the depressions of pavements or roadways in such quantity as to leave a slight crown after being tamped firmly into place. The traffic over it will then iron it down hard. This mixture will keep anywhere, an indefinite time, and will always be ready for use. If it is long exposed to a dry atmosphere so that the chemical has had a chance to dry out, it should be thoroughly saturated with water before being used. If used as a temporary patch, when permanent repairs are made, it may be gathered up and re-used as long as any of the combination lasts.

Calcium chloride is a chemical sponge in that it will absorb moisture and allow it to evaporate exactly like a sponge. If the elements have provided moisture enough for a thorough packing no wetting is needed. One should be sure that this moisture exists, for it depends upon that for a bond. It is not hard as with a cement bond, nor sticky as with oil or tar. It creates an elastic surface without any perceptible wear or disintegration.

This method makes a valuable use for ash and cinder wastes, and places are generally found for this use close to the point of accumulation. The combination also insures a smooth, even road surface at a trifling cost at all times. In fact the saving in wear on rutty pavements will make good the cost of application many times over, and the saving in wear and tear on vehicles will prove another very decided gain. There is the added advantage of a road which makes possible speed and comfort in riding at a season of the year when roads generally are rutty and dangerous.

On dirt roads a little co-operation is needed between the dweller on the road and the road maintaining officials. The people living on these roads should scatter their ashes during the winter months into the wheel ruts and low places. In the spring the road commissioner can go over them with a fine spike harrow or with a mixing and leveling drag, thoroughly mixing the dirt and ashes. This will give a firmer and better road body than will an excess of either dirt or ashes alone. If after the spring dressing people want to spend one to five dollars per lot for a chemical application and mixture, they will have a smooth and absolutely dustless roadway, a thing they cannot get with any form of pavement except by frequent sweepings or flushings and too frequent applications of either of these cleansing methods is detrimental to any form of roadway.

I have had the fullest co-operation of the Hon. Jacob J. Haarer, Detroit commissioner of public works, in working out these experiments. Many of the industrial plants in and around the city have treated and are treating their roads and walks through and around their places, while nearly all of the cemeteries have maintained their roads by this chemical treatment for the past year or two, so that I am confident we are well past the experimental stage. Cities, towns and industrial institutions can now have ideal road conditions at a trifling cost, if indeed they do not get them at an actual saving. Again, this method of construction is the only form of roadway that will stand up under the rapidly moving or heavy traffic, as, from its semi-elastic nature, rapidly moving auto tires and heavily-laden truck wheels simply iron down the surface, instead of breaking and grinding it up to later blow away. Here the road has no destructive tendencies. It is one that calls for no limitations on traffic and one that costs much less to make and maintain than any that has yet come into the field.

S. G. Howe, Detroit, Mich.

An Argument for Pitch Filler for Brick Pavements.

To the Editor of Municipal Engineering:

Sir—The following letter to the National Paving Brick Association was written with the sole idea of inducing the associatioi to change their specifications for the betterment of brick paved streets, believing as I do that brick is the only logical and economical pavement, and that streets paved with this material should last at least fifteen to twenty years under heavy traffic, and that no other known material, except stone, that has yet been tried, has lasted over ten years. Brick is the only material that can be readily repaired, and without the use of an auxiliary plant. If, in your judgment, the following letter contains anything that may be of benefit for the betterment of streets and you care to publish it, I shall be pleased to have you do so:

We received your letter dated November 21, in which you state that you are trying in many directions to persuade the use of paving brick on the streets and highways of this country, and that you are trying your best to teach the proper use and manner of laying them. In connection with the above statement, we beg leave to offer a few suggestions that occurred to the writer in connection with the laying of paving brick. I am not of that class of people who think they know it all, and I only offer the following suggestions as viewed from my own standpoint, and an experience in street paving extending over a period of the last forty years.

I was associated with the company that laid the first paving brick in the city of Detroit on Jefferson avenue and Griswold street, paved, I think, twenty-two or twenty-three years ago with Canton and Bucyrus brick. The bricks were of the ordinary stock size, without lugs, and the intersections were filled with pitch. The majority of the brick then laid are still on Griswold street, and are in passable condition.

The first brick used in Detroit for paving was a small brick. Where I have examined the brick paving in different cities throughout the United States, I find that this size brick has worn very much better, and with a more even surface than the larger brick. For myself, if I were to make my own bricks to pave my own street, I would make a brick running about fifty to the square yard, with a square edge, so that when laid, the brick would lie close together. It is impossible, under our present system of burning, to get an even vitrification on the brick. If a brick is so burned that the center is thoroughly vitrified, the outside will be over-burned. I venture to say that seventy-five per cent. of all paving brick used are burned too hard. A brick should be tough, but not brittle.

For the first twelve or fourteen years, and after the introduction of the large block, and before the introduction of the lug brick, pitch was used exclusively as a filler, and the majority of all the streets paved during all that time were in fairly good condition for many years, and some of them are in good shape today.

The specifications of our city, and nearly all the other cities in the country, were then changed by the association to the cement filler, composed of three parts sand and one part cement; and with lugs introduced about the same time. Pavements laid with these specifications lasted fairly well, although many of the bricks showed chipped edges and surfaces, and a decided tendency of the pavement to expand and crowd the curbing out of line, in many instances forcing the curb stone back from one to two inches on each side of the street. Then, the association saw fit to increase the proportion of cement used in the filler, and make the parts two of sand and one of cement. The result of this increase of the cement, caused a decided change, inasmuch as the bricks began to show signs of crystallizing and shelling off at the tops and with the thermometer above 78 the pavement lifted from its bed, and caused the rumbling noise now so much complained of. Pavements laid in this city soon show a decided breaking up and rough surfaces, and an appearance of having been laid for eight or ten years.

The necessity also arose for a space for expansion on the above streets of the city, next the curb, and also expansion joints laid transversely across the street every twenty-five or thirty feet.

Not content with this formula, the association then recommended, and I understand that your Mr. Blair, in his recent looking-up of our pavements in this city, also recommended a filler composed of one part sand and one part cement. This formula was adopted about three years ago in Detroit, with the following results:

Where a street was laid with a considerable crown, during the summer months the paving has lifted from its bed, and a displacement has taken place, so that when the street finally settles, it shows a rough and uneven surface; also, and in every instance has shown cracks parallel to the curbing all over the surface of the streets. To such an extent has this taken place here, that many of the people are seriously considering the discontinuance of brick as a factor in our paving. And now, what are the practical reasons and causes for the above showing?

It shows that you have been working along theoretical lines, instead of studying the practical conditions and results following the above methods.

In the first place, the engineers, as a rule, are not practical pavers, and with all due respect to the brick manufacturers, very few, if any, of them understand the paving proposition.

In the first place, there is very little, if any, expansion in vitrified brick, and if there be any expansion, it is within itself; and instead of expanding outwardly, it expands inwardly, closing in upon the voids; while cement, more susceptible to heat, is responsible for ninety per cent. of all the expansion that takes place in a brick pavement. Where your specification was three to one and there being absolutely no expansion in sand), there still was some room for movement. As you increased the proportion of cement you added to the expansion properties, and consequently in a one-to-one mixture the expansion is so great that it is impossible to take care of it in any known manner.

With the introduction of the lug, you left the edges of your brick farther apart, thus giving a greater chance for cleavage; whereas without lugs, the bricks were laid close together and overcame this objection. The bricks are often found broken in half in the pavement, caused by uneven pressure.

Now, I beg leave to submit that the above statements and facts borne out by the actual results here in this city, and in my humble opinion, the lugs are an injury to the pavement, although a temporary benefit by saving material to the manufacturers. I maintain that the life of the pavement would be increased twenty-five per cent. by leaving them off; but the point that I want to emphasize most is the filler.

By the use of pitch any good brick will not show wear to any great extent for a period of eight to ten years, under heavy traffic. Pitch is the only filler that will penetrate and fill all the interstices in brick. Take for instance, brick with lugs, the pavers will lay at least ten per cent. of the brick with the two flat sides together. In taking up the pavement, you find that the cement has not filled one-half of the spaces, therefore causing an uneven strain, and a breakage where the two lug faces come together.

Now, I am aware that the contractors are opposed to any other filler than cement on account of the tedious methods we have to use with a pitch filler. I am also aware that theoretically I may be in error, but practically I know I am right.

Just one more argument in favor of pitch filler:

It has been shown conclusively that wherever street flushers are used for the cleaning of the streets, the cement filler is being greatly worn away. I have just inspected a piece of pavement laid two years ago, on which the flusher is used, and the cement is at least three-fourths to an inch below the surface of the brick.

Now pitch will withstand all this; it makes a thoroughly waterproof pavement; prevents absorption; prevents frost, one of the greatest enemies of brick; prevents granulation, rotting, etc.; gives room for all expansion; lessens the noise fifty per cent., and takes away all disagreeable, rumbling sound.

This company is not interested in any pitch company, but we are in the brick business to stay, and we prefer any filler than cement. Dry fine sand would suit us.

Wherever the word "pitch" is used, I also include asphalt fillers.

Anything we can do to further the brick industry we shall be pleased to join with you.

DETROIT VITRIFIED BRICK CO.,
By R. M. Adams, Gen'l Agt.

The above letter is published because MUNICIPAL ENGINEERING desires to present all sides of matters which are under discussion, although it does not agree with all the statements made in the letter. Some of these statements make it evident that the brick pavements in Detroit, at least those referred to, have not been well laid, and this fact gives the reason why pavements mentioned in the letter are only in "passable condition," bricks used are "overburned," curbs are crowded out, blocks are laid with lugs on adjacent sides, etc. The statements regarding expansion and complete filling of joints do not agree with the writer's observation. Our readers may be willing to enter into this discussion on one side or the other and give the results of their observation and experience.

Specifications for Asphalt Pavement.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The writer very much appreciates the interest in this subject shown by your publication of his article in your last issue in connection with the Standard Specifications, and the editorial comment thereon.

An effort was made in writing the article referred to, to state in terse, vigorous English the basic principles upon which all mineral aggregates are mixed, whether the cementing material be an unyielding substance with a chemical set such as Portland cement, or a viscous substance with a temperature set such as the bitumens. How fully and completely the article was misunderstood will be plain to any one reading the editorial.

The writer did not "forget" that cement specifications went through the chemical stage. He well remembers that both asphalt and cement specifications "went" through the chemical stage. He uses the word "went" in the past tense, the ancient, old, useless and obsolete past. A past that has no business cumbering and retarding the progress of a present based upon ascertained and known principles. Let the dead past bury its dead.

Accurate, determined principles of engineering are no longer matters of opinion. They are the basic fundaments of the science. No man submits the question of the product of 2x2 to the opinion or judgment of another. The binomial theorem is no longer a mooted question. The strength of steel beams is a determined factor in engineering. Equally determined and scientifically ascertained are the mixes which insure the maximum density in a mineral aggregate. Given the maximum size of the crushed rock, gravel or sand grains, and the percentages of each smaller size to make a mix of maximum density can be ascertained with mathematical exactness, and have been determined so long that they are no longer questions of opinion, but are an integral part of the accepted science of engineering.

Your editorial comment questions the statement that 1 to 10½ per cent. of bitumen will fill 25 per cent. of voids in sand. This is a same simple problem in mathematics. The specific gravity of sand is 2.6, of asphalt 1. Voids are ascertained by volume, pavement is mixed by weight. 2.6x10 equals 26. 2.6x10.5 equals 27.3. Both these percentages will fill the voids and have some to spare. There is no room for argument with the engineer who cannot see it. The fault is in his lack of capacity.

These graded aggregates are not " empirical formulae." They are the actual percentage of each size of material required to fill the spaces between the next larger pieces and so on down to the smallest sizes, filling the smaller void spaces with pieces of increasing fineness. Mr. Warren is correct in the principles announced for bitulithic pavement. The dense mix can be made, no matter how large the maximum particles. The percentages for concrete are set out in the following table.

CONCRETE MIXING.

Sift on coarser sieves first.

Passing.	Pct.	Pct.	Pct.	Pct.
2.5 in.	100	...	...	...
2.0 in.	89	100	...	...
1.5 in.	78	86	100	...
1.0 in.	63	71	82	100
.75 in.	55	60	70	86
.50 in.	45	50	58	71
.25 in.	31	35	40	50
.10 in.	20	22	24	31

The proper gradings for sand below 0.1 inch were set out in my former article.

The variations in sizes suggested by Mr. Smith do not tend to density of mixture. They are only an encouragement to the old lack of uniformity, to the old happy-go-lucky rule of thumb methods which have caused a pavement, which should last ten years without repair, to disintegrate within two years. The standard mixes can be made and kept uniform by any competent paving engineer. There should be no concession to "available source of supply."

Upon the same well established principles there is no room for discussion as to the propriety of laying the "binder course." There is no valid engineering excuse for binder. This is not stated as a mere assertion. It is stated as a scientific fact, based upon the principles which underlie all rigid construction. The writer has confirmed the principles in his experience of several years in laying hundreds of thousands of yards of the best asphalt pavement in the West.

Paraffin in asphalt will cause it to be "short" or lacking in ductility. Gilsonite fluxed with paraffin residuum will emulsify and lack ductility. The classical quantitative chemical analysis for paraffin scale is long, difficult and unsatisfactory. The simple test for ductility determines the acceptability of the asphalt. Too high a percentage of the volatile bitumens gives too high a penetration at the ordinary temperatures. The penetration and not the loss at 325 deg. F. for 5 hours determines this quality.

Again permit the suggestion that pavements be laid as a matter of municipal improvement, as a means of improving streets and making them passable, smooth, clean and sanitary, and that paving specifications be drawn to this end. It is not the purpose of paving specifications to build up the business of industrial chemists or "to eliminate chemists." By all means let us get back to a good asphalt pavement once more.

E. M. Perdue,
Kansas City, Mo.

Our correspondent has made himself still clearer and has removed more of the opportunities for misunderstanding. He has reached the stage of physical tests not, perhaps, earlier than others, but he seems to be more willing to depend upon them to the exclusion of others, although he must still explain the reason for the showings which his physical tests make by the chemical composition of his material, as in the last paragraph but one. All the asphalt experts are on the same road, though few have traveled so far or are so radical in their positions. Possibly some of them will be interested enough to make their contributions to the discussion.

Municipality Not Liable for the Character of Its Water Supply.

The Oakes Manufacturing Company of Long Island City, N. Y., brought suit against the city, in which it was alleged that the quality of water supplied by the city was unfit for the manufacture of dye stuffs such as the concern manufactured. The company, which used about 50,000 gallons of water daily, asked damages to the amount of $300,000. The court held that in maintaining a water supply system for general public use the municipality acts as a governmental agent in the work of the state itself, and not as a proprietor engaged in a service for its own purposes and profit. Or, in effect, that a private concern cannot recover damages from a city caused by the failure of the municipality to supply wholesome water.

ROADS AND PAVEMENTS

Ann Arbor Concrete Pavement—Pennsylvania State Bridge—Earth Roads—Underground Street—Conneaut Brick Pavements

Tar Concrete Pavement in Ann Arbor.

A type of tar concrete pavement has been originated by Mr. Groves, city engineer of Ann Arbor, Mich., and about 18,000 square yards have been laid during the past eighteen months. The pavement is held to be very satisfactory and its cheapness has made it very popular. The 18,000 odd yards cost approximately $13,828.50. The same amount of brick paving would have cost $30,422.70. The difference that the city has saved is $16,594.20—more than enough to duplicate all the tar-concrete paving that has been laid. The same amount of asphalt block would have cost about $40,563.60. Figuring on this paving, the city has saved $26,735.10—within $1200 of enough to duplicate the present tar-concrete twice over.

The city engineer, who has not attempted to take out a patent on his idea, expects to attend the annual meeting of the American Road Builders' Association at Indianapolis, in December, and bring it to the attention of the delegates. So far the new pavement is far and away more popular than any other that has been used in the city. Every petition that has been circulated for paving in the city since the completion of the first street, has stipulated the use of tar-concrete.

First State Bridge in Pennsylvania.

The first bridge to be built by the state of Pennsylvania has recently been completed at Hammelstown. It was erected to replace a steel structure which was destroyed by a flood about a year ago. The State Board of Public Grounds and Buildings had charge of the work, and Mason P. Pratt of Harrisburg, Pa., was the engineer in charge.

The bridge is 311 feet in extreme length, with a twenty-foot clear roadway. The arches are built of concrete, with spandrel facing of five and ten-inch courses of brownstone, the courses being laid following the camber of the bridge. The curb and gutter, laid on top of the five-inch toothing course of brownstone, are made of concrete, upon which is set a sand-moulded railing made in five-foot sections. This railing is capped with a cut brownstone coping, nine inches in width over the railing and fifteen inches over the posts.

The posts are constructed of concrete, in each of which is inserted a brownstone keystone, emblematic of the state of Pennsylvania. In the center of the bridge are two Indian heads in bold relief made of molded concrete, indicative of the Indian name of the stream which the bridge crosses. The railings and posts were molded in sand forms, resulting in a very uniform and white concrete. The roadway is paved with vitrified brick, laid in hot pitch. The approaches are of macadam, carrying out uniformly the circular grade over the bridge. The Ferro-Concrete Company of Harrisburg were the contractors.

Earth Roads in Texas.

In speaking on the question of road construction, Robert J. Potts, of the A. and M. College of Texas, dwelt on the subject of earth roads. He did not attempt to class earth construction as superior to macadam or gravel roads, but merely offered a method of construction where the traffic was light and the money was not available for the more permanent construction. Mr. Potts remonstrated against the fact that attention was given entirely to the hard road construction; even the district road bonding law of Texas specifies that bonds may be issued for constructing "gravel, macadam or turnpike roads," with no reference to any other type.

Mr. Potts' paper is briefly abstracted as follow:

Granting that an earth road may be made firm and smooth, every one will admit its serviceableness. It is quiet, easy on the horse's feet, and its tractive resistance is actually less than almost any gravel road and is only equaled by the best macadam roads. This means that not only is the footing better for the horse, but the actual pull necessary for the horse to exert on the road is less for a dry, smooth, hard earth road than for most gravel roads. But it may be objected that it is not possible to have such earth roads under all conditions, and if it were possible, the expense of building them would be too great. My answer to this objection is that where the traffic is not extraordinarily heavy, a satisfactory earth road may be had under most soil conditions, and where it is adequate for the service required, it will, of course, be cheaper in first cost than any other type of road.

The next question which naturally presents itself is that of the permanence of earth roads. Many advocates of a bond issue would scout at the idea of an earth road being called a permanent improvement. Now the fact is there is no such thing as a "permanent road." When we use that phrase, we should always mean a road that may be permanently maintained. An earth road can be built in such manner that it may be permanently maintained at a comparatively small cost, and every day's work put on the road should be done with this idea in view. So we must conclude that an earth road, built correctly, is really a permanent improvement and is entitled to consideration as such.

But granting that a perfect maintenance of the earth road would be more expensive than that of either the gravel or macadam road, we may consider that the difference in cost above mentioned, when saved to the community, is a principal, the interest on which could be called a maintenance fund. This maintenance fund could be collected as a tax, which would be higher than the tax necessary to meet a bond issue fund in the latter case. This interest on the net saving in cost should then be added to the cost of maintenance of the gravel or macadam road, to give the total maintenance allowable for the earth road. There can be no question that this amount would be .more than sufficient to keep the earth road in perfect repair, and the community would be the gainer to the amount of the net saving in cost which constituted the principal in this calculation. Therefore, we conclude that it is the part of wisdom to choose the earth road in every case where it will meet the demands of the traffic to be carried.

When it comes to the technical side of this discussion, we can stop to mention only a very few of the leading points. A road should be located with regard to the topography of the country in order to insure ease of construction and of maintenance. This forbids the usual policy of locating the road along the land lines regardless of drainage, distance or heavy grades.

A sufficient width of right of way should be provided. Forty feet is the legal minimum for a first-class road and is recommended for most conditions. Having secured the proper location and determined the needed width for the traveled portion, the ditches should be located, all obstructions, such as stumps, removed, and the roadway proper given a uniform crown. Sand beds and soils that are too light to remain firm during the dry weather should have clay mixed with the native soil to form a wearing surface. If the soil is too heavy and sticky to be good in wet weather, sand should be put upon the surface and alowed to work in during the wet weather, care being taken to preserve the crown.

The ditches should be cut to a definite grade, that is, they should have a definite fall all the way to some natural drainage outlet. No road is properly drained when it is crowned up and side ditches are cut, unless these side ditches will empty themselves by continuous flow into the natural water courses. Again, these side ditches should not carry the water any further than is absolutely necessary to get it into some other outlet. "Ditch the side ditches" is a splendid epigram in road work.

It is here that the road drag becomes of value. After the road has been given the proper crown and its ditches properly constructed, it should be dragged after every rain while the soil is still soft and plastic. If properly done, this will not only prevent the formation of ruts and maintain the crown of the road, but each dragging of the wet surface makes it cake that much harder in the same way that the dirt cakes when plowed while too wet. This pudding action on the surface of the road after each rain gradually makes the surface harder and more impervious to water. And so the road gets better the longer the dragging is kept up.

For this purpose nothing is better than the simple split-log drag or a similar design made of 2x12-inch pine timbers. These homely road tools can be made at such a trifling expense that every overseer in the county should be provided with at least one of them. Then instead of "warning out all the hands" at one time to "work the road," one man at a time could be called upon to take the drag and go over all the road assigned to that overseer after each rain. The result of such systematic work on any road that has been properly graded, if continued for one year, will be truly gratifying.

Underground Street in New York.

Chief Engineer N. P. Lewis of the Board of Estimate and Apportionment of New York, has reported to the board that an underground street under Fort George Hill from Broadway to the subway station at the corner of St. Nicholas avenue and One Hundred and Ninetieth street is feasible. The subterranean street as planned will be between 800 and 900 feet long. It will be for pedestrian traffic only and it is estimated that it will cost about $800,000. The expense would be levied on the property benefited. Residents of the district who wish to reach the station have to climb the hill, which is 190 feet high, and then take elevators down to the station, which is 150 feet under ground. The new street would do away with the climb on the part of the residents in the Broadway district.—*Municipal Facts.*

Brick Pavements at Conneaut, O.

In the City of Conneaut, Ohio, are a number of examples of brick streets laid in a variety of different ways and with widely varying results as to durability. This conglomerate array of good, bad and indifferent brick pavements is, of course, not unusual, but to those who are interested in securing the best and most durable brick streets the following brief description of several sections may offer some facts worthy of consideration.

Main street in the business district of the town was paved about 16 years ago with repressed brick laid on a concrete base. Cement filler was used. No expansion joints were allowed either along the curb or across the street, and a few years after laying the pavement, quite naturally, became much warped and out of surface. After allowing this condition to exist for almost nine years the street was repaired by introducing adequate expansion joints, allowing the surface to settle, and then refilling where needed. The street is in fair condition today. In some places the filler has been chipped off and joints and edges exposed. Such defects apparently were due to careless laying and improper filling of joints.

Short stretches of Park avenue and Day street were paved eight years ago with repressed blocks laid on gravel base with cement filler. The cost was $1.20 per yard. These sections are in practically perfect condition, although the traffic is comparatively heavy. Proper expansion joints were allowed on these sections.

State street, also, was paved eight years ago with repressed blocks laid on a gravel base. Cement filler was used except for four or five joints every 30 feet, which were filled with asphalt or tar to allow for longitudinal expansion. Transverse expansion was provided for by filling along the curb with asphalt or tar. This pavement is in good condition at present.

In the residence section on West Main street is a section paved ten years ago with repressed block laid on a sand base with cement filler. Apparently no attempt was made to provide for expansion and long irregular longitudinal cracks have appeared. In this pavement are shown many spots where imperfect filling was done. There are numerous examples of separate blocks which are in perfect condition on one side to which the filler still adheres, and in very bad condition on the other from which the filler has been chipped away. There are also shown examples where the brick were laid so closely together that no filler found its way between the blocks and consequent wearing of the edges and "cobbling" has occurred. There are, however, numerous places in this section where several square yards of the pavement are in imperfect condition.

Harbor street from the L. S. & M. S. railroad north was paved about two and one-half years ago with repressed block laid on a 6-inch concrete foundation. Asphalt filler was used. The cost was about $1.80 per yard. The surface is fairly smooth at present and along the curb and outer edges is in perfect condition. On the crown of the street, however, where the heaveist traffic occurs, much of the filler has disappeared and the edges of the blocks are fast becoming worn. In places no filler can be detected except by projecting a knife point or other sharp pointed instrument between the block to a depth of ½ or ¾ inch.

Harbor street from the L. S. & M. S. Railroad south was paved ten years ago with repressed blocks laid on a sand base with cement filler at a cost of $1.06 per yard. Although the traffic is the same as on the more recently paved section of Harbor street, this pavement has stood the wear much better and is still in good surface and good condition.

On West Main street in the outer residence section a brick pavement was laid about two and one-half years ago on a concrete base with an asphalt filler. The traffic is mostly automobiles and pleasure vehicles. This pavement is still in good condition, but in places the filler is beginning to disappear and the edges of the blocks are beginning to chip. This street along the curb is in perfect condition.

ORGANIZATIONS AND INDIVIDUALS

Standardizing Specifications—American Road Builders—Road Conterence—California Surveyors—Board of Trade—Municipal Congress—Technical Schools—Charles H. Peters—Octave Chanute—Technical Meetings—Calendar of Meetings—New Mayors—Personal Notes

The American Road Builders' Association.

About one thousand delegates comprising highway officials, trustees, commissioners, engineers, contractors and automobile association representatives attended the sessions of the seventh annual convention of the American Road Builders' Association. The sessions were held in the German House, Indianapolis, on December 6-9 inclusive. An exhibit of road building materials and machinery was held in connection with the convention, at which were shown a number of novel and interesting features for road construction. The titles of the following papers which were given at the various sessions will serve to indicate the character of the organization and the value of the convention: "State Highway Legislation," Logan Waller Page, Director U. S. Office of Public Roads. "Relation of the City to its Adjacent Country Highways," A. B. Lea, Director of Public Service, Cleveland, O. "Highways of the Northwest," Samuel H. Lea, State Engineer of South Dakota. "Earth Roads," Charles P. Light, Commissioner of Roads, of West Virginia. "Present Highway Laws of Ohio and the Proposed New Law," James C. Wonders, State Highway Commissioner of Ohio. "Progress of the Good Roads Movement in North Dakota," T. R. Atkinson, State Engineer of North Dakota. "Bridge and Culvert Construction," W. S. Gearhart, State Highway Engineer of Kansas. "Progress of Road Building in Michigan," Townsend A. Ely, State Highway Commissioner of Michigan. "What State Aid Has Done in Maine," Paul D. Sargent, State Highway Commissioner of Maine. "Standard Specifications," James H. MacDonald, State Highway Commissioner of Connecticut. "The Father of Our Country as a Road Builder," T. Hugh Boorman, New York.

Over 1600 delegates were registered.

The exhibitors were the following:

Adams & Co., J. D., Indianapolis, Ind.

American Asphaltum & Rubber Co., Chicago.

American Association of Creosoted Wood Paving Manufacturers, Chicago.

American Paving and Manufacturing Co., Indianapolis, Ind.

American Sewer Pipe Co., Akron, O.

Atlas Portland Cement Co., New York.

Amies Road Co., Philadelphia, Pa.

F. C. Austin Drainage Excavation Co., Chicago, Ill.

Austin-Western Co., Ltd., Chicago.

A. & C. Stone & Lime Co., Indianapolis, Ind.

Barber Asphalt Paving Co., Philadelphia.

Barrett Manufacturing Co., New York.

Burch Plow Works, Crestline, O.

Case Threshing Machine Co., J. I., Racine, Wis.

Collapsible Steel Form Co., Detroit, Mich.

Crawfordsville Corrugated Culvert Co., Crawfordsville, Ind.

Du Pont de Nemours Powder Co., E. I., Wilmington, Del.

Geiser Mfg. Co., Waynesboro, Pa.

G. F. W. Co., Saratoga, N. Y.

Huber Mfg. Co., Marion, O.

Iroquois Iron Works, Buffalo, N. Y.

Kelly - Springfield Road Roller Co., Springfield, O.

Lehigh Portland Cement Co., Allentown, Pa.

Municipal Engineering Co., Indianapolis, Ind.

Municipal Engineering & Contracting Co., Chicago.

National Bitumen Co., Indianapolis, Ind.

National Paving Brick Manufacturers' Association, Indianapolis, Ind.

Port Huron Engine & Thresher Co., Port Huron, Mich.

Quenner Dry Crusher Co., New York City.

Rauschenbach Construction Co., Evansville, Ind.

Robeson Process Co., Au Sable Forks, N. Y.

Ruggles Coles Engineering Co., New York.

Standard Oil Co., New York City.

Stark Rolling Mill Co., Canton, O.

The Kindling Machinery Co., Milwaukee, Wis.

Texas Co., New York City.

Warren Bros. Co., Boston.

Watson Wagon Co., Canastota, N. Y.

Yellow Pine Manufacturers' Association, St. Louis.

California Surveyors Organize.

County surveyors from all parts of California have formed a state association, the object of which will be to discuss the different engineering problems that confront them in line with their duties, and to arrive at a uniform system in the matter of selecting plans and specifications for bridges, culverts and other engineering work, for which bids are invited by the counties of the state.

The organization was effected at a meeting held in the Alaska building, San Francisco, on December 17. J. G. McMillan of San Jose, was elected president, P. A. Haviland of Oakland, vice president, and F. S. Miller of Sacramento, secretary.

A committee on by-laws was named, consisting of President McMillan, Vice President Haviland, Mr. Aeger of Solano, Mr. Quail of San Joaquin and Mr. Cowell of Merced. This body will report back at the next meeting, which will be held at the call of the president. A committee on legislation, consisting of seven of the oldest county surveyors of the state, was also appointed to attend to matters that come before the legislature affecting the office of county surveyor.

The next meeting of the association will be held early in the new year, when papers will be read before the members, prepared by men who are prominent in different lines of engineering.

A Live Board of Trade.

A small handbook or directory of the Board of Trade of Winston-Salem, North Carolina, is a voltmeter which indicates that the organization is thoroughly alive. One indication of this is the fact that the membership has increased from 168 on Oct. 1 to 600 on Dec. 15. Mr. J. L. Ludlow, consulting engineer, is president of the organiation.

International Municipal Congress and Exposition.

Although far in advance of the time set, the Chicago Association of Commerce is already making active preparations for the International Municipal Congress and Exposition which is to be held in that city on September 18-30, 1911. This Congress and Exposition will cover in a practical as well as theoretical manner matters of interest to all branches of municipal service. Upon each day of the Congress papers will be read and discussed by prominent municipal officials, and prominent municipalities of this country and foreign countries will have attractive exhibits of municipal undertakings in which they excel. The manufacturers of municipal appliances will have elaborate exhibits that will interest and instruct municipal officials everywhere. Edward H. Allen, 77 Jackson Blvd., is general manager. John MacVicar, one of the commissioners of Des Moines, Ia., as noted elsewhere, has been selected as Commissioner General of the exposition.

Organization of City Officials for the Standardizing of Paving Specifications.

The second annual meeting of the Organization of City Officials for Standardizing Paving Specifications will be held at the Hotel Astor, New York City, beginning Tuesday, January 10th and extending through the remainder of the week.

The organization represents thirty American cities with five associate members. The work outlined at the preliminary convention at Chicago in February last has been perfected by the various committees, and final reports for complete specifications will be adopted at this meeting.

Any city is eligible to membership upon payment of dues, and is entitled to as many delegates as it may choose to appoint; but in voting, each city has but one vote.

The Secretary is John B. Hittell, City Hall, Chicago. Any mail dated after January 4th, 1911, should be sent him care Hotel Astor, New York City.

Road Conference of the American Society of Civil Engineers.

The American Society of Civil Enginerrs will hold three meetings for discussing road construction and maintenance. These meetings will be held at the house of the society, 220 West 57th street, New York city, on January 20 and 21, the days following the annual meeting of the society. The topics to be discussed are as follows:

(1.) Preliminary investigations.

(2.) Relative value of three methods of carrying on work:

(a) That in which both labor and material are furnished by the contractor.

(b) That in which the material is supplied by the party of the first part and the labor by the contractor.

(c) That in which both the labor and material are supplied by the party of the first part.

(3.) Systems of maintenance.

(4.) The use of water, calcium chloride, light oils, etc., as dust palliatives.

(5.) Surface treatment with tars, heavy oils, etc.

(6.) The use of bituminous materials by penetration methods.

(7.) The use of bituminous materials by mixing methods.

The discussion on each of the above topics will be presented by an engineer specially selected for that purpose, and such presentation will be limited to ten minutes; the discussion of each of the subsequent speakers will be limited to five-minute talks.

The Technical Schools.

The December issue of *"The Wisconsin Engineer,"* a publication of the University of Wisconsin, contains a number of articles of interest to the engineer.

The forty-first annual catalogue of the Worcester Polytechnic Institute has recently been issued. Courses in Civil, Mechanical and Electrical Engineering, and in Chemistry and general science are described.

The Colleges of Engineering of the University of Illinois and Purdue University arrange each year a series of exchange lectures delivered by the members of the faculty of each institution. The first lecture delivered at Illinois this year was by Prof. C. R. Moore of Purdue on "Power Manufacture and Its Dangers."

Dr. J. A. L. Waddell, the noted bridge engineer of Kansas City, recently delivered two lectures before the faculty and students of the College of Engineering of the University of Illinois, one a technical talk on "Materials of Bridge Engineering and Foundations" and the other a general lecture on bridge construction.

Charles H. Peters.

Charles H. Peters, one of the leading men in the municipal affairs of Saginaw, Mich., died at his home in that city on November 12th. Mr. Peters was for a number of years associated with the Saginaw Enterprise, and the Saginaw Evening News, in which work he did much to advance the civic affairs of his city. For a number of years he was a member of the Board of Education and was on the building committee, personally drawing the preliminary plans for a number of the school buildings of the city.

He was appointed as a member of the board of park and cemetery commissioners by Mayor Henry E. Lee and was reappointed January 1, 1909, for a five-year period.

At the time of his death he was engaged in the printing business with the firm of Seeman & Peters.

Octave Chanute.

Octave Chanute, Past President of the American Society of Civil Engineers, died at his home in Chicago on November 23. He was born in France in 1832, and was brought to this country in 1838. His engineering career commenced in 1849, when he was engaged on the Hudson River Railway under the late John B. Jarvis, then Chief Engineer. After this Mr. Chanute came to Illinois and engaged in the construction of a road between Joliet and Bloomington. Following this he was engaged in railroad work with various companies until in 1889 he established a consulting office in Chicago, giving especial attention to the question of wood preservation, a subject with which he was thoroughly familiar and which he brought to the attention of many engineers.

Of late years he had taken active interest in the development of aviation, and the present success of the flying machines of the aeroplane type is due largely to the work of Mr. Chanute. When in Paris last summer he contracted pneumonia, and had a very serious illness. He returned to this country in October, but was unable to regain strength and died practically of extreme weakness and exhaustion.

Funeral services were held at the residence on November 25, at which a number of prominent engineers and associates of Mr. Chanute were present. The burial was at Peoria, Ill., on November 2.

Technical Meetings.

The eleventh annual meeting of The National Civic Federation will be held in New York City, January 12, 13 and 14, 1911, at Hotel Astor. The questions to be discussed are: "Regulation of Corporations and Combinations," "Regulation of Railroads and Municipal Utilities," "Compensation for Industrial Accidents," and "Arbitration and Conciliation." Leading men from different parts of the country will speak on the various topics and their names will be announced in the near future. There will, also, be occasion for general discussion at each session.

At a regular meeting of the Municipal Engineers of the City of New York, held at the Engineering Society's Building on December 28, 1910, Mr. F. S. Cook presented a paper on the "Construction of the Croton Falls Reservoir of the City of New York Water Supply."

Nebraska and western Iowa are to give an exposition in Omaha February 1, 2 and 3 of next year, to be known as the Mid-West Cement Exposition, and The Nebraska Cement Users' Association has secured the Omaha Auditorium for the show. H. G. Calkins of the Nebraska Superior Portland Cement Company has been made chairman of the general arrangements committee for the exposition with F. W. Whipperman of the Omaha Concrete Stone Company as secretary.

In connection with the convention of the American Association of Cement Manufacturers held in New York City, lectures were given in Madison Square Garden Concert Hall, at 3 p. m. and 8:30 p. m., except Thursday and Friday evening and Sunday. The following were the topics considered: "Transportation Terminals," Calvin Tomkins, Commissioner of Docks and Ferries of New York City; "Fireproofing Materials," Rudolph P. Miller, Commissioner of Buildings, New York City; "The Largest Commercial Building in the World," J. Hollis Wells; "Large Reinforced Concrete Buildings," E. P. Goodrich, Consulting Engineer, New York City; "The Part Played by Concrete in Rural Highways," Logan Waller Page, Director of Public Roads, U. S. Department of Agriculture; "The Age of Cement" (lecture in the German tongue), Charles Wisch, former Chief Municipal Architect, Cologne, Germany.

A convention of the Washington State Good Roads Association was held at Walla Walla, on December 1. A great deal of contention was stirred up at this convention relative to a state aid road law. A majority and a minority committee report was presented for the sake of debate. It was decided to draft and present a bill to the legislature embodying the most practical methods for securing good roads. The following officers were elected for 1911: R. H. Thomas, Seattle, president; J. J. Donovan, Bellingham, first vice president; H. A. Reynolds, Walla Walla, second vice president; H. H. McGowan, Tacoma, third vice president; P. W. Cox, Colfax, fourth vice president; E. M. Gillette, Wenatchee, fifth vice president; J. C. Scott, treasurer.

In conjunction with the New York Cement show held in Madison Square Garden December 14-20, was held the seventh annual convention of the National Association of Cement Users. A number of delegates were present from foreign concrete associations, municipalities and governments. The Austrian Concrete Association (Oesterreichischer Beton Verein) was represented by Dr. Karl Bittner, its director, and Dr. Franz Boehm, engineer, both of Vienna Austria; the German Concrete Association (Deutscher Beton Verein) by Dr. Otto Schott, of Heidelberg, and the French Society of Civil Engineers (Societe des Ingenieurs Civils de France) by M. Joseph Boreo, of Neuilly. M. Baneth acted as special representative of the Lord Mayor of Budapest, Hungary.

Calendar of Technical Meetings.

Canadian Society of Civil Engineers.—Annual meeting, Winnipeg, Manitoba, Can.—C. H. McLeod, Secretary, 413 Dorchester street, West, Montreal, Que., January 2-6.

American Society of Engineering Contractors.—New York City.—D. J. Hauer, Secretary, January 10-11.

Organization of City Officials for Standardizing Paving Specifications.—Conference, New York, N. Y.—B. T. Fendall, City Engineer, Baltimore, Md., Chairman of Committee. January 10-15.

National Tariff Commission Association.—National Convention, Washington, D. C.—Henry T. Wills, Secretary, 66 Lafayette street, New York, N. Y. January 11-12.

Michigan Engineering Society.—Annual Meeting, Lansing, Mich. January 11-13.

New York Tax Reform Association.—State Conference on Taxation.— A. C. Pleydell, Secretary, New York, N. Y. January 12-13.

Indiana Engineering Society.—Annual Meeting, Hotel Denison, Indianapolis.—Charles Brossman, Secretary, Union Trust Building, Indianapolis, Ind. January 12-14.

National Civic Federation.—Annual Convention, New York, N. Y.—D. L. Case, Secretary, 1 Madison avenue, New York, N. Y. January 12-14.

Montana Society of Engineers.—Annual Meeting, Helena, Mont.—Clinton H. Moore, Secretary, Leysen Block, Butte, Mont. January 12-14.

Canadian Cement and Concrete Association.— Annual Convention and Exhibition, Toronto, Ont.—R. E. W. Hagarty, Secretary, 662 Euclid avenue, Toronto, Ont. January 16-20.

Engineers' Society of Western Pennsylvania.—Annual Meeting, Pittsburg, Pa.—

Elmer K. Hiles, Secretary, 803 Fulton Building, Pittsburg, Pa. January 17.

American Institute of Architects.—Annual Convention, San Francisco, Cal.—Glenn Brown, Secretary, Octagon, Washington, D. C. January 17-19.

American Society of Civil Engineers.—Annual Meeting, New York.—C. W. Hunt, Secretary, 220 West 57th street, New York. January 18-19.

Illuminating Engineering Society.—Annual Meeting, New York, N. Y.—P. S. Millar, Secretary, 29 West 39th street, New York, N. Y. January 20.

Ohio Engineering Society. — Annual Meeting, Columbus, O.—C. J. Knisely, Secretary, New Philadelphia, O. January 24-26.

Illinois Society of Engineers and Surveyors.—Annual Meeting, East St. Louis, Ill.—E. E. R. Tratman, Secretary, 1636 Monadnock Block, Chicago, Ill. January 25-27.

The Nebraska Cement Users' Association and the Mid-West Cement Exposition. — Omaha, Neb. — F. W. Whipperman, Omaha Concrete Stove Co., Secretary, February 1-2-3.

National Brick Manufacturers' Association.—Annual Convention, Louisville, Ky. —T. A. Randall, Secretary, Indianapolis, Ind. February 6-11.

American Water Works Association.—Annual Convention, Rochester, N. Y.—J. M. Diven, 14 George street, Charleston, S. C. May 29.

New Mayors Elected.

Portland, Me.—Oakley C. Curtis.

Brockton, Mass. — Former Alderman Harry C. Howard.

Fall River, Mass.—Thomas Higgins.

Fitchburg, Mass.—M. Fred O'Connell, re-elected.

Gloucester, Mass. — Alderman Isaac Patch.

Haverhill, Mass.—E. H. Moulton.

Holyoke, Mass.—Alderman John J. White.

Lawrence, Mass.—John T. Cahill, re-elected.

Marlboro, Mass.—John J. Shaughnessy, re-elected.

New Bedford, Mass.—Charles S. Ashley, re-elected.

Northampton, Mass.—Calvin Coolidge, re-elected.

Pittsfield, Mass.—Kelton B. Miller.

Quincy, Mass.—William T. Shea, re-elected for the fourth term.

Springfield, Mass.—Edward H. Lathrop, re-elected.

Waltham, Mass.—Edward A Walker, re-elected.

Port Huron, Mich.—John J. Bell, re-elected under Commission government, with Sam O. Aikman, Andrew J. Smith, F. J. Dixon and Charles E. Mudford as Commissioners.

Rochester, N. H.—Joseph Warren, re-elected without opposing vote.

Newport, R. I.—Patrick J. Boyle, for fifteenth term.

Personal Notes.

Mr. E. N. Chisolm, superintendent and engineer of the Knoxville, Tenn., water works, has resigned to enter private practice as member of the firm of Chisolm & Osborne, civil and hydraulic engineers.

Mr. James A. Bell, for the past twenty-five years city engineer of St. Thomas, Ont., has resigned to enter private practice.

Harrison P. Eddy, Boston, Mass., has been retained by the Sewerage Commission of Fitchburg, Mass., to investigate and report on the city's sewage disposal problem.

Mr. Robert M. Clayton, city engineer, Atlanta, Ga., has appointed Mr. W. T. B. Wilson, assistant engineer in charge of sewers, Mr. N. Hurt assistant in charge of streets and Mr. T. Wilson assistant in charge of sidewalks.

Mr. A. B. Alderson, who for the past twelve years has been engaged as engineer for the town of West Hartford, Conn., has established an office for the practice of civil engineering, at 49 Pearl street, Hartford, Conn.

Mr. B. B. Lathbury, consulting engineer, formerly president of the firm of Lathbury & Spackman, inc., has merged his interests with the D'Olier Engineering Co. under the firm name of The Lathbury-D'Olier Company, Engineers.

Alexander Potter, consulting engineer, of New York City, has been retained by the City of Muskogee, Okla., to design a water supply system, and a sewerage system and disposal plant for a population of 150,000. The present population is about 28,000.

Irving W. Patterson, Jun. Am. Soc. C. E., has recently resigned from the position of Resident Engineer with the State Board of Public Roads of Rhode Island to accept the position of Assistant Engineer with Arthur H. Blanchard, Consulting Highway Engineer, Providence, R. I.

D. J. Whittemore, chief engineer of the C. M. & St. P. Ry., has resigned from active service to take up study and investigational work. Mr. Whittemore is a member of two of the greatest engineering bodies in the world, the Institution of Civil Engineers of Great Britain, and the American Society of Civil Engineers.

Arthur H. Blanchard, M. Am. Soc. C. E., Associate Professor of Civil Engineering, Brown University, Providence, and consulting highway engineer, has recently been appointed Expert and Consulting Engineer to the United States Office of Public Roads by the Secretary of Agriculture and the Director of the Office of Public Roads.

John MacVicar, of Des Moines, Ia., has been selected Commissioner General of the International Municipal Congress and Exposition to be held in Chicago, September 18-30, 1911. John MacVicar is one of the best known workers in this country on the lines of municipal government and the administration affairs of cities. He has been in active service in municipal work for more than twenty years. He was named to the office of President of The League of American Municipalities upon its organization, and has ever since been actively connected with it for the past ten years as Secretary. Mr. MacVicar is at present a member of the Commission, and Superintendent of Streets and Public Improvements, at Des Moines, Ia.

MACHINERY AND TRADE

A Centrifugal Machine for the Drying of Sludge.

The Lathbury-D'Olier Engineering Company, of Philadelphia, have purchased the rights on a new centrifugal sludge-drying machine, which has been in use in Europe for a number of years. The company is arranging to manufacture the machines in its own plant at Philadelphia, but at present has some of them on hand of European manufacturers.

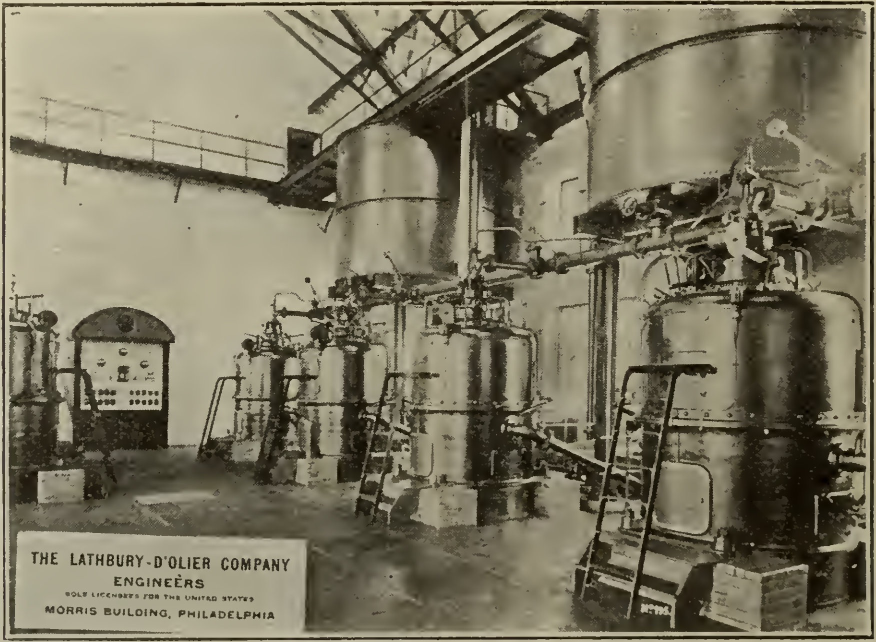
The apparatus is built as a continuous drying machine, working automatically and acting in two distinct and constantly repeated periods. During the first period the sludge is introduced into the machine and dried by the action of centrifugal force, which extracts the water contained in it. During the second period the solid dried residue is automatically ejected from the machine.

The drum of the centrifugal machine is fitted with a central tube for the introduction of the raw sludge, and contains a number of chambers. The latter are provided with sieves, and each is fitted with an inner and outer checking device. The process of drying may be described as follows:

While the machine is rotating the sludge is allowed to flow into the chambers from a reservoir fixed above the former, the inner valve being open. The heavy solid matter contained in the sludge is projected by centrifugal force toward the outer part of the chambers, while the water, the specific gravity of which is less, is forced back, and thus separated from the solid matter. The separated water passes through the sieves and flows off by an annular canal into the shell of the apparatus. Fresh sludge now enters the chambers through the delivery pipe to replace the separated water, so that these chambers are filled up completely in a comparatively short time with material from which the water has been extracted and which is now air dry. As soon as this stage of the process is reached the inner slide is closed, thus cutting off the feed and separating the dried matter in the chambers from the raw sludge in the delivery pipe.

The outer slide is now opened and the dried matter is ejected by centrifugal force. This matter strikes the walls of the shell, is broken up into small pieces and falls into barrows which take it to a conveyor. As soon as the outer slide has been closed and the inner one opened the different stages of the process are repeated.

As the composition of sludge varies so



CENTRIFUGAL SLUDGE DRIER AT FRANKFORT-ON-THE-MAIN, GERMANY.

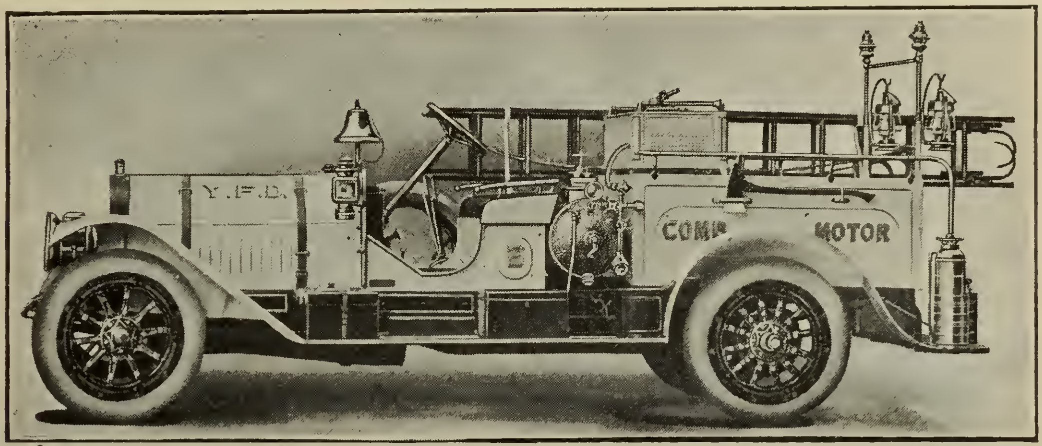
much, from day to day, and even during the different hours of the day, it is difficult to give any figures of output for the machine. In installations now in operation from 70 to 140 cubic feet per hour of raw material have been treated, giving a residue of dry sludge weighing from 660 to 1,000 pounds. The power required to operate varies from 8 to 10 horse power.

There are at present a number of the machines in use in Europe, some of which will be described in a later issue. The accompanying photograph is that of a plant in Franfort-on-Main, Germany. Through the courtesy of the local officials of that city, the first of the machines was installed for practical experimental purposes. Since the development of the machine others have been installed until the plant is at present as shown.

The Marriott Curb Conduit System.

The accompanying illustration shows the Marriott curb-conduit system, which in addition to being a curb as is indicated has practical utilitarian uses. It is made of concrete with metal covers, which as are shown are surfaced with concrete in such a way as to make the metal a protector for the edges of the curb. This conduit feature of the system has three practical uses, namely, surface drainage, street cleaning and snow removal.

The operation of the conduit in the removal of surface water is obvious. It provides a free channel for the flow, with practically continuous openings for inlet, abolishing the frequent trouble with clogged inlets and the consequent backwater pools which often extend over the tops of the gutter plates at street crossings. The surface gutter stream is, of course, abolished.



BOYD'S MOTOR FIRE TRUCK.

Yonkers Motor Fire Apparatus.

The automobile combination chemical engine and hose wagon shown in the accompanying illustration is one of two recently delivered to the city of Yonkers, N. Y., by James Boyd & Bro., Inc., of Philadelphia. The specifications and equipment are as follows:

Motor—6 cylinder, 70 horse power, 4 cycle, vertical type; water cooled.

Transmission—Sliding gear, selective type; four speeds forward and one reverse.

Drive—Double chain drive from jack shaft to rear wheels.

Tires—38 inch by 5½ inch; demountable rims.

Hose Body—Capacity 1,000 feet of 2½-inch fire hose.

Chemical tank—One 40-gallon copper tank, Holloway type, with pressure gauge, controlling valves and by-pass connection.

Hose Basket—Made of sheet steel having a capacity of 200 feet of ¾-inch chemical hose.

Equipment—200 feet ¾-inch chemical hose with shut-off nozzle and three extra tips; 1 20-foot rope hoist extension ladder; 1 12-foot roof ladder; 1 12-inch locomotive bell, mounted on dash; 2 3-gallon Boyd plunger fire extinguishers; 2 fire department lanterns; 2 fire axes; 2 10-inch electric headlights; 2 side oil lamps.

With reference to street cleaning, the conduit system makes it possible to not only sweep the streets, but allows them to be thoroughly washed without the attendant evils of side gutters filled with water, or with the filth left after the subsidence of the water.

With regard to snow removal, the conduit system is admirably adopted for one of the best practical methods of accomplishing this work. The method in most common use for the removal of snow is that of hauling it from the streets in wagons to some more or less convenient dumping ground, where it may be disposed of. To any one who has been in any of the larger cities even a week after a ten or twelve-inch snow fall, the tediousness of such procedure is apparent.

Other means for snow disposal can be classified under two general divisions:

1. Those devices which use heat derived from burning oil, steam or electrical energy to melt or "fry" snow, and then discharge the resulting water into the sewers; and

2. Curb conduits flushed with running water, into which snow is shoveled and converted into thin slush, which flows rapidly to the sewers.

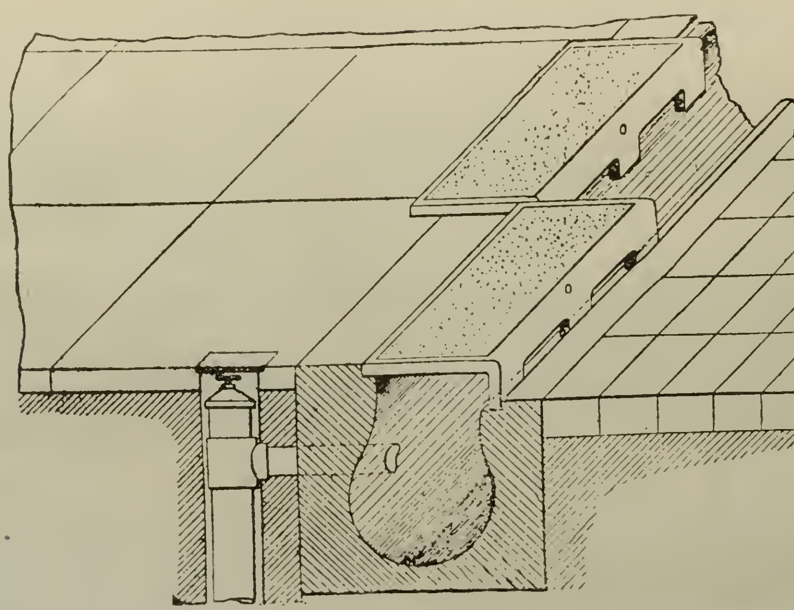
In steam and electrical devices for melting snow the plant is used but a few days in each year; during the remaining 320 or 330 days of each year it remains idle and useless under wear and tear, depreciation, interest, storage and other charges.

The Marriott curb conduit system comes under subdivision No. 2. It is without the objections urged against the other type, in that it is useful throughout the entire year for the purposes of snow removal, surface drainage and street cleaning. It combines in a single unit the equipment for ideal municipal sanitation in these fields. Furthermore, it obviates the traffic congestion occasioned by the use of horses, teamsters and vehicles. As it removes snow, obviously at minimum cost, it seems to solve the problem of snow removal and municipal sanitation. To dispose of snow, mechanical sweepers (or other means) heap it near the curb conduit. When so piled in any section, water from the supply mains, shown at the left of the conduit section, is admitted to the conduit; and the snow is shoveled thereinto, to be partly melted by the heat latent in subsurface water, and wholly transported by the flow of the same.

Its efficacy in snow removal is made clear by the following considerations:

1. Will water run down grade?
2. Will snow and ice float in water?
3. Will such floating snow and ice be transported in running down grade?
4. Is it possible in 90 seconds to freeze a stream of water twelve inches wide and six inches deep, moving with a velocity of 200 feet per minute in a conduit?

Other points in favor of the system make themselves apparent upon study, inasmuch as the form of construction lends itself readily to the plan of having wire and other conduits set in the concrete under the flow line of the water conduit as is shown in the illustration. James C. Marriott, Park Row Building, New York City, is the patentee and manufacturer of the system.



THE MARRIOTT CONCRETE CURB CONDUIT.

Basic Bitulithic Patent Sustained in New York.

In granting the plaintiffs an injunction in the case of Warren Brothers Company vs. The City of New York and Uvalde Asphalt Paving Company of New York, Judge A. C. Coxe of the U. S. Circuit Court of the Southern District of New York has covered a number of points which have been under discussion recently in conventions and in Municipal Engineering. The following extracts from the opinion may serve to show the method of treatment:

This court must, therefore, consider as established the following propositions, which were at issue in the Owosso case.
First. The validity of the patent.
Second. That the patent is not invalid for double patenting.
Third. That the patent is not anticipated by any of the alleged prior uses proved in the Owosso case.

This leaves only to be considered the Washington, Chicago and Cincinnati prior uses and the question of infringement.

I have examined the affidavits and the specimens taken by both sides from the Washington pavements and am confident that the testimony does not establish anticipation beyond a reasonable doubt. Some of the specimens produced by the defendants have a general resemblance to the patented composition. Others, taken by the complainant from the same locality, have no resemblance to the particular features upon which patentability rests.

The fact that the samples furnished differ so materially in structure and appearance seems to indicate that the influence of heat and cold and the use of the streets for heavy traffic during long periods of time have worked changes in these pavements, so that their present structure is not what it is when originally laid. The pavement on Corcoran street, for instance, is shown to have been laid under the patent to Scharf, which provides three distinct layers. It would not avail the defendants if they were able to show that in the process of time, these layers have in some places been broken up and something resembling the complainant's structure has thus been sporadically produced. This would not be a prior use, but a prior misuse.

The Cincinnati use is even more remote. The pavement there is laid in blocks and is not intended at all for vehicular traffic. The Chicago uses need not be discussed as they are no better references than those to which attention has been called. It is enough to say that in my judgment the proof does not establish the invalidity of the patent beyond a reasonable doubt.

The claims in issue are for a product, not a process. Of course the claims must be read in the light of the description, but it cannot be doubted that anyone using the Warren pavement will infringe, no matter how the pavement is produced. For instance, the specification says, "It is desirable to have the mineral aggregate rich in particles of the size passing the 200, 100 and 80 mesh sieves," but if the mineral particles are of the indicated size, it is immaterial whether they have passed through a sieve or not. We are dealing with a pavement, not the method of producing it.

On the part of the defendants a large number of experts of high standing and ability state that the use of the stone as it comes from the crusher without screening, sifting or selecting, takes the proposed pavement out of the claim of the Warren patent. But this is all matter of opinion, where something more than opinion is required. The defendants should show the court the pavement which they propose to lay. It does not materially aid the investigation to show what they do not propose to lay. The complainant has produced exhibits in which the crusher run was used, which seem to conform to the structure of the patent. The defendant has produced no sample of its proposed pavement.

As it is said that thousands of yards have been laid in Washington and elsewhere under specifications substantially similar to those in the case at bar, it would seem that the production of such a sample would not have been difficult.

WARRENITE PAVEMENT, TRENTON, N. J.

Advanced Curb and Gutter Construction.

Each new form of construction which receives the stamp of approval, after a thorough trial, brings into existence methods and appliances for building it economically. The concrete curb and gutter has come to be generally accepted as the best construction for all kinds of pavement; but, until very recently, the slow and uneven hand methods of construction have hindered its full development on account of uneven surfacing and bad alignment.

A machine for building cement curb and gutter has been placed on the market which not only accomplishes the purposes for which it is intended in a rapid and economical manner, but also attains a perfection of construction which cannot be reached by the older methods. This machine, shown in the accompanying photograph, was invented by a practical contractor, who realized the needs of more efficient methods in this work.

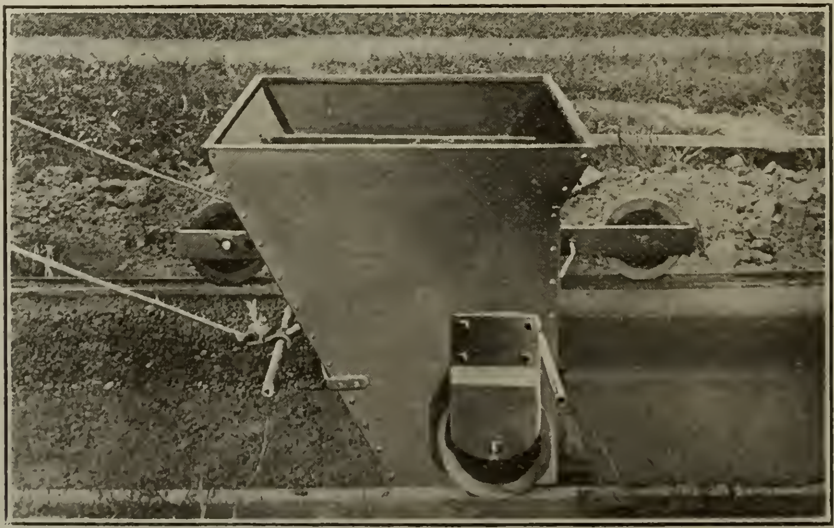
The machine is supported on three wheels, two of which run along the back board of the curb and the third moves on the gutter boards. The two rear wheels are grooved and follow a light steel rail, which is easily and quickly attached to the back board. The frame to which these wheels are attached is braced rigidly assuming a perfect alignment and grade, free from minor irregularities. The second photograph shows this rigidity of construction.

The method of operation is illustrated by the second cut. The finishing material is placed in the hopper, and the machine is drawn along with a slow, uniform speed allowing the mortar to flow down upon the base. The heavy phosphor-bronze spreading and finishing plate forces the mortar into proper shape under pressure and finishes the surface superior to any obtainable by hand troweling. As will be noted, the design of this finishing plate allows of the batter upon the face of the curb, which is now so strongly advocated for strength and protection of the curb edges against scarring and abrasion. The machine is manufactured in different sizes to fit the various specifications. The type shown constructs a 6-inch by 6-inch curb with an 18-inch gutter, the over-all dimension being 25¾ inches.

The capacity of the machine is limited only by the amount of base that can be prepared for it. With a gang of eighteen men, one machine in Evansville, Ind., averaged between 900 and 1,000 feet per day of 6-inch by 24-inch work, with an absolute uniformity and excellence of finish. Two unskilled laborers operated this machine.

The advantages of the appliance will be at once apparent. It assures an excellence of finish, free from hollows or ridges, unattainable by hand methods. A perfect grade and alignment is obtained. A wet mixture may be used on the base, assuring a better bond between base and surface. The machine requires no adjustments, is of solid, lasting construction and may be operated by cheap

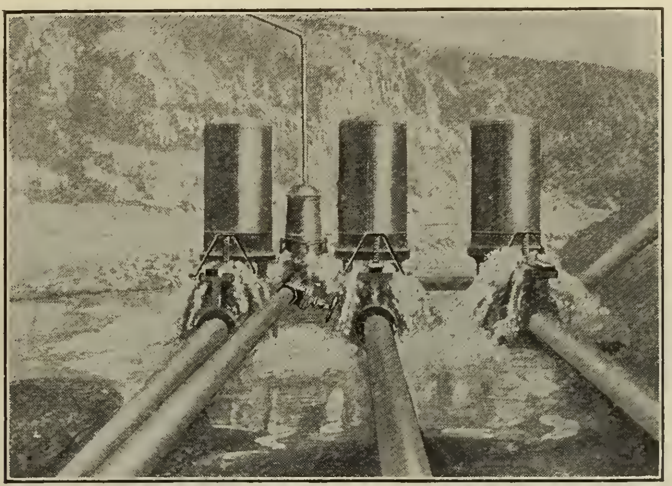
RAUSCHENBACH CURB AND GUTTER MACHINE.



RAUSCHENBACH'S CURB AND GUTTER MACHINE.

labor. The rapid work, simplicity of operation and the fact that all the mortar is put in place without waste, all contribute to the economy of its operation.

The appliance is handled by Thomas L. Barret, general sales agent, Board of Trade, Louisville, Ky., who will furnish information regarding it upon application.



I. RIFE RAM INSTALLATION AT APIZACO, MEXICO.

Hydraulic Rams.

There has been but little advancement in the design of hydraulic rams since their invention in 1776 by Montgolfier, until of late years the Rife Engine Co., of 111 Broadway, New York City, have developed and made them practical for use in supplying water economically for small plants or country estates. The Rife ram is now built with automatic air feeding device, preventing water-logging and consequent destruction by concussion, and are successfully used for town water works, irrigation, railroad tank supply, as well as for farms, domestic purposes, etc. There are thousands of locations where it is desired to elevate water, where the cost of fuel and attendants is prohibitory, and where there is running water with two or more feet fall to operate a ram. With this system land lying above irrigating ditches or streams is even more valuable than the land below the ditches, particularly for fruit orchards.

II. RIFE RAMS IN COLOMBIA.

The Rife ram is built in sizes varying in capacity from three gallons to 700 gallons a minute; they will operate under two or more feet fall and elevate water 30 feet for each foot of fall used, developing an efficiency of from 60 to 90 per cent, according to the ratio of fall to pumping head.

The first accompanying illustration shows a battery of three No. 80 Rife rams, with a capacity of 300 gallons a minute each, all pumping through one pipe a distance of 10,000 feet, supplying the carshops, railroad tank and town of Apizaco, Mexico.

The Colombian government, five years

ago, installed three No. 120 rams with a capacity of 700 gallons a minute each, delivering water through a pipe line 13,-000 feet long to an elevation of 262 feet. This installation is shown in the second illustration.

The third photograph is that of two No. 40 Rife rams supplying water to a railroad tank for the Pennsylvania Railroad Company at Claysburg, Pa. The

III. RIFE RAMS IN CLAYSBURG, PA.

folowing are operative data for this installation:

Water used, 120 gallons per minute.
Fall used, 12 feet.
Elevation, 39.4 feet.
Amount delivered, 28 gallons per minute.
Efficiency, 77 per cent.

Full information and catalogues may be had upon application to the above-mentioned manufacturers.

Smoke Prevention.

At the present time when the term "city beautiful" has come into such common usage as to almost fall into disrepute, a great deal of attention is given to keeping our streets and boulevards clean and free from litter of all descriptions. But in only a few cities are there measures taken to keep the air clean and the sky-line as free from the dirt and the nuisance of smoke. True, there are in most cities ordinances which make the manufacturer who besmirches the air with coal smoke a law breaker and an offender against public policy. But even in the cities where these laws are enforced there are sufficient instances of violation to often cause newspaper mention and unpleasant notoriety to all concerned. The reason for this violation is not from the fact that the manufacturer is voluntarily allowing all the black smoke which represents power to be discharged into the air, but for the reason that no economical method has been devised for preventing this waste.

The Harris Smokeless Furnace Co. of Nashville, Tenn. seems to have solved the problem to the satisfaction of all concerned. They have invented and are manufacturing a furnace designed for use with any type of externally-fired boiler, carrying high pressure for power purposes. This furnace, by the principles of its construction, provides such perfect combustion that there is no smoke even from the most objectionable coals. This is provided by the burning of a mixture of air and producer or water gas, the latter being obtained by superheating the steam to dissociation and passing the dissociated oxygen and hydrogen in fine jets into the products of combustion arising from the burning fuel in the fire box, the air being highly heated before entering the fire box and reaching the producer gas. This result is obtained by the peculiar construction of the fire box, and not by the means commonly used, that is, by the use of a steam jet, which is very uneconomical of fuel.

A test was recently made of an installation of the smokeless furnace at the plant of the Howe Ice Co. of Nashville. This test was run under the direction of disinterested engineers, a careful analysis being made of the coals used with observations made to determine if the furnace were really "smokeless."

The condition of the stack was watched closely, and when any smoke was produced the time taken for the stack to clear after the firing was finished, was noted. On test No. 1 there were 76 smoke observations taken, or one at every firing. Sixty of these showed 5 per cent smoke (black smoke being 100 per cent and clear stack 0 per cent), and 16 showed 10 per cent. The average time of clearing of stack was 30 seconds. During test No. 2 there were 65 observations made. Twenty-one showed 5 per cent, 20 were 10 per cent, 2 were 20 per cent, 1 was 30 per cent, and 21 were 40 per cent. The stack smoked considerably until the method of firing was changed from throwing the coal well back into the furnace to pushing the live coals, which were in the front of the furnace, back against the bridge wall and firing the fresh coal in front. All of the 5 per cent smoke occurred after this method of firing was begun. The average time of clearing of stack on this test was one and one-half minutes.

The furnaces have been used in a number of concerns for terms varying from one to two years, so that they are by no means an experiment.

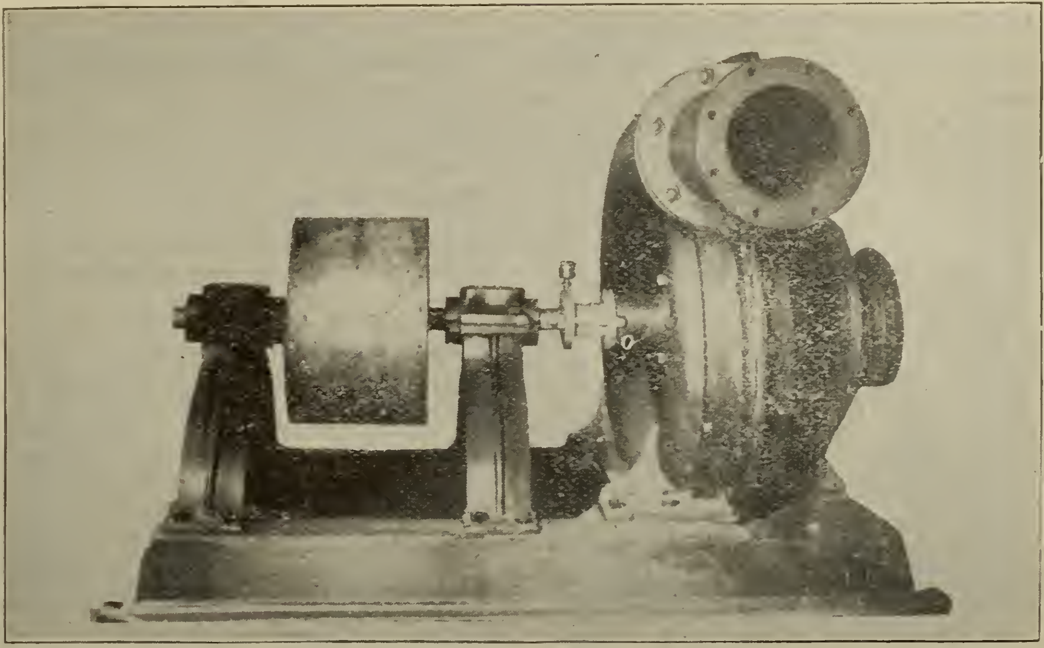
Their initial cost is one-third to one-half that of stokers; cost of maintenance fully 75 per cent less, with less smoke and more economy than any device made for the purpose.

The Harris Company is contemplating the manufacture of a smokeless garbage incinerator which should prove very popular with cities which are obliged through necessity to have their disposal plants within the corporate limits.

An All-Purpose Centrifugal Pump.

The Jesse Craft centrifugal pump shown in the accompanying photograph is the result of more than 40 years' experience in actual work, and today embodies features of market value. Built on scientific principles, they are durable, easily managed and not liable to get out of order; they will pass foreign material and water in greater quantities, with less wear to working parts, and require little power to operate, and, moreover, they are cheap in first cost.

This pump is of particularly durable construction, the wings being of high-grade steel, and are concave and convex in section so as to cause a direct movement of the water. The wings are entirely separate and interchangeable. The disc is of the balanced type, relieving the shaft of end thrust.



THE JESSE CRAFT CENTRIFUGAL PUMP.

The pumps for drainage work are put out in sizes varying from a capacity of 200 gallons per minute to 5,000 gallons per minute. The largest size requires only 1.60 h. p. for each foot of elevation, while the smaller sizes require a very small amount of power, less in fact than their proportionate discharge.

The pumps will handle almost any kind of liquid or semi-liquid, cases having been recorded in which stones as large as 10 inches by 5 inches have been lifted a distance of thirty feet. The smaller sized pump requires from 375 revolutions for a lift of 4 feet to 1,200 revolutions for a 50 foot lift. The larger sizes require a proportionately fewer number of revolutions; the largest, in fact, requiring only 320 revolutions for a 50 foot lift.

More complete information may be had upon application to the Greaves Specialty Co., 154 Nassau street, New York, N. Y.

An Interesting Test of a Sewer Cleaner.

On Dec. 7 at Kansas City, Mo., was held a test of the new Sieben sewer cleaner, which demonstrated in a very satisfactory manner the efficiency of the apparatus.

The machine consists of a nozzle supported on runners which discharges through a small turbine water motor, causing one or two sets of hook-shaped blades to revolve rapidly. In so doing they stir up the dirt and sediment in the sewer to a thin grout, which the waste water from the turbine carries out. The machine is drawn slowly through the sewer by means of cables operated by windlasses. Four men are necessary to operate this machine, two on the windlass running the machine through the sewer, and two feeding in hose at the manhole.

In the event that the sewer is entirely clogged, making it impossible to pass a cable through the pipe, a special forcing jack with a number of coupling rods is provided, making it possible to force the machine through the sewer, first allowing it to run for a time in order to soften the obstruction. With a water pressure of only 60 pounds, the machine generates three horse power at the turbine, so that the blades will cut through weeds or tree roots that may be responsible for the clogging. A cartridge of chemical preparation may be inserted within the machine so that the water flowing through it may be made to disinfect as well as clean and scrub the sewer.

With reference to the recent test of the machine. Theodore Naish, engineer, who had charge of the work, reported as follows:

The Sieben machine was to clean the sewer from manhole No. 1 to No. 2. The average depth of sediment in this sewer was about 12 inches.

At 12:30 p. m. the Sieben crew, consisting of four laborers, one foreman and one team began the work of stringing hose to the nearest fire plug, 1,250 feet distant, and getting rods through the stretch of sewer between No. 1 and No. 2 preparatory to running the machine through. All preparatory work was done, water turned on and the machine started from manhole No. 2 at 3 p. m. A few minutes after the machine was started a length of hose burst, which caused a delay of 12 minutes while a new length was being put in. The machine was taken out at manhole No. 1 at 3:42, having traversed 371 feet of pipe in 42 minutes, or deducting the 12 minutes' delay for repairing hose, the actual time of cleaning the sewer was 30 minutes. The hose was then taken up and rolled and everything cleaned and put away by 5:30 p. m. That this sewer was actually cleaned was shown by running a Shannon bucket through the sewer after the Sieben machine had gone through. In the whole length of the sewer only about one-third of a cubic foot of dirt was gathered in the bucket. The cost of the work was as follows:

Foreman 5 hrs. at 37½c..........	$1.85
Team, 5 hrs. at 50c..............	2.50
Labor, 20 hrs. at 25c..............	5.00
Total labor cost	$9.35

Length of sewer cleaned 371 feet.
Cost per foot of sewer by Sieben machine, 2.52 cents.

Full information and prices on the machine will be furnished upon application to the Sieben Co., Eighteenth and Central streets, Kansas City, Mo.

Dedication of Indianapolis City Hall.

On December 21 the Indianapolis new city hall was dedicated with appropriate ceremonies. The dedicatory program was given in the afternoon, being opened by a brief address by Mayor Samuel Lewis Shank, head of the present administration. Speakers of the afternoon were former Mayors John L. McMaster, Thomas L. Sullivan, John W. Holtzman, Caleb S. Denny and Charles A. Bookwalter. Former Mayors Daniel W. Grubbs and Thomas Taggart were not present.

The new city hall was erected at a cost of $669,239.83. The building is of Bedford stone and is a modern adaptation of the classic Greek Ionic. It consists of four stories and covers an area of 188x133 feet. Floors of all lobbies and corridors are of marble and in the corridors the wainscoating and pillars are in marble. All offices are provided with hardwood floors and an interior wood finish of mahogany. Rubush & Hunter were the architects and the Westlake Construction Co., of St. Louis, were the contractors.

When the city hall building first was proposed by former Mayor Charles A. Bookwalter, the City Council voted a bond issue which amounted to $600,425. Other money since has been appropriated, the most of which was transferred from the old coliseum fund to the city hall fund, making the total cost to date.

All of the city offices except the police department will be housed in the new city hall. This will include the mayor's office, the board of public works, the city engineer, the assessment bureau, the board of public safety, the legal department, the city controller, board of health, the city clerk, the superintendent of streets, the building inspector and the board of park commissioners.

A Book on Concrete.

"Confidential Trade Notes" is the title of a new book by Amos Strouffer of Waynesboro, Pa. The author is a man of wide experience in concrete work and his book is said to embody the practical results of his work. Particular attention is given to the use of concrete in ornamental work such as interior finishing, lawn, park and cemetery work.

Trade Publications.

"The Wadsworth Macadam, The Coming Roadway," is the title of a booklet issued by the Wadsworth Stone and Paving Co. of Pittsburg, Pa. It consists of a number of views showing the use of Kentucky rock asphalt in road construction and the resultant road.

The Rochester Chamber of Commerce in an effort to secure the next convention of the American Road Builders Association for that city, distributed at the Indianapolis session a booklet of views and statistics of the city of Rochester which is very creditable in every particular.

The December issue of the publication of the Lehigh Portland Cement Co. contains a description with illustrations of the new Asylum avenue viaduct in Knoxville, Tenn. Other photographs showing the Galveston sea wall, and several pieces of private construction are given.

The Association of Creosoted Wood Paving Manufacturers of Chicago have a very well executed book of views and descriptive matter relative to the use of wood in pavements. The photographs shown are collected from cities in Europe as well as in the United States.

The Amies Road Company of Philadelphia have a book of descriptive matter and photographs showing the use of "Amiesite" in road construction and the roads built with this product. They also have a set of specifications of value to one interested in road work.

The Knox Automobile Co. of Springfield, Mass., have an illustrated catalogue of motor vehicles for commercial use, and among them are some excellent examples of modern fire fighting machines.

The general catalogue of "Peerless" machinery, made by the Geiser Manufacturing Co. of Waynesboro, Pa., contains descriptions of a very complete line of road rollers and traction engines.

The monthly Edison Portland Cement Co. "Aggregate" is devoted to stucco and concrete residences. Some very attractive examples of construction are shown.

The James Boyd and Brothers Company of Philadelphia, have a handsomely illustrated catalogue of fire apparatus. A number of modern motor equipments are shown.

The monthly booklet of the Universal Portland Cement Co. contains among other topics of interest, a description of a concrete warehouse in Minneapolis, of "mushroom" construction; a concrete dock on the Chicago river; a concrete cube pavement; and the railroad rules on returned cement sacks.

Richard Dudgeon, 24 Columbia street, New York, N. Y., has a very complete catalogue and price list of hydraulic jacks and pressure pumps.

"The Latest Word on an Old Subject" is a booklet descriptive of the use of "Glutrin" in road building and maintenance. It is issued by the Robinson Process Co. of Sable Forks, N. Y.

The American Paving and Manufacturing Co., of Indianapolis, have a small book and a set of specifications regarding the use of Bitu-Mass in road work.

The Milwaukee Concrete Mixer and Machinery Co. have a booklet giving illustrations and data regarding their concrete mixer.

Reinforced metal of all kinds is described in an illustrated booklet of the William B. Hough Co., Chicago, Ill.

The Crawfordsville Corrugated Culvert Co. of Crawfordsville, Ind., have a leaflet and price list of their product.

The Yellow Pine Manufacturers' Association of St. Louis, have a booklet of data and facts on wood block pavements.

The Goit Manufacturing Company of Oklahoma City, Okla., have a leaflet descriptive of their patent dump wagons, cars and carts.

The Quenner Crusher is the title of a booklet issued by the Quenner Dry Crusher Co., Singer Building, New York City.

Among the pamphlets and publications distributed by the National Paving Brick Manufacturers' Association are Directions for Laying Vitrified Brick Street Pavements; An Object Lesson in Street Pavements; Good Roads at the Home of Indiana University; The Proper Conctruction of Brick Streets; The Indianapolis Motor Speedway; and The Permanent Roadways.

The International Harvester Co. of Chicago, Ill., has recently issued a new departure in almanacs. The feature articles in the new almanac are by Frank P. Holland, President Texas Farm and Ranch Pub. Co., who writes on "Trees Worth Growing;" Prof. P. G. Holden, of the Iowa College of Agriculture, who writes on "Corn;" W. D. Hoard, editor of Hoard's Dairyman, who tells about "Up-to-date Dairying;" and Henry Wallace, editor of Wallace's Farmer, who advises on "Sanitation in the Country;" "Building Suggestions" by J. E. Wing; "Farm Power" by Prof. E. C. Lucke of Columbia University; "Farm Machines and Progress," together with maps showing the number of machines in use and the production of wheat by decades from 1840 to 1900.

Trade Notes.

ASPHALT.

St. Louis, Mo.—Bids will be received on Jan. 10, 12 m., for the construction and installation of a municipal asphalt plant. Deposit of $725 required. Board of Publib Improvements, rm. 399, new city hall, St. Louis, Mo.

CEMENT.

Houston, Tex. — Special. — A contract for the construction of two concrete oil storage reservoirs in California of 1,000,000 barrels capacity each, was awarded to Weber-Duller Company of Houston, Tex. They will be 600 feet in diameter and 20 feet high.

Los Angeles, Cal.—Plans are being prepared for a reinforced concrete tank 80 ft. diameter by 11 ft. high and will have a capacity of 415,000 gallons.

Indianapolis, Ind.—Prices and catalogues are requested for machinery for the manufacture of cement blocks and concrete construction. John C. Treetor, Spruce st., Indianapolis, Ind.

Richmond, Va.—The contract for furnishing 6,000 bbls. of Old Dominion Portland cement was awarded to C. P. Lathrop, Richmond, Va.

MACHINERY AND SUPPLIES.

Minneapolis, Minn.—Bids will be deceived until Jan. 13, 7:30 p. m., for furnishing paving material and cement for sewer construction for the year of 1911. Certified check required. Henry N. Knott, cy. clk.

Point Gray, B. C.—Bids will be received until Jan. 11 for furnishing about 35 miles of 6 to 24-in. steel pipes and special castings for water supply. Cleveland & Cameron, 506 Winch Bldg., Vancouver, B. C.

MISCELLANEOUS.

Tucson, Ariz.—Preparations are being made for the erection of a rock crusher to prepare crushed rock material for road work in anticipation of a great quantity of road work that will be done in the valley within the next few years.

Mattoon, Ill.—Special.—The H. W. Clark Co., manufacturers of the Clark meter box and water works appliances, contemplate the building of a new enlarged and modern factory, comprising both iron and brass machine shop and concrete works. The rapidly continuous increase of this company's business has made this move necessary. We are not informed as to whether they will build in Mattoon or elsewhere.

Indianapolis, Ind.—Special.—Mr. C. M. Brown, 321 Board of Trade Building, Indianapolis, Ind., has been put in charge of an agency for the Harris Smokeless Furnace Co. of Nashville, Tenn.

Louisville, Ky.—Thomas L. Barret has established an agency for contractors' supplies and equipment in Louisville. Everything from concrete mixers to nails is handled.

New York.—The Ingersoll-Rand Company has acquired a controlling interest in the stock of the A. S. Cameron Steam Pump Works, whose plant is located at the foot of East Twenty-third street, New York. George Doubleday is president.

Columbus, O.—Special.—The Jeffrey Manufacturing Company, who manufacture elevating, conveying and moving machinery, have opened a new office in the Fourth National Bank Building, Atlanta, Ga., with Mr. D. C. Rose, formerly with the Dodge Mfg. Co., as manager. A stock of Jeffrey chains and catalogs will be on hand.

Philadelphia, Pa.—Special.—The Lathbury-D'Olier Company, engineers, announce a merger of the interests of B. B. Lathbury, consulting engineer, (formerly president of Lathbury & Spackman, Inc.,) and of the D'Olier Engineering Company. The company will continue the general and special engineering, manufacturing and contracting business, heretofore carried on by the respective interests. Their main offices are in the Morris Building, Philadelphia, with a branch office in New York.

Seattle, Wash.—An ordinance was passed authorizing the board of public works to purchase an auto spring wagon fo rthe city electrician.

Racine, Wis.—Special.—The addition to the boiler shops of the J. I. Case Threshing Machine Co., Inc., Racine, Wis., is just being completed. This is a building 60 ft. by 215 ft., which will be used exclusively for a stock room for the Case boiler shops. A boiler storage has been completed 230 ft. by 60 ft. This is equipped with a traveling train for movement of boilers from one part of the building to another.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Wetumpka, Ala.—Voted $70,000 bonds for good roads in Elmore co.

Tucson, Ariz.—Preparations are being made for the erection of a rock crusher to prepare crushed rock material for road work in anticipation of a great quantity of road work that will be done in the valley within the next few years.

Azusa, Cal.—Voted $40,000 bonds for road improvements.

Los Angeles, Cal.—Voted $100,000 bonds for completion of paved highway to Long Beach from the business district of Los Angeles.

Long Beach, Cal.—The paving of Pine and 3rd sts. is contemplated.

Riverside, Cal.—Plans are being prepared for the paving of portions of Denton and Center sts. and Prospect ave. Cost about $85,000.

Placerville, Cal.—The construction of a road between Folsom and Placerville to connect Sacramento co. road with the state road to Lake Tahoe is contemplated.

Pomona, Cal.—Bids will soon be asked for paving 2nd st. T. R. Trotter, city clerk, Pomona, Cal.

San Francisco, Cal.—Voted $18,000 bonds for state highway improvements.

Sausalito, Cal.—Arrangements are being made for expenditure of $50,000 on the improvement of various streets, using a system of road building known as oilcrete. The foundation of the roadbed will be built of concrete 4 ins. deep and reinforced in the center with wire netting; on top of this will be placed a composition of 90 per cent asphalt.

St. Augustine, Fla.—The city will spend about $30,000 for street improvements.

Rome, Ga.—Voted $50,000 bonds for paving various streets.

Springfield, Ill.—The paving of Edwards st. from 9th to 21st sts.; Jackson st. from 6th to 11th sts. and Candey st. from Walnut to alley between 5th and 6th sts. is contemplated.

Huntington, Ind.—The paving of Cherry st. is contemplated.

Indianapolis, Ind.—The contract will be let soon for laying cement walks on Capitol ave.

Carroll, Ia.—The paving of 5th and other streets is contemplated.

Council Bluffs, Ia.—The paving of Broadway is contemplated.

Mason City, Ia.—The paving with cement of 9,000 lin. ft. of sts. is contemplated.

Iola, Kan.—Plans are being prepared for a macadm highway extending south to Tulsa and north to Kansas City.

Wichita, Kan.—The paving of W. 8th st. is contemplated.

Bloomington, Ill.—About 30,000 sq. yd. of brick pavement and about 5,000 sq. yd. asphalt on concrete foundation will be laid next year.

Crookston, Minn.—Paving Houston ave. and three other sts. with Westrumite is contemplated.

Duluth, Minn.—The construction of an automobile road to Port Arthur, Ont., Can., is contemplated.

Hazlehurst, Miss.—Voted $50,000 bonds for road improvements.

St. Joseph, Mo.—Resurfacing of the brick paving on 8th st., Olive to Messanie st. and Messanie st., 8th to 6th with asphalt is contemplated.

Raton, N. M.—An expenditure of $60,000 for street improvements is contemplated.

Brooklyn, N. Y.—The following street improvements are contemplated: Paving with asphalt E. 26th st. from Clarendon rd. to ave. D, proposed contract time 20 days, estimated cost, $4,000; paving with asphalt block 56th st. from 6th ave. to

7th ave., proposed contract time, 20 days, estimated cost $5,300; paving with asphalt E. 2nd st. from Ditmas ave. to a point about 160 ft. north of ave. F, proposed contract time 20 days, estimated cost, $4,100; paving with asphalt E. 28th st. from Foster ave. to Flatbush ave., proposed contract time 25 days, estimated cost $7,000; paving with asphalt E. 31st st. from Church ave. to Snyder ave., proposed contract time 20 days, estimated cost, $3,700; regulating and grading 10th ave. from Fort Hamilton ave. to 61st st., and from 62nd st. to 69th st., estimated cost $10,000, assessed valuation $300,000; regulating, grading and paving with asphalt 52nd st. from 13th ave. to 16th ave., estimated cost $18,800, assessed valuation $175,000; regulating and grading Howard ave. from E. New York ave. to E. 98th st., estimated cost, $22,000, assessed valuation $83,500; paving with asphalt W. 23rd st. between Surf ave. and a line about 530 ft. southerly therefrom, estimated cost, $4,900, assessed valuation $182,800; paving with asphalt Gravesend ave. from ave. C to Foster ave., omitting space occupied by Prospect Park and Coney Island railroad, estimated cost $38,400, assessed valuation $518,000; paving with asphalt 67th st. from 2nd ave. to 3rd ave., estimated cost $6,100, assessed valuation $41,100; repaving with asphalt and curbing and recurbing E. New York ave. from Pitkin ave. to Douglass st., estimated cost $7,800, assessed valuation $48,000.

Canton, O.—Plans are being prepared by the city engr. for about 5 mi. of brick block paving on concrete foundation to be constructed during the coming year.

Canton, O.—The construction of 8 mi. of permanent highway improvements in Stark Co. is contemplated for the coming year.

Jefferson, O.—The construction of the Jefferson-Colebrook macadam road is contemplated.

Oklahoma City, Okla.—Voted $500,000 bonds for highway construction.

Portland, Ore.—A macadam pike from the Columbia river to Oregon's southern boundary line is planned. This will mean about 300 miles at an estimated cost of $5,000 a mile. The paving of E. Waters st. with stone blocks is contemplated.

Bellevue, Pa.—Paving Lincoln ave. and Brighton and West Bellevue roads is contemplated.

Mitchell, S. D.—The paving of Main st. is contemplated.

Jonesville, Tenn.—Voted $300,000 bonds for road improvements.

Memphis, Tenn.—The paving of Madison ave. with creosote wood blocks is contemplated.

Temple, Tex.—Bids will soon be requested for paving N. Main st. and W. French ave. with durable material.

Jonesville, Lee Co., Va.—Voted $300,000 bonds for construction of good roads.

North Yakima, Wash.—Plans have been prepared for paving various streets to cost about $125,000 and the paving of Yakima, Miles and 7th aves. is contemplated.

Seattle, Wash.—Plans will shortly be prepared for the construction of the Hugo Kuhnhausen road, about 2 miles long.

Seattle, Wash.—Sidewalks on N. 82nd and 80th sts. and various others are contemplated.

Spokane, Wash.—Plans have been prepared for grading, curbing, sidewalking and paving, with oileroid, 7th ave., cost about $10,300; grading, curbing and sidewalking 16th ave., cost about $6,750; Stevens st. estimated cost $4,750; also for removing parking strip in roadway and paving same with asphalt on Riverside ave. between Monroe and Cedar sts. and Cedar st. between 1st and 2nd aves., estimated cost $9,490; and the grading, curbing and sidewalking of Lacey st. is contemplated.

Toppenish, Wash.—The paving of seven blocks of streets is contemplated.

Walla Walla, Wash.—Plans have been prepared for the construction of the McDonald road, estimated cost $25,000.

Wenatchee, Wash.—The construction of a 40-mile road to cost about $200,000 is contemplated.

Milwaukee, Wis.—About $100,000 will be expended for good roads.

CONTRACTS TO BE LET.

Los Angeles, Cal.—Bids will be received until Jan. 16 for improving portions of Huntington drive. C. G. Keyes, co. clk.

St. Petersburg, Fla.—Bids will be received Jan. 5 for about 4,000 lin. ft. of brick paving with granite curb. W. F. Devine, cy. clk.

East St. Louis, Ill.—Bids will be received until Jan. 5 for grading, curbing and paving with brick, 1620 sq. yds. on Linden ave. and 8305 sq. yds. on 40th st. Frank B. Hanna, clk. bd. of local impvt.

Beech Grove, Ind.—Bids will be received until Jan. 3 for constructing a highway including a parkway from 11th ave. in Beech Grove to city limits of Indianapolis. E. C. Martin, town clk.

Madison, Ind.—Bids will be received on Jan. 3, 1 p. m. for the construction of road in Madison tp. Gaylor F. Crozier, audt.

Martinsville, Ind.—Bids will be received on Jan. 3, 2 p. m. for highway improvements in Adams tp. B. E. Thornburgh, audt.

Vincennes, Ind.—Bids will be received on Jan. 3 for the construction of the following gravel roads: Emisen Laten, James Williams. John T. Scott, audt., Vincennes, Ind.

Washington, Ind.—Bids will be received on Jan. 3 for the construction of 2 gravel roads in Barr tp. Thomas Nuget, audt.

Hutchinson, Kan.—Bids will be received until Jan. 6 for improving 6 miles of Haston road. A. R. Hamma, audt.

Oskaloosa, Kan.—Bids will be received until Jan. 9 for grading and macadamizing a portion of James Neal road. Geo. A. Patterson, chmn. co. com.

Paducah, Ky.—Bids will be received on Jan. 16, 3:30 p. m. for improvement of the following streets: Broadway from the I. C. R. R. to 15th st., including 14,325 sq. ft. concrete sidewalks, 820 sq. ft. of concrete driveway, 2,900 lin. ft. concrete gutters, 2,900 lin. ft. granite curbing; Jefferson st. from 11th to 14th sts., including 23,000 sq. ft. concrete sidewalks, 800 sq. ft. concrete driveways, 3,940 lin. ft. concrete gutters, 3,940 lin. ft. granite curbing, 200 lin. ft. of cast iron drain pipe; N. 10th st., from Trimble st. to Burnett st., including 13,300 sq. ft. concrete sidewalks, 380 sq. ft. concrete driveways, 2,520 lin. ft. concrete gutters, 2,500 lin. ft. granite curbing, 500 lin. ft. of cast iron drain pipe., Board of Public Works, Paducah, Ky.

St. Louis, Mo.—Bids will be received on Jan. 10 for constructing a municipal asphalt plant. W. B. Dryden, secy., Board of Public Improvements.

Sedalia, Mo.—Bids will be received until Jan. 2 for paving with brick 10,000 yds. on Prospect ave. C. E. Baker, cy. clk.

Salem, N. J.—Bids will be received until Jan. 11 for grading and placing gravel and oyster shell surface on the Mannington. Pilegrove and Woodstown road, 5.05 mi'es. Bd. of ch. freehldrs.

Albany, N. Y.—Bids wi'l be received until Jan. 9, 11 and 13 for improving highways. S. Percy Hooker, chmn. highway com.

Brooklyn, N. Y.—Bids will be received until Jan. 4 for paving with asphalt on portions of E. 2nd, E. 26th, E. 28th, E. 31st and 56th sts., with 5 years' maintenance guarantee. Alfred E. Steers, prest. borough Brooklyn, N. Y.

Cincinnati, O.—Bids will be received on Jan. 6 for improving Dick road in Crosby tp. Fred Dreihs, clk.

Circleville, O.—Bids will be received on Jan. 3 for paving Court st. with vitrified brick, including 6 in. concrete foundation, cement or asphalt filler, etc. John W. Lowe, Circlevil e, O.

Cleveland Heights, Cleveland, O.—Bids will be received on Jan. 3, 12 m., for improving Euclid Heights blvd. H. H. Canfield, village c'lk.

Salem, Ore.—Bids will be received until Jan. 16 for paving about 175,000 sq. yds. with hard surface pavement. W. A. Moses, cy. recdr.

Walla Walla, Wash.—Bids will be received until Jan. 18 for construction and macadamizing the McDonald state road in Walla Walla county. Highway bd. Olympia, Wash.

Beloit, Wis.—Bids will be received on Jan. 20 for paving various streets with brick, cement curb and gutter. Bert Woods, c'lk., Be'oit, Wis.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for constructing 120,000 sq. yds. of bitulithic paving was awarded to Southern Bitulithic Co., Birmingham, Ala.

Fayette, Ala.—The contract for constructing 3 miles of cement sidewalks was awarded to James C. Lang Jr., 415 Empire Bldg., Birmingham, Ala.

Selma, Ala.—The contract for grading and graveling 32 miles of public road was awarded to Newell & Bradford, Brown-Marx Bldg., Birmingham, Ala.

Little Rock, Ark.—The contract for the construction of 10 miles of gravel road on the Sulphur Springs and Camden roads leading out of Pine Bluff was awarded to Woodmall & McCarthy, Little Rock, Ark., $42,980.

Glendale, Cal.—The contract for the improvement of Glendale and Tropico rds. and 6th st. and La Cadda-Verdiogo rd. was awarded to M. K. Peaseley, Wilcox Bldg., Los Angeles, Ca., $23,888.

Los Angeles, Cal.—The following contracts were awarded: Improving portion of Bellevue ave., to T. H. McGowan, Los Angeles, Cal., $5,283; paving Hoover st. with asphalt, to Fairchild-Gilmore Wilton Co., Pacific Electric Bldg., Los Angeles, Cal., $13,500.

Pasadena, Cal.—The contract for asphalt paving on Delacy st. between Union and Green sts. was awarded to Chas. A. Baldwin, Los Angeles, Cal.

Pomona, Cal.—The contract for paving portions of 2nd st., including culverts and manholes was awarded to Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., Los Angeles, Cal.

Riverside, Cal.—The contract for the improvement of Locust st. was awarded to Johnson-Shea Co., 5th and Market sts., Riverside, Cal., $11,998.

San Francisco, Cal.—The contract for paving Mission st. was awarded to A. J. Raisch, San Francisco, Cal., $50,000.

Waterbury, Conn.—The contract for the construction of 13,300 ft. of road was awarded to Jenks & Goepule Co., Wilton, Conn., $14,900.

Jacksonville, Fla.—The contract for constructing 20 miles of road in Duval Co. was awarded to Engineering Paving Co., Jacksonville, Fla.

Dalton, Ga.—The contract for paving Hamilton, King and Crawford sts. was awarded to West Construction Co., Chattanooga, Tenn., $56,820.

Bloomfield, Ind.—The contract for the construction of macadam road was awarded to Samuel Hays, Wilmington, Ind., $5,010.

Crawfordsville, Ind.—The contract for the improvement of John B. Layne et al. stone road was awarded to Geo. B. Lynch, Darlington, Ind., $7,699.

Kokomo, Ind.—The contract for the construction of gravel road to Neis & Co., Frankfort, Ind., $4,027; construction of macadam road was awarded to W. F. Smith & Co., Rensselaer, Ind., $4,770.

Greencastle, Ind.—The contract for the construction of gravel road 13,957 ft. long in Jackson and Franklin tps. was awarded to A. G. Day, Greencastle Ind., $6,500.

Lafayette, Ind.—The contract for macadamizing 4 miles of riverside road was awarded to W. F. Frey, Lafayette, Ind., $24,842.

Lebanon, Ind.—The contract for paving the roadway of N. Lebanon st. was awarded to Geo. T. Miller, Lebanon, Ind., $6,234.

Logansport, Ind.—The following contracts were awarded: Construction of roads in Cass Co. to Barnes & Grau, Logansport, Ind.; Walter Girton, Logansport, Ind.; James Pierce, Delhi, Ind.

Peru, Ind.—The contract for the construction of 2 gravel roads in Washington tp. was awarded to H. C. Modlin, & Co., Peru, Ind., $11,429.

Terre Haute, Ind.—The contract for the construction of the Roonce gravel road in Fayette tp. was awarded to Geo. Fuqua, Vermillion, Ill.

Wabash, Ind.—The contract for the construction of gravel road in Paw Paw tp. to Geo. Sewell, Laketon, Ind., $5,380; construction of gravel road in Noble tp. was awarded to A. F. Hipskind, Wabash, Ind., $18,230.

Williamsport, Ind.—The contract for the construction of gravel road in Jordan tp. was awarded to W. W. Crane, Hedrick, Ind., $5,000.

New Orleans, La.—The following contracts were awarded: Paving lake side of Claiborne st. to Barber Asphalt Co., 205 Chartres st., New Orleans, La.; paving Rendon st. to Standard Paving Co., Society for Savings Bldg., Cleveland, O., $13,004; paving Prytania st. from Robert to Joseph st. with wooden blocks and bitulithic was awarded to A. Black, New Orleans, La.; paving on river front from Thalia to Bienville st. with small granite blocks on concrete foundation was awarded to Grasser Contracting Co., New Orleans, La., $56,457.

New Orleans, La.—Paving of Soniat st., repaving 7th st. etc., to Standard Paving & Construction Co., $22,548; paving Jeanette st. to J. A. Cravenoff Co., $17,013; paving Erato st. to Southern Bitulithic Co., First Natl. Bank Bldg., Nashville, Tenn., $34,755.

Belzoni, Miss.—The contract for about 3 miles of concrete sidewalks was awarded to Delta Paving Co., Clarksdale, Miss.

Gulfport, Miss.—The contract for the construction of about 10,000 sq. yds. of cement sidewalk was awarded to J. B. Silver & Son, Alliance, O.

Lincoln, Neb.—The contract for paving

the following sts.: B st. from 7th to 11th, C st. from 19th to 27th; B st. from 19th to 20th st., 20th st. from A to D was awarded to Badger Asphalt Paving Co., Omaha, Neb., $50,626.

South Omaha, Neb.—The following contracts were awarded: Paving of alleys to Jas. Park, others to National Construction Co., South Omaha, Neb.

Las Cruces, N. M.—The contract for paving Main st. with asphalt was awarded to O. H. Brown, Las Cruces, N. M.

Newark, N. J.—The contract for grading, curbing and flagging Carlisle and Clay sts. was awarded to Van Kueren & Son, Newark, N. J.

Albany, N. Y.—The contract for paving Jeanette st. was awarded to Muldarry Bros., 115 1st st., $8,145.

Buffalo, N. Y.—The contract for paving Rano st. Riverside ave. to north end of street with standard asphalt was awarded to German Rock Asphalt Co., Morgan Bldg., Buffalo, N. Y.

New York, N. Y.—The contract for furnishing and delivering wool paving blocks to 3rd ave., 145th st., was awarded to U. S. Wood Preserving Co., 165 Broadway, New York, N. Y.

Syracuse, N. Y.—The contract for paving Concord place was awarded to John Young, Syracuse, N. Y., $6,508.

Syracuse, N. Y.—The contract for paving a portion of Catherine st. was awarded to T. J. Baker, University blk., Syracuse, N. Y., $20,590.

Cincinnati, O.—The contract for the improvement of Hill road near the residence of Jacob Stephan, in Colerain tp. was awarded to N. Ruebel, Bridgetown, O., $1,840.

Cincinnati, O.—The following contracts were awarded: Paving with brick block Herschel ave. from Observatory rd. to the old corporation line to Morgan & Springmeier, Cincinnati, O., $7,257; and for paving Plum st. from Court to S. Canal st. with granite, to J. M. Quill, Cincinnati, O., $5,618; improvement of North Bend rd. from Harrison pike to north corporation line of village of Cheviot in Green tp. was awarded to R. E. Cash, 115 Ehrman ave., Cincinnati, O., $11,177; macadamizing Sutter ave. between Beekman and Linden sts. was awarded to County Construction Co., 409 Schofield Bldg., Cleveland, O., $5,545; paving Rutland ave. between Montgomery rd. and Trimble ave. was awarded to Patrick Gleason, 1906 Highland ave., Cincinnati, O., $7,422.

Columbus, O.—The contract for paving High st. from 5th ave. to Doderidge st. with asphalt, Harris block gutters and asphalt filter was awarded to Andrews Asphalt Paving Co., Hamilton, O., $74,154; the contract for improving a portion of W. High st. was awarded to Andrews Asphalt Paving Co., Hamilton, O., $74,000.

Linden Heights, O.—The contract for the construction of about 190,000 sq. ft. of flagstone sidewalks was awarded to R. Deckard & Son, Bowling Green, O.

Lisbon, O.—The contract for furnishing the labor and material necessary to grade the East Liverpool and Lisbon rd. was awarded to W. D. Hammond, Jacobsburg, O.

Toledo, O.—The contract for improving Ragan rd. in Maumee was awarded to Garrigan Bros., Valentine Bldg., Toledo, O., $22,000.

Pawhuska, Okla.—The contract for paving various sts. cement base, vitrified brick and asphalt filler was awarded to Howard Walton, Copperville, Okla. and E. A. Hanna, Ochelata, Okla.

Portland, Ore.—The contract for paving street surrounding Ladd Park about 3 blocks on E. 33rd and 39th sts., 6 blocks on E. Ankeny and Oak sts. and 2 blocks on E. Ash st. was awarded to Barber Asphalt Co., Portland, Ore.

Portland, Ore.—The following contracts were awarded: Paving E. 40th st., E. Glisan st., Kerby st. and Klickitat st. to Oregon Hassam Paving Co., Board of Trade Bldg., $30,032; paving Constance st., grade and concrete walks on Princeton st., grades and walks on E. Lincoln st., Spokane ave., grade Claybourne st., grades and walks on E. 13th to Giebisch & Joplin, Portland, Ore., $23,600; asphalt pavement on E. Market st. to Barber Asphalt Paving Co., Worcester Bldg., $4,404; bitulithic pavement on Parkside drive to Warren Construction Co., Portland, Ore., $5,489.

Harrisburg, Pa.—The following contracts were awarded: Paving 19,330 sq. yd. and 16,135 ft. of curbing to Central Construction Co., Commonwealth Bldg., Harrisburg, Pa., $40,012; paving 58,922 sq. yd. and 14,685 ft. of curbing to Barber Asphalt Co., Harrisburg, Pa., $121,822.

Pittsburg, Pa.—The contract for paving Ardmore blvd. was awarded to Booth & Flynn, 1942 Forbes, Pittsburg, Pa.

Wilkes Barre, Pa.—The contract for paving Stetson and Empire sts. was awarded to John E. James, Wilkes Barre.

Providence, R. I.—The following contracts were awarded: Furnishing 100,000 granite paving blocks to Cato Granite Co., Westerly, R. I.; 200,000 granite paving blocks to Hurricane Isle Granite Co., N. Y.

Amarillo, Tex.—The contract for paving with vitrified brick was awarded to Ocklander Bros., Dallas, Tex.

Austin, Tex.—The contract for laying 41,500 sq. ft. of sidewalks was awarded to J. Brueggermann, Austin, Tex.

Dallas, Tex.—The contract for paving Grand ave. and Holmes st. with bitulithic was awarded to Texas Bitulithic Co., Dallas, Tex.; the contract for paving portion of Main st. with bitulithic was awarded to Texas Bitulithic Co., Western Bank and Trust Bldg., Dallas, Tex., $30,000.

Fairfield, Tex.—The contract for constructing 35 mi. of clay and sand roads was awarded to C. E. Johnson, Houston, Tex., $50,000.

Galveston, Tex.—The contract for paving Tremont st. between ave. P½ and the North line of the county boulevard was awarded to Kelso & Vautrin, Galveston, Tex.

Norfolk, Va.—The contract for grading the new road to be built from Tanner's creek across roads through the lands of J. D. Guy and others was awarded to Southern States Engineering & Equipment Co., Norfolk, Va.

Portsmouth, Va.—The contract for the construction of about 80,000 sq. yds. of street paving next spring was awarded to Barber Asphalt Co., Philadelphia, Pa.

Aberdeen, Wash.—The contract for paving Broadway from Wish Kah st. to First st. was awarded to Barber Asphalt Paving Co., Tacoma, Wash.

North Yakima, Wash.—The following contracts were awarded: Grading on Walnut ave. et al. to West Coast Construction Co., Madison Bldg., North Yakima, Wash., $32,528; the contract for grading E. 47th st. was awarded to A. Peterson, Pioneer Bldg., North Yakima, Wash., $13,651; the contract for grading 32nd st. et al. was awarded to J. L. Stanley, 604 Fairview ave., North Yakima, Wash.;

the contract for grading 31st st. was awarded to J. A. Zinkham, 1324 Howard ave., North Yakima, Wash., $3,041; the contract for paving 4th ave. and others was awarded to Allain & Hull, Alaska Bldg., North Yakima, Wash., $2,831.

Seattle, Wash.—The following contracts were awarded: Paving 14,330 sq. yds. with brick to Barber Asphalt Paving Co., Seattle, Wash.; the contract for paving 4th ave. and others was awarded to Barber Asphalt Paving Co., Seattle, Wash., $72,661; the contract for grading and paving Crawford Place was awarded to S. Norwich, Seattle, Wash.; the contract for grading in McNaughts 3rd add. was awarded to Lewis & Wiley, Central B'dg.

Tacoma, Wash.—The following contracts were awarded: Sidewalks in district No. 773 to Smith Cement Brick Co., 772 Commerce st., Tacoma, Wash., $6-595; grading and sidewalks to Pacific Fuel Co., 1950 South C st., Tacoma, Wash., $1,629.

Berlin, Ont.—The contract for paving various streets was awarded to Warren Bitulithic Co., Boston, Mass., between $80,000 and $100,000.

New Westminster, B. C.—The contract for paving 3rd st. was awarded to Hassam Paving Co., Vancouver, B. C., $44,-760.

SEWERS.

CONTEMPLATED WORK.

Anaheim, Cal.—Plans and estimates are being prepared for a sewer system.

Bakersfield, Cal.—The installation of sewers in I st. and Truston ave. is contemplated.

Corning, Cal.—Sewer and water works systems to cost about $68,800 is contemplated.

Colusa, Cal.—The city engineer is preparing plans for water works and sewer system.

Hanford, Cal.—Plans have been adopted for extensions to the sewer system. Cost about $63,000.

Long Beach, Cal.—Installation of sewers in 2nd, 3rd, 4th, 5th, 6th and 7th sts., Alamitos and Olive aves. and various alleys is contemplated.

Colorado Springs, Col.—Plans have been completed for storm sewers from Platter ave. to Costilla st. and from Cascade ave. to Shoaks Run. Cost about $40,448.

Rome, Ga.—Voted $50,000 for construction of various sewers.

Bloomington, Ill.—Plans are being prepared for 1,000 ft. brick sewer.

Chicago, Ill.—The board of local improvements have ordered the construction of sewers in the following streets: Albany ave. from 9 to 4 ft. in size; Rockwell st. from 10 ft. to 4½ in. in size. Estimated cost $810,000.

Galesburg, Ill.—Construction of trunk sewer is contemplated.

Vinton, Ia.—The city council is considering the laying of a sanitary sewer, and it is expected that work will be started the first thing in the spring.

Dawson Springs, Ky.—Plans are being prepared for 1½ miles of new sewers to cost about $10,000.

Easton, Md.—The construction of various sewers and sewage disposal plant is contemplated.

Bessemer, Mich.—Voted $15,000 bonds for sewers.

Kalamazoo, Mich.—Bids will soon be requested for construction of sewer in Fulford st., estimated cost $15,000.

Duluth, Minn.—Plans are being prepared for laying a sewer from Woodlawn Co. line to Fischers creek. Estimated cost $71,000.

Black Mountain, N. C.—Construction of sewer system to cost about $12,000 is contemplated.

Delaware, O.—Plans are being prepared for a sewage disposal plant.

Duncan, Okla.—Will vote bonds in January to the amount of $45,000 for the construction of a system of sanitary sewers, and for the extension of the present water works system. Two deep wells are at present in the course of construction. and a good supply of water is assured. Later the proposition of paving the business district of the city will be taken up by the board of commissioners. W. L. Benham, cons. engr., 714-16 Campbell Bldg., Oklahoma City, Okla.

Portland, Ore.—Plans are being prepared for sewers in the following streets: Market, E. Salmon, E. Water and E. 3rd.

Corpus Christi, Tex.—Plans are being prepared for a sewer system to cost about $140,000.

Dallas, Tex.—It has been decided to construct a sewer between Houston and Texas Central Ry., Ervey st., Live Oak st., and Ross ave. Cost about $20,000.

Houston, Tex.—Plans are being prepared for a storm water lateral along McGovern ave. from Main st. to a connection with the big Austin st. sewer.

Virginia Beach, Va.—Bids will soon be asked for construction of various sewers.

Chehalis, Wash.—Sewers will be constructed next spring to cost about $56,000.

Seattle, Wash.—Sewers in Meridian ave. and various others are contemplated.

Spokane, Wash.—Plans are being prepared for a sanitary and storm concrete sewer for the Union Park district to cost about $300,000.

Tacoma, Wash.—The laying of a 15-in. sewer in Miller's third acre-tract plat and Miller's acre tracts from S. 66th st. to S. 72nd sts. on S. 66th st. and others and S. 61st st. is contemplated.

Vancouver, B. C.—The sum of $500,000 is available for sewer extensions and it is stated that work will be started on the sewers in the near future.

CONTRACTS TO BE LET.

Monrovia, Cal.—Bids will be received on Jan. 7 for furnishing material and constructing a sewer system. C. H. Reed, cy. clk.

Oroville, Cal.—Bids will be received on Jan. 3 for furnishing material and constructing a sewer system, liquefying tanks and sewage disposal works. E. J. Mitchell, cy. clk.

Boston, Mass.—Dec. 6, 12 m. For pipe sewer in Mallon rd. between Rosseter and Bowdoin ave. Surety bond for $600. Louis K. Rourke, supt. of streets, Boston, Mass.

Syracuse, N. Y.—Bids will be received on Jan. 26 for constructing Harbor brook intercepting sewer, etc. G. D. Holmes, chf. engr.

Checotah, Okla.—Bids will be received on Jan. 16 for constructing about 11 mi. of 8, 10 and 12-in. sanitary sewer with manholes, flush tanks, lampholes, disposal plant, etc. Ben Huddleston, cy. clk.

Buffalo, N. Y.—Bids will be received until Jan. 3 for repairing foundations of boilers at the Hamburg sewage pumping plant. Francis G. Ward, chair. bd. of pub. wks.

Masontown, Pa.—Bids will be received until Jan. 16 for constructing sewer and water works systems. C. V. Cloud, chair. borough coun.

Pottsville, Pa.—Bids will be received

on Jan. 17 for constructing water supply, sewage disposal plant, elevator, heating, ventilating, plumbing and electric wiring complete for a building for the insane at Schuylkill Haven, Pa. Charles T. Straughn, cy. contr., Pottsville, Pa.

Aberdeen, S. D.—Bids will be received on Jan. 9 for building 5,600 ft. of 12, 15 and 20-in. pipe sewer extensions, 14 manholes. F. W. Raymond, aud.

Corsicana, Tex.—Bids will be received on Jan. 6, 6 p. m., for constructing 13,200 ft. of additional sewer mains. Certified check 10 per cent. Walter Burgess, cy. secy.

Portage, Wis.—Bids will be received on Jan. 3 for the construction of various sewers. City Council, Portage, Wis.

Buffalo, Wyo.—Bids will be received on Jan. 6 for furnishing labor and material for sewerage system, 24,450 lin. ft. 6 to 15-in. pipe sewer, 51 manholes, 15 flush tanks, 22 lamp holes, outlets, etc. Hayden M. White, cy. clk., Buffalo, Wyo.

Vancouver, B. C.—Bids will be received on Jan. 3 for constructing sanitary sewers in various streets. City Engineer, Vancouver, B. C.

CONTRACTS AWARDED.

Alameda, Cal.—The contract for the construction of sewer in Grant st. between Clinton and Dayton aves. was awarded to Hutchinson Co., 401 14th st., Oakland, Cal.

Fresno, Cal.—The contract for installing main sewer in Belmont annexed territory was awarded to Joe House, Oakland, Cal., $37,000.

Roseville, Cal.—The contract for furnishing material and constructing sewer system was awarded to C. D. Vincent, Oakland, Cal., $42,850.

Ansonia, Conn.—The contract for a sewer system requiring about 6,500 ft. 27, 24 and 18-in. vitrified pipe, 35 manholes and drop manholes, was awarded to O'Neil & Neva, Hartford, Conn., $15,162.

Atlanta, Ga.—The contract for the construction of the Peachtree creek disposal plant has been recommended for award to Chester A. Dady, Brooklyn, N. Y., at $195,563.

Atlanta, Ga.—The following contracts were awarded: Constructing the Peachtree creek and Orme st. intercepting sewer, including about 7 mi. of 48-in. concrete sewer, etc., sec. 4 to Dysard Construction Co., Atlanta, Ga., $35,547; secs. 5, 6, 7, 8, to Nichols Construction Co., Atlanta, Ga., $160,024; construction of Proctor creek sewage disposal plant to Muncipal Engineering & Construction Co., Chattanooga, Tenn., $95,686.

Carlinville, Ill.—The contract for the construction of sewer in the East end of 1st South st. was awarded to Castle Improvement Co.; Carlinville, Ill.

Pekin, Ill.—The contracts for the construction of the following sewers: Dist. No. 2, 98 manholes, 131 catchbasins, 250 ft. 12-in. cast iron pipe, 10-in. pipe for catch basin connections; dist. No. 3, 190 manholes, 278 catch basins, 150 ft. 16-in. cast iron pipe, 10-in. pipe for catch basins to Ottawa Construction Co., Ottawa, Ill. John W. Alvord and Chas. B. Burdick, cons. engrs. for the city of Pekin, Ill.

Rock Island, Ill.—The contract for laying sewer and water mains on 6th ave. between 34th and 35th sts. was awarded to P. E. Frenkenschuh.

Indianapolis, Ind.—The contract for laying a sewer in and along the alley of Hiawatha st. from Owosso st. to alley south of New York st. was awarded to Sheehan Construction Co., Indianapolis, Ind.

Kokomo, Ind.—The contract for the installation of 3,000 ft. 15-in. vitrified pipe sewer was awarded to J. H. Watson & Co., Kokomo, Ind.

Sioux City, Ia.—The contract for laying a storm water sewer in Myrtle st. was awarded to W. B. Carter, Sioux City, Ia.

Louisville, Ky.—The contract for the construction of concrete sewer, 7 ft. in diameter in Preston and Fulton sts. was awarded to C. T. McCracken Co., Pittsburg, Pa., $30,978.

Boston, Mass.—The contract for the construction of sewers and catch basins in Western ave. and Lincoln st. was awarded to Chas. J. Jacobs, Boston, Mass.

Flint, Mich.—The contract for the construction of sewer in 12th st. from Harrison to Elm sts. was awarded to Timothy Lynch, 12th st., Flint, Mich.

Kalamazoo, Mich.—The contract for the construction of Fulford st. sewer was awarded to Johnson & Van Dyke, Kalamazoo, Mich., $14,919.

Virginia, Minn.—The contract for constructing storm sewer in 1st ave. and 1st st. was awarded to T. C. Butler, Virginia, Minn., $4,060.

Windsor, Mo.—The contract for the construction of sewer system was awarded to T. C. Brooks & Sons, Jackson, Mich.

Atlantic City, N. J.—The contract for constructing storm water drainage system was awarded to W. G. Root, 20 Broad st., New York, N. Y., $31,000.

Keysport, N. J.—The contract for sewage disposal and pumping works; 41,250 ftt. of 8-in. pipe sewers; 12,335 ft. of 10-in. pipe sewers; 1,310 ft. of 12-in. pipe sewers; 690 ft. of 15-in. pipe sewers; 182 manholes; 4 siphon chambers 10 ft. and under; ¾-in. cast iron pipe to flushing manholes; 6,495 ft. 6-in. cast iron pipe; 375 ft. 12-in. cast iron outfall pipe;; 30 tons cast iron pipe; 10,000,000 ft. lumber; 1 sedimentation and sterilization tank; 1 pump and engine; 1 Cedar st. pump station; 1 Florence ave. pump station; 35 lamp holes; 1,100 ft. cast iron pipe was awarded to Harrison Construction Co., Newark, N. J., $68,463.

New Brunswick, N. J.—The contract for laying a sewer in Richardson st. from Easton ave. to a point near Wycffoff st. was awarded to Farley Bros., New Brunswick, N. J.

Newark, N. J.—The contract for laying storm sewers in ave. C and Dawson st. was awarded to Jersey Paving Co., Union Bldg., Newark, N. J., $5,252.

South Amboy, N. J.—The contract for constructing a portion of sanitary sewer system to include 100 cu. yd. concrete, 30,000 ft. 15, 12, 10 and 8-in. clay pipe sewers, 200 manholes and 20 flush tanks was awarded to Miele Bruno, Newark, N. J., $50,000.

South River, N. J.—The contract for a sewerage system and disposal plant was awarded to Mille & Bruno, Newark, N. J.

New York, N. Y.—The contract for constructing sewer in Monroe ave. was awarded to John E. Donovan, 2205 Richmond Terrace, Port Richmond, N. Y., $7,579.

Charlotte, N. C.—The contract for repairing septic tank was awarded to W. S. Stamill, Charlotte, N. C., $12,510.

Rocky Mountain, N. C.—The contract for the construction of sewage purification plant was awarded to Edwards Construction Co., Hickory, N. C., $5,300.

Fostoria, O.—The contract for laying a sewer in south part of town was awarded to Modern Construction Co., Fremont, O.

Hamilton, O.—The contract for the construction of sanitary sewer at 11th and Hanover and on Vine st. between 3rd and 4th sts. was awarded to W. H. Louthan, Hamilton, O.

Piqua, O.—The contract for the construction of northwestern sewer was awarded to Backus Construction Co., Dayton, O., $10,000.

Warren, O.—The contract for the construction of sewer system in the northwestern portion of the city was awarded to Dennis & Smith, Warren, O.

Fairfax, Okla.—The contract for the construction of water works and sewer system was awarded to Southwestern Engineering Co., Oklahoma City, Okla.

Yukon, Okla.—The contract for installating sewer system and modern sewage plant was awarded to N. S. Sherman, Jr., Sherman Iron Works, Oklahoma City, Okla., $40,000.

Gresham, Ore.—The contract for the construction of sewer and water systems was awarded to L. C. Kelsey, Portland, Ore.

Watertown, S. D.—The contract for the construction of a sewer was awarded to E. T. Webster, St. Paul, $17,265.

Beeville, Tex.—The contract for constructing a sewer system was awarded to Rees & Peters, San Antonio, Tex.

Brownsville, Tex.—The contract for machinery to complete septic tanks was awarded to Texas Machine & Supply Co., Dallas, Tex.

Dallas, Tex.—The following contracts were awarded: Construction of storm sewer in the regions of River, Nussbaumer and Peak sts. to C. W. Olcott, Dallas, Tex., $14,622; construction of storm sewer to drain the area bounded by Masten, Ross, Central and Live Oak sts. to Dallas Lime & Gravel Co., Dallas, Tex., $19,391.

Fort Worth, Tex.—The contract for the construction of north side sewer was awarded to General Supply & Construction Co., Ft. Worth, Tex., $51,000.

Provo, Utah.—The contract for constructing sewers in sewer dist. No. 11 was awarded to Kennedy Construction Co., Fargo, N. D., $30,000.

Salt Lake, Utah.—The contract for sewer extension 279 on second West st. between S. Temple and E. South sts. was awarded to Dalt L. Pitt, Salt Lake, Utah, $962.50.

North Yakima, Wash.—The contract for laying a sewer in 15th ave. N. W., was awarded to J. L. Stanley, 604 Fairview ave., North Yakima, Wash.

Pasco, Wash.—The contract for constructing sewer system was awarded to Newport Engineering Co., Portland, Ore., $90,000.

Seattle, Wash.—The contract for laying sewers in 15th ave. and other streets was awarded to H. Dahlstrom, 2437 W. 56th st., $6,456.

New Westminster, B. C. The contract for furnishing sewer pipe was awarded to Gilly Bros., New Westminster, B. C.

Vancouver, B. C.—The contract for furnishing vitrified pipe for sewers was awarded to Colin Jackson, Vancouver, B. C.; $3,119.

WATER WORKS.

CONTEMPLATED WORK.

Co'usa, Cal.—The city engineer is preparing plans for water works and sewer system.

Corning, Cal.—Water works and sewer systems to cost about $68,800 are contemplated.

Oceanside, Cal.—Water works improvements to cost $20,000 are contemplated.

Palo Alto, Cal.—The laying of water pipes in Fulton st. between Hamilton and Forest aves. has been ordered.

Porterville, Cal.—Contemplating the expenditure of $75,000 for water main extensions.

Sacramento, Cal.—The city engineer has been authorized to prepare plans for a pump of 15,000,000 gallons capacity to be installed at the water works on Front and I sts.

Temescal (Oakland P. O.), Cal.—The Temescal Water Co. will construct a new pipe line from Temescal to Corona. It will be 8 miles long and of reinforced concrete. H. R. Case is manager.

Tracy, Cal.—Construction of water works system is contemplated.

Oakville, Conn.—Surveys are being made for the construction of water works and sewers.

Dublin, Ga.—Voted $30,000 bonds to improve streets, water and light plants.

Roberta, Ga.—Bids will be received in January for construction of water works and electric light plant for the town of Roberta, Ga. W. J. Marshall, Lizella, Ga.

Rome, Ga.—Voted $75,000 bonds for water works improvements.

Galesburg, Ill.—Voted $75,000 bonds for extension of water system.

Evansville, Ind.—The purchase and installation of a new pump and apparatus to cost about $40,000 is being considered by the water board.

Coffeyville, Kan.—Plans for a gravity filtering system have been prepared.

North Attleboro, Mass.—Electric light and water departments are considering a change in their plant, owing to the increase in the output of electricity and water.

West Bridgewater, Mass.—Water works improvements to the extent of $10,000 are contemplated.

Big Rapids, Mich.—Plans are being prepared for water works system to cost $30,000.

Flint, Mich.—A mechanical filtration plant and extension of the water mains, to cost about $400,000 is contemplated.

Lewistown, Mont.—Rebuilding water works at a cost of about $85,000 is contemplated.

Townsend, Mont.—Plans are being prepared for water works system.

Battle Creek, Neb.—The installation of a water works system is contemplated.

Cortland, Neb.—The installation of an electric light plant and water works system is contemplated.

Lodge Pole, Neb.—Plans are being prepared for the installation of a water works system.

Manchester, N. H.—The construction of a 1,000,000 gallon tank on Rock Remmon, to be used as an emergency reservoir, is being considered by the water biard.

Branchville, N. J.—Plans for an additional reservoir are being prepared.

Bay Shore, L. I., N. Y.—Water works improvements, including new pumping station, pumping engines and boilers are contemplated.

Syracuse, N. Y.—About $50,000 will be expended during the coming year for extending the water works system.

Haines, O.—Construction of water works system is contemplated.

Lakewood, O.—Plans are being prepared for two 500,000-gallon standpipes.

Sugarcreek, O.—Voted $12,500 bonds for water works system.

Sylvania, O.—Plans have been prepared for the construction of a municipal water works system.

Toledo, O.—Increased capacity of the

filtration plant and the establishment of a pure water storage basin at the pumping plant is contemplated.

Wooster, O.—Voted $30,000 bonds to construct water works system.

Duncan, Okla.—Will vote bonds in January to the amount of $45,000 for the construction of a system of sanitary sewers, and for the extension of the present water works system. W. L. Banham, cons. engr., 714-16 Campbell Bldg., Oklahoma City, Okla.

Hood River, Ore.—Water works improvements and extensions are contemplated.

Portland, Ore.—Plans are being prepared for laying water mains in the following streets: E. Yamhill, 21st, 11th, 12th, 13th, 49th, E. Washington, Waverleigh and Park.

Union, Ore.—Plans are being prepared for water works improvement to cost $71.000.

Coraopolis, Pa.—About $22,500 will be expended for improvements to water works and electric light plant.

Somerset, Pa.—Construction of reservoir and water works improvements is contemplated.

Huron, S. D.—Voted $40,000 bonds for construction of water works.

Memphis, Tenn.—The purchase of two 20.000,000-gallon electrical pumps to cost $28,612 is contemplated.

San Augustine, Tex.—Plans have been completed for new water works at an estimated cost of $235,000. R. H. Hall, mayor.

Barre, Vt.—Voted $45,000 bonds for constructing the Orange brook reservoir.

Cambridge, Vt.—The construction of a water works to cost $15,000 is contemplated.

Richmond, Va.—Enlargement and improvement of water mains and system in Washington Ward is contemplated.

Ellensburg, Wash.—Plans have been completed for water works system.

Leavenworth, Wash.—Voted $45,000 bonds for municipal water works system.

Spokane, Wash.—Bids will soon be requested for constructing Lincoln Heights reservoir.

Tacoma, Wash.—Bids will be requested for a steel bridge over Nisqually river, pipe line from tunnel to forebay, 6-acre reservoir; penstock line; power house, machinery, water wheels, generators, transformers and 31 miles of transmission line for Nisqually power project. All items to be included under one bid. Hamilton F. Gronen, engr., city hal', Tacoma, Wash.

Tacoma, Wash.—Bids will soon be asked for the construction of Lincoln Heights reservoir. Estimated cost $129,000.

Madison, Wis.—The city council authorized the issuance of $26,000 bonds for water works improvements.

Prescott, Wis.—Bonds have been voted for a water works system.

Gleichen, Alberta, Can.—Plans are being prepared for water works system to cost about $30,000.

Grand Forks, B. C.—Plans are being prepared for a $10,000 reservoir for the city water works.

CONTRACTS TO BE LET.

Oroville, Cal.—Bids will be received on Jan. 3 for constructing water works and sewer systems. Board of village trustees.

Newton, Ia.—Bids are asked until Jan. 9 for erecting elevated tank. E. G. Finch, cy. clk.

Onoga, Kan.—Bids will be received on Jan. 10 for furnishing material and constructing water works system. Elmer E. Hines, cy. clk.

Stafford, Kan.—Bids will be received on Jan. 3 for furnishing material and constructing a water works and electric light plant. N. P. Reid, cy. clk.

Ft. Smallwood, Md.—Bids wil lbe received on Jan. 10 for constructing pump house and installing pumping machinery. Constr. Q. M., U. S. A., Ft. Howard, Md.

Grand Rapids, Mich.—Bids will be received on Jan. 19 for the construction of filters and equipment. Board of public works, Samuel A. Freshney, secy., Grand Rapids, Mich.

Superior, Neb.—Bids will be received until Jan. 6, 8 p. m., for water works construction. Certified check for $500. J. T. Robbins, cy. clk.

Superior, Neb.—Bids will be received on Jan. 6, 8 p. m., for furnishing material and labor for the equipment and construction of water works. Certified check, $500. J. T. Robbins, cy. clk., Superior, Neb.

Euclid, O.—Bids will be received until Jan. 9 for constructing a 6-in. water main in a portion of Cliffview ave. Nelson J. Brewer, vil. clk.

Masontown, Pa.—Bids will be received until Jan. 16 for constructing sewer and water works systems. C. V. Cloud, chair. borough coun.

Pittsburg, Pa.—Bids will be received on Jan. 11 for furnishing and installing a water power air compressor plant at Lock 1, Monongahela river, Pittsburg, Pa. H. C. Newcomer, Lieut. Col., Pittsburg, Pa.

Pottstown, Pa.—Bids will be received on Jan. 17 for increased water supply, sewage disposal plant, etc. Chas. T. Straughn, co. audr.

Spokane, Wash.—Bids will be received on Jan. 3, 2 p. m., for construction of Lincoln Heights add. concrete reservoir. J. C. Argall, secy., board of pub. wks.

Tacoma, Wash.—Bids will be received on Jan. 6 for 3,600 ft. of 18-in. water pipe to witstand a working pressue of 125 lbs. per sq. Certified check for 10 per cent of bid. John Giord, cy. pur. agt.; Jan. 16, 3. m., furnishing motor-driven combination chemical engine and hose wagon, one motor-driven aerial ladder truck; also auto roadster to carry four persons.

Souris, Man., Can.—Bids will be received on Feb. 1 for furnishing and delivering during the spring and summer of 1911 the following material: about 585 tons of 4 to 12-in. standard cast iron water pipes and special castings; 75 fire hydrants; 45 gate valves, from 4 to 8-in.; 45 cast iron valves boxes; 20,000 lbs. pig lead; 2,000 lbs. oakum; 31,100 ft. of standard vitrified sewer pipe from 8 to 20-in. and specials. J. W. Breakey, secy.

Vancouver, B. C.—Bids will be received on Jan. 11 for furnishing steel pipe, castings, valves and hydrants. H. Floyd, C. M. C., Kerrisdale, B. C.

CONTRACTS AWARDED.

Albertville, Ala.—The contract for the constructing water works system was awarded to H. E. Taylor, Ttlanta, Ga.

Adel, Ga.—The contract for water main extensions was awarded to J. B. McCrary Co., Atlanta, Ga., $8,000.

Rock Island, Ill.—The contract for laying water mains and sewer on 6th ave. between 34th and 35th sts. was awarded to P. E. Frenkenschuh.

Burlington, Ia.—The following contracts were awarded for erection of pumping station to Tom McCarthy, Davenport Ia., $13,000; for pumps and machinery to Erie City Iron Works, Erie, Pa., $14,500.

Indianapolis, Ind.—The contract for a 10,000,000-gallon steam turbine centrifugal pump was awarded to DeLaval Steam Turbine Co., Trenton, N. J.

Stuart, Ia.—The contract for the erection of water tank was awarded to Des Moines Bridge & Iron Co., Des Moines, Ia., $5,248.

Hammond, Ind.—The contract for furnishing 15,000,000-gallon pump to Snow Pump Works, Buffalo, N. Y.

Brunswick, Md.—The contract for furnishing water pipe, hydrants, gate valves, etc., was awarded to Edward S. Moberly & Bros., Frederick, Md.

New Bedford, Mass.—The following contracts were awarded: Furnishing 1,500 tons of 16-in. to 6-in. straight cast iron pipe and 44 tons of special castings to the Standard Cast Iron Pipe & Foundry Co., of Bristol, Pa., for $32,070 and $2,024 respectively. The company bid $21.38 per ton for the cast iron pipe and $46 per ton for specials.

Lawrence, Mass.—The contracts for furnishing quantity of pipe, bell and spigot castings was awarded to Chas. Miller & Sons, Utica, N. Y.

Centerville, Mich.—The contract for furnishing mechanical and pumping equipment for water works and lighting plant, to Young-Gray Co., Toledo, O.; electrical equipment was awarded to F. Bissel Co., 226 Huron st., Toledo, O.

Harbor Springs, Mich.—The contract for furnishing pipe for water works was awarded to J. B. Clow & Sons, Chicago, Ill.

Saginaw, Mich.—The contract for the installation of intake and pump well at east side pumping station was awarded to Wm. N. Sager, Saginaw, Mich., $16,743.

Duluth, Minn.—The contract for repairing intake pipe at Lakewood station was awarded to H. H. Thompson, Duluth, Minn., $6,138.

Fairmont, Minn.—The following contracts were awarded: Installation of a 400-h. p. engine to Minneapolis Steel & Machinery Co., Minneapolis, Minn., $21,985; and for new pump and motor, etc., to Allis Chalmers Co., Minneapolis, Minn., $2,885.

Kenyon, Minn.—The contract for drilling and completing a deep well at the pumping station was awarded to M. Holland, Cannon Falls, Minn.

Minneapolis, Minn.—The contract for two electrically driven 20,000,000-gallon pumps was awarded to Henry R. Worthington, New York, $28,612.

Owatonna, Minn.—The contract for furnishing cross compound Corliss duplex pumping engine, capacity 1,500,000 gallons was awarded to Laidlaw Dunn Gordon Co., New York, $5,993.

Windsor, Mo.—The contract for constructing water works system was awarded to T. C. Brooks & Son, Jackson, Mich., $28,579.

Beatrice, Neb.—The contract for furnishing material and labor for water works improvements was awarded to Mathews Construction Co., Kansas City, Mo., $57,000.

Stratton, Neb.—The contract for the construction of water works system was awarded to Intermountain Bridge & Construction Co., Tecumseh, Neb., $11,000.

East Orange, N. J.—The contract for furnishing 180 tons of 8-in. cast iron pipe and 25 tons of specials was awarded to United States Cast Iron Pipe & Founry Co., New York.

Newark, N. J.—The contract for a new pump pit and subfoundation at the Quindaro pumping station was awarded to A. M. Blodgett Construction Co., Newark, N. J.

Bay Shore, L. I., N. Y.—The contract for pumping station was awarded to John Thatcher & Sons, Brooklyn, N. Y.

Buffalo, N. Y.—The contract for furnishing 3 steam turbine electric generators for new pumping station at foot of Porter ave. was awarded to Westinghouse Machine Co., Pittsburg, Pa.

Poughkeepsie, N. Y.—The contract for furnishing 6 and 8-in. water pipe was awarded to R. D. Wood & Co., Philadelphia, Pa.

Athens, O.—The contract for the construction of water works system at the hospital was awarded Kinnicutt Co., Chicago Heights, Ill., $12,047.

Cincinnati, O.—The contract for furnishing water pipe for the Delhi water connection was awarded to United States Cast Iron Pipe & Foundry Co., Chicago, Ill., $42,369.

Dunkirk, O.—The contract for the constructing water works system was awarded to Nation Co., South Bend, Ind.

West Carrollton, O.—The following contracts were awarded: Pumping station, reservoir, pipe and machinery for water works; reservoir to Ernest Kroemer, 647 Oak st., Dayton, O., $2,216; 2 triplex pumps, 1 motor, 1 gasoline engine to Fairbanks-Morse Co., Cincinnati, O., $3,069; 3,000 ft. of 8-in. pipe to United States Cast Iron Pipe & Foundry Co., Cincinnati, O., $6,675.

West Carrollton, O.—The following contracts were awarded: For 2 triplex pumps, 1 25-h. p. motor and 1 25-h. p. gasoline engine to Fairbanks, Morse & Co., Cincinati, O., $3,079; for pumping station to Ernest Kromer, 647 Oak st., Dayton, O.; for reservoir, laying pipe, etc., to J. Plocher & Son, Miamisburg; for furnishing 8-in. cast iron pipe to United States Cast Iron Pipe & Foundry Co., Cincinnati, O.

Fairfax, Okla.—The contract for the construction of water works and sewer system was awarded to Southwestern Engineering Co., Oklahoma City, Okla., $50,000.

Stigler, Okla.—The contract for the construction of water works, including river dam and watershed, was awarded to Healy Construction Co., McAlester, Okla., $26,700.

Stilwell, Okla.—The contract for constructing new water works was awarded to Southwestern Engineering Co., Oklahoma City, Okla., $45,000.

Gresham, Ore.—The contract for the construction of sewer and water systems was awarded to L. C. Kelsey, Portland, Ore.

Medford, Ore.—The contract for constructing new water works system was awarded to James A. Maer, Portland, Ore.

Jacksonville, Ore.—The contract for the installation of water works system was awarded to James J. Means, Portland, Ore.

Sagertown, Pa.—The following contracts were awarded; for constructing reservoir and laying pipe for water works system to Henry Knipple, Olean, N. Y.;

for pipe and special castings to United States Cast Iron Pipe & Foundry Co., Buffalo, N. Y.; for hydrants and valves to Kennedy Valve Mfg. Co., Elmira, N. Y.

Fort Greble, R. I.—The contract for the construction of a 1,000,000-gallon reinforced concrete reservoir was awarded to Simpson Bros. Corporation, 166 Devonshire st., Boston, Mass., $28,028.

Timmonsville, S. C.—The following contracts were awarded. General water works construction to Abee & Hart, Hickory, N. C., $26,393; wells to Hughes Specialty Well Drilling Co., Charleston, S. C., $1,496; a 100-h. p. boiler and a steel tank and tower to R. D. Cole & Co., Atlanta, Ga., $5,610; valves and hydrants to Columbia Iron Works, Chattanooga, Tenn., $1,655; and general service pumps to Platte Iron Works, Atlanta, Ga., $1,185.

Belle Fourche, S. D.—The contract for water works, a 30,000 and a 200,000-gallon reinforced concrete reservoir, pumping station; air compressor; air receiver; air lines to wells; 20-h. p. motor for compressor! triplex power pump with motor; wiring, switches, lighting circuit; 18,815 ft. cast iron pipe from 4 to 10 in; 6 and 8-in. cutoff valves; 12 hydrants; special castings; 970 ft. of 4 and 6-in. cast iron pipe, was awarded to Kat-Craig Construction Co., Omaha, Neb., 31,935; the contract for furnishing cast iron pipe, beams and grillage bars for the Belle Fourche project was awarded to Marshall Foundry Co., Pittsburg, Pa., $7,697.

Denison, Tex.—The contracts for water works materials were awarded as follows: pipe to United States Cast Iron Pipe & Foundry Co., Chattanooga, Tenn.; valves to R. D. Wood & Co., Philadelphia, Pa.; lead and jute to Hardwick Etter, Denison, Tex.; total cost $28,000.

Denison, Tex.—The contract for an engine and pump was awarded to Briggs-Weaver Machinery Co., Dallas, Tex., $11,740.

North Yakima, Wash.—The contract for the construction of about 40 miles of laterals in connection with Yakima irrigation project was awarded to Nelson Rich, Prosser, Wash., $116,070.

Spokane, Wash.—The contract for laying water mains in dist. No. 501 was awarded to Gallucii & De Rose, 1404 S. 13th st., $13,219.

Winnipeg, Man., Can.—The following contracts were awarded for furnishing materials for domestic water works; water pipe to Canada Iron Corporation, Montreal, Que., $47,538; valves to McAvity & Sons, St. John, N. B., $3,523; hydrants to Canadian Fairbanks Co., Winnipeg, Man., $37 each.

Montreal, Que., Can.—The contract for furnishing motor driven centrifugal pump of 5,000,000 gallons capacity. It consists of a 16-in. two-stage tuhbine pump, driven by an Allis-Chalmers-Bullock 500 h. p. rotor wound motor was awarded to John McDougal, Caledonia Works Co., Montreal, Que., Can.; $7,716.

BRIDGES.

CONTEMPLATED WORK.

Bridgeport, Conn.—Construction of a bridge on E. Washington ave. is contemplated.

Hartford, Conn.—Construction of a bridge connecting Riverside st. with Pope Park is contemplated.

Fernandina, Fla.—The construction of a bridge across the Nassau river and marsh is contemplated.

Jacksonville, Fla.—A bridge over St. John river to connect with South Jacksonville is contemplated.

Covington, Ky.—A bridge at Willow st. to cost $20,000 is contemplated.

Lagrange, Ind.—The construction of bridges over the new Fly creek is contemplated.

Laporte, Ind.—The construction of steel and concrete bridges is being considered by the board of county commissioners.

Fitchburg, Mass.—The erection of a $100,000 bridge and highway to connect Water and Summer sts. sections is contemplated.

Kalispell, Mont.—Construction of five new bridges is contemplated.

Kansas City, Mo.—A reinforced concrete bridge over Blue river at 15th st. and a viaduct on 12th st. to cost $1,400,000 are contemplated.

Bloomington, Neb.—The contract for constructing a steel bridge over Republican river, near Reverton will be let soon.

Franklin, Neb.—Bids will soon be requested for the construction of a steel bridge across the Republican river east of Reverton.

New Brunswick, N. J.—The Middlesex county board of freeholders are having plans prepared for a lift bridge over Cheesequake creek. Plans are being prepared for a reinforced concrete bridge at Roosevelt. Fred F. Simons, co. engr.

Black River, N. Y.—Construction of a concrete and steel bridge 18 ft. wide and 172 ft. span across Black river is contemplated.

Salamanca, N. Y.—Construction of a concrete bridge to span Alleghany river at Main st. is contemplated.

Drayton, N. D.—A bridge across Red river to cost $50,000 is contemplated.

Brilliant, O.—The construction of a bridge over the Ohio river near Brilliant is contemplated.

Haskell, Okla.—Plans are being prepared for a bridge over Arkansas river at Haskell.

Muskogee, Okla.—Voted $150,000 bonds for construction of 33 new bridges.

Brady, Tex.—Bonds have been voted for construction of two bridges across the Colorado river.

Knoxville, Tenn.—The construction of a new bridge across the Southern railroad tracks on Gay st. is contemplated.

Coleman, Tex.—The construction of two bridges over Colorado river, one at Waldrop to cost $15,896, and the other at Stacy to cost $21,484, are contemplated.

Cuero, Tex.—The contract for rebuilding Clear creek bridge was awarded to C. H. Horton, Austin, Tex. $12,095.

Nacogdoches, Tex.—Two concrete bridges, one over the Bonita creek and the other on S. Fredonia st., are contemplated.

Lynchburg, Va.—Plans are being prepared for a bridge over James river at Lynchburg, Va. Estimated cost $200,000.

North Yakima, Wash.—The construction of a bridge to span the Kuskilana river is contemplated.

Spokane, Wash.—Plans have been approved for the construction of a concrete bridge over Latah creek at a cost of $425,000.

CONTRACTS TO BE LET.

Piggott, Ark.—Bids will be received on Jan. 5 for the construction of a bridge over Black river. B. B. Holifield, Rector, Ark., co. judge.

East St. Louis, Ill.—Bids will be received on Jan. 9 for the construction of four highway bridges over Cahokia creek, Division channel, Madison Co., Ill. Board of trustees, East St. Louis, Ill.

Edwardsport, Ind.—Bids will be received on Jan. 5 for constructing steel bridge with reinforced concrete piers across White river at this place. Cost about $18,000. J. P. Scott, audr. Knox Co., Vincennes, Ind.

Vincennes, Ind.—Bids will be received on Jan. 5, 10 a. m., for constructing a bridge over White river. John T. Scott, audr. Knox Co.

Marshalltown, Ia.—Bids will be received on Jan. 4, 12 m., for the construction of three reinforced concrete bridges. 10 per cent certified check. County Auditor, Marshalltown, Ia.

New Hampton, Ia.—Bids will be received on Jan. 5 for the construction of several reinforced concrete bridges. Board of County Supervisors.

Mexico, Mo.—Bids will be received until Jan. 2 for constructing a 126-ft. span steel bridge with concrete abutments and wooden floor. E. H. Carter, co. clk.

Geneva, Neb.—Bids will be received on Jan. 10, 12 m., for furnishing material and constructing all county bridges. Certified check $500. Uriah F. Standard, cy. clk.

York, Neb.—Bids will be received on Jan. 10, for the construction of steel and wooden bridges that may be built in the county during the coming year. Certified check for $500. H. F. Chapin, co. clk., York, Neb.

Ashland, O.—Bids will be received on Jan. 2, 12 m., for the erection of Race street arch. William Shider, chr. co. com.

Cincinnati, O.—Bids will be received on Jan. 13 for the construction of concrete bridge on Cooper ave. in Lockland, Springfield, tp.; $2,000 bond required. Fred Dreihs, clk.

Portland, Ore.—Bids will be received on Jan. 2 for the construction of superstructure of Broadway bridge. City Clerk, Portland, Ore.

Wessington Springs, S. D.—Bids will be received on Jan. 7 for furnishing material and constructing 8 combination steel and concrete bridges. H. O. Refvem, audr.

Richmond, Va.—Bids will be received on Feb. 1 for the construction of a reinforced concrete bridge over James river. Certified check for $5,000. Chas. E. Bolling, cy. engr., Richmond, Va.

CONTRACTS AWARDED.

Anniston, Ala.—The following contracts were awarded: Concrete bridge over Morrisonville road, to Fred Laudt, Anniston, Ala.; and concrete bridge over Cornhouse creek to N. F. Morris, Anniston, Ala.

Cullman, Ala.—The contract for the construction of a 4-deck girder bridge, consisting of 7 80-ft. spans, 1 60-ft. span, and 2 90-ft. spans, 2 half through bridges of 80-ft. spans and 1 60-ft. span, was awarded to Virginia Bridge & Iron Co., Roanoke, Va.

Madera, Cal.—The contract for the construction of bridge over Cottonwood creek was awarded to Pacific Construction Co., 16 California st., San Francisco, Cal.

Santa Ana, Cal.—The contract for constructing bridge across W. 4th st. channel was awarded to A. E. Bird, Santa Ana, Cal.

Ukiah, Cal.—Tre contract for the construction of a 460-ft. bridge over Russian Gulch was awarded to Mervey-Elwell Co., East Oakland, Cal., $7,340.

Visalia, Cal.—The contract for the construction of a reinforced concrete bridge 70 ft. long across Mill creek was awarded to Oscar Parlier, Tulare, Cal.

Delta, Col.—The contract for the construction of a state bridge 2½ miles west of the city was awarded to Pueblo Bridge Co., Pueblo, Col., $11,500.

Miami, Fla.—The contract for constructing two bridges, one over Snake creek and the other over Little river, was awarded to Champion Bridge Co., Wilmington, O.

Douglasville, Ga.—Voted $20,000 bonds for construction of water works.

Chicago, Ill.—The contract for repairing of the Clark st. bridge over the Chicago river was awarded to Strobel Steel Construction Co., 98 Jackson blvd., Chicago, Ill.

Joliet, Ill.—The contract for the construction of two new bridges in Radnor and Logan tps. was awarded to Joliet Bridge Co., Joliet, Ill., $1,674.

Peoria, Ill.—The contract for constructing two bridges in Radnor and Logan tps. was awarded to Joliet Bridge Co., Joliet, Ill., $3,848.

Lebanon, Ind.—The contract for repairing Prairie creek bridge at Thorntown was awarded to Earl Sparks, Kirklin, Ind., $1,097.

Paoli, Ind.—The contract for constructing a concrete bridge at Paoli, Ind., was awarded to International Steel & Iron Construction Co., Evansville, Ind., $2,662.

Burlingame, Kan.—Concrete arch over Switzer creek was awarded to Topeka Bridge & Iron Co., Topeka, Kan., $2,145.

Leavenworth, Kan.—The following contracts were awarded: Two bridges in High Prairie tp. to J. W. Orr, Leavenworth, Kan.; building the Fletcher bridge to Leavenworth Bridge Co., Leavenworth, Kan., and the Wheat bridge to J. B. Tierny, Leavenworth, Kan.

Rozel, Kan.—The contract for the construction of reinforced concrete arch bridge over Pawnee river was awarded to Topeka Bridge & Iron Co., Topeka, Kan., $5,365.

Harlan, Ky.—The contract for constructing steel bridge over Clover Fork was awarded to F. F. Cawood, Harlan, Ky., $13,750.

Saginaw, Mich.—The contract for the construction of a bridge in Brant tp. was awarded to Joliet Bridge & Iron Co., Joliet, Ill.

Columbia, Mo.—The contract for the construction of steel bridges was awarded to Missouri Bridge & Iron Co., St. Louis, Mo., $21,000.

Galena, Mo.—The contract for a bridge across the James river at Galena was awarded to Western Bridge Co., Kansas City, Mo., $12,000.

Lincoln, Neb.—The contract for the steel work for all bridges to be erected in the county the coming year was awarded to Ward Bridge Co., Tecumseh, Neb.

New York, N. Y.—The contract for constructing the painting platforms and runways for the Manhattan bridge between Manhattan and Brooklyn was awarded to Vulcan Rail & Construction Co., 175 N. 9th st., Brooklyn, N. Y.

New York, N. Y.—The contract for repairs to 3 bridges in Forest Park was awarded to Joseph Casey, 136 Liberty st., New York, N. Y., $1,298.

Cincinnati, O.—Plans have been prepared for a concrete and steel bridge 900 ft. long and 6 ft. roadway to be constructed at Gilbert ave. Estimated cost $750,000.

Lima, O.—The contract for the construction of Geiger bridge in Sugar creek tp. was awarded to Engineering Construction Co., Canton, O.

Miami, O.—The contract for the construction of two iron bridges over Snake creek and Little river was awarded to Champion Bridge Co., Wilmington, O.

Oklahoma City, Okla.—The contract for constructing a reinforced concrete bridge over Canadian river was awarded to Topeka Bridge & Iron Co., Topeka, Kan.

Allentown, Pa.—The contract for widening Hamilton st. bridge was awarded to Stewart Contracting Co., Easton, Pa., $19,750.

Rock Hill, S. C.—The contract for an iron bridge over Catawba river between York and Lancaster counties was awarded to Roanoke Bridge Co., Roanoke, Va., $17,800.

Cuero, Tex.—The contract for rebuilding the bridge over Clear creek was awarded to C. H. Horton, Austin, Tex., $12,095.

Dallas, Tex.—The contract for the construction of Oak Cliff terminal of the Dallas-Oak Cliff viaduct was awarded to H. H. Yorty, Ft. Worth, Tex., $15,970.

Waco, Tex.—The contract for the construction of new bridges at 8th st. over Waco creek and at 4th over the same stream was awarded to Austin Bros., Dallas, Tex.

Madison, Va.—The contract for three steel bridges in Madison Co. was awarded to Roanoke Bridge Co., Roanoke, Va., $3,842.

Petersburg, Va.—The contract for the construction of superstructure of viaduct over valley of Lieutenant run at Petersburg, Va. was awarded to Roanoke Bridge & Iron Co., Richmond, Va., $50,000.

Centralia, Wash.—The contract for the construction of 4 steel bridges was awarded to Coast Bridge Co., Portland, Ore.

Ritzville, Wash.—The contract for three bridges in western part of the county was awarded to Coast Bridge Co., Portland Ore., $7,723.

Seattle, Wash.—The following contracts were awarded: Construction of a bridge at Entiat over Entiat river to Gerrick & Gerrick, Seattle, Wash., and a drawbridge across Spokane ave. to International Contract Co., Central Bldg., Seattle, Wash., $30,044.

Spokane, Wash.—The contract for the installation of steel work across the North Coast Ry. bridge spanning Hangman creek and the Spokane river was awarded to Missouri Bridge & Iron Works, Leavenworth, Kan.

Wheeling, W. Va.—The contract for the erection of concrete bridge to span Woods run was awarded to L. G. Hallock & Sons, Wheeling, W. Va., $3,200.

STREET LIGHTING.

CONTEMPLATED WORK.

Lodi, Cal.—New bids will soon be requested for installation of an electric light plant, former bids having been rejected.

Loyalton, Cal.—Installation of an electric light system is contemplated.

Piedmont, Cal.—Installation of a municipal electric light plant is contemplated.

Richmond, Cal.—A modern electric lighting system is contemplated.

San Bernardino, Cal.—Construction of an electric light plant is contemplated.

Dublin, Ga.—Voted $30,000 bonds to improve light and water plants and streets.

Roberta, Ga.—Bids will be received about January for construction of water works and electric light plant for the town of Roberta, Ga. W. J. Marshall, Lizella, Ga.

McDonough, Ga.—Municipal light plant is contemplated.

Brazil, Ind.—The construction of a municipal light and power plant is contemplated.

Colfax, Ind.—The installation of municipal electric light plant is contemplated.

Yorktown, Ind.—Installation of lighting system is contemplated.

Atlantic, Ia.—Voted $50,000 bonds for a new lighting plant and consolidating it with the municipal water plant.

Coggan, Ia.—The installation of a municipal electric light plant is contemplated.

Stafford, Ia.—Voted $25,000 bonds to purchase an electric light plant.

Horton, Kan.—Contemplating the installation of an electric light plant, and desirous of learning the approximate cost of installing a plant for a town of 4,000. B. F. Norris, cy. clk.

Fort Scott, Kan.—Installation of modern street lighting system is contemplated.

Sandusky, Mich.—Installation of an electric light plant is contemplated.

Foley, Minn.—The installation of an electric light plant is contemplated.

Thief River Falls, Minn.—An electric light and power plant will be installed in the spring.

Ansley, Neb.—Municipal electric light plant is contemplated.

Cortland, Neb.—The installation of an electric light plant and water works system is contemplated.

Wymore, Neb.—Voted bonds for an electric light plant.

Newark, N. J.—The question of running a municipal electric light plant is being considered.

Gloversville, N. Y.—Construction of an electric light plant is contemplated.

Silver Springs, N. Y.—The installation of a combined electric light and pumping plant is contemplated.

Warrenton N. C.—A municipal light plant is contemplated.

Union, Ore.—Municipal lighting plant is contemplated.

Bryant, S. D.—The business men have contributed $3,000 toward the construction of a municipal lighting system.

Letcher, S. D.—The installation of an electric light plant is contemplated.

Metaline, Wash.—An electric plant will be installed to generate power for the operation of its water pumping plant.

Seattle, Wash.—Voted $1,400,000 bonds for enlarging and extending the electric light plant.

Spokane, Wash.—A $5,000,000 municipal power plant is contemplated.

Maiden Rock, Wis.—A municipal electric light system is contemplated.

Lovell, Wyo.—Voted $7,000 bonds for installation of an electric light plant.

North Toronto, Ont., Can.—An electrical plant for lighting the streets and residences is contemplated.

CONTRACTS TO BE LET.

Stafford, Kan.—Bids will be received on Jan. 3 for furnishing material and constructing a water works and electric light plant. N. P. Reid, cy. clk.

CONTRACTS AWARDED.

Fairfield, Conn.—The contract for city lighting was awarded to American Street Lighting Co., Fairfield, Conn.

Plainville, Conn.—The contract for street lighting for a period of five years was awarded to Housatonic Power Co., Plainville, Conn.

Cairo, Ga.—The contract for improvements to municipal electric light plant was awarded to J. B. McCrary & Co., Atlanta, Ga.

Allentown, N. J.—The contract for the erection of municipal electric plant was awarded to Adams Electric Co., Trenton, N. J., $40,000.

Warren, O.—The contract for street lighting for 10 years was awarded to Warren Water & Light Co., 114 E. Market st., Warren, O.

Neodesha, Okla.—The contract for the installation of municipal electric light plant was awarded to Square Electric Co., Kansas City, Mo., $11,800.

Howard, S. C.—The contract for the installation of electric light plant was awarded to Harry Lyon, Sioux City, Ia.

Rock Hill, S. C.—The following contracts were awarded: Municipal light plant: for generators and supplies to Westinghouse Co., Pittsburg, Pa.; for poles to Mill Supply Co., Charlotte S. C.; for wire and cross arms to Southern Electric Co., Baltimore, Md.

Occoquan, Va.—The contract for furnishing and installing a complete electric lighting plant was awarded to National Electrical Supply Co., 1330 New York ave., Washington, D. C.

FIRE APPARATUS.

CONTEMPLATED WORK.

Oakland, Cal.—$55,000 has been appropriated for 3 auto combination hose wagons, an auto pumping engine, 2 steamers, hose, hose wagon, horses, etc.

Denver, Col.—The purchase of auto fire apparatus is contemplated.

New Haven, Conn.—The purchase of a chemical engine is contemplated.

Jacksonville, Fla.—The purchase of an additional combination hose wagon for station No. 3 is contemplated.

Chicago, Ill.—The purchase of 25 fire engines is contemplated.

Oakley, Ky.—Fire Chief Fred Schmidt has recommended the purchase of 500 ft. of fire hose.

Monroe, La.—Contemplating the purchase of chemical engine, hose and hose wagon.

Lynn, Mass.—Contemplating the purchase of a motor-driven combination chemical wagon.

Springfield, Mass.—The town of Merrick is considering the purchase of an auto fire engine.

Highland Park, Mich.—Bids will be asked for an auto engine, hose wagon and chemical truck. Fire Marshal Malcom E. Lawrence, Highland Park, Mich.

Rochester, Minn.—The purchase of a chemical fire engine is contemplated.

Hackensack, N. J.—The purchase of an auto chemical is contemplated.

Rochester, N. Y.—Will buy two chemical tanks and 5,000 ft. of hose.

Akron, O.—Will buy an auto combination chemical. Address Chief Mertz.

Weston, O.—Contemplating the purchase of new fire apparatus.

Rexmont, Pa.—Contemplating the purchase of a chemical engine.

Edgewood, R. I.—The purchase of an auto truck is contemplated.

Richmond, Va.—Contemplating the purchase of an auto fire engine.

Tacoma, Wash.—The purchase of an automobile hose and chemical wagon and an automobile ladder truck is contemplated.

CONTRACTS TO BE LET.

Missoula, Mont.—Bids will be received Jan. 9 for a 6-cylinder auto-propelled combination chemical engine and hose wagon from 60 to 80 horse power. City Clerk.

Lakewood, O.— Bids are requested for fire apparatus. C. M. Cook, cy. clk.

Tacoma, Wash.—Bids will be received on Jan. 16, 3 p. m., for furnishing motor driven combination chemical engine and hose wagon, one motor driven aerial ladder truck; also auto roadster to carry four persons.

CONTRACTS AWARDED.

Freeport, Ill.—The following contracts were awarded: Combination hose and chemical wagon with 40-gallon chemical cylinder to Seagrave Co., Columbus, O.; 1,000 ft. of fire hose to Voorhees Rubber Co., Chicago, Ill.

Wahpeton, N. D.—The contract for furnishing 500 ft. of fire hose was awarded to S. N. Knott & Co., Minneapolis, Minn.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Alameda, Cal.—The board of health has recommended that a garbage crematory be established in this city.

Santa Cruz, Cal.—Bids will soon be asked for construction of municipal incinerating plant.

Bridgeport, Conn.—The purchase of two street flushing machines is contemplated.

Waterbury, Conn.—Board of health is considering the building of a new garbage disposal plant.

Chicago, Ill.—Installation of a garbage incinerator at the Bridewell is contemplated.

Kansas City, Mo.—Plans will be prepared for three garbage disposal plants.

Omaha, Neb.—Contemplating the expenditure of about $100,000 for a plant to generate from burning garbage enough power to light the streets and furnish heat for public buildings.

Rochester, N. Y.—The construction of a garbage crematory to cost $100,000 is contemplated.

Nashville, Tenn.—Installation of garbage incinerator is contemplated.

Marlin, Tex.—The construction of a garbage crematory is contemplated.

Temple, Tex.—A crematory for the reduction of all municipal garbage, etc., to cost between $5,000 and $10,000 is contemplated.

Benwood, W. Va.—Crematory site has been purchased; the plant will be about 10-ton capacity.

CONTRACTS TO BE LET.

Cumberland, Md.—Bids will be received on Jan. 3, 3 p. m., for collecting and disposing of garbage, ashes, etc. Ward M. Eichelberger.

CONTRACTS AWARDED.

San Francisco, Cal.—The contract for constructing municipal incinerator plants was awarded to Destructor Co., San Francisco, Cal., $255,216.

New Albany, Ind.—The contract for collecting garbage from streets for one year was awarded to W. H. Newhouse, New Albany, Ind.

Boston, Mass.—The contract for removing snow in dist. No. 3 was awarded to Mark L. Lynch, Boston, Mass.

Municipal Engineering

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Cracking of Cement Grouted Brick Pavements*

By Earle R. Whitmore, City Engineer, Port Huron, Mich.

THE first essential to be recognized in the study of the cause of the failure of cement filled, or "grouted," brick or block pavements by cracking of the paved surface, is that these failures are due not to a single cause, but to several distinct and widely differing causes. A fairly careful investigation of available literature on brick pavement construction has failed to bring to the writer's attention any competent analysis of these various causes of failure and the corresponding remedies.

The following are causes of cracks in brick or block pavements which the writer has observed; and they are placed, he believes, in the order of their importance and frequency of occurrence, and will be discussed separately in that order:

1. Frost.
2. Expansion.
3. Settling of sand cushion.
4. Settling of sub-grade.
5. Contraction between transverse expansion joints.

1. *Frost.* The writer's observations seem to him to prove beyond doubt that the longitudinal crack along the crown of the pavement (or sometimes several feet to one side of the crown) is nearly always, if not always, caused by frost. This is the cause which the average layman usually assigns, and perhaps that is the reason that the average engineer, in his assumption of wisdom, is convinced that it is the wrong solution. The following observations support the layman's theory:

(a) These longitudinal cracks invariably first appear in the form of a very small and insignificant appearing crack, when the snow goes off in the spring.

(b) Where the sub-soil is clay, the cracks are found where ample expansion joints are provided next the curb, as well as where there are no expansion joints.

(e) Where the sub-soil is sand, or on fills where there is good natural drainage, these cracks are "conspicuous by their absence," even where there are no expansion cushions.

(d) The cracks follow along the line of travel on the street usually along near the crown, where the snow is packed by traffic during the winter and the frost penetrates deepest. Where there are one or more car-tracks on the street, there is usually a crack along the driveway each side of the tracks, if the subsoil is impermeable clay or of such a nature as to retain water. At intersecting streets which cross the paved street, the crack does not continue across the intersection, presumably because the travel across street and around the corners packs snow and permits the frost to penetrate over sufficient area to raise the pavement uniformly without breaking it; but where the intersecting street comes in from one side only, the crack runs off toward the opposite curb as it approaches the intersection, and continues across the intersection, coming back to the crown again on the other side.

(e) A careful examination of the concrete foundation under the longitudinal crack will reveal the fact that the foundation is also cracked. Is this expansion? And yet the specifications of the National Paving Brick Manufacturers' Association, admirable and complete in most respects, make no provision for drainage except the statement that "If the ground is spouty clay, tile drainage should be provided to carry off the accumulation of wet;" and even this meagre suggestion is modified by the statement that "Underdrainage is not absolutely essential, but in wet and spouty clay under-

*From a paper before the Michigan Engineering Society.

stratum much is added to the durability of the structure by keeping the sub-foundation dry, and under foregoing wet conditions is the only way to accomplish the best results." No mention of frost. The report of the Asphalt Committee of the Organiziation for Standardizing Paving Specifications provides for drainage "when the soil is of such a character that it retains an excessive amount of moisture, such as clays subject to swelling or heaving under the action of frost;" but the report of the Brick Committee makes no mention of underdrainage. Techincal books also are uniformly vague on this subject, and the inexperienced engineer has little indeed to warn him of the danger of frost.

Inasmuch as it is an established fact that frost has no tendency to swell or heave any kind of soil from which the moisture is thoroughly drained, the writer ventures the opinion that the best way to prevent this form of cracking is to provide a suitable drain under each curb where the sub-soil is clay, and connect same with sewer inlets. Such drains should be placed about three feet below the top of the curb, and the trench over the drain filled up to the bottom of the curb with coarse material such as cinders or small field-stone. Placing cross-drains under the povement is probably to be discouraged, as water cannot penetrate through the pavement after it is once built, and there seems to be little necessity for making provision for carrying water from the middle of the pavement toward the surbs; and these cross-drains tend to carry water under the pavement during the wet season, where it may percolate through the sub-grade, rather than to remove it. Too shallow side-drains are also to be guarded against.

Also, the writer does not consider his observations sufficiently final to warrant the omission of expansion cushions next the curb, in view of the fact that all modern paving specifications require such expansion cushions. His personal opinion, however, is that they seldom if ever serve any useful purpose except on very wide pavements. It is undeniably true that after the crack is once started it continues to widen from the action of alternate expansion and contraction; but I have never seen a crack of this kind that appeared to have been caused by expansion originally.

2. *Expansion.* Expansion cracks occur on a hot day in summer, usually at a crown in the longitudinal grade of the paved street, where several courses of brick are sometimes thrown into the air with considerable violence, and when the repair gang comes to relay them they find that there is at least one row of the blocks which were thrown out that cannot be relaid. This form of cracking is quite spectacular, and furnishes exceptional opportunities for advertisers of bituminous fillers. At the same time the damage to the pavement is comparatively slight and easily repaired.

Where there is no abrupt change of grade to permit the pavement to buckle, the observations of the writer seem to indicate that the filler between the brick courses is sometimes crushed in places, and the surface cracked into diamond-shaped or triangular divisions, the cracks following the joints and seldom breaking a brick. If there is a bend or angle in the paved street, the effect of expansion will be carried to this point of weakness, and will shove the angle considerably out of line.

The specifications of the National Paving Brick Manufacturers' Association provide expansion cushions along the curbs only, no transverse joints. The report of the Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications also provides for longitudinal expansion joints only, being practically copied from the specifications of the National Paving Brick Manufacturers' Association. I understand that he secretary of the association, Mr. Will P. Blair, maintains that the longitudinal expansion, failing to find room to act longitudinally, is in some mysterious manner transformed into transverse expansion, and is then taken care of by the side cushions. This may be true to the extent that the breaking of the surface into diamond-shaped or triangular areas probably has a tendency to force the brick apart and outward toward the curb to some extent; but this is taking care of the expansion after it has done its damage.

These diagonal cracks, zig-zaging along the brick joints, are inconspicuous, and in fact are often not visible except at such times as foggy mornings, when each crack is outlined by a line of moisture. They are not conspicuous like the longitudinal crack caused by frost, and make no spectacular expansion like the failure by buckling of the paved surface; but they extend over the whole surface of the pavement, tending to destroy its waterproof condition, and forming starting points for the jar of heavy traffic to begin its destructive action; and no doubt shorten the life of the pavement much more than the widely advertised buckling, which is all in one place and easily repaired.

It is believed that the most logical method of preventing this form of failure is to provide frequent transverse expansion joints, and that these joints are best formed by laying several courses of brick about one-fourth inch apart and filling these quarter-inch joints with a suitable bituminous filler before grouting the balance of the pavement. The use of single expansion joints one-half inch or more in width is to be condemned for several reasons: it makes a bump for loaded vehicles, causing a hammering action on the adjoining brick which soon loosens them, and the fault this started spreads rapidly under traffic; the bituminous filler is very apt to run in a wide joint from the crown toward the curbs in warm weather; the expansion sometimes forces the bottoms of the blocks next the expansion joint together, while the tops are held apart by earth, etc., which has become packed into the joint, causing the brick to heave up next the joint.

3. *Settling of Sand Cushion.* This occurs from several sub-causes:

(a) If the sand cushion is spread on a macadam foundation, it is apt to work down into the foundation in places and cause unequal settlement, thereby breaking the paved surface. One or two cities, at least, have had disastrous results from attempting to lay brick pavements on macadam foundation in this manner. It could probably be avoided by filling and rolling the macadam foundation in about the same manner as for a finished macadam pavement, but there would usually be no economy in that. It is believed that a good concrete foundation is the most economical in the long run, except possibly under some very exceptional conditions.

(b) If sufficient care is not exercised in forming the surface of the concrete foundation parallel with the plane of the required pavement surface, the sand cushion will be of varying thickness, and therefore liable to settle unevenly.

(c) The foundation having been properly laid, if the cushion is carelessly luted it will still be of unequal thickness; or if spread with a templet, and the templet is not carried back and drawn over the surface several times, the surface will invariably be wavy and cushion of unequal thickness. It is a serious mistake to leave the sand cushion uneven, depending on the rolling to level it. The roller will probably make it appear quite level, but some of the blocks will be well bedded while others will have received practically no benefit from the rolling, and these will naturally settle later under traffic.

(d) If the sand is partly dry and partly moist when spread, it will naturally settle unevenly. If the sand were all uniformly moist, the settlement would perhaps be as uniform as though dry sand were used; but a pile of sand is often dry on the outside and damp inside, or vice versa, and may not be thoroughly mixed in spreading. When such sand is used it should be dried, or if it were moistened uniformly by sprinkling the same purpose might be served.

Cracks caused by settling of sand cushion are usually roughly retangular, do not break across the bricks, and the inclosed rectangle drops below the balance of the pavement. These rectangles vary in size from two or three bricks to several square yards. They go down under traffic sufficiently heavy to break the bond of the grout, and if the bond does not break an arch is formed, giving rise to the rumbling noise so often complained of. If not repaired at once the fault spreads rapidly, under the hammering action of traffic, over the surface of the adjoining pavement.

The proper thickness of the sand cushion has been the subject of much discussion. The writer believes that any thickness from one to two inches is all right, if properly applied. Some have claimed that a mortar-bed, in place of the sand cushion, is the panacea for all these difficulties. It is probable that a mortar-bed properly prepared would give satisfactory results, as it has been extensively and successfully used for creosoted wood block pavements. The sand cushion is probably equally good, or better, if carefully and properly handled.

4. *Settling of Sub-Grade.* This fault is also due to various sub-causes:

Pavements laid across fills are very apt to settle. It is only with the greatest care that a fill can be made so that it will not settle more or less.

Improperly filled trenches for sewer, water and gas pipes, etc., often cause settlement many years after the pavement is laid. The pavement arch is strong enough, perhaps, to bridge the trench when settlement first starts, but as the earth from the sides of the trench is gradually jarred down the span widens until it becomes too broad to support the load of traffic. Too great care can hardly be exercised in properly back-filling such trenches.

Very wet and undrained sub-grade sometimes is the cause of this trouble. Suitable side drains would usually remedy the matter when moisture is the cause.

5. *Contraction Between Transverse Expansion Joints.* When expansion joints are placed a considerable distance apart, it is noted that fine cracks appear at intervals, following the grouted joint from curb to curb. Where expansion joints are fifty feet apart two such cracks appear in the fifty feet, dividing the pavement into sections of about one rod in length. These cracks are hardly noticeable, and sometimes can only be observed at certain times when outlined by moisture.

It is believed that they should be obviated by placing the transverse expansion joints only about fifteen feet or a rod apart. It would then be necessary to fill only one or two joints with the bituminous filler at each place.

It is hoped that these suggestions and the discussion which they may bring out at this time may be of value to those of our profession who, like the writer, must rely largely upon the experience of others for guidance in their work.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Design of Plant

In my preceding articles the discussion has been brought to the point where the development scope and program have been determined. The available potential flow volume of the natural or regulated discharge has been clearly established, as well as the maximum obtainable fall, and the project has advanced to the stage when the required works are to be designed and the equipment is to be specified.

The designing of the plant requires an analytical knowledge of the topography and geological formations at and in the vicinity of the sites to be occupied by the works, which is obtained from detail surveys and from borings and tests of rock and alluvial materials.

The most reliable foundation for the topographical surveys is a well selectedquadrilateral with two stations on either shore, one side being accurately measured as a base-line and the four angles being read to the closest agreement. These four triangulation points should be marked in a permanent manner so that they may be accessible until the works are completed. The river banks are then to be cleared of timber and brush for double the width required for the restraining works and well above the highest level of pondage and parallel cross section lines are to be carried up both lines at ten-feet intervals and fifty-feet points marked by hubs. These are referred to the center line of the section and begin at a zero line along the river shore. After cross section lines are established. permanent benches are established at the most convenient zero points at either shore, being on a horizontal plane, and from these the precise elevation of each of the cross-section hubs is determined and marked on them. Where the difference in elevation between adjoining hubs exceeds two feet the intermediate space must be contoured to one-foot intervals.

Bank sectioning being completed, the lines are extended across the river channel, soundings being taken at ten feet intervals on each line. When water depth and current permit this is to be done by walking across, the most economical method, otherwise it is advisable to stretch a wire or rope across above the upstream line and sound from a raft hanging from this cable. The raft is most readily constructed from planking secured to empty barrels. The guide ropes should be secured to blocks passing along the cable. The raft should be roomy enough to permit four men to operat conveniently, two attending to the cable guides, one sounding and the fourth taking the record. Side lines are secured to the raft, reaching both shores, by which the raft is pulled across ten feet at a time, these lines being tagged at ten-feet intervals. When water depth exceeds eight feet or the current is swift. the sounding is best done by aid of a reel with weighted wire secured to it and a clock dial and rigid hand. the dial being subdivided into ten spaces and tenths subdivisions in ratio to the diameter of the reel. The sounding reel stands in the center of the raft. During the river sounding a gauge, with its zero referred to reference plane, is read for each sounding.

This refers specifically to the dam site, but those of the power station and tailrace channel, and of diversion works locations are similar. The subsurface formations on all sites must be clearly developed by sinking pits in alluvial deposits and making diamond drill borings in rock formation, and these borings must be sufficiently plentiful so that no reasonable doubt remains as to the depth and character of the different materials and dip of the rock strata. All these subsurface examinations are referred to the reference plane for elevations. The data secured from these surveys are mapped on a large enough scale to make one foot depth or length measurable and the material samples are classified and tested for permeability, porosity and crushing resistances.

These surveys and examinations can not be excessively minute or precise, as economical designing is practicable only when these conditions may be read like an open book; if there is doubt as to formations below, it must be insured by perhaps unnecessary and costly safeguards, and if the surface topography is insufficiently developed the structural quantities may fall short of those required and render the estimate of cost unreliable.

A second preparation for designing of plant is the collection of all available information concerning construction materials. This relates chiefly to timber for coffer dam, concrete forms and other purposes and the concrete aggregate, sand gravel and suitable rock for crushing. The proximity, quality and quantity of these materials should be ascertained and the probable cost of delivering them to the development site.

The restraining works are first considered. They consist of some spillway section flanked by reservoir dams to the extent of the river valley to be closed. The type of recommendable spillway is determined from the required height, foundation character and flood-water volume to be passed over it. For a height of twenty feet and less a timber structure may be considered, provided suitable material is obtainable within close proximity. A timber spillway may be of crib, trestle or gravity design. Either of them will, when constructed of sound material; make a safe and durable structure, and their first cost may be considerably less than that of a concrete or masonry spillway. When the height exceeds twenty feet the cost of timber structures equals and soon exceeds that of other types. The foundation conditions should decide the type of higher spillways. On alluvial formations a gravity spillway may prove the most economical. This form is designed to eliminate the horizontal water pressure by giving the upstream face a 45 degree inclination downstream, on which the vertical and horizontal water thrusts are balanced. This spillway consists of a concrete-steel shell braced by transverse partitions. It represents little weight as compared with a solid masonry mass, and sub-surfaces seepage does not endanger its stability. Many of these spillways have been constructed since concrete-steel construction has been perfected, some to heights exceeding one hundred feet, and they have proven themselves to be satisfactory. On hard rock the monolithic concrete ogee-shaped spillway remains the standard type and where the material is in close proximity the cyclopean structure represents some economy. For a height exceeding one hundred feet a masonry structure of coursed stone is the most recommendable, as the weight becomes too great for safe crushing resistance of the average concrete. The flood volume to be passed over the spillway exerts an important influence on its design, both because of the effect of the increased horizontal pressure on the structure and on the river bed downstream of it, due to the overfalling water. When the overflow is likely to exceed one-tenth of spillway height, the design should provide other flood water passage opportunities, which leads to the type of open spillways which are provided with apertures ordinarily closed by some movable devices which can be opened to pass the flow. These are of many descriptions, but those available for water-power restraining works are limited to that class which guarantees water-tightness when closed, which comprises vertical lift, revolving segment, flutter and roller gates. Each of these types is represented by some variety of designs, their adaptability meeting specific conditions.

The spillway type being determined, its length must be fixed, which depends largely upon the flood flow volume. It is a good rule to make the spillway length not less than the width of the natural flood channel, though this can not always be complied with economically, but whenever the channel is contracted, other flow passages should be created of sufficient discharge capacity to make up for the reduction of flow area from that which nature has provided. The spillway sections should always be designed for an overturning safety factor of not less than two. When the height exceeds 69 feet the upstream face should be battered downstream, whereby the pressure lines are inclined downward and the pressure lever arms are reduced in length. The spillway lip must be given the correct overflow curve and the downstream face must be shaped to insure adherence of the highest overflow to spillway surface. A sufficiently long apron must be provided, also some scouring sluices, to withdraw accumulated silt deposits and unwater the upper pool. Much more might be said of the restraining works, but space will not permit any broader treatment.

The diversion works may be open or closed conduits, canals, flumes or pipe lines. Canals should have a section which will pass the potential flow at a velocity not exceeding two feet per second. They must be water-tight and therefore require generally some impermeable lining. This holds good not only when canal location is in alluvial material, but also when in stratified rock. The flow prism must be protected against erosion and subsidences. On side-hill locations a berme of ten feet width must be provided above high-water level and the bank above paved. Canals must have ample spillway capacity, preferably near the ends, intakes and forebays to pass excess flow, ice and logs. Canals should be guarded by headgates, and it is recommendable to set up above them coarse trash racks, the service racks being arranged in front of the turbine chambers.

Flumes are applicable only when the flow is 100 c. f. s. or less; they are generally of timber construction, should be watertight and rigidly supported to prevent their sagging. They must be provided with waste weirs.

Pipe conduits may be wooden stave, concrete-steel or steel plate. The first are limited to pressure heads of 100 feet and must be kept constantly filled with water. The second are likewise limited to low pressure-heads, and even then it is difficult to prevent leakage. Steel-plate pipes are available for any head and can be made watertight.

Any conduit must be laid on rigid supports and preferably above surface. Air valves must be placed at all points where gradient changes, but no portion of the conduit should be above the hydraulic gradient. Manholes and mud-boxes should be provided at 500 feet intervals. Pipe lines require relief valves or standpipes to prevent injuries from pressure fluctuations. They should terminate at the power station in a receiver from which the water is drawn for the turbines.

The power station may be located at or near the dam or at a distance downstream of it. When at the dam its location should be selected to secure unobstructed tail-water discharge. Of recent years the station has been arranged in the interior of a hollow concrete-steel gravity dam, an arrangement which represents some economy in first cost and secures the highest obtainable flow and fall efficiency. The power station should be of ample dimensions, not less than 25 feet width per generating unit, and be of sufficient length to allow of placing transformer equipment in an isolated part; repair shop facilities should not be omitted. The structure should be fireproof and be well ventilated. Ordinarily very little attention is paid to the architectural features, though it is a matter of small expense to give the station an appropriate appearance.

The efflux arangements are as important for best efficiency output as those of influx; draft tubes should dip not less than three feet and have water cushion under them of at least five feet. The tailrace should have plenty of fall and be protected from spillway overfall by wing walls.

It goes without saying that the foundation of the power house must be equally as carefuly designed as the dam, and that the substructure, or pit, must be given absolute rigidity. All parts of the station building may preferably be of concrete and concrete-steel construction, the roof of steel frame and slate covering.

Standardizing of the Rattler Test for Paving Brick*

By Marion W. Blair, Indianapolis, Ind.

THE rattler test for paving brick has been a matter of more or less concern both to manufacturers and engineers for a period over twenty years. The need of some definite and standard method of determining the degree of those qualities recognized as requisite to a satisfactory pavement which any particular lot of brick may possess is unquestioned, these qualities being uniformity of structure, toughness and an ability to withstand abrasion and impact.

The object of this paper, therefore, is not to discuss an obvious need, but to point out certain deficiencies in a method supposed at one time to be scribe certain investigations which adequate for the purpose and to dehave been made in an attempt to relieve a situation which has come to be a menace on the one hand, a source of endless annoyance on the other, and which has lost to the manufacturers many thousands of dollars in legitimate profit and forced the taxpaying public of some communities to pay more than a legitimate price, without enhancement of quality, but shutting out competition, because of an importance attached to the test out of proportion to its real value, instead of to the service obtained in the street.

In 1896 H. J. Bart reported in the Technograph, University of Illinois, that in fifteen cities the specifications showed variations ranging in rattler and conditions of test as follows: Length of rattler, 24 to 54 inches; diameter, 15 to 40 inches; speed, revolutions per minute, 15 to 45 inches; duration of test, 30 to 36 minutes; weight of iron in the charge, 50 to 800 pounds; loss permissible in one hour, 3 to 10 per cent. These figures show something of the variation in practice at that time.

Even as late as 1909 the following was found in the specification of a Wisconsin city: "*Abrasion Test.* The abrasion test shall be made by the following proportions: Rattler, 28x48; 800 pounds scrap iron pieces varying in weight from ¼ to 5 pounds; 900 revolutions of 15 revolutions per minute; loss of weight shall not exceed 9 per cent."

It can be readily seen that such variation would lead to endless confusion. Comparisons of one city with another were impossible and the manufacturer was at sea as to whether or not the conditions could be met by his product. Experiments were made in the next few years by different investigators, notably by Professors Baker and Talbot of Illinois. University, and Prof. Orton at Ohio State University.

In 1897 Prof. Orton, acting for a committee of the National Brick Manufacturers' Association, reported a standard method. Abrasive material other than the brick charge itself was omitted but the speed was fixed at thirty revolutions per minute, and the size of the barrel recommended as 28-inch diameter by 20 inches in length.

Defects in this test were soon pointed out by Prof. Talbot and others and it was shown that results obtained were not uniform or reliable. Owing to this irregularity and lack of uniformity in results, the N. B. M. A. undertook a further investigation, which was conducted by Prof. Orton during the year of 1899. These experiments were conducted on a machine in which the brick were clamped edgewise in pockets around the inside surface of a cylinder rattler and 1½-inch cubes of cast iron were used for impact and abrasing material. This device is known as the Jones Rattler and the report was submitted by Prof. Orton in January, 1901.

There were many objections to this device of Mr. Jones', so when the report was presented to the Association in February, 1901, further investigations were ordered. These investigations covered a series of experiments upon a machine similar to the Jones Rattler but which had been improved somewhat by Prof. Talbot and was then known as the Talbot-Jones rattler. Experiments were also made upon the other style of rattler and a report made to the committee in August, 1901. After a careful study of the evidence submitted, this committee recommended the adoption of what has since been known as the Standard N. B. M. A. test and it is with the further development of this test that the present investigation has been concerned.

In this specification the description

*A paper before the Indiana Engineering Society.

of the machine to be used is by no means accurate or complete. The only fixed dimension is that which says it shall be 20 inches in length. All others are left optional and not a word is said about the material to be used in the construction of same. Since taking up this work, the writer has had opportunity to examine machines in many localities and he has found all the allowable variations. He has found machines with staves ranging from ⅜-inch steel plate to 1⅛-inch. He has found at least four different patterns of cast iron and at least two different patterns of cast steel and two weights of structural channel in use. All of these variations, however, come within the recommendations of the N. B. M. A. specifications, and no provision is made as to manner and method of renewal or the amount of wear to be permitted.

The condition of the cast iron charge is even more deplorable. There is no system by which the charge has been kept up to standard weight or dimension, this feature being left entirely to the judgment of the operator, and the specification allows a variation of 10 per cent. in individual weights, so we have found charges ranging under normal from twenty to twenty-five pounds in weight, and absolutely no record or evidence that they had ever been standardized. In addition to this variation in weight, nothing is said as to the quality of the iron except that it shall be what is known as ordinary machinery cast iron.

The tendency, however, for the past ten years has been to find a material which would last the longest in the machine, but as this feature has not been of particular interest to those laboratories in which but few tests were made, there has grown up a condition in which scarcely any two machines in use are using iron abrasives of the same quality. In fact, until the present investigation, the effect of quality of the abrasive had scarcely met with any consideration.

The speed of the machine was fixed within fairly close limits, but the number of brick to be tested was 9, 10 or 11, and it is obviously unfair to submit brick of such a size that it requires 11 to make up 1,000 cubic inches to the same test as that of which it requires but 9 to make up the same amount.

The foregoing variations probably explain to a certain extent why it has been practically impossible to obtain results under the N. B. M. A. specification which checked one with another, even to a fair degree. These were the conditions found about a year ago when the writer was employed by the National Paving Brick Manufacturers' Association to investigate the subject and if possible arrive at some specification for the test which would produce uniformity of results. Prof. Orton, of the Ohio State University, volunteered to assist in this work and it was agreed that the experiments should be in all cases run in parallel so that the results of two laboratories using same methods and apparatus would be available for comparison.

Material was chosen and selected in such quantities as to give both laboratories a sufficient amount of a number of different brands or makes of paving brick to conduct over 1,000 tests each. A new machine was designed and duplicates were built for each laboratory. It was determined to carry on the investigation not only on the original test, without abrasive and the N. B. M. A. standard, using abrasives in the form of cubic and oblong block, but to conduct a new series of experiments using abrasives in spherical form, similar in weight to the cubes and blocks employed.

The results of the first two series thus run showed that while the spheres used by Orton had given average results considerably higher than those obtained by the use of cubes, the reverse was true in the results obtained by the writer. A study into the causes of such results disclosed the fact that the composition of the abrasive material varied greatly and that the abrasive action obtained increased in severity with the amount of combined carbon contained in the abrasive material. Further experiments led to the conclusion that it would be impossible to obtain like results unless the quality of the abrasive material was specified within rather close limits.

The effect of the condition of the staves of the machine was carefully noted and it was found that as the staves distorted, the severity of the machine increased. This distortion in some cases was very marked and showed after comparatively few tests. Experiments were made covering the following range of staves: ¼, ½, ¾-inch steel plate; two grades of cast iron; manganese steel; plain structural channel and structural channel with the face protected by a wearing plate. After a long series of tests, it was concluded that the latter named stave gave the most uniform condition of the barrel of the machine to be had and gave closer uniformity in the results obtained.

A progress report of these experiments, which have covered a period of one year, so far, is referred to a little later on. The recommendations embraced in a rattler specification have been presented to the Organization of City Officials for Standardizing Paving Specifications and consideration of same is presented to this society.

While we believe that we have eliminated considerable variation from this machine, it must still be recognized that there remains a hazard in the machine itself which is unavoidable. Attention is also called to the charts herewith, which show a certain variation in weight and structure of the brick of the same make and, to all practical purposes, of the same grade.

RATTLER SPECIFICATIONS.

The machine shall be of good mechanical construction, self-contained, and shall conform to the following details and dimensions, and shall consist of barrel, frame and driving mechanism as herein described.

The Barrel. The barrel of the machine shall be made up of the heads, head-liners and staves.

The heads shall be cast with trunnions in one piece. The trunnion bearing shall not be less than 2½ inches in diameter or less than 6 inches in length.

The heads shall not be less than ¾ of an inch thick nor more than ⅞ of an inch. In outline they shall be a regular 14-sided polygon inscribed in a circle 28⅜ inches in diameter. The heads shall be provided with flanges not less than ¾ of an inch thick and extending 2½ inches from inside face of head, to afford a means of fastening the staves. The flanges shall be slotted on the outer edge, so as to provide for two ¾-inch bolts at each end of each stave, said slot to be 13-16 of an inch wide and 2¾ inches center to center. Under each section of the flanges, there shall be a brace ⅜ of an inch thick and extending down the outside of the head not less than 2 inches. Each slot shall be provided with a recess for the bolt head, which shall act to prevent the turning of the same. There shall be for each head a cast iron headliner 1 inch in thickness and conforming to the outline of the head, but inscribed in a circle 28⅛ inches in diameter. This liner or wear plate shall be fastened to the head by seven ⅝-inch cap screws, through the head from the outside. These wear plates, whenever they become worn down one-half inch below their initial surface level, at any point of their surface, must be replaced with new. The metal of which these wear plates are to be composed shall be what is known as hard machinery iron, and must contain not less than 1 per cent. of combined carbon. The faces of the polygon must be smooth and give uniform bearing for the staves. To secure the desired uniform bearing, the faces of the head may be ground or machined.

The Staves. The staves shall be made of 6-inch medium steel structural channels 27¼ inches long and weighing 15.5 pounds per lineal foot.

The channels shall be drilled with holes 13-16 of an inch in diameter, two in each end, for bolts to fasten same to the heads, the center line of the holes being 1 inch from either end and 1⅜ inches either way from the longitudinal center line.

The space between the staves will be determined by the accuracy of the heads, but must not exceed 5-16 of an inch. The interior or flat side of each channel must be protected by a lining or wear plate ⅜ of an inch thick by 5½ inches wide and 19¾ inches long. This wear plate shall consist of medium steel plate, and shall be riveted to the channel by 3½-inch rivets, one of which shall be upon the center line both ways and the other two upon the longitudinal line and spaced 7 inches from the center each way. The rivet holes shall be counter sunk on the face of the wear plate and the rivets shall be driven hot and chipped off flush with the surface of the wear plate. These wear plates shall be inspected from time to time, and if found loose shall be at once re-riveted, but no wear plate shall be replaced by a new one, except as the whole set is changed. No set of wear plates shall be used for more than 150 tests under any circumstances. The record must show date when each set of wear plates goes into service, and the number of tests made upon each set.

The staves when bolted to the heads shall form a barrel 20 inches long, inside measurement, between wear plates. The wear plates of the staves must be so placed as to drop between the wear plates of the heads. These staves shall be bolted tightly to the heads by ¾-inch bolts, and each bolt shall be provided with lock nuts, and shall be inspected, at not less frequent intervals than every fifth test and all nuts kept tight. A record shall be made after each inspection, showing in what condition the bolts were found.

The Frame and Driving Mechanism. Investigation into the effects of variations in the construction of the frame, and in the mode of driving the barrel, has not yet been undertaken and hence no established accuracy is offered at all comparable to that which has been reached in the construction of the barrel and uses of shot herein set forth. Without insisting, therefore, upon absolute uniformity in the frame or driving mechanism, the following principles of constructions are recommended, pending the completion of further studies upon the points involved.

The barrel should be mounted on a cast-iron frame of sufficient strength and rigidity to support same without undue vibration. It should rest on a rigid foundation and be fastened to same by bolts at not less than four points.

It should be driven by gearing whose ratio of driver to driven should not be less than one to four. The counter shaft upon which the driving pinion is mounted should be belt-driven and the pulley should not be less than 18 inches in diameter and 6½ inches in fact. A belt of 6-inch double-strength leather, properly adjusted so as to avoid unnecessary slipping, should be used.

The National Paving Brick Manufacturers' Association will furnish without cost to all proper applicants, the complete drawings of a machine which will meet the above specifications and requirements.

The Abrasive Charge. (a) The abrasive charge shall consist of two sizes of cast-iron spheres. The larger size shall be .75 inches in diameter when new and shall weigh when new approximately 7.5 pounds (3.40 kilos) each. Ten shall be used.

These shall be weighed separately after each ten tests, and when the weight of any large shot falls to 7 pounds (3.175 kilos) it shall be discarded and a new one substituted, provided, however, that all the large shot shall not be discarded and substituted by new ones at any single time, and that so far as possible the large shot shall compose a graduated series in various stages of wear.

The smaller size spheres shall be, when new, 1.875 inches in diameter and shall weigh not to exceed 0.95 lbs. (0.430 kilos) each. Of these spheres so many shall be used as will bring the collective weight of the large and small spheres most nearly to 300 lbs., provided, that no small sphere shall be retained in use after it has been worn down so that it will pass a circular hole 1.75 inches in diameter, drilled in a cast-iron plate ¼ inch in thickness, or weigh less than 0.75 lbs. Further, the small spheres shall be tested by passing them over such an iron plate, drilled with such holes, or shall be weighed after every ten tests, and any which pass through or fall below specified weight, shall be replaced by new spheres, and provided further that all of the small spheres shall not be rejected and replaced by new ones at any one time, and that so far as possible the small spheres shall compose a graduated series in various stages of wear. At any time that any sphere is found to be broken or defective, it shall be at once replaced.

(b) The iron composing these spheres shall have a chemical composition within the following limits:

	Per Cent.
Combined carbon	Not less than 2.50
Graphite carbon	Not more than 0.10
Silicon	Not more than 1.00
Manganese	Not more than 0.50
Phosphorus	Not more than 0.25
Sulphur	Not more than 0.08

For each new batch of spheres used, the chemical analysis must be furnished by the maker, or be obtained by the user, before introduction into the charge, and unless the analysis meets the above specifications, the batch of spheres shall be rejected.

The Test. The rattler shall be rotated at a rate of not less than 29½ nor more than 30½ revolutions per minute, and 1,800 revolutions shall constitute the standard test.

A margin of not to exceed ten revolutions will be allowed for stopping. In case a charge is allowed to run several minutes beyond its proper termination, and the loss incurred is still within the prescribed limits, then the test shall not be discarded, but the fact shall be entered on the record.

Stopping and starting. Only one start and stop per test is regular and acceptable. If from accidental causes a test is stopped and started twice extra, and the loss exceeds the maximum permissible, the test shall be disqualified and another made.

A counting machine shall be attached to the rattler for counting the revolutions.

The Results. The loss shall be calculated in percentage of the original weight of the dried brick composing the charge. In weighing the rattled brick any piece weighing less than one pound shall be rejected.

Records. (a) The operator shall

keep an official book, in which the alternate pages are perforated for removal. The record shall be kept in duplicate, by use of a carbon paper between the first and second sheets, and when all entries are made and calculations are completed, the original record shall be removed and the carbon duplicate preserved in the book. All calculations must be made in the space left for that purpose in the record blank, and the actual figures must appear. The record must bear its serial number and be filled out completely for each test and all data as to dates of inspections, and weighing of shot, and replacement of worn-out parts must be carefully entered, so that the records remaining in the book constitute a continuous one. In event of further copies of a record being needed, they may be furnished on separate sheets, but in no case shall the original carbon copy be removed from the record book.

(b) The blank form upon which the record of all official brick tests is to be kept and reported is as follows:

[The form of record is not herewith reproduced.—EDITOR.]

Asphaltic Oils in the Preservation of Railway Ties*

By Frank W. Cherrington, Cincinnati, O.

The results obtained in the asphaltic crude oil treatment of railway ties by the Santa Fe railroad and the Mexican National railways have proven the fact that water-proofing asphaltic crude oils have a claim for serious consideration as successful wood preservatives.

As early as 1885, a report was made by the committee on wood preservation of the American Railway Engineering and Maintenance of Way Association, which concluded with the statement that crude petroleum would prove a preservative so long as it would continue to saturate the wood by the exclusion of water, but that if injected once and for all, its volatile nature would result in its evaporating and leaving the timber unprotected. This report was made after a thorough investigation of the eastern crude paraffin petroleum, which had continually dripped on the railroad bed in the oil-producing region, and prolonged the life of the ties in the tracks. These paraffin oils are not stable in their composition, being susceptible to the disintegrating influence of the action of the elements, and therefore, in order to secure results by the exclusion of water, a continual application of fresh oils became necessary.

About fifteen years later, the Santa Fe railroad injected Bakersfield, California, asphaltic crude oil into pine ties and laid them in a section of track in southern Texas, where the climatic condition is one of the most severe, for ties, to be found in North America. A maximum quantity of oil was forced into these pine ties, the absorption per tie being, of course, dependent upon the amount of heart and sap wood in each tie.

An investigation of the asphaltic crude oils located in sections of the country other than California or Mexico discloses the fact that, in their natural condition, they are volatile, highly inflammable and not sufficiently viscous to prove of value as a wood preservative; therefore, it is necessary to refine oils having an asphaltic base, in other localities, thereby securing preservative oils which are similar and, in some instances, superior to the western asphaltic oils.

In the attached table No. 1 may be found a complete analysis of three asphaltic oils, viz.: the western Bakersfield (Cal.), asphaltic crude oil now in use by the Santa Fe railroad at Albuquerque, N. Mex.; the Mexican Ebano asphaltic oil; and finally, the refined product of an asphaltic crude oil found in the central United States. All of these oils are obtainable in large quantities and at low cost. The analysis of the refined asphaltic oil obtainable from the central United States is presented as a representative of what may be accomplished by refining the asphaltic crude oils of the east, and thereby securing an asphaltic residual oil which is practically non-volatile, non-inflammable, and at the same time, not nearly so viscous or hard to handle by the average plant equipment as the

* A paper before the Wood Preservers' Association at Chicago.

California crude product of the Mexican Ebano oil.

The following discussion of the "Analysis of a Residual Oil," which had been refined from an asphaltic base crude oil, taken from the central United States, has recently been submitted as the first progress report of the Government Forests Products Laboratory, at Madison, Wis., the object of which is to determine the value of this residual oil as a wood preservative.

"The distillation data show that the fractions from this oil have rather high boiling points, comparing in this respect very favorably with good coal-tar creosotes. The index-of-refraction values of the fractions lie in a range generally assigned to crude oils. These observations would be expected of an oil which, according to the manufacturer's description, is a residue left on distilling off the lighter fractions from the crude oil.

"Both the flash and burning points are high. This is a desirable property from the standpoint of fire risk.

"The viscosity curve represents from the wood-preservation viewpoint undesirable properties, as it is found necessary to heat the oil to 80 degrees C before readings could be obtained on the viscosimeter. It is, therefore, more difficult to circulate this material through pumps or pipe than coal-tar creosote."

The last paragraph of this report has been found to be true in actual tests, as creosote is naturally easier to handle in pumps and pipes than the more viscous asphalt oils. In actual prac-

TABLE NO. 1.

COMPARATIVE TESTS MADE BY A., T. & S. RAILWAY ON BAKERSFIELD, CAL., ASPHALTIC CRUDE OIL, SUCH AS IS BEING USED FOR TREATING BY THE SANTA FE PLANT AT ALBUQUERQUE, N. M., AND THE INDIAN REFINING CO. ON TIMBER ASPHALT.

	Mexico Ebano	California Bakersfield	Central U. S. Timber asphalt
Flashes in closed tester at deg. F.	176	256	410
Flashes in open tester at deg. F.	190	268	470
Degrees Beaume at 60 F.	12.1	11.9	19.2
Specific gravity at 60 F.	.9849	.9867	.9388
Distilling Tests using a retort (per cent coming over)—			
0 C. to 100 C., per cent	......	....	....
100 C. to 150 C., per cent	1.0	....	....
150 C. to 300 C., per cent	20.1	15.0	....
Distilling Tests using flash thermometer opposite take-off—			
0 C. to 100 C.	......	....	....
100 C. to 150 C.	1.1	....	....
150 C. to 300 C.	22.6	16.0	23.5
Evaporation Tests, placed in open dishes in air oven at 140 F.—oil 1.4 in. deep—			
In 24 hours, per cent	6.8	2.3	....
In 96 hours, per cent	9.4	4.6	....
Evoporation Tests, placed in open dishes in air oven at 200 F.—oil 1 in. deep—			
In 24 hours, per cent	9.8	4.8	.033
In 96 hours, per cent	11.4	11.5	.132

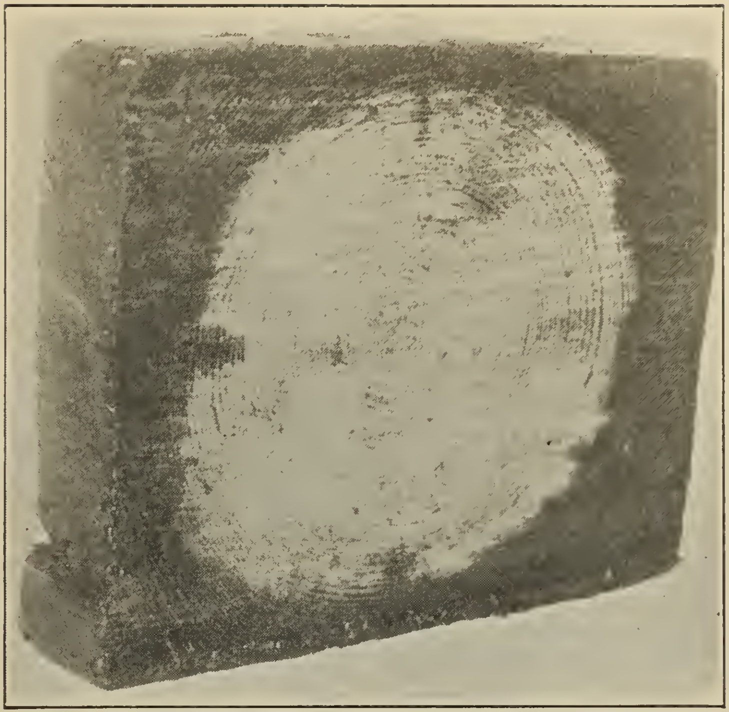
Fractional Distillation (Standard method)—

	Creosote	California Bakersfield	Central U. S. Timber asphalt
Specific gravity at 38 C.	1.04	0.965	.928
Below 210, not more than (per ct.)	.5	0.50 water	.333
210 to 235, not more than (per ct.)	.25	0.60 naphtha and water	.50
235 to 270	....	1.50 light oil	} 34.166
270 to 315	....	6.70 gasoline	
315 to 355	....	14.50 kerosene	
Residue	....	75.00 asphaltum	65.00
Specific gravity of residuum at 38 C.		0.99	

NOTE.—Bakersfield oil has been exposed in an open pan for one year, and so far has shown practically no loss by evaporation.

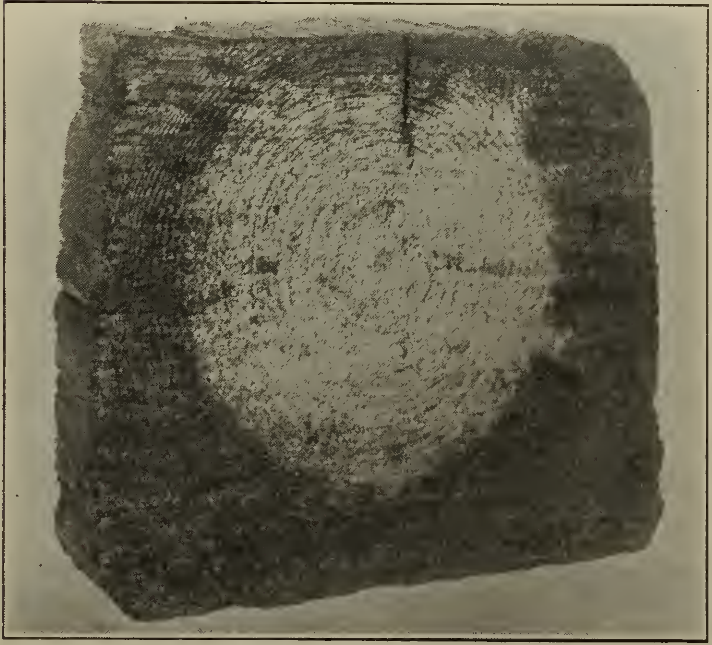
Viscosity Tests.—Using Scott's viscosimeter, in which 200 c.c. oil is put in the viscosimeter and the number of seconds required to pass 50 c.c through a small artifice is recorded. The standard for this machine is 11 seconds for 50 c.c. distilled water at 60 F.

	Mexican Ebano	California Bakersfield	Timber asphalt	Creosote
Oil heated to 100 F.	3,000	1,565	595	18
Oil heated to 150 F.	339	238	115	16
Oil heated to 200 F.	110	44.5	32	15
Oil heated to 220 F.	70	31.5	23	11
Oil heated to 250 F.	40.5	22	20	11



LONG-LEAF PINE TIE

Treated with Timberasphalt, Pressure Process. Mt. Union Plant of Pennsylvania Kailroad.



SHORT-LEAF PINE TIE

Treated with Timberasphalt, Preessure Process. Mt. Union Plant of Pennsylvania Railroad.

tice, however, at the several tests on plants of standard equipment, the pumps and valves were not affected to any appreciable degree by the viscosity of the oil.

During the month of April, 1910, various tests were made at the C. B. & Q. experimental plant at Galesburg, Ill., by a representative of an eastern refining company in order to thoroughly investigate the properties of this refined grade of an asphaltic oil as a wood preservative. Tests were run to determine whether this more economical oil could be used as a substitute for creosote oil in the Card process. In this test a mixture of 23 per cent. of asphaltic oil and 77 per cent. of a 5 per cent. zinc chloride solution was used. The results from this experiment proved that asphaltic oils could not be used in the Card process, because of the formation of a viscous emulsion, or saponification, which permitted the zinc chloride to penetrate the wood in large quantities but prevented the entrance of asphaltic oil into the wood. The fact that the zinc solution separated from the emulsion and penetrated the wood, leaving a thick mass of oil and emulsion distributed either irregularly through the wood or on the exterior of the timber, proved the futility of trying this process further, especially as the mixture was exceedingly hard to handle in the pumps and valves.

TABLE NO. 2.

C., B. & Q. EXPERIMENTAL CYLINDER, GALESBURG, ILL.

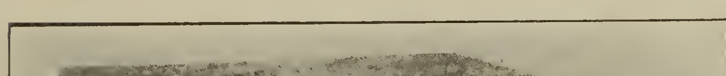
NOTE.—This table was too large to reproduce in full. It showed the length of time the ties had seasoned; the time in vacuum, under pressure, in vacuum again, time of steaming, preparation of tie, place in retort of each tie, volume of tie and absorption per tie, and per cubic foot. Each run showed the individual results on four ties. The results given below, except where but one volume of tie is given, are the averages of those for the four ties in each run.

Species of wood	Volume of tie, cu. ft.	Absorption per tie	per cu. ft.	% of vol.	Remarks
STRAIGHT ASPHALTIC CRUDE OIL PROCESS.					
Red Oak	2.63 to 3.85	15.75	5.38	9.24	Penetration good.
Red Oak	2.82 to 3.09	12.37	4.27	7.33	Penetration good.
Red Oak	2.61 to 2.96	17.00	6.21	10.65	Penetration good.
Short Leaf Pine	2.38 to 2.66	49.50	19.24	33.07	Saturated.
Beech	2.49 to 3.01	14.50	5.29	8.98	Penetration 1 in.
Beech	2.55 to 2.87	18.00	6.61	11.35	Penetration good.
Elm	2.66 to 3.07	19.50	6.94	11.92	Penetration good.
Soft Maple	2.63 to 3.02	14.75	5.20	8.98	Penetration ½ in.
Soft Maple	1.92 to 3.20	16.00	6.10	10.52	Penetration poor.
CARD PROCESS. Using 23 per cent Asphaltic Crude Oil and 77 per cent of 0.5 per cent. Zinc Chloride Solution.					
Hemlock	2.81	10.5	3.73	.....	Penetration ⅛ in.
Tamarack	2.63	10.5	4.00	.....	Penetration ⅛ in.
Beech	2.63	28.5	10.83	.....	Saturated with oil and zinc. Zinc found center heart all ties.
Red Oak	2.83	44.5	15.72	.....	Fair penetration of zinc and oil. Zinc found at center of heart by borings analysis.
Red Oak	2.34 to 3.07	28.0	10.32	.....	Well treated with both zinc and oil.
Red Oak	2.92 to 3.15	31.8	13.02	.....	Oil thoroughly distributed
Red Oak	2.37 to 3.01	24.1	9.31	.....	Coating of oil ¼ in. Zinc found at center of heart
Tamarack	2.34 to 2.90	14.2	5.46	.....	Well penetrated with zinc
Tamarack	2.51 to 3.22	21.2	7.79	.....	and oil.
Hemlock	2.47 to 2.78	16.4	6.41	.....	Oil penetrated ½ in.
TREATMENT WITH 25 PER CENT CREOSOTE TO 75 PER CENT ASPHALTIC CRUDE OIL.					
Beech	2.51 to 2.91	7.80	21.13	12.91	Thorough penetration.
Beech	2.53 to 2.71	10.83	28.38	17.93	Thorough penetration.
Red Oak	2.75 to 2.91	9.54	27.00	15.80	Thorough penetration.
Red Oak	2.67 to 2.88	7.54	21.12	12.48	No sample taken.

After determining the fact that the asphaltic residual oil could not be successfully used in the Card process, additional test runs were made to determine with what degree of success the straight asphaltic oils could be injected into the wood, and finally a mixture of 75 per cent. of asphaltic oil to 25 per cent. of creosote. The detailed results of the treatment, absorption and penetration secured in these tests are given in Table No. 2.

The experiments at Galesburg demonstrated that fairly good penetration could be secured on the various oaks,

WELL-SEASONED RED OAK TIE
Treated with Timberasphalt, Pressure Process. Mt. Union Plant of Pennsylvania Railroad



LONG-LEAF PINE PAVING BLOCK
Treated with Timberasphalt by Pressure Process, Sixteen Pounds per Cubic Foot.

elm, beech, gum, etc., ties, when injecting all the preservative the ties would absorb. This maximum amount was found to be about 7 pounds per cubic foot, as may be seen from Table No. 2. Pine ties (short leaf) were found to readily absorb the straight asphaltic oil in good quantities with thorough penetration.

The treatment with 25 per cent. creosote to 75 per cent. asphaltic oil proved that the viscosity of the oil was greatly reduced and absorption could be obtained as with straight creosote with a greatly reduced cost of treatment.

In order to determine whether the same proportion of 25 per cent. creosote to 75 per cent. asphaltic oil existed in the tie after its injection, a sample of the borings extracted from several ties injected with this mixture was taken and analyzed by a competent chemist, which proved that the mixture remained in a stable and homogeneous combination. The analysis secured from the boring extractions from the treated ties was ultimately compared with the analysis of the mixture remaining at the end of the test and the original creosote oil. The boring samples were analyzed for specific gravity, moisture content and amount of tar acids present. Finally, a fractional distillation of each of the three samples was made, taking the fractions in each case at the same temperature and determining the percentage, specific gravity and refraction of each. The results are tabulated in Table No. 3.

From the results secured in the comparative analyses of the oil extracted from the borings of the treated ties, the original creosote oil and the original mixture of 25 per cent. creosote to 75 per cent. asphaltic residual oil, it is safe to state that the mixture found in the treated ties approached the original proportions, and that the mixture injected into the ties contained about the same proportion as the original mixture before injection; hence, the mixture of creosote and asphaltic residual oil obtained from the central United States remained in homogeneous solution before, during and after its injection into the wood.

In the fall of 1909, the refining company shipped a large tank car of heavy asphaltic residual oil to the low pressure plant of the Indianapolis, Columbus & Southern Traction Company, at Columbus, Ind. At that time a cooperative agreement was entered into between the refining company to furnish the plant and ties, and the Forest Service of the United States Government to supervise the tests and to record the experimental data. This initial test at Columbus, Ind., proved a failure because of the inability of the small capacity pressure pump at the treating plant to handle the thick, viscous asphaltic residual oil which was at that time a grade very much heavier than the product which has eventually been adopted by the refining

TABLE NO. 3.

OIL EXTRACTED FROM BORINGS.

Spec. Grav. at 60 F.	.99416
Water	None
Tar Acids, per cent	1.5

Distillation.

	Pct.	Spec. Grav.	Ref.
190 to 220 C.	2.0	1.012	1.558
225 C.	2.3	1.020	1.567
230 C.	1.8	1.022	1.573
240 C.	2.5	1.029	1.578
250 C.	2.2	1.019	1.571
260 C.	2.6	.9987	1.541
270 C.	3.2	.9788	1.511
285 C.	3.8	.9524	1.487
300 C.	3.5	.9413	1.476
315 C.	2.0	.9318	1.472
330 C.	5.7	.9467	1.474
345 C.	5.2	.9416	1.479
360 C.	40.5	.9409	1.483
Res.	22.1		

SAMPLE MARKED "ORIGINAL CREOSOTE OIL."

Spec. Grav. at 60 F.	1.049
Water, per cent	1.0
Tar Acids, per cent	6.7

Distillation.

	Pct.	Spec. Grav.	Ref.
170 to 220 C.	12.16	1.017	1.568
225 C.	9.24	1.024	1.594
230 C.	6.96	1.029	1.612
240 C.	10.08	1.038	1.617
250 C.	8.76	1.049	1.621
260 C.	6.32	1.066	1.630
270 C.	4.56	1.078	1.637
285 C.	5.20	1.088	1.644
300 C.	5.52	1.096	1.650
315 C.	5.32	1.108	1.652
330 C.	6.24	1.117	1.659
345 C.	6.76	1.121	1.662
360 C.	3.60	1.130	1.664
Res.	8.40		

SAMPLE MARKED "RUN 167—END—MIDDLE."

Spec. Grav. at 60 F.	.9908
Water, per cent	18.6
Tar Acids, per cent	1.8

Distillation.

	Pct.	Spec. Grav.	Ref.
170 to 220 C.	2.4	1.009	1.551
225 C.	3.0	1.018	1.563
230 C.	2.2	1.026	1.568
240 C.	2.0	1.034	1.572
250 C.	3.4	1.019	1.566
260 C.	3.1	.9996	1.546
270 C.	3.5	.9891	1.522
285 C.	4.4	.9769	1.486
300 C.	5.0	.9655	1.471
315 C.	4.2	.9567	1.475
330 C.	4.5	.9432	1.473
345 C.	4.1	.9429	1.477
360 C.	38.9	.9411	1.489
Res.	19.0		

company as a more satisfactory material. Before this test was completed, however, it was found that the asphaltic oil resisted the forcing of zinc chloride solution through an injection of three pounds of asphaltic oil per cubic foot to a very much greater degree than the same quantity of creosote. This proved the superior water-proofing quality of the asphaltic oil, as it is safe to assume that a material which would resist the forcing of a water solution through such a limited injection as three pounds per cubic foot, would successfully resist the action of water even under abnormal conditions to which treated material is generally subjected.

One other test, made at the laboratory of the above mentioned refiner, may prove of interest in showing the additional water-proofing quality of the asphaltic oil. A paving block of standard size was treated with residual asphaltic oil to the amount of 16 pounds per cubic foot. It was then dried in an oven of a temperature of 120 degrees F. for a period of 24 hours. The gain in weight was found to be .02 of 1 per cent. The same block, if treated with .20 pounds per cubic foot of creosote, would have been allowed to absorb as high as 3 or 4 per cent. of water, by weight.

The most recent test on asphaltic oils occurred in November, 1910, when several tank cars of asphaltic residual oil were shipped to the Mount Union plant of the Pennsylvania Railroad Company for a trial in the large cylinder at that plant. At this test, three charges were run with straight asphaltic oil, and three with a mixture of 33 1-3 per cent. creosote to 66 2-3 per cent. asphaltic oil. When this proportion of asphaltic oil and creosote was exhausted, more creosote oil was added as required until the proportion again assumed 100 per cent. creosote. The tabulated results given in Table No. 4 give in detail the treatment of these charges. Each charge averaged about 500 ties of 7x9x8½ dimensions.

Sections sawed out of the center of the pine ties showed complete penetration through the sap wood to the heart, this being an equivalent penetration to that secured by the use of creosote.

It was found that red oak, beech, elm and gum ties varied in the penetration secured, being dependent upon the amount of sap and heart wood in each tie. The penetration was not equivalent to that secured by creosote in all cases, but approached very nearly the results secured through the use of creosote. When the difference in viscosity between the two oils is considered, this result is not remarkable.

In each of the straight asphaltic runs, eight ties were marked and weighed before treatment, being selected as average samples from among the 500 ties composing each charge, and placed in various positions in the cylinder. After the process of treatment had been completed, the ties were again weighed and the absorption results of two charges with straight asphaltic oil are given in Table No. 5.

Reference to Tables No. 4 and 5, proves that the absorption per tie in the various woods was not excessive, at the same time giving good penetrattion in almost all cases; therefore, considering the fact that the asphaltic oil was not absorbed in large quantities when the woods were given a maximum treatment and again giving a penetration comparing favorably with that secured by the use of creosote, asphaltic residual oils may be considered an economical substitute for creosote.

The results secured on the mixture of creosote and asphaltic oils, as may be observed from the results in Table No. 4, proved, in every instance, as far as absorption per tie and the element of time for treatment may be concerned, equivalent to the results secured by the use of straight creosote oil. It must be admitted, however, that the asphaltic oils when used alone require a larger period of time for injecting an equivalent quantity of creosote, which quantity has been observed to be, in most cases, on hard woods, the maximum quantity.

Following these tests in the large cylinder, tests were made in the experimental cylinder on the Rueping process in the treatment of mixed oak and pine ties with straight asphaltic oil. The absorption obtained in the limited number of tests made on the Rueping process were very satisfactory, as the same penetration was secured by a limited quantity of oil as was secured by a larger quantity of oil in the straight asphaltic oil pressure process. This experimental test merely proved the applicability of asphaltic oils for use on a large scale in the Rueping process, although it is readily admitted that there was no long-time practical tests to emphasize the theoretical deduction that the treatment would be a good one. It is also readily admitted that the only value of asphaltic oil, obtained from the central United States, as a wood preservative, would be in using a parallel treatment to that in which the Santa Fe railroad have obtained such excellent results, viz., the injection of a maximum quantity of oil into the wood. The only object in citing the experiment on the Rueping process is to show that the asphaltic oils are at least applicable.

As the distillation data in Table No. 1 demonstrate that the fractions of asphaltic resudual oil possess high boiling points, comparing in this respect very favorably with good coal-tar creosote, and at the same time comparing favorably with the analysis of the Bakersfield oil, it seems reasonable to assume that it has great value as a wood preservative.

It has been claimed that if the asphaltic oils were injected in maximum quantities into the various species of red oak, beech, elm, gum, etc., the quantity which would be absorbed per tie would be so great that there could be no economy in its use. The attached data and the cross section samples taken from the ties in the several tests made on these species of wood with asphaltic residual oil prove that this is not the case. Good penetration has been secured by not over an eight-pound per cubic foot injection of asphaltic oil, which also proved to be the average amount the various timbers would absorb.

This proved the case with all except the short-leaf pine ties, and even with that species, the amount of oil necessary to secure a maximum injection was not found to be prohibitive from the standpoint of economy.

The Santa Fe railroad and the National Lines of Mexico have demonstrated by a practical test, under abnormal conditions of about nine years' duration, the value of asphaltic oils when injected into pine ties to refusal. Some of the ties which successfully withstood this test contained a small amount of oil, yet it was in all

TABLE NO. 4.

PENNSYLVANIA RAILROAD TEST AT MT. UNION, PA.

STRAIGHT ASPHALTIC OIL PROCESS (TIMBERASPHALT).

No. ties in Chge.	Species	Cu. ft. in ties	Condition	Total absorp. gals.	Absorption per cu. ft. lbs.	Absorption per cu. ft. gals.	Absorption per tie lbs.	Absorption per tie gals.
480	Mixed	1758	Seasoned	1870	8.38	1.06	30.7	3.89
486	Mixed	1792.6	Seasoned	1730	7.60	.96	28.0	3.56
517	M. Oak	1654.4	Seasoned	1930	9.19	1.16	29.4	3.73
CREOSOTE MIXTURE PROCESS (66 2-3 PER CENT TIMBERASPHALT, 33 1-3 PER CENT CREOSOTE).								
314	M. Oak Timber	1720	Seasoned	1920	8.79	1.11	8.17	1.12
511	B. B. & M.	1635.2	Seasoned	2040	9.83	1.24	31.5	3.99
547	M. Oak	1702.6	Seasoned	1810	8.37	1.06	26.1	3.3

RUEPING PROCESS (TIMBERASPHALT) (EXPERIMENTAL CYLINDER).

No. ties in Chge.	Species	Weight in Pounds Before treatment		After treatment		Gain	Penetration
3	M. Oak	Pine	125	Pine	140	15	2 in. to heart
	Pine	Pine	177	Pine	195	18	Good
		M. Oak	164	M. Oak	190	26	Good

TABLE NO. 5.

MT. UNION TEST ON TIMBERASPHALT—FOR PENNSYLVANIA RAILROAD.

WEIGHT OF TIES BEFORE AND AFTER TREATMENT.

Species.	Before lbs.	After lbs.	Lbs. abiorbed per tie	Gals. absorbed per tie	Lbs. per cu. ft.
—Run No. 915.—					
Hdwd. Special	212½	224	11.5	1.46	3.48
Sap Pine	210	234	24.0	3.045	7.27
Sap Pine	146	156	10.0	1.269	3.00
Seasoned L. L. Pine	180	211½	31.5	4.00	9.54
Birch	149	157	8.0	1.015	2.42
Gum	134	164	30.0	3.807	9.1
Red Oak	163	191½	28.5	3.61	8.66
Beech	180	198	18.0	2.284	5.45
—Run No. 916.—					
Seasoned Elm	148	178	30.0	3.807	9.1
Seasoned Birch	163	178	15.0	1.903	4.53
Seasoned S. Elm	168	221	53.0	6.72	16.06
Seasoned Gum	196	247	51.0	6.4	15.45
Seasoned M. Oak	136	152	16.0	2.03	4.83
Seasoned Pa. Pine	103	135	32.0	4.06	9.7
Green Y. Pine	125	152	27.0	3.42	8.18
Hdwd. Special	212	230	18.0	2.2	5.45
Seasoned Beech	189	220	31.0	3.93	9.4

cases the maximum quantity which the ties would absorb.

The foregoing data are the result of observations and experiments extending over several years with the asphaltic base oil to be found in such immense quantities throughout the central part of the United States.

Water Rates in Municipal Plants

By Leonard Metcalf, M. Am. Soc. C. E., Boston, Mass.

IN a paper before the Pennsylvania Water Works Association, Leonard Metcalf makes a study of the financial statistics of municipal water works which are given in the report of the U. S. Census Bureau on "Statistics of Cities Having a Population of Over 30,000" for the year 1907. The conclusions which he draws are given as they are briefly and clearly stated and show the average condition of municipally owned water works, notwithstanding the numerous details which are insufficiently reported or are not in shape to be compared accurately. —[Editor.]

Under the prevailing rates the public water works in this country have gross actual incomes (without allowances in the majority of cases, for water used for municipal purposes) of approximately

$2.58 per capita of population,
$1,800 per mile of pipe,
$71 per million gallons of water supplied,

and operating and maintenance expenses (including allowance for taxes, but excluding allowances for depreciation, fixed charges, and profit) of

$1.52 per capita of population,
$1,100 per mile of pipe,
$41 per million gallons of water supplied,

corresponding to

61% of gross actual income,

and net annual income of approximately

$1.06 per capita of population,
$700 per mile of pipe,
$30 per million gallons of water supplied,
39% of gross actual income.

The question arises, is this so-called net income sufficient to provide a reasonable allowance for depreciation and for fixed charges? Let us see.

The Government statistics of "net cost of system" and "present value of system" are admittedly neither reliable nor comparable, as reported for the different cities, and obviously the "outstanding debt" is of no significance except as indicating the extent to which past generations have contributed to the liquidation of the water works debt, and thus have been taxed for the benefit of the present and future generations. Moreover, for our purposes here the Government's method of computing the interest is unsatisfactory, as it involves the relative credit of the several cities and the probably erroneous estimate of present value of the works. Therefore we are forced to base our conclusions upon certain assumptions.

If we assume a "per capita value of the works" of $25, an annual depreciation allowance of 1% based upon value, not upon reproduction cost of the works, and fixed charges of 4%, corresponding to the best credit conditions, we should require

		Per Capita.
Depreciation....	1% of $25=	$0.25
Fixed Charges...	4% of $25=	1.00
Total		$1.25

If we assume a per capita value of works of $50, an annual depreciation allowance of 2% of the value of the works, fixed charges of 4%, we should require for

		Per Capita.
Depreciation....	2% of $50=	$1.00
Fixed Charges...	4% of $50=	2.00
Total		$3.00

or if we assume, as reasonable for average conditions, a per capita value of $35, a depreciation allowance of 1% (based upon the value not the reproduction cost of the works), and fixed charges corresponding to city conditions of 4%, we should require for

		Per Capita.
Depreciation....	1% of $35=	$0.35
Fixed Charges...	4% of $35=	1.40
Total		$1.75

As against these depreciation and fixed charge requirements we have seen above that the Government report indicates an average net income, applicable to these uses, of approximately $1.06 per capita of population.

Broadly speaking, therefore, it appears that the net income of our public water supplies, upon prevailing rates and existing methods of supplying free water for municipal uses, is not sufficient to meet a proper depreciation allowance and fixed charges corresponding to the value of these works. Obviously no water company could do business upon such a basis. Moreover the rate (4%) upon which the fixed charges have been figured, is entirely inadequate for such works, if privately owned.

I do no appear before you as an exponent either of municipal or of private ownership of water works. Whether the present method of operating those public works is desirable, or not, is not at issue here, nor whether it is wiser to pay the cost of public water service by charging higher rates for domestic and manufacturing service than by direct tax for water used for municipal purposes, nor yet whether it is desirable, in the interest of a conservative public policy and to assist the city to meet such possible emergencies as conflagration or earthquake, to charge off the water debt at a more rapid rate than depreciation requirements alone would make necessary.

The significant point which I desire to call to your attention is one well known to you already—that it is not safe to compare water rates found in different cities, without full knowledge of all existing conditions, including the value of the works and the character of the service rendered. Therefore if the attempt is made to compare your water rates directly with those charged in neighboring cities, you should inquire immediately what the conditions of operation and allowances for depreciation and fixed charges may be, or in other words the financial policy in the operation of these works is.

Were you in the position implied by the Government statistics, with an average net annual income of $1.06 per capita, applicable to depreciation, fixed charges and profit, you might well find yourself with an annual deficit of between $1.25 and $1.75 per capita, derived as follows:

Average Per Capita Net Income, applicable to Depreciation, Fixed Charges and Profit (as per U. S. Government Report)		$1.06
Depreciation. 1¼% on $35=	$0.43	
Fixed Charges 5 % on $35=	1.75	
Profit........ 1¼% on $35=	0.52	
Total	$2.70	2.70
Deficit Per Capita...........		$1.64

While these figures are only approximate, as the operating cost under private ownership is probably considerably less than that shown for public ownership, they serve to bring home the lesson to be drawn from these Government statistics, which has already been pointed out—that water rates cannot be compared equitably at their face value, without due allowance for difference in value of the works, character of service rendered, and any other important factors; and they show that upon the Government's average figures for gross and net annual income for municipal water works, under prevailing rates, these works are not earning a reasonable depreciation allowance and fixed charges corresponding to the probable present value of these works, under prevailing rates, and that private works or corporations could not earn a reasonable return upon the value of their plants upon water rates yielding such an average net income as that reported by the Government.

Des Moines River Improvements

THE situation of the city of Des Moines on the banks of the Raccoon and the Des Moines rivers might, perhaps, be considered as unfortunate as regards traffic and sanitary conditions; but a more ideal condition for the application of the principle of civic adornment would be hard to conceive. That this condition has been appreciated and taken advantage of, is evident from the river improvements which have been made up to the present time.

The first attempts towards the beautifying of the river banks were made about 1901, when retaining walls were built along some of the river shore. With the change in city government

I. DES MOINES RIVER, LOOKING WEST FROM MUNICIPAL BATH HOUSE.

and the adoption of the "Des Moines Plan of Government," a more systematic plan of improvement was adopted and is being worked out as rapidly as the legal tax rate and other conditions will allow.

In 1909 contracts aggregating $75,000 were awarded for river front improvement work. These were the first of a series which, if completed as planned, will bring the cost of the work to over one-half million dollars. This work is to be preliminary to the establishment of a civic center, and the development of a riverside park and boulevard system. The first photograph indicates the character of the natural river scenery along which these boulevards would run.

The second photograph shows the present condition of the river front at the point where it is proposed to establish the civic center. The number of spider-like truss bridges, the haphazard placing of the buildings, and the unkempt condition of the river bank are all very much according to the accepted condition of things in those cities so situated with reference to rivers. Contrast this with the third photograph, which shows the proposed civic center, with its parkways, boulevards and bridges all consistent with the plans for future adornment.

The Locust street bridge, which was completed in 1909, is an example of the type of bridge that will probably be adopted for all the structures within the limits of the proposed improvements. This bridge is of reinforced concrete, 66 feet wide and 502 feet long. The hand rails and copings are finished with a mixture of Portland cement and limestone screenings; the spandrel walls with cement and reddish brown granite; and the ends of the arch rings with cement and grey quartz. The surface was rubbed so as to bring the colored stones into prominence, giving a very pleasing appearance to the structure. In the background of the photograph may be seen the City Library, and new Government Postoffice buildings. Their appearance is no doubt much better as seen across this bridge than across the structure at the extreme left of the photograph.

The last two photographs are scenes in the Des Moines public parks, of which the city has about fifteen. Municipal bath houses and bathing beaches will be given much consideration in the development of the park system.

We are indebted to J. W. Hawke, city auditor, and Chas. W. Schramm, superintendent of the department of accounts and finance, for the accompanying photographs.

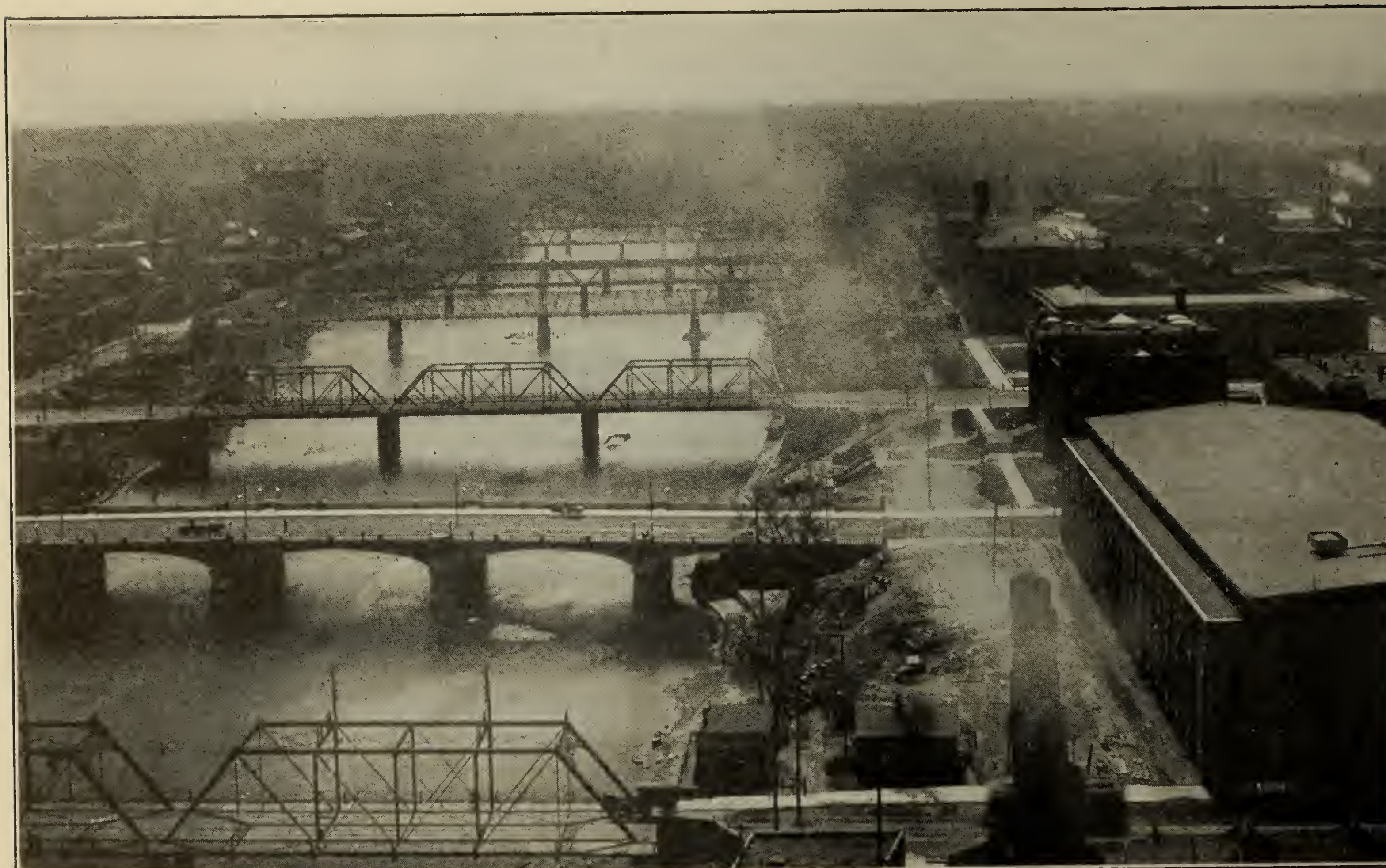
Garbage and Refuse Collection and Disposal*

By Charles Carroll Brown, M. Am. Soc. C. E., Consulting Engineer, Indianapolis, Ind.

But recently has it been recognized that garbage and refuse collection and disposal is an engineering question, which requires the best of study of men who have become familiar with the conditions by close observation and experience. It has long been considered a sanitary matter, and as such has been referred to the Health Officer or Board of Health for attention, all the other city departments passing it by as a vexing problem with no apparent method of solution. The Board of Health have been too apt to consider it in the same way, and to accept the labor of taking care of the city's wastes only because it is forced upon them and they cannot shirk, at least in words, something which all unite in declaring to be a matter concerning the public health.

As a consequence of this neglect of the question, and refusal to give it serious scientific study, opportunity has been given for others to exploit the city in one way or another and, by playing upon the ignorance of the city officials, to make considerable profit out of that ignorance. This attempt has been made by some who are equally ignorant and have therefore failed in realizing their expectations, as well as by those who have succeeded because of greater knowledge. It has also been made both with and without success by those who are trying honestly to do their communities a service. It has also allowed many experi-

*A paper before the Indiana Engineering Society.



II. SITE OF PROPOSED CIVIC CENTER.

menters to develop their plans at the public expense, leaving the said experimenters to reap the benefits when their systems have been fully developed. Few, if any, of these experimenters have attacked the problem of garbage and refuse collection, and few have attacked the whole problem of disposal of all the garbage and refuse of the city. The very important matter of the collection has been left almost to accident for its development. The result of all this neglect is a different method of collection in every city, almost as many methods of disposal, and the development of customs and habits among the people and the city officials which make any change looking toward uniformity very difficult to make. Conditions vary so much that all cities cannot be expected to follow exactly the same methods of collection and disposal, but the number of methods in use should be reduced to the few which have been and may be scientifically designed and will properly meet the demands of the local conditions in an economical manner.

The problem as a whole is to collect and dispose of the following classes of city refuse, more or less of each class being found in every city of sufficient size to make individual care for the waste matters of the inhabitants difficult, and the creation of nuisance too great to be permissible a probability.

The sewage of the city, collected through a sewer system, has long been considered a subject of expert engineering study, and will not be considered here, except to suggest that in some cases the sludge from disposal plants may be disposed of in connection with some other city wastes.

Garbage, in the strictest sense of the term, is the animal and vegetable refuse which attends the preparation of food for consumption. Garbage may be divided into two classes for convenience in discussing methods of collection and disposal, viz:

Household garbage is that produced by households separately, is generally small in amount in a single house and may not require removal, so far as quantity is concerned, oftener than once or twice a week, or even less frequently.

Commercial garbage is that produced in large quantities by hotels, large boarding houses, flats, if the garbage from the whole collection of households is deposited together. It requires frequent removal, at least once each day, and often several times a day. This frequent removal prevents the fermentation which takes place if garbage is stored for any considerable length of time in the ordinary climate, and the freshness, amount and concentration in a few deposits makes such garbage valuable enough in many places to warrant calling it "commercial" as it is often a matter of commerce. This commercial garbage also includes the refuse and spoiled materials from markets, vegetable and fruit commission houses, groceries, meat, fish and fowl shops and slaughter houses, docks, etc. Some is valuable for feeding to hogs, and some is valuable for reduction to recover the valuable ingredients, such as oil or grease, fertilizer, etc.

Manure may in some cases be classed as garbage, but is so often collected and taken care of separately that it must be named as a separate class of the city's wastes.

Dead animals can scarcely be classed with the commercial garbage, and yet may be disposed of in the same plant. While the amount of such refuse is very irregular, it is sometimes a difficult problem and must receive separate consideration in making any plan for refuse collection and disposal. Small animals are often collected with garbage or find their way to the garbage disposal plant for treatment.

Ashes, except in cities with natural gas, have a larger tonnage than all the other refuse. They contain a considerable proportion of combustible matter, variable in different places and at different times. If cinders and clinker are also considered, being of like nature and origin, i. e., refuse from fires, this class of refuse may be separated into commercial refuse, the collection of which equals or exceeds in cost the returns that may be obtained from its disposal.

Street sweepings may form a separate class, which partakes of the nature of manure when the sweepings are by hand from paved streets with heavy traffic, or of the nature of ashes or other inorganic matter when the mud from unpaved streets is allowed to accumulate and is then cleaned off. It may consist of any mixtures between these two extremes.

Large volumes of refuse not belonging to any of these classes are collected in every city. These matters have classified themselves largely according to the possibilities of disposing of them as follows:

Combustible refuse consists of paper, wood, straw, excelsior, grass, tree-trimmings, cloth, mattresses, etc., collected

III. PERSPECTIVE OF PROPOSED CIVIC CENTER, DES MOINES RIVER FRONT.

from householders, and like materials, collected often in large volumes from mercantile and manufacturing establishments. That from the latter sources is ordinarily classed as commercial refuse and has quite a definite value. That from houses and small commercial establishments is too small in amount and too miscellaneous in character to have much, if any, commercial value.

Incombustible refuse includes such household waste as tin cans, bottles, broken crockery and glass, leather, metals, remains of building repairs, etc., besides occasional earth, brick, cement, mortar, etc., the result of more extensive building and repair. Some of this material is of considerable commercial value and is sold or given to the junk men who go about gathering it up, but much of it cannot be so disposed of and must be considered as one class of the city's wastes which must have consideration in a comprehensive plan for keeping the city clean.

There is one class of city refuse which should not be permitted, but must be taken care of under existing circumstances in all cities to a greater or less extent. This is night-soil. A city with a complete municipal water and sewer system can enforce proper water and sewer connections and eliminate this matter. If water or sewers do not cover all the city there are districts in which deposits of night-soil now accumulate, and they must be taken care of until such time as they are eliminated by the extension of the water carriage system of removal or are prevented as suggested later.

As stated above, the collection of these wastes is a most important part of the problem and one which has been greatly neglected. If they are to be collected separately, the householders and others must be carefully instructed as to their separation and the kinds and sizes of receptacles to be used, the methods of storage and collection adopted, etc. This is a matter of sanitary importance, first and foremost, and when treated in the most sanitary manner is also treated in the most satisfactory manner, from the point of view of the collector who knows his business. The city department having most authority in such matters is the Board of Health, and it has been customary to intrust the supervision of the collection of refuse, or more particularly garbage and other organic refuse to that department. Unless a separate department is established, which has the fullest endorsement and co-operation of the sanitary authority, it is probably best to keep the collection in the hands of the Board of Health, whether the collection is made by contract or by the city's own forces.

It is very evident that if these various classes of waste are collected separately, they must be treated in quite different ways, if they are to be taken care of in the most economical as well as the most sanitary way. And it is equally evident that if any two or more classes of the refuse are collected together the method of disposal must be made to conform to the method of collection. Most of the failures in garbage and refuse disposal have come, not so much on account of the method of disposal or the apparatus used, as on account of the failure to suit the method of collection to the method of disposal adopted, so that the furnace or other process of destruction or utilization has been called upon to do work for which it was not intended and which it was unable to take care of satisfactorily. Any serious consideration of the disposal problem must therefore include a consideration of the collection problem.

There are so many local considerations which will modify any general plan that may be outlined, that the following will serve only as examples of methods of solution of the double problem, from which selections may be made, with the necessity in view of making these modifications; or which may serve as suggestions of the method of study of any problem which they do not happen to suit exactly.

Night-soil, as the most objectionable city refuse, is usually the first to be taken care of. In the smaller towns and cities without sewer systems, the earth-closet is the most sanitary manner of caring for such refuse, the polluted earth being used for fertilizer with success and without nuisance. Until the Board of Health can enforce the use of earth-closets in towns or in portions of cities not reached by water and sewer systems, the cess-pool collections must be removed by hand or by odorless excavators. This material is much more difficult to take care of, because it cannot be used so directly for fertilizer and is not so valuable as such. It can be buried if not put too deep nor in too large quantities in one place nor too thick a layer. Its discharge into any stream, even the largest, is little short of a crime. The mass cannot be satisfactorily treated in a septic tank, be-

IV. LOCUST STREET BRIDGE ON DES MOINES RIVER.

ing largely well past the septic tank stage and a mixture of sludge and matter which has not yet decomposed to the sludge condition. Possibly it might be handled in a sewage settling tank if sufficiently diluted, for example, by dumping it into a sewer with a good flow of water, in small quantities at a time. Night-soil is of course impossible in a garbage reduction plant, and can be taken care of in a destructor, incinerator or other form of furnace, whether using high or low temperatures, only in small proportion to the other matters burned and when properly mixed with them. The best treatment of this matter is to prevent its deposit, as already stated.

When householders keep hogs or other animals to which garbage can be fed, the problem of its disposal is solved. The fact that, when fresh, this is a valuable material for such purposes leads to the idea that garbage is too valuable to throw away and that its value must be extracted. This idea is correct, provided the cost of extracting the values is not greater than the financial return. What has been classed above as commercial garbage can be collected and fed to hogs before it is decomposed sufficiently to become objectionable as food or as producing odors in the neighborhood of the removal wagons or the feeding places. If the garbage can be collected often enough to keep it in the same condition it can be used in the same way. Unfortunately climatic conditions and the expense of collecting the usual small accumulations of household garbage daily cause either the objectionable decomposition with its attendant nuisance and deterioration in food value, or too great a bill for the labor of collection. Not all cities are in the fortunate position of Denver, which, on account of its climatic conditions is able to follow this plan and lets the contract for the collection and feeding of its garbage to hogs for a term of five years for the total cost of one dollar. In other words, the value of garbage as feed for hogs fully equals the cost of collection. The work is done under the close supervision of the Board of Health and is reported to be entirely sanitary both in collection and disposal. Los Angeles has been trying the same method lately with less satisfactory results, because the work is less thoroughly organized and the sanitary features are not properly taken care of. Some of the smaller eastern cities follow the same plan, but the writer without inspecting the hog-pens has always entertained doubts as to the condition of the hogs as well as of the freedom of the process from nuisance. Boards of Health are prone to close their eyes and noses when an improvement has been made, even if it does not produce all the results desired, if they see nothing better available for the money they have to spend.

The quality of garbage, from the point of view of the valuable matter in it, varies much in different cities and in different districts of the same city. In general it may be said that the reduction of garbage alone, for the purpose of saving the oil and using the tankage for making fertilizer, etc., is not profitable. Some of the commercial garbage may be sufficiently rich, but this is more valuable for feeding hogs and does not reach the reduction plant if it can be disposed of for hog-feed. There is, of course, no return from the incineration of garbage in the ordinary garbage furnace of any of the usual designs. On the contrary, it requires coal to complete the incineration of the garbage if not mixed with other refuse of a combustible nature, and there is therefore always an expense in the destruction of garbage in this way beyond the cost of the labor of collecting it and handling it at the plant. Some designers of furnaces refuse to construct them for the burning of garbage alone. It is surprising that American cities should not have discovered these facts earlier. They have wasted much money and made many failures trying to burn garbage, collected separately at considerable trouble and expense, when better results could have been obtained at less expense and trouble by change in the regulations governing separation and collection. The Health Officer of Minneapolis, for example, secures excellent results with considerable labor by householders, by requiring each bit of garbage to be drained over the kitchen sink and wrapped in paper before it is deposited in the garbage can. This mixes combustible refuse with the garbage and prevents freezing of the garbage to the can.

If dead animals are included with the garbage at a reduction plant, it is probable that the products will pay the expenses of the process of disposal, and quite possible that there will be a little profit to help pay the cost of collection. A well managed reduction plant for animals alone will make a profit, if all the items of value from hide to fertilizer base are taken into account.

Manure is said to have some value as a fertilizer, but the fact remains

V. A VIEW IN UNION PARK, DES MOINES, IOWA.

that many loads are disposed of by dumping in low places as filling material, and in some cities, more fastidious as to the material upon which future districts of the city shall be built, much manure is burned with other more and less combustible refuse in the destructors.

Ashes have considerable combustible material in them and may be used in helping burn other material. In England they have long been mixed with the other city refuse taken care of by the destructors and they seem to be needed to produce the most valuable clinker, which in that country seems to have some value. The cities of this country have had so many hollows to fill, in the process of preparing their areas for buildings, that ashes have been very convenient material and there has been little thought of their value for other purposes. They are possibly not of much value when mixed with wet garbage and refuse to pass through the usual incinerator, for the mixture does not remove the water which must be evaporated, but only conceals it and probably makes it more difficult to evaporate. The ashes seem to be desired in the high temperature destructors of the English pattern, partly because they make clinker out of the furnace ash, but the early reports from the new Milwaukee furnace indicate that the desired result is not as yet obtained there. If ashes are of greater value for other purposes than filling, the fact has not yet been demonstrated beyond doubt.

Street sweepings, as already stated, are of all compositions from almost straight horse-droppings to almost wholly inorganic matter, the result of the wear of the road materials. They are used indiscriminately for filling and there is little, if any, thought of separating the hand-sweepings of the down-town streets from the sweepings of the streets on to which mud is tracked from unpaved, sprinkled or muddy streets, or the cleaning of macadam streets. The fastidious cities referred to would do well to make this separation, running the more nearly complete collections through the garbage destructor before using them for filling. The remainder is very small, and the trouble from settlement in such filled areas is thereby greatly reduced.

Even in cities which burn their garbage it has been common custom to collect the combustible refuse separately from the garbage, partly because it is easier to drain the water from the straight garbage than to evaporate it from the mixture. The Minneapolis plan of wrapping the garbage in paper, however, makes it possible to collect the garbage and combustible refuse together and burn the mixture in the most economical way possible. If the city uses the reduction process it is necessary to collect the garbage separately, and it is then necessary to burn or otherwise dispose of the combustible and incombustible refuse. A few cities use the combustible refuse for filling along with ashes and incombustible refuse, but observation teaches that this custom means long continued settlement of the filled area and occasionally rather serious trouble from smoldering fires in the deposit. This material burns so well that it can be used in a furnace designed for it to produce steam or heat for other useful purposes, for which it is more valuable and much more suitable than it is for filling.

Incombustible refuse is so miscellaneous in its character that no general plan for its disposal can be made. What the junk men leave may be hauled to a dump, possibly passing on the way through a machine in which it can be picked over again by those willing to do so and to agree to stay by the job.

All sorts of combinations of these various wastes are made for the purpose of collection and disposal, most of them without any reference to the proper method of making the combinations or their suitability for the method of disposal selected. This, as stated, accounts for most of the failures in garbage disposal. This has in many cities given wrong habits to the citizens, which are in the way of the adoption of better methods and must be explained away before appropriations for the better methods can be obtained.

No attempt has been made to consider in detail proper methods of separation, collection and disposal, nor the furnaces, reduction plants or other apparatus or methods which produce the best results, for, as stated in the beginning, these methods and plants must be fitted to the work to be done, and to each other, and no one method can be applied to any great number of cities. If the nature of the problem has been stated definitely, and the importance of all the terms in it has been demonstrated, together with the necessity of considering all the parts in planning the collection and disposal of a city's wastes and thoroughly co-ordinating them, the purpose of this paper has been reached. Details of particular methods may be taken up at a later time.

VI. MUNICIPAL BATH HOUSE, DES MOINES, IOWA.

EDITORIAL COMMENT

Paving and Road Making—The Year to Come

PAVING AND ROAD MAKING.

Two notable conventions have been held in New York City during the past month, which, though presenting little that is new, should have much influence upon the development of the science of building streets and making and mending highways.

The first of these was the second convention of the Organization of City Officials for Standardizing Paving Specifications. This organization met last year at Chicago and adopted what it termed tentative specifications. This year it took up those specifications, made such revisions as seemed to be necessary after the hurried work of last year, such additions as were then foreshadowed, and a few corrections of mistakes.

The principal addition was that of the description of the standard rattler and the method of testing paving brick therein to the specifications for brick paving. A specification for bituminous filler and the method of applying it was also added, although the committee expressed its preference for cement filler. But little change was made in the wooden block specification, the claims of monopoly of the material specified being met by the counter claim that it can be purchased by any one in the market. No attempt was made, however, to answer the question, which was asked in the December and January numbers of MUNICIPAL ENGINEERING and again of the committee at the convention, and to give names of independent marketers of such products. The asphalt specifications received a few corrections, none of great importance. The bituminous concrete specification was entirely rewritten in accordance with the advancement in the knowledge of this form of pavement, and all suitable bituminous materials can now be used under the specification, the intention being to exclude only those which are admittedly unfit for the purpose. The macadam specification was made largely a local matter, and the stone block specification was not ready for presentation before the adjournment of the convention.

The second convention was one of the American Society of Civil Engineers under the direction of its Committee on Bituminous Materials for Road Construction, to which engineers and others not members of the society were invited. It was devoted almost entirely to the matters of construction and maintenance included under the title of the committee, but little concerning other materials and methods being presented. Little that is new was heard, but the exchange of experiences and the recital of difficulties should result in much good.

The need was clearly shown of standards for the determination of the quality of materials, and of more accurate knowledge of the properties which materials should have in order to produce good results, as well as of the proper combinations of materials, both chemical and physical. If the convention has added anything to the information for which the committee holding it is searching, or has given it any suggestions which will lead to study and experiment, and will save the committee the waste of time arising from duplication of the work of others, it will have justified itself.

Both the conventions seemed to be desirous of limiting discussion almost too closely. It is very easy to waste much time in profitless discussion and a tactful presiding officer is necessary unless strict rules are made and adhere to, but on the other hand the limitations may be too severe and so discourage the presentation of valuable information and suggestions but little off the direct line and throwing most valuable side-lights upon the main discussion. There is also the danger of giving opportunity for the accusation that specific restrictions are made for ulterior purposes, especially if for any reason the strict rule may be broken at any one point.

The plan of organization of the city officials' convention transfers all the discussion concerning each class of specifications to the committee having that specification in charge. Some of the committees held open sessions to which any interested were admitted, and such as wished to enter into the discussion were given opportunity to be heard. The resulting specifications were also open to amendment on the floor of the convention, by direct invitation of the chairmen of the committees. These specifications seem to have been satisfactory to all. Other committees held closed sessions, but admitted each one who wished to make any statement to the committee, making such use of those statements as seemed good. One committee definitely announced to some of those wishing to appear before it that the committee would call before it those whom it wished to hear, and did not call some of those desiring to be heard. There is more or less dissatisfaction and even protest against the specifications prepared by those committees, and much doubt of the authenticity of some of the information given by one of them, owing to its indefinite character and, at least officially, unknown origin. Such management is not in keeping with the non-partisan, technical character of the proceedings of the organization as a whole.

Full discussion was invited by the president of the American Society of Civil Engineers of all subjects presented at the meetings to discuss bituminous and other materials for treating roads, but little was presented beyond official statements of methods in use by various eastern states and counties. Perhaps this was in part because of the discouragement of wide discussion by the secretary of the committee having the meeting in charge, but it seemed rather to be a lack of confidence in the efficiency of the methods presented and in those followed by some but not presented. The trail of the proprietary process was seen in this convention also, but not of the same nature nor to the same extent as in certain parts of the proceedings of the other convention. The general opinion seemed to be that one of these proprietary processes produces the best road obtainable with bituminous materials, and there seems to be a general effort to produce a road that will approach this as nearly as possible without infringement and without excessive cost.

The suggestions regarding duplication of work done by associations, heretofore made by MUNICIPAL ENGINEERING, are in line with the expressions heard on the floor of the city officials' convention, to the effect that organization will probably declare its work completed after another convention or two and may then turn the matter of revisions of paving specifications, as they may be needed from time to time, over to the corresponding committees of such a body as the American Society of Municipal Improvements.

The need of an organization of those interested in good roads which shall be independent and broad enough to cover the technical as well as the popular features of the road discussions, was shown by the evident desire of some of those at the roads convention to discuss other forms of road material than those to which the discussions were limited. The new American Association for Highway Improvement promises to be such an organization. It can take up phases of the question not coming well within the more purely technical field of the American Society of Civil Engineers, at the same time that it can sustain the dignity now conferred by that body, and will eliminate the unpleasantly commercial features in other good roads organizations. The devotion of so much time at the last two annual meetings of the American Society of Civil Engineers to the road question is most encouraging, but at the same time it was inevitable, for there are now so many engineers of standing sufficiently high to give them membership in the society, who are now engaged in road construction and maintenance, that no other course was open. It is to be hoped that the next convention, under whatever auspices it may be held, will contain more men with the courage of their convictions and with information obtained by another year or so of experience, who will be willing to go into details more fully and discuss matters of cost and policy more freely.

THE YEAR TO COME.

This is the time of year when the engineer and the contractor are looking over the field and locating their probable fields of work in the coming season. Upon the possibilities of municipal work many of them depend, and, with some exceptions, such work depends but little upon general financial conditions. In fact, in bad times some cities do more work than in good times in order to give work to those out of their regular employment. So longs as bonds can be sold or special improvement taxes can be spread over a series of years this procedure is possible and the good work goes on. But this year reasonably good times are in prospect, and municipalities will proceed with their work on the usual lines.

The smaller cities and towns are rapidly taking up the improvement problems, and all cities, large and small, are emulating their neighbors not alone in the useful improvements but in those which beautify the city as well. As a consequence the municipal work in prospect is larger than in any preceding year.

Political changes have caused some to fear stagnation in business until the intentions of the new Congress have been shown, but the usual cry of "wolf" has not yet been heard, and it has been heard so often that its effect is now discounted by those who know from whom it comes and that those who issue it are themselves responsible for the commotion, if one arises.

A general view of the business situation, especially among manufacturers of machinery and materials of construction, indicates a generally hopeful tendency and a conservative preparation for increasing business.

Under these circumstances it has seemed proper to the management of MUNICIPAL ENGINEERING to prepare a special construction number to be issued on March 1, which will show in detail what the prospects are for work in 1911. The municipalities, the engineers, the contractors are already sending in their reports not only of the work in prospect for 1911 but also of the work completed in 1910 and that now in progress, so that full comparison can be made between the past year and the coming year.

These returns show large projects and thousands of small projects on the list for the ensuing year, and if they continue on the same scale as those already received will show more than a billion dollars worth of municipal improvements to be put under contract and much of it completed during the coming season. As this information comes in it is tabulated, condensed and summarized, and the results will be shown in the special number in detail. The contractors, in addition to their reports of work in sight, are sending in statements of the materials and machinery they will want in the near future and this is also collected and classified for the benefit of those whom the magazine is trying to serve. This, also, will be put in shape for publication in the March number in such form as to be of interest and value to all our readers.

The reports will be arranged under the various states for the cities from which they come, so as to be most conveniently available and will be valuable for reference for all the rest of the year.

Although this special information will necessitate a considerable enlargement of the magazine, a specially full table of contents has been arranged with special reference to the practical work of the engineer and the contractor, so that the number will be more than usually valuable from this point of view also.

Paving, sewers, sewage disposal,

street cleaning, water supply, garbage and refuse collection and disposal, street lighting, fire equipment, street signs, contractors' supplies and machinery, are all included, and combine to increase the size of the magazine again.

When to these increases are added those in the advertising pages, which also promise much of value and interest to our readers, it will be seen that the March number of MUNICIPAL ENGINEERING will be one of the most valuable single numbers of a municipal magazine which has ever been issued.

If any one has inadvertently been missed in the distribution of the blanks for reports he is requested to send for them at once that his city and his business may be properly represented in this inclusive number. The success of the information department depends upon those who supply it, and, while the response has been surprisingly prompt, it is difficult to reach every official in a city who can make a report, and every contractor; therefore, this request is made to all those who have not already received the blanks.

THE QUESTION DEPARTMENT

Periodicals in Water Works Field.

Our company desires to be up to date, hence wants to know the magazines published that deal especially with their line of business. It is a private company supplying artesian well water only.

W. R. R., ———, Pa.

All of the periodicals devoted to civil engineering pay more or less attention to the field of water works. There is no strictly technical publication known to the writer except the society journal named below, which devotes itself entirely to water supply subjects. From a list of periodicals published in MUNICIPAL ENGINEERING, vol. xxxiii, pp. 177 and 335, the following are selected as paying an appreciable amount of attention to the field.

Engineer, London, weekly, $10.

Engineering, London, weekly, $10.

Engineering Magazine, New York, monthly, $3.

Engineering News, New York, weekly, $5.

Engineering Record, New York, weekly, $3.

MUNICIPAL ENGINEERING, Indianapolis, Ind., monthly, $2.

Municipal Journal and Engineer, New York, weekly, $3.

Journal of the New England Water Works Association, Boston, quarterly, $3.

Fire and Water, New York, may be added as a trade journal.

MUNICIPAL ENGINEERING devotes its entire attention to the municipal field and believes it succeeds in covering the portion of the field occupied by our correspondent more completely than any of the others.

Location of Water Pipe in Street.

The contractor who is about to put a water main down the Grand Boulevard and Concourse has been granted a permit by me to place the water main under the sidewalk so as not to interfere with the roadbed. He now asks a change in the permit, whereby he may put the water main in the roadbed. I have stated to him that as the Grand Boulevard and Concourse is a wide road, intended for automobiles and pleasure traffic, it should not have its surface broken up continuously, as would be the case if the water main were in the roadbed, by excavating for house connections. Probably within the next few years a great deal of building will go on along the Concourse and every house must be connected with the water main. The design of our engineers, in ordering the water main put under the sidewalk, was to escape breaking up the roadbed.

Please let us know what your ideas are on the subject, and oblige,

CYRUS C. MILLER,
President of the Borough of the Bronx, New York City.

If but one water main is laid in the street there will be no reduction in the length of the cuts for making house connections, assuming each side of the street to be built up with approximately the same number of houses as the other; for all the houses on one side of the street would be obliged to cut entirely across the street to put in their connections. The saving of cutting into the street would therefore be only that of the water main itself. Evidently, under this condition it would be necessary for the city to pay for laying these house connections across the street, or an equivalent adjustment, otherwise property on one side would pay more for its water connections than property on the other side. If two mains are laid, one on each side of the street, probably the ideal condition exists, especially if this main can be located near the property line, so that excavations for making connections can be made within the property line, with only such slight undercutting of the sidewalk (without disturbing its surface or foundation) as may be necessary to reach the main line and make the connection. Questions of assessment, distribution of cost, etc., may modify this best location.

It is sometimes difficult to locate a water pipe in a sidewalk because of the structures at the ends of the blocks, the depths of sewer connections, location of conduits and conduit connections to the houses, poles, if any, etc. The ordinary structures at the ends of blocks are catchbasins and inlets for sewers, lamp and street sign posts, letter box posts, telegraph and other poles, hydrants, and the like. One is astonished at his enumeration of these obstructions to travel and to underground locations the first time he stands on a street corner and counts those which he sees, and still more when he adds those which he cannot see and knows exist underground. Nevertheless, it is frequently possible to locate a water pipe line under a sidewalk in a fairly straight line.

It is sometimes proposed to locate such pipes in the lawns which usually exist on streets of the class named, but this is not always possible. The difficulty with locating sewer lines in this space is considered in the January number of MUNICIPAL ENGINEERING, p. 43. Water pipes would not have the trouble from tree roots there named, but repairs to breaks in the pipe, relaying with new or larger pipe and sometimes the making of house connections might interfere very seriously with the life of trees planted in these lawns. Also, the catchbasins for storm water are ordinarily located near the curb lines and, unless the lawn is wide enough or is located far enough back from the curb for the water pipe line to miss the catchbasins, very objectionable sudden double bends must be made around them.

It may be necessary in laying the water pipe anywhere between the curb and property lines to relay some sewer and conduit connections, but it ought to be possible, where the sewers and conduits and their connections have been laid according to proper rules and regulations, to lay the water pipe above the sewer connections and below the conduit connections and keep the pipe straight enough in the vertical plane as well as in the horizontal plane, and always below the frost line.

If the comparatively small increase in cost due to the difference in cost between the double main, one on each side of the street, and the house connections to a single main is not objectionable, the writer favors the main on each side of the street located between the curb and property lines in the most convenient place. It may readily cost a little more to lay the water main in the sidewalk space, on account of the obstructions named and the necessity of replacing some of them. But a street may also be crowded with underground structures which would make the location of the pipe there more expensive.

The consideration is general and the proper reply to the questions asked, for any particular street, could only be made after a careful study of the location of all the obstructions to be met with in that street and with some knowledge of the taxing and assessment powers of the authorities in case the property owners must pay the cost.

Information About Aqueducts and Engineers.

What sources of information are there on the laying of aqueducts to bring pure water to cities? Can you give me the addresses of engineers in the Central States who have had experience in this work?

C. D. O., Saginaw, Mich.

Books which treat on this subject among others in water supply engineering are Turneaure and Russell's "Public Water Supplies" ($5); Folwell's "Water Supply Engineering" ($4), a brief consideration.

Among articles in MUNICIPAL ENGINEERING which will be of interest in this connection the following may be specially mentioned:

In vol. xxxix: "Machine-Banded Continuous-Stave Wood Pipe," p. 13; "The New Gravity Water Supply for Pulaski, Va."; "The Municipal Water Works of Mattoon, Ill."

In vol. xxxviii: "Day Labor vs. Contract Work on Los Angeles Aqueduct," p. 425; "Plans for Concrete Conduit," p. 45, giving references to a number of previous articles.

Names of engineers competent to design and construct aqueducts can be procured from the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Civil Engineers," "Consulting Engineers," taking those named as making water supply a specialty.

Charges for Sprinklers and Standpipes for Fire Protection.

This city owns its water works. Of late a number of factories, storehouses and stores have put in systems of sprinklers and standpipes. Could you inform me what are the charges that cities of about 20,000 make for this protection? Some of our citizens think it should be free.

F. J. G., ———, Que.

Theoretically a municipal water works should receive for each service that it supplies the full cost of the service. In a case such as that named, the value of this service cannot be measured by the amount of water used. The principal item of cost is the increase in size of supply and service mains necessary to furnish the water required for the new fire protection systems. Theoretically this should be very small, if anything, because the proper action of the sprinklers will obviate the necessity of using the fire hydrants, so that under perfect conditions even smaller supply mains might be required. Practically, however, it is possible for the connections to such sprinkler systems to draw so much water from the street mains in time of conflagration as to reduce the pressure at hydrants below the point of ability for service, unless the mains and the supply of water are increased to allow for the simultaneous action of the two draughts upon the water works. In any event, there are connections, valves, check-valves, meters, etc., to install, and there must be some small charge to cover their maintenance, operation, depreciation and interest. The amount of this charge cannot be fixed arbitrarily, but, in justice, should be determined by a study of the local conditions.

Standpipes, if used only to make it easier for the firemen to reach the upper stories of a building, through attachments of hose at their lower ends for supply and at their branches for the fire service, are apparently a convenience to the water works rather than an expense, and if these standpipes are installed by the owners of the buildings under municipal regulations it would seem quite proper to make no charge for them.

Such standpipes have no connection with the water mains except when it is made by the firemen, whereas the sprinkler systems are ordinarily in direct connection with them, so that water could be drawn from the system without detection unless careful inspections are made at frequent intervals. While such thefts of water are not usual, they are altogether too common, and the water department must admit the danger, and provide, in fixing the amount of its charges, for the expense of this inspection.

No opening of sufficient size to decrease the pressure in the mains materially, if left open, should be permitted, unless the service pipe has a gate valve far enough away from any building so that it can certainly be operated at any time, thus insuring that the waste can be cut off in case a conflagration should cause the fire service to run an open stream.

The fact that sprinkler systems reduce insurance rates from 30 to 50 per cent. should make the property owner willing to pay the full cost of maintaining the service and a reasonable additional allowance for unforeseen contingencies.

Charges are reported from various places of 5 to 12½ cents per sprinkler head, according to the number of square feet sprinkled, according to value of property protected, according to number and size of connections, etc., showing the entire lack of uniformity.

Following are some of the charges made in American cities for these services, showing still further that there is no definite principle of fixing them which is in general use:

Selma, Ala., municipal plant, charges $45 a year for private fire hydrants, 10 cents each for the first 100 sprinkler heads and 5 cents for each additional, with minimum of $100 a year with sealed fire connections, frequent inspections, and $5 forfeiture for every seal broken, unless in case of fire.

Atlanta, Ga., municipal plant, requires consumer to pay expense of all installations, connections, valves, meters, placing same, testing, etc., the city employes to do all work to property line and charge the same to the consumer.

Rome, Ga., municipal plant, furnishes fire protection free.

Kankakee, Ill., private plant, charges $300 a year minimum for fire protection, giving the privilege of using water to that amount at 10 cents per 1,000 gallons.

Terre Haute, Ind., private plant, requires meter set at expense of consumer, and a minimum rate of $20 to $25 a month, or $240 to $300 a year, whether the fire service has been drawn upon during the year or not.

Davenport, Ia., municipal plant, has similar provisions and sets a gate valve on the branch as near the street main as possible.

Lexington, Ky., permits no fire services of more than 2-inch pipe.

The Baltimore suburban plant, private company, charges for fire protection systems for 10-inch pipe, $1.25 a linear foot for laying and $150 a year; for 8-inch, 90 cents and $100; for 6-inch, 60 cents and $50; for 4-inch, 40 cents and $50, respectively. The company decides the size of pipe necessary.

Battle Creek, Mich., municipal plant, charges the following schedule of prices per year for fire services and other special uses: 8-inch pipe, $400; 6-inch, $200; 4-inch, $100; 3-inch, $75; 2-inch, $50; 1½-inch, $35; 1-inch, $20. Half the price for the first pipe will be charged for each additional pipe serving the same premises. The rules state that "the above rates are required in order that the burden of carrying a supply of water at high pressure, and under such difficulties as surreptitious uses, leaks, and danger of contamination of city water from tanks, wells, etc., as have been found to exist in a large number of water works, shall be carried by the people who have the advantage of lower insurance, better fire streams, and preparation for emergencies such as cannot be easily foreseen."

St. Paul, Minn., municipal plant, has a rate, where fire services are not equipped with meters, of $100 a year for the ordinary sprinkler service of not more than two 4-inch connections and $50 a year for each additional connection; $150 a year for existing 6-inch connections, not exceeding two, and $75 for each additional; $300 a year for each 8-inch sprinkler connection; $1,000 a year for each 10 or 12-inch connection. The connections larger than 4-inch are to be dispensed with as rapidly as circumstances will permit. Meters can be ordered on connections at the discretion of the water board.

Hackensack, N. J., will provide a meter with a by-pass of full size of pipe, whose gate is sealed and opened only in case of fire, or will provide a connection without meter if it is independent of the regular supply and an agreement is made that the fire service is to be used only in time of fire, the charge to be one-half the regular minimum meter rate for the size of pipe used.

Elmira, N. Y., charges $75 a year for a 6-inch fire or sprinkler service, with the privilege of using water up to 1,000,000 gallons a year through such service; $50 for a 4-inch service, allowing use of 750,000 gallons a year; $35 for a 3-inch service, allowing use of 475,000 gallons a year; $25 for 2-inch service, allowing use of 400,000 gallons a year. These are in addition to the regular charges for water for general purposes, which must also be paid. Regulations are given below.

Jamestown, N. Y., municipal plant, furnishes fire service free, consumer paying all expense of making the connection.

Walkerville, Ont., private company, charged one plant about $100 a year for two 4-inch and two 5-inch fire service connections.

Catasauqua, Pa., charges $100 a year for sprinkler system on 3-inch metered connection in addition to charge for waater used for all purposes.

Erie, Pa., municipal plant, furnishes one connection up to 6-inch size, laid to curb, for fire purposes only, without charge.

Wilkinsburg, Pa., private plant, requires detector meters installed and under its control, at expense of property owner, sealed outlets to the private fire system and immediate notice of breaking of any such seals.

Richmond, Va., municipal plant, charges $50 a year for each fire protection system with an agreement to use the water through such connections for no other purpose.

One private company reported to the American Water Works Association a contract with one consumer for fire protection service which was changed from 6 cents per 1,000 gallons with a minimum of $50 a month to a rate of 5 cents per 1,000 gallons with a minimum of $125 a month and a sealed unmetered valve which they had the right to open in case of fire.

Worcester, Mass.; Hartford, Conn.; Belmont, Mass., require meters on fire services; New Haven, Conn., reserves the right to put meters on fire services. Bridgeport, Conn., requires meters on fire services to be paid for by owner of property at actual cost.

Herewith are given the rates and regulations for private fire protection in a municipal plant and in a private plant, which may be taken as good practice in most respects and as about the ordinary practice in plants making no charge for the service and in plants attempting to charge what the service costs, with a reasonable addition for profit. These charges, or lack of charges, should not be accepted blindly for any other place, for local conditions may materially modify the amounts.

Atlanta, Ga., with a municipal plant, has the following rules, which have met the approval of the insurance rate makers of the Southeast, and of Atlanta:

Water for fire protection shall not be introduced into any premises without application of the property owner having been first made to the water works and granted officially.

Water for fire protection shall consist of the following systems and be governed by the rules and regulations as prescribed for each class of service:

Class 1. Combination domestic and fire hydrant service shall consist of a pipeline with a meter on by-pass of suitable size for domestic service required. A valve of the same diameter as the pipe shall be placed on the line and be closed and sealed, so as to divert all water through the meter. This is the only class of fire service on which a tap will be allowed for domestic use. The seal on the closed valve is not to be broken only in the case of actual fire. When seal is broken the water department shall be notified in writing at once and the valve will be resealed by the department.

Class 2. Fire hydrant service shall consist of a pipe-line with fire hydrants on same, the fire hydrant to be of the same size hose thread and operating nut as the city hydrants. All hydrants to be closed and sealed, and opened only in case of actual fire. When seal is broken on any hydrant, the water department must be notified in writing at once, and the hydrants will be resealed by the department.

Class 3. Stand pipe service shall consist of a pipe-line with hose connections smaller than that of the standard 2½-inch hose as used by the city. All hose valves to be closed and sealed, and opened only in case of actual fire. When the seal is broken the water department shall be notified in writing at once and valves will be resealed by department.

Class 4. Automatic sprinkler service shall consist of a pipe-line equipped with all the necessary appliances, as required by the insurance companies, water to be supplied either direct to tank or a combination of both. Valve on by-pass to fill tank shall be closed and sealed. Seal to be broken only by an employe of the water department, who will fill tank and reseal valves, which will be done upon request at the water works office.

Class 5. Automatic sprinkler and fire

hydrant service combined shall consist of a pipe-line supplying both automatic sprinkler and fire hydrants. The rules governing Class 2 and Class 4 shall apply to this service.

Seals will not be required on Classes 2, 3, 4 and 5, when an improved detector meter is placed in the line.

All drain valves on any of the above classes of service are to be closed and sealed. When broken, the water office shall be notified in writing at once, when same will be resealed.

Water will not be turned into any fire service until the company making same has filled and signed a blank installation report furnished by the water department.

The above classes of fire service are for the protection and benefit of the property owner, for which the city does not receive compensation. When the seal on any of the above classes of services is found broken and the water department not notified of the same, the offending party shall be subject to a fine in the discretion of the board of water commissioners. Any abuse or illegal connection for the use of water through these services shall forfeit the right of such service for fire protection, and the board of water commissioners, in their discretion, have the power to require any such service provided with a meter, to be put in at any time as said board may in each case prescribe and to make any change or just and reasonable requirements as good service may from time to time require in each instance, either as to said meter or as to any other part of said appliances pertaining to the same.

The parties having connections used for fire protection can test their fire apparatus at any time under the following conditions:

1st. Notice to be given at the water office that such test is desired, when date and hour will be fixed when test can be made.

2d. When test of fire service is made by the duly authorized insurance representative or insurance inspector, no permit will be required to break the seals, but in each instance the water department shall be notified in writing at once, and the valve will be resealed by the department. This notice must be made by the insurance inspector or representative.

The expense of tapping mains, making connections, testing completed work, placing valves, meters, or any other protective device that the board of water commissioners may deem necessary to prevent the illegal use of water, must in all cases be borne by the owner of the property benefitted. All connections from the city mains to the property line must be made by the authorized employes of the water department, and all piping, valves, hydrants and connections to said fire service inspected and approved by the water department before the water is turned into said service.

The Elmira, N. Y., Water, Light and Railroad Company uses the following rules and regulations for private fire services, the rates for them being given above:

No private fire or sprinkler service will be run into a building or supplied with water unless water is used on the premises for general purposes.

Private fire or sprinkler services shall be entirely separate from the general supply or other services, and shall be used exclusively for the extinguishing of fires.

Private fire or sprinkler services shall be provided with an indicator post valve of a make and pattern to be approved by the said Elmira W., L. & R. Co., at the curb line, or at such other place as shall be agreed upon by said company.

Private fire or sprinkler services shall have a by-pass around the indicator post valve, or some other valve provided for the purpose and located at such place as the company may designate. This by-pass to have a small water meter attached and placed in a suitable pit or other convenient place for reading and repairing it, and where it will be at all times accessible to the inspectors of the said company, for the purpose of testing the fire sprinkler service for leaks or improper use of water.

No tap or water connection shall be allowed on a private fire or sprinkler service for use except for extinguishing fire.

The agents or servants of the said company shall be permitted at all reasonable times to inspect the fire or sprinkler services, and all other water services or connections on the premises, and may, if it deem it necessary, put seals on any valve, hydrant or other outlet from the fire or sprinkler service.

Upon the discovery of any breach of these rules and regulations the said Elmira W., L. & R. Co. may terminate this agreement and permanently shut off the water from the private fire or sprinkler service, or may impose a fine of not over $100. And in case water is found to be running in the fire service, except when being used for extinguishing fires, the service will be shut off and remain off until proper repairs or alterations are made.

Private fire or sprinkler services, including valves, meters, etc., for controlling them, shall be put in at the expense of the property owner, and under the supervision of the Elmira W., L. & R. Co., who shall be supplied with complete maps and plans of the system.

And it is expressly understood and agreed that the said company shall not be held to guarantee the sufficiency of its water supply for fire protection in said building; and that said company shall not be liable for the failure of water through said private fire or sprinkler service, whether occasioned by the scarcity of water in its mains, lack of pressure from any causes, or the breaking of a valve, main or connection, or the shutting off of water for repairs, new connections, or for any other cause.

The Baltimore County Water and Electric Company of Baltimore County, Maryland, has some paragraphs in its contract which are important, as shown by experience. They read as follows:

Any fire protection system supplied with water from the company's service shall be supplied exclusively with such water, and no connection will be allowed with any other system drawing its supply from any other source, whereby the company's water may be contaminated by the failure to close valves, or leaking check valves, etc., and no auxiliary or secondary suction pipe to any underwriters' pump taking water from the harbor, streams or other source whatever will be permitted. Any fire protection system using water from the harbor, streams or other source whatever will be permitted. Any fire protection system using water from the harbor, streams or other source than the company's service shall be kept separate from any such system supplied from the company's service.

All fire services shall be subject to inspection by the company from time to time, and the owner or tenant shall give the inspectors all reasonable facilities for making the inspections, and any information concerning the same that the inspector or the company may require. Care will always be taken that inspections will be made with as little inconvenience to the owner or occupant as possible.

The circumstances in one case are detailed in an article in MUNICIPAL ENGINEERING, vol. xxxiv, p. 344.

Books on Electrical Engineering.

Have you any price list of engineering publications? If not can you suggest any good list of such books? I have been requested to prepare order list for a small library of electrical engineering books.

M. BANKS, New York City.

A list of "Books for Engineers" was published in MUNICIPAL ENGINEERING, giving brief statement of character of book, and prices. It appeared in several numbers between April, 1907, and January, 1908. The list of books on electrical subjects includes those on "Dynamo Electric Machinery" in vol. xxxii, p. 382, continued in vol. xxxiii, p. 14; "Miscellaneous Applications of Electricity," p. 16; "Electricity and Electrical Measurements," p. 16; "Electric Lighting and Distribution," p. 18, continued on p. 96.

To these lists may be added the following:

Parshall, Horace F., and Hobart, Henry M. Electric Machine Design. A revised and enlarged edition of their "Electric Generators." $12.50.

Branch, Joseph G. Electric Wiring. $2.

Hobart, H. M. Electricity. A book for engineering students.

Cramp, William. Continuous Current Machine Design. $2.50.

Hobart, H. M. Electric trains. $2.50.

Dawson, P. Electric Traction on Railways. $9.

Manufacturers of Electric Rock Drills.

On page 470 of the December issue of your magazine, we note you request additions to lists of manufacturers of "Electric Rock Drills," and would ask you to refer party interested to the "Denver Rock Drill & Machinery Co., Eighteenth and Blake streets, Denver, Colorado.

H. W. CLARK Co., Mattoon, Ill.

Small Cities with Commission Form of Government.

Will you kindly give me a list of cities of our size, about 4,600 people, which have put into practice the commission form of government?

P. G. ELLIS,
City Attorney, Durango, Cal.

Of 3 commission cities in California, Modesto; of 2 in Colorado, Grand Junction; the 2 in Idaho, Boise and Lewiston; of 19 in Kansas, Abilene, Coffeyville, Cherryvale, Caldwell, Girard, Independence, Marion, Neodesha, Wellington; the 1 in Mississippi, Hattiesburg; the 1 in New Mexico, Roswell; the 3 in North Dakota, Bismark, Mandan and Minot; of 10 in Oklahoma, Ardmore, Bartlesville, Duncan, Enid, Miami, McAlester, Sapulpa, Tulsa, Wagner; of 7 in South Dakota, Dell Rapids, Huron, Pierre, Rapid City, Vermilion, Yankton; of 5 in Tennessee, Bristol, Etowah, Richmond City; of 20 in Texas, Anthony, Corpus Christi, Kennedy, Lyford, Marble Falls, Port Lavaca; of the 2 in West Virginia, Bluefield; have populations not far from that of Durango, some being larger and some smaller. All of the following are much larger, viz.: 1 in Alabama, 7 in Iowa, 1 in Louisiana, 4 in Massachusetts, 1 in Michigan, 1 in Minnesota, 1 in Missouri, 1 in North Carolina, 1 in South Carolina, 1 in Washington, 1 in Wisconsin.

How to Find Area of Segment of Circle.

What is the "near rule" for determining (approximately) the area of a segment of a circle when you have no means at hand for determining the diameter of the circle of which the segment is a part? That is when you have only given the chord and the versed sine.

M. G. H., Memphis, Tenn.

The radius of the circle is obtained as follows:

Square the half of the chord;
Square the versed sine;
Add the two squares;
Divide the sum by twice the versed sine.
The result is the radius.

The length of the circular arc is obtained as follows:

Divide the versed sine by the chord;
In a table of circular areas giving the length of arc for each height, take out the length corresponding to the above quotient in the column of heights:
Multiply this length by the length of the chord;
The result is the length of the arc.

To find the area of the segment proceed as follows:

The area of the sector is equal to the product of the length of the arc by half the radius.

The area of the triangle between the two radii and the chord of the segment is obtained as follows:

From the square of the radius subtract the square of one-half the chord, extract the square root of the difference and multiply the result by one-half the chord. The product is the area of the triangle.

The area of the segment is obtained by subtracting the area of the triangle from the area of the sector.

Trautwine's "Engineers' Pocket-Book" ($5) gives a table of areas of circular segments when the diameter of the circle and the versed sine of the segment are known. To use the table find the radius as above, find the ratio of versed sine to diameter, enter the table with this and multiply the corresponding number by the square of the diameter.

Gas Processes and Rates.

(Continued from page 40)

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
IOWA.						
Atlantic, Lowe	6.80‡	3.25	1.75	1.65	1.75	1.65
Centerville, Lowe	....	....	1.75	1.575	1.75	1.575
Charles City, Lowe	6.50	4	1.70	1.50	1.70	1.50
Cherokee, Tenney	6.80	3.03	....	1.50	....	1.50
Creston, coal	6.50	....	1.45	1.35	1.45	1.35
Fairfield, coal	4.55	....	....	1.55	....	1.55
Grinnell, Tenney	....	....	1.50	1.40	1.50	1.40
Iowa City, coal	6.00	....	1.30	1.25	1.30	1.25
Le Mars, Lowe	8.25	3.09	1.40	1.33	....	....
Oelwein, coal	4.55	....	1.50	1.40	1.50	1.40
Perry, Lowe	7.00‡	3.6	1.50	1.35	1.50	1.35
Red Oak, Lowe	6.90‡	3.25	1.75	1.65	1.75	1.65
Shenandoah, Lowe	6.15‡	2.45	1.75	1.58	1.75	1.58
Washington, Lowe	....	....	....	1.50	....	1.50
KANSAS.						
Emporia, coal	....	....	....	1.40	....	1.40
Winfield, coal	....	....	....	1.60	....	1.60
KENTUCKY.						
Danville, coal	3.06	....	1.25	1.125	1.25	1.00
Georgetown, oil	....	....	1.65	1.50	1.375	1.25
Maysville, coal	....	....	1.50	to		1.00
Paris, coal	2.50	....	1.60	1.50	1.35	1.25
Richmond, coal	2.25	....	1.50	1.25	1.50	1.25
LOUISIANA.						
Jennings, Beals oil	....	90†	1.50	1.35	1.50	1.35
MAINE.						
Bath, coal	....	....	....	1.50	....	1.50
Calais, coal	6.00	....	4.00	2.00	2.00	1.00
Rockland, coal	....	....	2.25	2.00	1.50	1.25
MARYLAND.						
Annapolis, coal	....	....	1.75	1.75	1.50	1.50
Cambridge, coal	4.00	....	1.65	1.50	1.65	1.50
Frostburg, Paul oil	....	....	....	1.00	....	....
Havre de Grace, Lowe	5.00	3	1.50	1.275	1.50	1.125
Salisbury, Lowe	5.25	2.85	1.40	1.25	1.40	1.25
MASSACHUSETTS.						
Amherst, Patton, oil	....	....	6.00	4.00	3.00	3.00
Athol, Lowe-Granger	5.98	4.9	2.00	1.75	2.00	1.45
East Hampton, coal	5.00	....	1.80	1.60	1.80	1.60
Greenfield, Lowe	6.60	3.4	2.00	....	2.00	....
Ipswich, Kendall, oil	....	3.3	2.00	2.00	2.00	2.00
Marblehead, coal	....	....	2.20	2.20	2.20	1.80
Middleboro, Patton, oil	....	3	3.50	....	2.75	....
Natick, coal	5.75	....	....	1.65	....	1.50
North Attleboro, coal	....	....	1.60	1.35	1.60	1.15
Norwood, coal	....	....	....	1.50	....	1.60
Plymouth, coal	....	....	2.00	1.90	2.00	1.50
Spencer, Lowe	5.70	4	1.80	1.60	1.80	1.40
Stoughtonfi naphtha, oil	....	....	5.50	4.95	5.50	4.95
Ware, coal	....	....	1.75	to		1.25
MICHIGAN.						
Albion, coal	3.10	....	1.50	1.20	1.50	1.00
Belding, coal	3.25	....	....	1.25	....	1.25
Big Rapids, Patton, oil	....	3.5	....	1.25	....	1.25
Cadillac, coal	3.35	....	1.15	1.00	1.15	1.00
Charlotte, coal and Lowe	3.05	....	1.35	1.25	1.35	1.25
Cheboygan, coal	3.25	....	1.40	1.26	1.40	1.26
Coldwater, coal	....	....	1.50	1.25	1.50	1.00
Dowagiac, coal	....	....	1.50	1.35	....	....
Grand Haven, coal	3.25	....	1.35	1.25	1.35	1.25
Greenville, coal	....	....	....	1.25	....	....
Hillsdale, coal	3.15	....	1.35	1.25	1.35	1.00
Ionia, coal	....	....	1.25	1.25	1.25	1.25
Iron Mountain, Lowe	6.00‡	3.4	1.50	1.35	1.50	1.35
Ludington, coal and Lowe	3.25‡	3	1.30	1.235	1.30	1.235
Marshall, coal and Lowe	5.10	....	1.50	1.35	1.50	1.00
Monroe, coal	2.95	3	1.20	1.10	1.20	1.10
Mt. Clemens, coal	3.25	3.65	1.15	1.00	1.15	1.00
Mt. Pleasant, coal	....	....	1.40	1.20	1.40	1.20
Niles, coal	2.95	....	1.25	1.19	1.00	0.95
Owosso, coal and Lowe	2.95	3	1.20	1.18	1.20	1.18
Three Rivers, coal	3.10	....	1.40	1.30	1.40	1.30
Ypsilanti, coal and Lowe	2.90	3.65	1.25	1.00	1.05	0.80
MINNESOTA.						
Albert Lea, Lowe	6.00‡	4	1.67	1.50	1.67	1.50
Austin, Lowe (Springer)	4.00	3.78	1.60	1.50	1.60	1.20
Faribault, Lowe	6.10‡	3.7	1.70	1.50	1.70	1.20
Rochester, coal	....	....	2.00	1.75	1.75	1.50
St. Cloud, coal	7.00‡	....	1.85	1.75	1.35	1.25

Information About Commission Form of City Government.

Will you kindly send me a notation of the articles you have had in past numbers of your magazine on the subject of the Commission Form of Government for cities and towns—especially, with reference to towns of our class—say, 5,000 people; and also any works accessible in any ordinary public library on the subject.

We are beginning to have the matter agitated here, and would like to become informed on the subject.

P. G. ELLIS,
City Attorney, Durango, Cal.

The January number and this number of MUNICIPAL ENGINEERING contain several articles on this subject, the following being in the January number:

"Comparison of Des Moines and Indianapolis Forms of Municipal Government," p. 8; "The Des Moines, Indianapolis and Boston Plans of City Government:" "Commission and Other Forms of City Government," p. 45, giving references to articles in vols. xxxix and xxxviii.

The following articles in vol. xxxvii may be of interest in this connection: "Self Government of Cities," p. 103; "Professional Mayors," p. 250; "The Latest Commission Form of City Government," p. 393; "Cities Adopting the Commission Form of Government," p. 399, giving a list of earlier articles on the subject.

Various volumes of the proceedings of the National Municipal League give papers on the various modifications of the original Galveston plan of municipal government as well as upon other successful forms. They can be obtained of the secretary, Clinton Rogers Woodruff, North American Building, Philadelphia, Pa.

Cost of Brick Paving.

Could you recommend any book where I could find some up to date cost data on the construction of brick pavement? Perhaps some of the back numbers of the MUNICIPAL ENGINEERING would be valuable in this matter. If so would you kindly refer me to the particular volumes. I have the National Paving Brick Manufacturers Association's specifications, etc.

H. M. S., Bryan, O.

Bakers "Roads and Pavements" ($5) and Gillette's "Hand-Book of Cost Data, ($5) contain information regarding cost of brick pavements. Their information must be used with care, for local conditions so vary that general figures or special figures for one case cannot be applied directly to any particular place, except by making the modifications required by the differences in conditions and in prices of material and labor.

MUNICIPAL ENGINEERING has a large amount of information on the subject. Reference may be made to the following articles:

In vol xxxix: "Brick Highways in Ohio," p. 182; "Cost of Brick Paving in Florida," p. 122; "Cost of Brick Paving with Granite Curb," p. 33.

In vol. xxxvii: "Cost of Pavements," p. 152; giving a collection of figures from various parts of the country; "Cost of Street Paving," p. 177, giving another collection of prices for which work has been let.

"Brick Street Paving in Columbus, O.," vol. xxxv, p. 141; "Brick Pavements in Paris, Ill.," vol. xxxiii, p. 160; "Paving in the Southwest," vol. xxxii, p. 32; "Some Points in Street Paving, vol. xxxii, p. 389; Paving bids in Knoxville, Tenn., vol. xxxi, p. 407; "Streets of Wilmington, Del.," vol. xzx, p. 7.

Reference to the department of "Improvement and Contracting News" under the heading "Paving" and the sub-heading "Contracts Awarded" since September, 1909, will add to the list of prices given in the articles given above.

Oiling Unpaved Streets of Small City.

I am superintendent of the light and water department and I wish to ask your Question Department regarding the sprinkling of streets with oil.

What is the best oil to use, and in what quantities must the oil be used to accomplish good results on different unpaved streets? We are agitating the question of oiling our streets in St. Peter and I wish some expert advice on this matter so I can take it up with the council intelligently.

It costs us about 12 cents per 1,000 gallons to pump our water, and we have to hire four teams during the hot weather for sprinkling, which costs $3.50 per day; and using about 5,000 gallons per day makes the cost per day about $14.60.

Now what I particularly wish to find out is, how many applications, and the approximate cost of each application for an area of about three miles of street. Our streets are unpaved and of a kind of limestone and clay mixture, making a very dusty street. I will appreciate it very much if you can and will give me some data and information on this subject.

W., ———, Minn.

Hubbard's "Dust Preventives and Road Binders" ($3) will probably answer all the questions our correspondent may wish to ask on this subject.

Mr. Hubbard states that oils with an asphaltic base must be used and that the preference is for residual oils, heavy enough to require that they be applied hot. The lighter oils may be used as dust preventives but they last a shorter time and do not serve as binder for the road material.

Macadam roads require 0.3 to 0.6 gallon of the lighter oils per square yard and earth roads 1.5 gallons or even more. The street described would require an intermediate amount, possibly not far from 1 gallon per square yard; the amount to be determined by experiment as to the amount of oil the road will absorb.

The cost depends on the cost of the oil and the expense of the outfit for sprinkling the oil and of storing and distributing the oil, as well as labor, and can hardly be stated, but would probably be not far from 4 to 6 cents per square yard per application. The heavy oils would cost more, as the oil costs more and the special appliances for heating and distributing it, as well as the fuel, add to the cost.

A clay road is difficult to treat, being almost non-absorbent of the oil. It may be necessary to add sand if the limestone mixture has not taken its place. It will probably be found more economical as well as more satisfactory to harrow the oil into the body of the road, which has been shaped and ruts filled with a road machine.

Will our readers report their experience, taking care to include the data which will answer our correspondent's questions.

Book on Street Paving Laws.

I am under the impression that I saw advertised in MUNICIPAL ENGINEERING a book relating to street laws, mode of procedure for construction under the "Vrooman Act" and other ways. Would you kindly let me know the name of it and where it is to be gotten.

M., Ontario, Cal.

McCullough's "The Vrooman Act" ($2) was published a number of years ago by Edward Denny & Co., San Francisco, Cal. Whether it has been kept up to date is not known to the writer. The National Paving Brick Manufacturers' Association has published a pamphlet giving the forms necessary to follow in carrying through paving improvements in Illinois.

Can our readers give references to such books as asked for by our correspondent?

Baltimore Collects Its Own Garbage and Refuse.

In your December issue of 1910, there is a letter signed "S. D. C.," Cleveland, O., making inquiries in regard to list of municipalities operating their own garbage disposal plant, etc.

In your answer to his inquiry, you put Baltimore in the list of cities in which garbage is collected and reduced by contractors. I wish to correct this statement and say that the city of Baltimore has been collecting its own garbage and ashes for the last three years, and finds this system a big improvement over having it done by contractors.

J. L. W..
Commissioner of Street Cleaning, Baltimore, Md.

Makers of Ice Plant Machinery.

Will you kindly inform me where I can get information and data on ice-making machinery.

J. D. M., Elko, Nev.

The makers of ice and refrigerating machines are the most prolific sources of information. There are about sixty of them listed in Hendricks' Directory. Among the leading manufacturers are the following: American Linde Refrigeration Co., 346 Broadway, New York; Baker Ice Machine Co., Omaha, Neb.; Buffalo Refrigerating Machine Co., 126 Liberty street, New York; Carbondale Machine Co., Carbondale, Pa.; Carolina Ice Machine Co., Charlotte, N. C.; Castle Refrigerating Machine Co., Indianapolis, Ind.; De la Vergne Machine Co., ft. E. 138th street, New York; Frick Co., Waynesboro, Pa.; Harris Ice Machine Works, Portland, Ore.; Morris & Co., Dallas, Tex.; Murray Iron Works Co., Burlington, Ia.; Newburgh Ice Machine and Engine Co., Newburgh, N. Y.; United Iron Works, Oakland, Cal.; United Iron Works Co., Springfield, Mo.; Vilter Manufacturing Co., Milwaukee, Wis.; Vulcan Iron Works, 604 Mission street, San Francisco, Cal.

Books on the subject are Wallis-Taylor's "Refrigeration and Ice Making" ($1.50), "Refrigerating and Ice Making Machinery" ($3), "Refrigeration and Cold Storage" ($4.50); Wakeman's "Refrigeration and Ice Making and Refrigerating Machinery" (25 cents); Redwood's "Ammonia Refrigeration" ($1); Ledoux's "Ice Making Machines" (50 cents); Leask's "Refrigerating Machinery" ($2); Dixon's "Ice Making and Refrigerating Machines" ($1).

Best Form of Municipal Charter.

As an interested reader of MUNICIPAL ENGINEERING, I presume to ask some questions.

How, where, when, and at what cost can I secure the best copies of methods of obtaining a charter, modern and up to date in its construction?

We are located in a fertile section with mineral and natural resources all about us, but we are a little city grown up on the side of the road, with blessings forced upon us, without any citizen endeavoring to modernize or adopt regulations in construction.

We own our own water plant, electric light and gas plants, and they were recently put under commission, but having been built one at a time, and without double units, they need renovation and condensing towards a greater efficiency and economy.

We need wide streets, established grades, sewerage, parks, paving, powers to condemn building laws, with powers to govern and regulate every improvement of a regulated city plan.

J. W. V., Cartersville, Ga.

The best method of obtaining a good, modern municipal charter is to form a committee of the best and most progressive citizens, who should call to their aid one or more of the experts in the country who have become familiar, by observation and experience, with the various forms of municipal government and the results thereof. Attorneys familiar with the constitution and laws of the state of Georgia should be members of the committee or in its employ.

After a careful study of the conditions this committee can probably prepare a document which will meet the requirements of the constitution and statutes at the same time that it gives the city and its officials the powers and duties necessary for the officials of a progressive city and provides the checks upon the rapid movement and upon inefficiency and dishonesty which seem to be absolutely necessary.

It is the writer's observation that a charter prepared for one city will never suit exactly another city, even one in the same state. But if the constitution prohibits special legislation for single cities, the following of general plans has brought the cities under the provisions of the laws into sufficient conformity to make the application of uniform charters possible, modifications of details being usually possible to some extent within the terms of the law. If such a general law is required under the constitution, it may be necessary to secure the co-operation of other cities before the law can be passed.

After the form of charter is prepared by the committee and its advisers, there must be a campaign of education to secure the support necessary to press the passage of the law by the legislature. This campaign must be pushed into the other cities interested, in case a special law applying only to Cartersville is not possible.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Smokeless Firing in a City Boiler Plant.

It has been understood for some time by combustion engineers that the most effective way to solve the problem of smoke production with soft coal is by means of underfeeding and providing sufficient space in the furnace. The recent movement for the prevention of smoke in cities has led many people to an investigation of how best to accomplish this result who would otherwise not have understood the proposed methods upon which effective smokelessness are based.

The fallacy of attempt to provide smoke catchers or other devices intending to change smoke after it has formed into something else or to deposit it in various ways so that the escaping gas should be clean has been demonstrated many times. Smoke once formed cannot be suppressed and therefore those interested are now rapidly arriving at the unanimous opinion that the place to attack the smoke problem is in the furnace. This narrows the field of investigation down to a straight combustion problem, and the combustion engineers have proved conclusively that underfeeding of the coal, combined with proper air regulation nad sufficient volume for the burning of volatile hydro-carbons, are necessary requirements for success.

The experience of the superintendent of the State War and Navy Building in Washington, D. C., is an added instance of successful smoke prevention by this means. The problem was unusually aggravated in this case because of the size of the boiler plant in this building, which is probably the largest of the government buildings in Washington, and the fact that the smoke laws of the city are exceedingly rigid. The power plant consists of four 185-h.p. B. & W. boilers, two turbo-generator sets, hydraulic elevator service, and a combination of steam and hot water heating system. The boilers were originally hand-fired and it has always been considered necessary to burn hard coal under them in order to conform to the smoke ordinance. In order to work economy in operation it was decided to attempt the burning of soft coal by installing a trial underfeed stoker.

After this stoker has been installed a series of comparative tests on the stoker-fired boiler and on the hand-fired were run in order to get accurate figures on which to base a request for an appropriation from Congress to equip the remaining boilers with stokers. The results were conclusive. Not only did the stoker, which is of the Taylor gravity underfeed type, burn soft soal smokelessly at all loads, but it exaporated the same amount of water as the hand-fired boilers on 60 per cent. as much coal, while the efficiency was nearly 15 per cent. higher. The stoker furthermore demonstrated its ability to carry very heavy overloads continuously, and it was decided to attempt to carry the entire load of the building on the one stoker-fired boiler. Accordingly the fires were pulled under the hand-fired boilers and the stoker-fired boiler has been carrying the load continuously ever since.

A careful comparison of coal burned showed that another stoker could be bought and would pay for itself without it being necessary to obtain any further appropriation. The coal being used on this stoker installation is New River run of mine, analyzing about 14,700 B. t. u. per pound, and with this coal a combined efficiency of approximately 80 per cent. is obtained.

In this case, the underfeed stoker which was installed primarily to solve the smoke problem has gone much further and changed the entire operating method of the station. This, of course, is possible because of the remarkable overload capacity of stokers of this type. The correlation of air and coal supply makes the stoker's capacity limited only by the capacity of the fan engine, which not only furnishes the forced draft but also operates the stoker mechanism. By means of the mechanical underfeeding, the coal is forced to pass up underneath the firebed, becoming gradually heated as it advances and distilling off the volatile matter before the fixed carbon reaches the temperature of combustion. The distilled gases then pass up through the incandescent fuel bed and are burned completely, thus obviating any chance of smoke being formed.

A Sewer Semi-Siphon.

One of the peculiar features in the new sewerage work at Louisville, Ky., has been the necessity for carrying various main sewers under Beargrass creek, which flows north through the eastern part of the city. One interesting device applied in the case of a 39-inch sewer is described in the report of the chief engineer, J. B. F. Breed, and Harrison P. Eddy, of Boston, consulting engineer.

This sewer passes below the south fork of Beargrass creek, the elevation of which is so low that the sewer cannot be built upon its normal grade. A special design for this crossing was, therefore, prepared. The structure consists of two 12-inch iron pipes carried under the creek, with the same invert grade as that of the sewer. In addition to these, there is provided a 36-inch iron pipe dipping down from the grade of the sewer beneath the bottom of the creek. This large pipe will act as an inverted siphon, but will not be put into use until the flow in the sewer exceeds the combined capacity of the two 12-inch pipes. At each end of this semi-siphon there is a concrete chamber, giving access to the sewer to facilitate cleaning when found to be necessary. There is also provided an emergency outlet into the creek, through which the sewage may be turned when the siphon is being cleaned or repaired. A sluice gate provided in the westerly chamber also makes it possible to shut off any back water from the Beargrass intercepter at such times. The three pipes are surrounded by concrete, the top of which will be coincident with the bottom of the invert channel of the creek when it is improved.

Specifications for Drilling Artesian Wells.

The following specifications for drilling 10-inch artesian wells at Jacksonville, Fla., were prepared by B. N. Ellis, superintendent of water works, to suit the local conditions and are found necessary to get good wells in that locality:

Well to be located in the city park, 150 feet west of prolongation of Pearl street and 100 feet south of prolongation of Third street; to be 10 inches in diameter and 980 feet in depth below the surface of the ground. Well to be cased with first quality standard wrought iron pipe, weighing not less than 35 pounds to the foot, to the rock below the sand and clay strata, about 500 feet; casing to be seated tight upon the rock so that there shall be no appearance of leak around the casing after the well is completed and shall have been shut up tight for 100 hours.

In sinking the casing it must not be driven hard enough to strain the threads in the pipe or couplings; if rock is encountered before the water bearing rock is reached an expanded reamer must be used to undercut the casing so as to enlarge the bore sufficient to allow the couplings to go through the rock. The bore of the well must be straight and full size so as to allow a piece of 8-inch pipe 4 feet in length to be lowered to the bottom of the well and pulled out again with ease. The top of the casing to be threaded so as to screw a flange on it and be left 2 feet below the surface of the ground. A flanged tee, valve and cap will be furnished by the board of trustees, and the contractor is to secure the same to the top of the casing. The contractor is to furnish all the necessary tools, casing, etc., for the sinking of the well, which is located close to Hogan's creek, into which the waste water is to be run. Care must be taken to prevent sand washing into the creek, also especial care must be taken not to injure roads, walks or shrubbery while erecting and removing machinery for the purpose of sinking the well. When the well is completed all the debris is to be removed and the ground left smooth and clean.

E. Ben Carter, superintendent of maintenance of way of the Florida East Coast Railway, in sending the above specifications also gives the following description of the method of handling contracts for railroad wells under the less definite conditions exisiting:

When I had our artesian wells driven at Mayport, East Mayport and Atlantic Beach I was entering upon then unknown "Chinaward" territory, and I made a combination contract and specification which read as follows:

"To drill an artesian well of 6 inches diameter at Mayport, Fla., the particular point to be designated by the railway company. To case out all loose material with approved iron casing of 6 inches in diameter so that the well can be closed with a valve without injury to the well (said valve to be furnished by the contractor without cost to the company), and to complete said well in every way in a workmanlike manner. * * * To furnish all casing, tools, machinery, transportation of men and material for the prosecution and completion of the said well at the contractor's expense. Contractor agrees to continue the drilling or boring of said well continuously day by day until a flow of water satisfactory to the party of the second part has been secured."

I could not be more definite in this case for the reason that it was untested soil. However, the well was drilled 630 feet deep and gave me a pressure at the ground of 22½ pounds. My idea in being indefinite was to be able to stop before reaching a flow, if at any time it was thought best to do so and put on pumps. The payment for this was $2.25 per foot, paid as follows: For each 100 feet of well drilled there was $1.00 per foot partial payment, and the balance of $1.25 per foot was paid upon the completion of the well in accordance with the agreement.

Monuments for Sewer Connections.

The city engineer and the chief sanitary inspector of Binghamton, N. Y., have devised a plan whereby the location of sewer connections may be readily determined.

Every year a considerable sum is expended by the city in seeking lot connections. The lot owner has paid for the connection in his sewer assessment, and if, when he attempts to use the sewer, he finds that the connection is missing, he does not search far, but applies to the city. Often it occurs that by excavating a foot or so either way the missing connection would have been discovered, but the city is called in and must stand the expense.

Under the proposed plan a marker similar to that used for water connections will be placed in front of every lot where the house is not connected with the sewer when the sewer is built.

This marker, which will cost in the neighborhood of $1.50, will be of iron, and will be charged up in the sewer tax against the lot owner. When the time arrives to connect with the sewer the marker is returned to the city and the owner reimbursed for the amount paid by him, the marker being used again in some other part of the municipality.

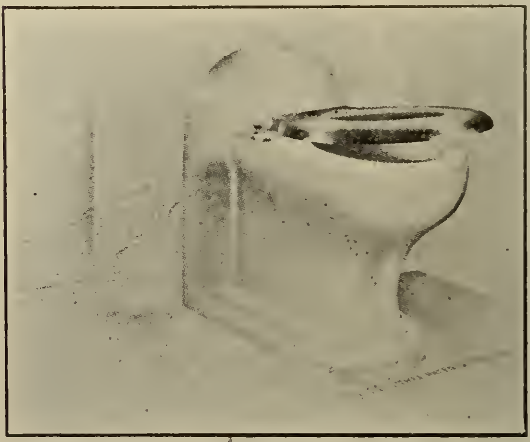
In this manner it may be possible to operate the sewer system with 200 markers, as all would be kept in constant use, and thus the expense of searching for lost sewer connections would be eliminated.

Appliances for Public Comfort Stations.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In connection with the presentation in your December number of a public sanitary for the city of Indianapolis, and one for the town of Brookline, designed by the writer, it has occurred to me that you might be interested to announce that the one in Brookline cost $8,000; also that the type of closet, not put in when the sanitary was built, as they were not on the market, but presently to be installed, is the "Keystone," cut of which accompanies. There is this difference, however, that those to be installed here have floor wastes while that in the sketch has a rear outlet.

You will, perhaps, be interested to learn that this closet was adopted for the new Pennsylvania Station in New York after most exhaustive tests by the architects and engineers; and from the fact that it offers very little opportunity for dirt and dust to collect about it, is superior to anything I have ever seen for general uses.



FOR PUBLIC COMFORT STATION.

ALEXIS H. FRENCH,
Town Engineer, Brookline, Mass.

Specifications for a New Asphalt Pavement.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I was interested in reading Kingsley and Warren's controversy over pavements and I enclose cut and specifications of a new asphalt pavement we have been laying for the past two years in Rochester, N. Y.

H. T. POWELL.

Following are the city specifications for the new asphalt pavement.

The asphalt shall be composed of:
1. Asphalt Cement.
2. Sand.
3. Crushed Rock.

The asphalt cement and sand shall be of the kind and quality prescribed for use in the asphalt paving mixture.

The crushed rock shall be clean, freshly crushed, hard trap, granite, or other rock satisfactory to the engineer, of the following sizes:

Passing ⅜-inch screen and retained on ⅛-inch screen.

Passing ⅛-inch screen to and including dust.

These materials shall be mixed to the following proportions:

⅜-inch to ⅛-inch stone..20 to 30 per cent
⅛-inch stone to dust....30 to 40 per cent
Sand ....30 to 40 per cent

Asphalt Cement—Sufficient to thoroughly and satisfactorily coat all the particles and to produce a mixture containing between 8.5 and 10 per cent of Bitumen.

The above ingredients shall be mixed in the general manner prescribed for the asphalt paving mixture. The crushed rock and sand may be mixed cold and then passed through the heating drums where they shall be heated to a temperature not exceeding 400 degrees F. The mixture of crushed rock and sand when mixed with the asphalt cement shall be of such a temperature as will facilitate proper mixing, but in no case shall it exceed 350 degrees F. The asphalt cement shall be heated to about 300 degrees F., and the temperature of the finished mixture shall not exceed 340 degrees F.

The various ingredients shall be of such a kind and so proportioned as to produce a pavement which shall show upon analysis:

Bitumen .... 8.5 to 10.5 per cent
Passing 80 mesh....20 to 30 per cent
(Of which at least 50 per cent shall pass a 200 mesh seive.)
Retained on 10 mesh.20 to 30 per cent

In all other respects the materials shall be manipulated and laid in accordance with the methods prescribed for the asphalt paving mixture. Should any segregation of the mixture occur during transit from plant to street, the material must be thoroughly mixed by shovels or other suitable appliances before being spread upon the street. The bottom inch is composed of larger stone flooded with No. 6 Distillate of Tar.

Pavements were laid in 1909 and 1910 of this improved mixture under city contract on the following streets: Plymouth avenue, Spring to Clarrissa; Monroe avenue, outside city line; Culver road, East avenue to University; Flower City Pike, Lake avenue to Dewey; Stillson street, University avenue to Grove; East avenue, Culver road to city line; Culver road, Monroe avenue to Canal; Winton road, East avenue to N. Y. C. R. R.; Dewey avenue, Augustine street to city line; Mt. Hope avenue, Comfort to Clarrissa.

Flushing Streets Under High Pressure.

Following is a report by W. A. Hogue, city engineer of Charleston, W. Va., to the board of affairs of that city:

Complying with your order of the 17th inst., wherein it is "ordered, That the question of flushing the streets and the question as to whether this manner of cleaning is injurious to the several kinds of paving used, to be referred to the city engineer for report, together with the literature now in the hands of the secretary, on the subject," I beg to report as follows:

I am pleased to note that the authorities are opposing the method of cleaning pavements by the use of water under high pressure from flushing machines or fire hose. The damage that necessarily will follow to all classes of pavements in the city by the use and continuance of this method of cleaning pavements is so obvious that it seems absurd for me to dwell upon the subject at length; however, I desire to call your attention to some of the objections or reasons why this system should not be used.

Most of your pavements are brick, and it will be noticed in some sections of the city that after the flusher has passed over the pavement several times and the gutters clear of water, there can be found lying in the gutter clean sand and particles of brick. The fact is that the filler is being washed out, the edge of the brick exposed, subjecting them to a severer test from traffic or abrasion, with the result that they are gradually wearing away.

The same holds good to a large degree as to other classes of pavements. The continual wetting and washing takes the sand and fine materials from the composition, and it may be expected sooner or later to go to pieces.

There are other features pertaining to this subject which it might be well for you to consider. It is not an uncommon thing to see the pedestrians, ladies especially, having to rush to the inner side of the walks to avoid being splashed with mud and water, thrown upon the sidewalks by the flusher.

Again, the filth is washed into the catch basins, often times stopping them and causing the streets to be flooded, the sediment having to be removed at a greater cost than if taken from the street.

In conclusion, I would recommend "hand patrol" or "block system" of street cleaning through the day, supplemented by machine-broom cleaning at night, immediately preceding the machine-broom sweeping at night by a very light sprinkling (just enough to lay the dust, but not to convert it into mud). Such a system would be more sanitary and thorough, and keep the pavements in the best condition for use, overcoming the damage done to all classes of pavements by both machine flushing and excessive sprinkling.

Flushing Street Pavements with Water Under Pressure.

A good deal of trouble has arisen in some American cities as a result of flushing pavements with water under pressure, presumably too high a pressure, and it is stated that in some cases the contractors who laid the pavements are repudiating their guarantees on the ground that the pavements are not receiving fair treatment. We read of "the sand and soil" being driven from between the granite blocks, and of serious damage being done to "artificially constructed asphalt or bituminous surfaces." It is plain, of course, that the municipal engineer must suit the flushing to the pavement, and that there are some pavements which will stand much fiercer flushing than others. Nothing is to be gained by cutting up this truism into a number of platitudes, but we may look beyond to two important fundamental principles. The first principle is that if we want to push things sideways it is usually best to apply the force sideways. If we apply the force of moving water vertically by means of a flushing machine, "forcing water from about one foot above it, under pressure, on the surface of the pavement," as described by an American contemporary, we must be sure that the pavement and its joints are capable of diverting that water sideways without absorbing much of its energy with damage to themselves. In any case, water delivered vertically expends a part of its energy otherwise than in shifting the dirt, but it would be going too far to say that vertical delivery is never advantageous. The greater the damage, however, the greater the waste of energy. It seems that on the whole the best practice tends towards either of two types, the cart and broom type or the long hose type. By the former we mean pouring water on fairly copiously from a cart, and following up quickly with brooms before the water has had time to flow away; by the latter we mean the swilling down with a long hose, successfully done in London on asphalt pavements and on wood pavements with water-proof joints. If American city pavements will not stand either of these two methods, or methods of which these are the types, then the sooner those pavements are improved the better it will be for the purses and the health of the citizens. An important advantage of the long hose method is that the dirt is not driven hither and thither, but can be swept sideways by the jet, applied at a flat angle.

The other matter of principle is an economic one, namely, that the cost of flushing or other means of cleansing must be considered when one pavement is being compared with another as regards first cost and maintenance. If a fierce method of flushing is cheap in a particular city, compared with a gentle method, then the pavement that will stand it may be the cheapest, even if it is more costly on other counts than its competitors. In crowded cities we may have to consider also what method of flushing least obstructs the traffic, for delays to traffic may result in losses which are considerable, and as real as, if less tangible than, rates and taxes. The long and short of it all is that very large sums may be saved by securing the deliberate and carefully weighted opinion of a competent city engineer who, instead of being overburdened with routine office work, has time to stroll quietly about the streets, listen to the remarks of drivers of vehicles, watch boots and wheels, and get a vivid impression of what is going on. In these, as in other matters, it is a point of great importance that the city authorities should decide in good time whether they are going to depend upon the judgment of their own engineer or whether a consulting engineer is to be called in; but a muddled idea as to the proper functions of different engineers is, unfortunately, an attribute of many civic bodies.—*The Surveyor and Municipal and County Engineer.*

Municipal Water Plant of Bradford, O.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I am enclosing the following information concerning the water plant that was completed and put in operation in our village, November 15, 1910.

In seeking a water supply four wells were sunk in various locations, but sufficient supply was not obtained. The fifth well drilled to a depth of 40 feet gave an abundant supply, and one near it, 116 feet deep, has been proved to be almost inexhaustible. Both wells give water of an excellent qaulity.

Five per cent. bonds to the amount of $25,000 were sold to provide for the water works, but after the work had been started, a number of changes in the plans made necessary an additional bond issue of $3,300.

The wells and pumping station are situated about 600 feet from the corporation line. From the station an 8-inch main leads to the standpipe; a cedar wood tank of 53,000 gallons' capacity, built on a 132-foot steel tower. Suitable valves and a Y-branch are provided to allow the standpipe to be cut off and a direct pressure supplied from the pumps in case of fire.

At the station two Cook working lead pumps raise the water from the two wells, which tap veins of water at different levels. A 22 gallon per minute pump operates the 40-foot well, and a 16 gallon per minute the 116-foot well. All of the pumps are operated by two 25 h.p. gasoline engines, only one engine being used at a time, and the other one held in reserve. About one gallon of gasoline is consumed for every horse power in 12 hours. Gasoline tanks of 50 gallons each are buried about 25 feet from the building. Engines are connected to a self-starting device of compressed air and can be started instantly.

A concrete reservoir of 50,000 gallons, located at the pumping station, provides a reserve supply. One Deming triplex power pump was installed to pump the water from the reserve reservoir into the mains. This pump has a capacity of 250,000 gallons in 24 hours. An air chamber has been provided at the pumping station which will, in event of failure of the standpipe, maintain the pressure for domestic consumption for a period of 24 hours.

There are 35 fire hydrants with two hose connections, conected with the 6 and 8-inch mains, six hydrants with one connection on the 4-in. mains. (Direct pressure from 80 to 120 pounds at hose nozzle for fire use.)

The total cost of the system was $28,300, which is itemized as follows:

Expense of advertising for letting contracts	$ 310.00
Engineer's services	2,179.14
Drilling wells	1,432.25
Water mains, 8, 6 and 4 inch	8,335.12
Pipe laying	3,715.42
Valves and hydrants	1,220.26
Standpipe	3,050.00
Reservoir and buildings	3,097.80
Machinery and pumps	3,723.15
Meters	260.60
Incidental expenses	976.26
Total	$28,300.00

Tony C. Heffel, Muncie, Ind., was the engineer in charge, and the contractors were the U. S. Pipe Company, Sullivan & Ryan, Bourbon Brass and Copper Company, Flint & Walling Company, A. R. Zimmerman, The Neptune Meter Company, and Fairbanks Morse Company.

A. P. LOWER, Mayor,
Bradford, O.

Use of the Recall.

A. L. Mason, of Indianapolis, contributes an article to the January number of MUNICIPAL ENGINEERING against the commission form of government, in which he has this to say about the recall: "Again, in several places where the recall is in use, as at Haverhill, Massachusetts, and at Los Angeles, the defeated candidate has used it to get another chance to win the office, by having a new trial. It is a dangerous instrument, unless," etc. Where does Mr. Mason get his facts, we ask, and is all the rest of his paper just as accurate as this? The recall has been used only twice in Los Angeles. In 1904 Davenport, a councilman who had voted to give the Times the city printing on a bid $15,000 higher than the other papers—a contemptible bit of graft—was defeated by A. D. Houghton, a newcomer to the city, unknown in politics, who had never before been a candidate for anything. There were no other competitors at this election. In 1909 Mayor Harper was recalled, that is to say, a petition was filed, and he resigned and refused to run. The man who won the election, George Alexander, the present mayor, had never been a candidate for mayor, nor for any other city office. The only other man running was on the Socialist ticket, and he had never been a candidate for mayor. That finishes the Los Angeles end of Mr. Mason's story. As for the Haverhill part, we recently read a detailed report of the working of the commission plan, and no mention was made of the use of the recall, which certainly would have been mentioned had it been used. We are not aware of a single case in any American city where the recall has been used as he describes.—*Pacific Outlook.*

MUNICIPAL MATTERS IN COURT

Higher Courts—Louisville Sewer Bond Case—Exclusive Privilege of Collecting Garbage—Right to Tax Gas Mains Sustained—What Constitutes Equipment

Decisions of the Higher Courts of Interest to Municipalities.

Report of Highway Commissioners—Sufficiency.—The variance between the preliminary report of the highway commission for the improvement of roads under St. 1907, c. 349, which stated that, where an asphaltic macadam pavement was to be made, it should be composed of a mixture of the best grade of hard, tough crushed stone, the best asphalt and other materials which would insure a pavement capable of sustaining heavy traffic, and the specifications for the work which allowed either gravel or crushed rock to be used in the composition of the asphaltic macadam at the option of the contractor, subject to requirements as to the quality and to the approval of the engineer of the commission, was not fatal to the contract for the work called for by the specifications.—City Street Improvement Co. v. Kroh, County Auditor (Cal.), 110 P. 933.

Special Assessments—Recovery of Surplus.—The law providing that any funds in the treasury of a city belonging to the fund of a local improvement district after the payment of the cost and expense of such improvement in excess of the sum required to defray the expenditures of the city on account thereof shall be refunded on demand, to the payers into such fund, and that no action to obtain any such refund shall be commenced until 90 days after such demand, in cases where the assessment roll is filed with the city treasurer for collection on or after the day such act takes effect, and not till six months after such demand, in "all cases where such assessment roll has heretofore been filed for collection," was intended to authorize such a recovery in all cases where there was such an excess from an assessment in the custody of the city at the time the act was enacted, though under prior acts an action for recovery thereof was barred.—State ex rel. McCullough v. City of Seattle (Wash.), 110 P. 1009.

Funds—Availability—Street Railways.—The city of Chicago can use the funds provided for by Traction Ordinance Feb. 11, 1907, Section 24, comprising a percentage of the net earnings of the traction companies or any other available corporate funds to purchase or construct subways in the streets or to do necessary preliminary work to enable the city to determine whether such construction is advisable. An act authorizing cities to own, operate, or lease street railways, applies to underground and elevated as well as surface, street railways.—Barsaloux et al. v. City of Chicago et al. (Ill.), 92 N. E. 525.

Violations — Smoke Ordinance — Nuisance.—Buffalo City Ordinances, c. 42, Section 1, makes it unlawful for any person to permit the discharge of large quantities of smoke, having a natural tendency to cause injury, detriment, or annoyance to any person or persons, or the public, or to endanger the comfort, repose, health, or safety of the public, or detriment to business or property. *Held,* that a violation of such ordinance did not depend on whether the acts constituted a nuisance at common law, and hence requests to charge that, in order to sustain a verdict for the city, the jury must find that a nuisance existed, and that defendant's use of its premises was unreasonable, were properly refused.—City of Buffalo vs. Geo. P. Ray Mfg. Co. (N. Y.), 124 N. Y. S. 913.

Public Improvements — Statutes.—The power conferred by P. L. 1907, p. 707, empowering municipalities to construct sewage disposal plants, is not affected by the supplement to the borough act, dealing with the construction or purchase of a drainage or sewer system including a disposal plant, and enacting that the two questions may be submitted to the voters at one election, and on the same ballot, without requiring the proposition to instal a disposal plant to be used in connection with an existing sewerage system to be first submitted to popular vote.—Wormser-Goodman Const. Co. et al. v. Borough of Belmar (N. J.), 77 A. 466.

Acts Authorized by Statute—Operation of Sewage Plant.—A county, through a commission created by Loc. Acts 1900-01, p. 1702, constructed as authorized by the act a sewer system and purification plant after contracting with an individual, who, in consideration of the exclusive right to use the products of the plant, bound himself to pay the cost of the plant and its maintenance. The county stipulated for the exclusive control of the purification of the sewage. The plant was built, and the individual operated it and paid the cost thereof directly. The plant was unequal to the accomplishment of its purpose, and a nuisance was created by its operation. *Held,* that since, in the absence of express statutory provisions, it could not be assumed that it was intended to legalize an act necessarily resulting in a nuisance, nor that the system would have been constructed except for treatment of the sewage in the purification plant, the proximate cause of the nuisance was not the statutory authorization, but the operation of the plant by the individual, and he was liable therefor.—Adler & Co. et al. v. Pruitt (Ala.), 53 S. 315.

Highways — Ownership. — Streets and highways belong not partially, but entirely, to the public at large, and the supreme control over them is in the Legislature. Any unauthorized obstruction which unnecessarily impedes or incommodes the lawful use of a highway is a public nuisance at common law.—Chambers v. Roanoke Industrial and Agricultural Assn. et al. (Va.), 68 S. E. 980.

Waters and Water Courses—Diversion. —A water company will be temporarily enjoined from operating artesian wells, where it is definitely shown that a large spring, whose waters are used by its owner for commercial purposes, is thereby rendered entirely dry.—Ross Common Water Co. v. Blue Mountain Consol. Water Co. (Pa.), 77 A. 446.

Measurements and Estimates—Decision of Third Person.—Parties to a contract for a street improvement consisting of excavating and the laying of a pavement may provide that all measurements and estimates of quantities of work shall be made by a third person, and that his determination shall be final. The estimates of a third person authorized by the parties to a contract to make estimates which shall be conclusive cannot be impeached by either party without a showing of fraud or mistake so gross as to imply bad faith of the third person, or his failure to exercise his honest judgment on the matters submitted to him.—McKivor v. Savage (Wash.), 110 P. 811.

Improvements—Estimates of Quantity of Work Done.—The judgments of the city engineer selected by the parties to a contract for a street improvement consisting of excavating and the laying of a pavement to make measurements and estimates of the quantity of the work which shall be conclusive cannot be impeached by proof that on a measurement by another engineer it was found that rather more excavation had been done than the city engineer's estimates showed, and that in certain places the concrete base and sand cushion were thicker than four inches, a uniform thickness of four inches being one of the dimensions used by the city engineer in making his estimates; it being conceded that the city engineer exercised his best judgment.—McKivor v. Savage (Wash.), 110 P. 811.

Street Improvement—Contracts—Construction.—A contract for a street improvement consisting of excavating and the laying of a pavement, which provides that the yardage shall be ascertained by measuring the cubic yards in the concrete base and adding thereto the number of cubic yards of sand used in the sand cushion and in the filler, does not allow for all materials furnished and put into the concrete, and, where yardage measurement of concrete when mixed is less than the sum of yardage measurements of the materials of which it is composed, a method of measurement need not be adopted that will allow a yardage equal to the yardage of the sand and gravel furnished if measured separately.—McKivor v. Savage (Wash.), 110 P. 811.

Status of Land Over Which Street is Dedicated—Necessity for Acceptance.—The status of land over which its owner has dedicated a street is that, while the owner may be estopped from retracting his dedication, yet, until there is an acceptance of the street by some municipal act, or by public usage, the public acquires no rights therein and is subject to no duties by reason of the dedication.—Atlantic & S. Ry. Co. v. State Board of Assessors et al. (N. J.), 77 A. 609.

Municipal Corporations—Contracts.—A stipulation of a contract awarding to a person the right to collect and remove the garbage of a city for a specified sum that no assignment of the contract or any part thereof shall be made without the consent of the city first obtained is valid to discourage collusion among probable bidders, and to prevent extortionate contracts from being forced on the city, and equity will not enforce a prior contract between such person and others for the carrying on of the contract as a partnership. Where a person has entered into two independent contracts with different persons, each valid and enforceable, equity will not compel him to violate provisions of one of the contracts to the injury of the other party thereto for the purpose of affording relief under the other contract.—De Vita v. Loprete et al. (Me.), 77 A. 536.

City Council—Place of Meeting.—Under Ky. St., Sec. 3633 (Russell's St., Sec. 1639), requiring all meetings of the city councils of cities of the fifth class to be held in places designated by ordinance, an ordinance passed at other than the regular meeting place is invalid.—Dunn v. City of Cadiz (Ky.), 130 S. W. 1089.

Ordinances—Attack—Estoppel.—A property owner is not estopped to attack the validity of an ordinance requiring her to lay a sidewalk, in an action by the city to enforce a lien for the cost of a sidewalk built by the city, through failure to test validity of the ordinance by the statutory remedy of writ of prohibition, where she served notice that she would not pay for the work, and notified the city and its contractors not to do it.—Dunn v. City of Cadiz (Ky.), 130 S. W. 1089.

Dedication—Implication.—Where there was no express dedication of land for a public highway, but the public authorities assumed control of it, and worked and used it as such, the public acquired merely an easement, leaving the fee in the abutting owners, so that such owners could lay water pipes below the surface to supply dwellings.—Wells et al. v. Village of Croton on Hudson (N. Y.), 124 N. Y. S. 1058.

Receivers—"Corporation for Public Improvement."—A corporation furnishing water to the inhabitants of a town, and to the town for municipal purposes, including service to fire plugs, and occupying the streets of the town with its conduits, though the corporation has not been given the right of eminent domain, or any other right usually accorded to quasi public corporations, is a "corporation for public improvement," within the statute providing that the act authorizing the appointment of a receiver of an insolvent corporation shall not apply to a corporation for public improvement.—Thoroughgood v. Georgetown Water Co. (Del.), 77 A. 720.

Contracts.—Where one entered into a contract with the proper county authorities for the furnishing of material and for the building of a courthouse, and the work contemplated by the contract was finished and accepted by the proper county authorities before the contract was entered on the minutes of the ordinary, such a contract was unenforceable until entered on the minutes of the ordinary; but where this was done after the completion of the work, in compliance with a judgment in mandamus proceedings instituted to compel the entry of the contract on the minutes, the defect resulting from a failure to enter the contract on the minutes before the work was begun or completed was cured, and the contract was enforceable by an action instituted therefor.—Wagener for Use of Bank of Cumming v. Forsyth County (Ga.), 68 S. E. 1115.

Injuries to Pedestrian—Contributory Negligence.—One employed as a street cleaner must, while at work, use ordinary care to avoid injury from passing vehicles, but he need not neglect his work to escape collision with those not using reasonable care.—O'Donnell v. Lange (Mich.), 127 N. W. 691.

Improvements—Contracts—Injunction.—A taxpayer may sue to enjoin a city and its officers from contracting for the construction of a sewer partly in the city and partly in a town, where a part of the cost of the improvement is charged to the city as benefits payable out of the general taxes, and where the contemplated improvement is unauthorized and void.—Loeffler v. City of Chicago et al. (Ill.), 92 N. E. 586.

Local Improvements—Ordinance—Resolution.—Under Local Improvement Act (Hurd's Rev. St. 1908, c. 24) Sec. 9, providing that the recommendation of the board of local improvements shall be prima facie evidence that the preliminary requirements have been complied with, and a variance shall not affect the validity of the proceedings, unless the court shall deem the same wilful or substantial, the resolution for a city improvement and the ordinance must agree as to the substantial features of the improvement; but the object of the statute is attained where the description of the improvement in the resolution, taken with the estimated cost, will give the property owners a general understanding of what is to be done.—City of Chicago v. Sonkup (Ill.), 92 N. E. 564.

Bonds—Sinking Funds.—Const., Sec. 159, requiring provision to be made for a sinking fund to redeem municipal bonds, does not require a levy sufficient to retire the principal of the bonds, without regard to accumulations to the sinking fund on account of its interest earnings; it being presumed that the fund will be invested in some safe way, which will produce annual interest, thereby lessening the taxpayers' burden.—E. T. Lewis Co. v. City of Winchester (Ky.), 130 S. W. 1099.

Officers—Individual Liability for Money Applied to Unauthorized Purpose.—Municipal authorities are not personally liable in an action to recover money lawfully collected by them for one purpose, but applied to some other lawful liability of the municipality, unless some charter provision or the general law of the state imposes a liability on them in such instances, or unless their action puts it beyond the power of the municipality lawfully to raise, during the current year, the money with which to discharge the obligations for which the funds thus misapplied were originally intended.—McCord et al. v. City of Jackson et al. (Ga.), 69 S. E. 23.

Contracts—Validity.—Where, at the time when the municipal authorities made a contract for the purchase of materials for the erection of water works and an electric light plant, which they were authorized to erect, they did not contract for a sum to be paid exceeding the available funds on hand for the payment thereof and the amount of taxes levied, or that might be lawfully levied, for the year for that purpose, the contract was not invalidated if subsequently, without the consent of the parties with which they contracted, the authorities applied such funds to other purposes, instead of paying off the amount thus contracted; and under such circumstances the parties so furnishing such materials under such contract would be entitled to a judgment against the municipality.—McCord et al. v. City of Jackson et al. (Ga.), 69 S. E. 23.

Franchises—Power of Revocation.—The franchise to operate a street railroad springs from the state, and not from the city where its lines lie, though it is essential that the consent of the municipal authorities should be secured, and hence the right to revoke the franchise rests in the state, and the municipality can not move to compel a removal of such a company's tracks on the ground that they constitute a nuisance, not from operation in a manner not authorized by the grant, but for mere nonuser. The control which a municipality exercises over the public streets is in trust for the state, and not as a corporate or municipal property.—City of New York v. Montague et al. (N. Y.), 124 N. Y. S. 959.

Construction—Rights in Streets—Constitutional Provisions.—Const. Art. 11, Sec. 4, providing that no law shall be passed by the general assembly granting the right to construct and operate a street railroad within any city, town, or incorporated village without acquiring the consent of the local authorities having control of the streets or highways proposed to be occupied by such railroad, did not confer on cities and villages the exclusive control of their streets, and hence did not preclude the passage of Act May 27, 1889 (Laws 1889, p. 223), giving to the railroad and warehouse commission jurisdiction to determine the manner in which one railroad shall cross another in so far as it relates to crossings within the streets of cities and incorporated villages. While a municipal corporation is vested with the control of the streets within its corporate limits, such control is not exclusive, but is subject to the superior control of the state.—Chicago & S. Traction Co. v. Illinois Central Ry. Co. (Ill.), 92 N. E. 583.

Public Ways—Dedication—Acceptance.—A street laid out and plot recorded is a dedication to the public, but it is not a public highway for all purposes until accepted, which may either be by user or by appropriate municipal action.—Corbett v. City of Wilkes-Barre (Pa.), 3 Municipal Law Reporter 65.

Taxation—Electric Power Companies.—An electric power company is a quasi-public corporation, and that part of its real estate which is necessary for the exercise of its corporate franchises is not liable to local taxation.—Martic Township School District v. McCall Terry Power Co. (Pa.), Vol. 2, Municipal Law Reporter 91.

Vacation of Road.—A private terminus not a place of necessary public resort, cannot be left by vacation of a public road. It cannot be held that the private residence of a farmer, together with his other farm buildings, is a place of public resort contemplated by the statute.—Pine Grove Township Road (Pa.), Vol. 2 Municipal Law Reporter 120.

Exclusive Privilege of Collecting Garbage.

Judge Garbreath, of the civil court of Butler, Pa., has handed down an opinion granting the injunction against Johnson & Logan, restraining them from collecting garbage in Butler, the court sustaining the exclusive contract now held by A. W. Wallace. The court held that the garbage ordinance did not create a monopoly; was constitutional and valid, and was a proper exercise of the police powers of the borough; that A. W. Wallace, in his license for the garbage contract, had a property right which was being taken from him by the defendants and for which Wallace had no other remedy at law.

Louisville Sewer Bond Case.

The Legislature of Tennessee in 1909 passed an act allowing the city of Nashville to issue five hundred thousand coupon bonds, the proceeds of which were to be used for the construction of trunk sewers in the city. The city council passed an ordinance submitting the proposition to the voters of the city at the regular election held in the city October 14, 1909, at which time the city officials were elected, and at this election the candidate receiving the highest number of votes received 9,691. Only 5,982 were cast at the election on the bond proposition, 3,909 being for the issuance and 2,072 against them. The contention of the complainants was that the city was not authorized to issue the bonds unless the proposition for that issuance received a majority of all the votes cast at the election.

The court held: First, that the proposition carried by receiving a majority of the votes cast on the proposition; second, that the city, being authorized under section 19 of its charter, to submit the proposition either at a special or general election held in the city, that the fact that the city submitted the propositiion to the voters at the election held for the election of city officials did not divest it as to the bond proposition of the legal characteristics of a special election. Henry Sperry et al. vs. Mayor and City Council of Nashville, Tenn.

What Constitutes Equipment.

In the case of the Darlington Electric Light and Water Power Company, of Darlington, Wis., the Railroad Commission of Wisconsin has defined what shall constitute equipment under the terms of an appraisal to fix rates. The petition filed by the company alleged that its income from electric service and for pumping water was grossly inadequate, and sought authority to increase its schedule of charges. Careful examinations and apportionment of memoranda of receipts and expenditures were submitted by the petitioner, disclosing net earnings that were not considered by the commission to be unreasonably low.

The most interesting part of the decision was that referring to the equipment of the plant. Where equipment is not actually part of the producing plant, but has been retained and serves as an emergency or reserve unit, it was held to be properly included as property useful in serving the public. Equipment which has been cast aside for larger or more up-to-date units was held to be not included as a part of the valuation serving as a basis for the adjustment of rates. In accordance with this and other conclusions of the commission, the petition was dismissed.

Right to Tax Gas Mains Sustained.

In the case of the City of Erie vs. The Pennsylvania Gas Company (Municipal Law Reporter, vol. ii, p. 81), a peculiar point was established. The defendant, a natural gas company, was authorized by ordinance to lay its pipes in Erie, and at once laid mains, which, with extensions, amounted to 100 miles in 1909, and supplied gas to about 14,000 customers. These mains were inspected and maintained by the gas company.

In April, 1908, a city ordinance was passed providing for an annual (or more frequent, if needed) inspection of all companies maintaining pipes or mains in the streets or alleys. The duty of this inspection was delegated to the police department of the city; and to cover the costs an annual license fee of $30 for each mile of main was provided. The gas company declined to pay this license fee, and suit was entered to recover the same.

The legal conclusions determined by the decision in favor of the city were, briefly, as follows:

First—A city has the right, in the exercise of its police powers, to supervise and inspect lines of mains which are located in its public streets, and to impose a reasonable charge as a license fee to reimburse it for the probable expense of such inspection and supervision, and the action of the city officials in such case is valid.

Second—The court may not interfere except where the license fee is clearly excessive and unreasonable.

Third—In deciding whether such license fee is clearly excessive and unreasonable, each case must stand largely on its own facts.

Fourth—While the license fee in question ($30 per mile of main) may seem large, it was not clearly evident that it should be set aside.

Fifth—A judgment was entered for the city of Erie for $3,000, with interest and costs.

ROADS AND PAVEMENTS

Road Supervision—Automobiles in Municipal Work—Electric Motor Fire Apparatus—Seattle's Civic Plans Commission

Road Supervision.

Supervision is the foundation stone on which road-building reform must be placed. Lack of management has been the cause of the enormous amount of waste in road expenditure. The outlay on township roads in Ontario, in statute labor and money, exceeds two millions anually. This is steadily increasing. Statute labor in pioneer days was the right thing in the right place. To-day it is more than undoing the good done in former years. Not only is statute labor of to-day inefficient in itself, but cash expenditure is largely made in conjunction with statute labor, by pathmasters, on the statute labor basis, so that it places two-fold handicap on road improvement. If this large outlay were handled in such a way as to give good roads, the misfortune would not be so great; but with statute labor squandered, and a considerable cash expenditure in its train, we still have the evil of bad roads. County roads systems with provincial aid are undeniably beneficial, but while increased outlay is needed, the greatest good can come from such an awakening on the part of the ratepayers as will lead to skillful direction of all expenditure now being made in the rural districts.

The remedy is not simply the abolition of statute labor. That is a minor part. The important feature is the system adopted in place of statute labor. Not only must that system be thoroughly efficient and practical, but it must be carried out with energy and good judgment. No system, however thorough, can be of use if left to itself; it will not be automatic. What is required is an active working out of an efficient system by men upon whom its administration falls, backed up by a clean-cut and healthy public opinion.

Road building, as with any other constructive work, has two parts, the theoretical and the practical. The one pertains to the engineer; the other to the contractor or foreman. The one includes the knowledge of what the completed road should be as regards materials, form, drainage, and the application of scientific principles to the design of a road. The other involves the direction of labor so as to produce maximum results at minimum cost.

How do pathmasters, trying to build roads with statute labor, serve these conditions? Without overestimating the scientific ability necessary to build roads, it is safe to say that in no township can one or two hundred men be found who, as pathmasters, can qualify as road engineers; while to expect them as foremen to efficiently manage statute labor as well is a travesty on the art of road-making.

No two pathmasters can agree as to what a road should be as to width, crown, grade, drainage, quality of material; yet it is only by the skillful treatment of such details that a good road can be cheaply and durably designed. A defect in one particular may readily mean the undoing of the entire work. In teaming material, which is one of the great factors of cost, the size and number of loads per day often does not amount to one-third or one-quarter what a contractor or good foreman would exact. This means in effect that, for a given quantity of material, the cost of teaming is three or four times what it should have been. In many townships a rate of $3 or $4 per day for man and team is nominally paid, yet it really amounts to $12 or $16 for a full day's work. This is the rigid economy being practiced on the township roads of Ontario, as their condition fully testifies.

The organization which should exist is very simple—that of a joint stock company. The ratepayers are the stockholders; the council, the board of directors; and there should be one permanent manager (or road superintendent) carrying out the wishes of the directors. This centralizes responsibility, while the growing experience of the superintendent will be of increasing value. So long as municipal councilors rotate in office from year to year, their services in actual supervision of road work can be only a series of experiments, in which they gain their experience at the expense of the people. If there is need for a permanent clerk or treasurer, much more is there need for a permanent road superintendent.

Cities and large towns, as a rule, have such a system in the employment of a city engineer who can supervise, through foremen and inspectors, all work of either day labor or contract. County councils, in carrying on systems of county roads under the highway improvement act, are required to have a road superintendent or engineer, while their steel truss bridges must be constructed under a qualified engineer who can see that the plans and specifications are properly carried out.

The duties of a road superintendent will vary in detail according to local circumstances, and the municipality in which he is engaged, whether township or county. In general, he should attend all regular meetings of the council to receive instructions from the council, or give information regarding work proposed or in progress. He should report to the council in the spring as to work he considers advisable, which report the council may adopt or amend. He should report at the end of the year, showing a full statement of work carried out and the cost. It will be his duty to purchase all ordinary supplies, and make such recommendations to the council as may be desirable regarding machinery or other equipment needed.

All men, teams, foremen and inspectors should be employed or discharged by him, and should be subject to his direction only. A councilor should never give instructions as to work, except through the road superintendent. A contractor never gives directions to laborers except through a foreman or superintendent, and the same principle should be rigidly followed in municipay road work. To do otherwise destroys the superintendent's prestige with the men, undermines his power to preserve discipline and to secure the best work. Every man should feel that he owes his employment to the superintendent only, and that no "pull" can save him if the superintendent wishes to dismiss him.

The superintendent should keep an accurate record of men employed and the work done, furnishing to the council at regular intervals accounts and pay sheets. The methods of payment and the keeping of accounts should be complete and above suspicion, requiring the certificates of foremen, the superintendent and chairman of the road committee, and should have the approval of the council. Wherever possible the certificates of two men should be on every account and pay sheet presented to the treasurer.

Sufficient of the duties of the road superintendent have been suggested to show the object of having a road superintendent—to make it one man's business in every municipality to have direct charge of road work. If he is thoroughly practical and a man of business, he can prepare plans and organize the work so as to get the greatest results for every dollar expended. The council and people will hold him responsible for so doing. He will study the best methods of road construction, of operating machinery and of organizing the work. He should have what few men possess—the ability to manage men so as to get full results from them. In the last analysis, upon the ability and energy of the man in charge will depend the success or failure of the municipal road expenditure. Road improvement is a work not of one year, but of many years; it should be planned as such, and the first necessity is a man who will give it continuous attention for a term of years.

On work which he does not personally oversee the superintendent should place a foreman. The foreman will receive his instructions as to how the work is to be done from the superintendent, and the foreman's essential qualification will be his ability to organize and control the labor to the best possible advantage. A first-class foreman is the most valuable part of any contractor's equipment. For a thoroughly efficient foreman a contractor will pay the highest market price, for he knows that the cost of the work may easily be one-half under one foreman of what it is under another. As with the superintendent or engineer, these foremen should be retained as permanently as possible, so that their growing experience will make their services of increasing value to the county.

So long as work is carried on in short patches, the need for expert supervision is not felt throughout the country. To build roads profitably they must be constructed in long sections, involving a very different degree of experience. A reeve recently pointed out to the writer with pride, "the first continuous mile of road to be built in the township." This is not an isolated case. Many townships in the province have yet to build their first continuous mile of road.

That the supervision of road work on each system—township, county, city or province—should be centralized is a principle that has been found valid wherever the best roads are being built. In France, Germany, England, and the American States advanced in road building, the centralizing of responsibility is recognized as a vital necessity. In this way expert knowledge is directed to the design of roads, and the forces available are directed by business-like methods adapted to any other form of construction. The country roads, looked at as a purely local quantity, do not impress with their importance; but as a part of the great transportation system spreading as a vast network throughout the province, the aggregate forms a work of magnitude, and the results of neglect will seriously retard the material development of the country.

W. A. McLean, Engineer of Highways,
In Report to Ontario Provincial Government.

Automobiles in Municipal Work.

At the Chicago automobile show, to be held in the Coliseum on February 6-11, city officials will be given an opportunity to appreciate the increased use of the automobile in various lines of municipal service. About 150 city officials have signified their intention of attending the show to investigate the motor police patrols, motor fire apparatus, ambulances and various styles of trucks suitable for street cleaning, garbage, and other municipal work. From many cities in Illinois, Indiana, Michigan, Ohio, Kentucky, Tennessee, Iowa and Wisconsin, all of the principal officials from mayor to city clerk, expect to attend the show.

The principal use found for the automobile seems to be in fire service. As the result of a carefully made count it is asserted that 200 American cities are now using motor fire apparatus. The record shows thirty-eight cities in Massachusetts, eighteen in California, fifteen in New York, fourteen each in Connecticut and New Jersey, twelve in Pennsylvania and eight each in Ohio and Texas. The central states are as yet but poorly represented in the list of cities which have adopted the more efficient fire-fighting machines.

Electric Motor Fire Apparatus.

Each month marks a further advance in the adoption of motor driven fire apparatus, and the sentiment is becoming more general in favor of its use in all cities. A recent meeting of New England fire chiefs adopted resolutions in favor of the motor apparatus. The fire commission of Buffalo has announced its intention of purchasing motor vehicles exclusively in the future. These are only some of the many instances of the growing favor of the more efficient apparatus.

The latest type of motor apparatus is the electrically driven truck. Springfield, Mass., was the first city in this country to adopt the electrically driven apparatus. It is a hose wagon 21 feet long, propelled by a motor on each wheel. Power is furnished by batteries; and a speed of 30 miles an hour may be obtained. The equipment of the wagon includes a 40-gallon chemical tank and reel with 150 feet of hose, 1,500 feet of large water hose, lockers for firemen's clothing, a turret pipe and the usual details of a hose wagon. The chassis was built by a Grand Rapids wheel company, and the body was built by a Springfield wagon works. An 85-foot electrically driven truck has been added to the fire department equipment since the adoption of the hose wagon.

That the electrical apparatus has received some notice in England is evident from the following description in a recent issue of the London "Surveyor and the Civil Engineer":

The machine is fitted with a special light-traction accumulator, and 25-mile journeys can be accomplished without any fear of injury to the cells. The current is supplied by two independent motors, fixed on either side of the frame, the drive being by means of a worm-wheel reducing gear and chains on to the rear wheels. Friction is reduced to a minimum by the employment of roller chains and oil-tight cases for the worm gearing. This engine will carry six or eight men at a speed of 20 miles per hour on the level and a gradient of 1 in 10 can be ascended at a good speed. Artillery pattern wheels are fitted, the tires being solid rubber and of twin section on the rear wheels. The engine carries a "Kemik" cylinder of a capacity of 30 gallons, which is kept under pressure by a cylinder of carbonic acid gas, and discharges through 180 feet of 1-inch rubber hose. (The cylinder can be operated by an acid and soda charge, instead of the gas cylinder, if preferred.) Accommodation is also provided for 1,000 feet of canvas hose, with standpipes, branchpipes and all the necessary material for getting to work from a hydrant. A set of telescopic ladders to reach a height of 30 feet is also carried in brackets overhead.

Seattle's Civic Plans Commission.

A civic plans commission is provided for in a recent amendment to Seattle's city charter. This commission is to be composed of representatives of the city and county authorities, the chamber of commerce, the banks, real estate, water front, harbor and manufacturing interests, the legal and arichtectural professions and the steam and electric railways. Twenty-one members in all compose the commission. R. H. Thomson, M. Am. Soc. C. E., city engineer, has been made a member of the commission. The purposes of the commission will be aided by the appointment of various sub-committees to investigate the different lines of work and report to the main commission.

The commission has assumed for the purposes of its endeavor, a population of 1,000,000 embraced in an area of about 150 square miles. With this assumption plans are to be made to provide arterial highways, quick, accessible transportation facilities, parks, boulevards, playgrounds and civic centers.

The greatest amount of attention will in all probability be devoted to the harbor development, for with the opening of the Panama Canal, Seattle anticipates an increased shipping business which will require a great amount of additional dockage facilities. This work, which could not be accomplished by individual effort, the commission hopes to accomplish in such a manner as to develop the entire harbor as a unit. In this manner each improvement undertaken will have a result in the completion of the work.

In addition to these purposes, the commission will consider the labor problems, which are at present attracting so much interest in the Western Coast states. An effort will be exerted to prevent the closely built-up congested factory and tenement districts; and suburbs will be opened to give inducements to the poorer classes to build and rent homes away from the congested areas. To aid in this plan transportation facilities will be provided, and schools, parks and public playgrounds will be placed in the outlying districts.

Few immediate public improvements are planned by the commission, but it is its aim to lay before the people a comprehensive plan for a future great city; to submit maps showing the location of future docks,. waterways and railroad yards, arteries of travel, boulevards, parks and playgrounds, so that as the territory contiguous to the present city is opened up and becomes a part thereof, it can be platted to conform to every other part of the city, thereby forming a unit which if rightly planned and successfully carried out will make Seattle not only a great commercial city, but a beautiful and healthful place in which to live.

Under the charter amendment, provision was made for employing an expert to assist in its work. Virgil G. Bogue, of New York, who constructed the Northern Pacific Railroad from Tacoma to Seattle and laid out the Seattle harbor, has been retained in this capacity. He will prepare and submit plans for civic improvement, which will be passed upon by the commission.

Municipally Furnished Houses in England.

The town of Newcastle-on-Tyne, England has furnished a very satisfactory solution for the slum problem. Two blocks of tenement dwellings have been erected upon corporation land, with their back to a twenty-foot street, and their face to the children's playground. Ten feet of this space form a pleasant avenue; thirty feet are utilized as front gardens to the houses. Here are seventy-two one-room dwellings in two stories. The blocks are divided from each other by a ten-foot passage, and access to the upper rooms is by way of a covered-in stone staircase at one end of each block, leading on to a balcony four feet wide. Each room is 15x11 feet and has a bay window 8-feet wide and projecting 2 feet 6 inches. A bed fitted with a wire mattress, occupies a recess 6x4 feet, and is screened by a curtain hung from a rod. There is a scullery portion 7x3½ feet, fitted with a sink, and a plate and pan closet. In the entrance lobby is a food locker and a coal bunker. The bay window is surrounded with fixed seats, which have lockers underneath. These single rooms are supplied with a wardrobe, containing a drawer and hat shelf; a combined dressing table and book rack; a plate rack with drawers and cupboards below; and even a rail for pictures.

These houses are rented for the sum of 12½ cents per day or 90 cents per week.

MUNICIPAL AND TECHNICAL LITERATURE

The Improvement of Fort Wayne, Ind.—Engineering Data—Cement Age—Books for Engineers

The Improvement of Fort Wayne, Ind.

A report has been compiled by Mr. Charles Mulford Robinson, of Rochester, N. Y., setting forth plans for the civic betterment of Fort Wayne, Ind. This report was prepared after a careful study of the local topographical conditions, and it is in its thoroughness indicative of an appreciation of needs of the city.

The compilation of the report is exceptionally good. The details of the city's ills are taken up separately and cures suggested, detailed suggestions being given in each case. Each point under discussion is illustrated by photographs, with topic sentences making clear the reasons for their use. In addition to these details, a general plan of procedure is outlined and the method of attaining the desired results is given.

In connection with the planning of a river drive several serious questions in engineering were involved. Mr. Charles C. Brown, of Indianapolis, was called into consultation to determine the safety of the proposed drive under flood conditions.

A section in conclusion deals with the financial questions involved and offers a comparison of the conditions in Fort Wayne with those in other cities of approximately the same size.

Engineering Data.

A unique little publication by Edward Wray, 92 La Salle street, Chicago, Ill., is entitled *Data.* It appears monthly, and the publication began in September, 1910. Each sheet is of the standard 3x5 size of stiff paper and those of a monthly number are lightly glued at one end so that they can be separated. Each card is devoted to one subject, which is printed in black-faced capital letters on the top line. The cards can be pulled apart and filed in alphabetical order in a standard card file, thus making them most convenient of access.

A serial list of headings used and of words that might be used as headings, but are not, is being printed on the earlier pages, thus giving a complete series of cross references. Any headings not found in the file of cards will probably be found in this list of "index headings" with reference to the heading under which the information can be found. The sheet or sheets of headings should be placed at the beginning of each corresponding letter of the alphabet for convenience of reference.

The folowing may be mentioned as examples of the information thus far printed under headings:

Four sheets regarding reinforced concrete beams appeared in October and November, two showing safe bending moments and reinforcement for beams of 5 to 48 inches depth and two showing proportion and spacing of rods for various sizes of rods.

Three cards on boilers, published in September, treat of boiler scale, efficiency of boilers with oil fuel and steam economies of boilers.

Two November cards give safe bearing values for brick masonry.

A September card gives a graphical showing of the cost of power house buildings of various types.

Cement Age and Concrete Engineering Consolidated.

Cement Age, of New York, and *Concrete Engineering,* of Cleveland, have been consolidated.

Mr. Robert W. Lesley will continue as editor of the new publication, which will be known as *Cement Age with which is combined Concrete Engineering.* Allen Brett, editor of Concrete Engineering, will take the position of associate editor.

Books for Engineers.

Reinforced Concrete Pocket Book, containing useful tables, rules and illustrations for the convenient design, rational construction and ready computation of cost of reinforced concrete girders, slabs, footings, columns, buildings, retaining walls, tanks, grain elevators, coal bins, water pipes, sewers, dams, bridges, smoke stacks, piles, etc. By L. J. Mensch, M. Am. Soc. C. E. Leather pocket book, 218 pp., $10. Published by the author, Monadnock Bldg., San Francisco, Cal.

The author has prepared a very practical book that will be found exceedingly convenient by the designing and estimating engineer. There is little lacking which is of interest in the field the little book is intended to cover. Data regarding the steel used and regarding structures of various dimensions of all the kinds named on the title page are arranged in tabular form for easy reference. Besides the subjects definitely mentioned there is given full information about the kind and amount of material required for forms for girders, columns, beams, floors and their supports. Poles for lines of wire are treated. The treatment of the arch bridge is brief, but quite comprehensive. Cost of labor on reinforced concrete and form work is discussed, also cost of the less prominent materials, such as nails, water, cleaning up, etc. A set of general specifications for reinforced concrete work is given also.

Tables have been carefully checked repeatedly by slide rule and many of them have been in use for ten years and have been thoroughly tested during that time. Most of the information is such as cannot be obtained in other books, or at least in any but the very few books of the same class.

The author is an engineer and a general contractor actively engaged in difficult gineering and building construction and prepared the book for his own convenience primarily, and publishes it for the benefit of other contractors and engineers.

Economic Geology, with special reference to the United States, by Heinrich Ries, A. M., Ph. D., professor of economic geology at Cornell University. Cloth, 589 pp., $3.50 net. The Macmillan Company, 66 Fifth avenue, New York.

This is the third edition of a standard text-book, which has been revised and somewhat enlarged to keep it fully up to date. The student or reader is evidently expected to have a general knowledge of geology and minerology and one with such preliminary information can read the book without difficulty. However, the reader who knows little of these subjects finds the book full of interesting and valuable information for him, although he may not understand the scientific discussions which are used to correlate and explain the information given. The book is profusely illustrated with plates of photographs and drawings as well as some hundreds of illustrations on the pages of text.

Coal has a chapter of 49 pages; petroleum, natural gas and other hydrocarbons have 51 pages; shorter chapters are devoted to building stones, clay, lime and calcareous cements, salines and associated substances, gypsum, fertilizers, abrasives, minor minerals, precious stones and underground waters.

The second part on ore deposits begins on page 305, with a general chapter on ore deposits, their occurrence, method of formation, age, etc., followed by chapters on iron, copper, lead and zinc, silver-lead, gold and silver ores, and two chapters on the minor metals.

The statistics of the U. S. Geological Survey are used in connection with each mineral and much additional information about quantities, qualities, prices, values, etc., is given from the additional wealth of data the author possesses.

There is much new material in the book, more than is shown by the additional 145 pages in this edition, for the type has been entirely reset and the style changed so that each page contains considerable additional matter.

The Collection and Disposal of Municipal Waste. By Wm. F. Morse, consulting engineer. Cloth, 462 pp. Municipal Journal and Engineer, New York.

The author of this book has been identified with the American development of the subject of which it treats almost ever since the beginning of its consideration in this country and he is competent both in ability and experience to give a full statement of what has been done, and of what has been attempted and the reasons for the failures, and his recommendations for the future are worthy of most respectful attention.

The five parts into which the work has been divided consider the municipal waste of American towns, the disposal of American municipal waste by crematories and incinerators, the disposal of waste by British destructor systems, the disposal of waste by reduction and extraction processes, and the utilization of municipal waste. This method of classification causes considerable repetition in order to make each part complete without cross-references to other parts, but this is not a serious objection.

The chapters of the first part consider the present conditions of waste collection and disposal in American cities and towns, showing the lack of system in the individual method of disposal, feeding, licensing cartmen, letting contracts for collection and removal, and collecting by municipal employes, as methods of collection; and dumping or tipping into water or on land and refuse sorting as means of disposal. The second chapter gives a close classification and clear definitions of the various classes of refuse, both organic and inorganic, and contains about all the available information regarding proportions and quantities of each class of municipal waste. The third chapter describes the methods of refuse disposal, meaning combustible matters and inorganic incombustibles, in Boston, New York, Brooklyn, Buffalo and Lowell. The fourth chapter shows the treatment of municipal ashes, street sweepings and stable refuse, and discusses briefly the commercial values of municipal waste, including the tankage from garbage reduction plants.

In the second part the fifth chapter gives brief descriptions in approximately chronological order of the early American garbage disposal plants, mainly crematories and incinerators. The sixth chapter is a table of the main facts regarding all the municipal garbage furnaces, arranged in chronological order, with a number of notes on patents and cost of construction, and additional tables of garbage crematories erected by the U. S. government and at public and private institutions. There are many miscellaneous notes showing reasons for failure and for slow progress, etc. The seventh and eighth chapters describe in detail the various American crematories, thus repeating to some extent previous chapters, and include the Engle, Dixon, Davis, Thackeray, Boulger, Morse-Boulger, F. P. Smith, Wright, Branch, Brown, Brownlee, H. B. Smith, Smith-Siemens, Vivarttas, Decarie, Bennett, Dundon, Sanitary Engineering Co., Lewis and Kitchen, and Public Service Co., furnaces. The ninth chapter describes the traveling crematories and rubbish destructors and gives a careful compilation of all the available information on the calorific value of municipal wastes of the various classes. It also discusses again the differences in forms of furnaces and the conditions necessary to their success.

In the third part, the tenth chapter goes into the details of British destructors, describing the Fryer, Beaman and Deas, Horsfall, Warner and Sterling destructors of the cell type and the Meldrum, and Heenan & Froude destructors of the continuous grate type, the high temperatures attained and the conditions of operation. The destructors of these types in America are described in detail. They are located at Westmount, Montreal, Que.; Seattle, Wash.; Vancouver, B. C.; West New Brighton, New York, and one under construction at Schenectady, N. Y. The eleventh chapter, written by W. Francis Goodrich, the eminent English authority on waste disposal, describes British destructor plants which have been installed in all parts of the world. The uses made of the products of the furnaces are also named.

The fourth part, on reduction and extraction processes, describes all the plants in the United States, using the Merz, Simonin, Arnold, Chamberlain, Holthaus, Wiselogel, American, Penn, and Edson processes.

The eighteenth chapter, which constitutes the fifth part, is devoted to a discussion of the economic side of the question and discusses the uses which can be made of the products of waste disposal and the revenue that can be derived therefrom.

Aside from the repetitions which might have been diminished in amount by more careful editing and a number of typographical errors, which show careless proof-reading, the book is as satisfactory in form as it is in contents, and will long be valuable as the first successful attempt to cover its subject for America as well as foreign countries. A material improvement in methods of collecting and disposing of garbage is probable in the near future; but this book will, nevertheless, long serve the purpose of the engineer who wants to know what has been done in these lines and the principles upon which the successes of the past have been based, as well as the reasons for many of the failures.

ORGANIZATIONS AND INDIVIDUALS

American Society of Civil Engineers—Standardizing Specifications—Chicago Cement Show—Engineering Contractors—Indiana Engineering Society—Highway Improvement—Illinois Society of Engineers—Civil Service—Technical Schools—Technical Organizations—Calendar—Personal Notes

American Society of Civil Engineers.

The annual meeting of the American Society of Civil Engineers was held at the society house in New York January 18 and 19. Special committees on steel columns and struts and on bituminous materials for road construction were made and the result of the election of officers was announced, Admiral Mordecai T. Endicott being elected president.

There was some very interesting discussion of the licensing of engineers by the state apropos of the introduction of bills in the last two legislative sessions in New York and the passage of laws in other states whose tendency is toward reducing the profession of civil engineering to the level of a trades union. A resolution was passed to the effect that the society "does not deem it necessary or desirable that civil engineers should be licensed in any state," in view of the fact that national societies of engineers have large and widely scattered membership among those who have demonstrated their fitness to practice as engineers before they could secure these memberships. At the same time the society passed a resolution recommending a form of statute in case a legislature deems the passage of a statute covering the practice of civil engineering desirable for the protection of the public. This form was not satisfactory to many of those present, and the recommendation of any form was objectionable to many, but, under the rulings regarding the reference of the question to the board of direction, the resolutions were accepted mainly as a progress report of the board, which was continued in charge of the matter. MUNICIPAL ENGINEERING will comment upon the subject editorially a little later, believing that the basis of the proposed form of statute is not the most satisfactory and that the state, aside from its police powers, which need not be invoked in such a matter as this, has the right only to prescribe qualifications of engineers to be employed by the state, county or municipality.

The annual report of the board of direction shows a total membership of 5,797, the increase during the year being 505. The society paid $10,000 on the indebtedness for building and put $17,000 into the reserve fund, drawing higher interest than the mortgage, and payments of $10,000 on indebtedness and $20,000 to reserve fund have been ordered to be made early in 1911.

Following the excursions of the membership on the 18th and 19th, a series of special meetings to discuss road construction was held under the direction of the society's committee on bituminous materials for road construction on January 20 and 21. The general result of these discussions is stated in the editorial department. Many interesting and valuable items of information gathered therefrom will be given in MUNICIPAL ENGINEERING from time to time.

Standardizing Paving Specifications.

The Organization of City Officials for the Standardization of Paving Specifications held its second convention in the United Engineering building, New York city, January 9 to 14, inclusive, taking up the tentative specifications adopted last year and working them into more satisfactory shape. The convention did not get into working order as promptly as it did in Chicago, nor did it put in as many hours a day, although it managed to use all the days in the week. The general result is commented upon in the editorial department.

There were 73 delegates from 32 cities in attendance for at least a part of the time, though scarcely two-thirds of the cities responded to any one roll call. This indicates a falling off of interest, especially as several cities present at Chicago were not represented in New York. Indeed, there were frequent expressions on the floor and in the lobbies to the effect that the organization will have completed its work by the end of its third convention and may then turn its work over to the more inclusive American Society of Municipal Improvements for future elaboration and modification to keep it up to the future advances in the science of paving. A committee on reorganization was appointed to report at this convention, but the report was not forthcoming. If the sentiment expressed as above reported is sufficiently wide-spread it may never report. Some anomalies arising from changes in the incumbents of municipal offices must be corrected or the conditions of membership must be modified if the organization is to remove some of the just causes for criticism which appeared at this convention.

To prevent unauthorized use of the specifications for advertising purposes, the preliminary reports were copyrighted and the final specifications will not be issued in any form until they have been printed and copyrighted by the organization, when they will be open for any legitimate use.

American Society of Engineering Contractors.

The annual meeting of the American Society of Engineering Contractors was held in the United Engineering Society building, New York City, on the afternoon and evening of January 10, 1911.

The principal business transacted was the counting of the vote for officers and the discussion of reports of committees on uniform specifications, and cost analysis. In the evening Hilder Daw of Montreal gave a most interesting illustrated lecture on "Railroading in West Africa," which was followed by a collation.

W. R. Harris of Louisville, Ky., was elected president of the society.

The Chicago Cement Show.

The Cement Products Exhibition Co., announces that the opening date of the Fourth Annual Chicago Cement Show has been advanced one day. The show will open at 8 p. m., February 16; and continue until February 23.

The entire Chicago Colisemu main floor, balcony and annex will be filled with exhibits. The year's progress in cement, cement products and cement machinery will be displayed according to an orderly and attractive plan.

To the architect, the engineer, the contractor, the business man and the home builder this show should prove not only of great interest, but should be of real value; for in no other place or manner are the many uses of cement, so thoroughly taught.

The Indiana Engineering Society.

The annual meeting of the Indiana Engineering Society was held at the Denison Hotel, Indianapolis, Ind., on the 12th, 13th and 14th of January. There were four business sessions and in addition a banquet was held on Thursday night, and an inspection of the Merchants Heat and Light Company and the Citizens Gas Company, was made on Friday afternon.

In his opening address on Thursday morning, President Edwyn E. Watts, of Princeton, called attention to the very low compensation allowed for public engineers in the State of Indiana. In this connection he mentioned the enormous amount of public work that was under the supervision of these engineers. Men capable of handling such work can find more remunerative positions in other lines.

Prof. W. K. Hatt of Purdue University, read a report as chairman of the committee on materials and construction. In this report he dwelt on the need of standardizing specifications; the revision of the rattler tests for brick; and the advancement being made in the matter of suitable wood preservatives. In the discussion following this report, C. W. Boynton, of the Universal Portland Cement Co. commented on the fact that concrete may be made as water tight as stone if a properly proportioned mixture is made, and sufficient water is used. Prof. Hatt made mention of a new substance called makalite, composed of carbolic acid and formaldahyde, which is being tested for its value as a wood preservative.

Prof. Hatt read a paper on wood paving blocks in which he brought out several valuable points. He emphasized the fact that contrary to the popular idea, coarse grained blocks will not absorb the creosote or oil as well as the finer grained woods. Prof. Hatt's paper was illustrated by a number of microscopic sections of woods which showed the cellular structure, and brought out the points discussed. Following this Mr. Boynton gave a very interesting talk on the manufacture of Portland cement, illustrated by a number of slides.

In the Friday morning session, Prof. R. L. Sackett read a report on the river and stream pollution in Indiana. This was followed by the report of Charles Brossman as chairman of the committee on water works, in which the need for uniform hydrant and hose connections was strongly emphasized. Theodore A. Leisen then presented a paper on the evolution of the Louisville water works. A full description of the newly improved pumping station was given. This was followed by an illustrated description of European sewage purification works, by Prof. Sackett. The Imhoff and Travis tanks were fully described and their action indicated. The traveling sprinkling filters were compared with the types used in this country. Mr. Brossman then read an illustrated historical paper on wells and well pumping machinery.

In the report of the committee on roads and pavements, given by Mr. John O. Potter, attention was called to the fact that judgment is not always shown by petitioning property owners in choosing the kind of pavement suitable for their needs. In the discussion of the report the relative merits of screened and crusher stone were argued, with the odds in favor of the crusher run. Indiana's "systematically unsystematic" road building was severely criticised.

Prof. Albert Smith read a paper on "The Relation of Bridge Specifications to Highway Improvements," which will appear later. Elsewhere in this issue will be found the paper which followed on the "Standardization of a Testing Rattler," by M. W. Blair.

Frank R. Daniel, in offering the report of the committee on central station light and power, recommended wire taps from pipes to return conductors to avoid electrolytic action. The increased use of welded rail joints was commented upon with favor. Prof. Hatt's paper on the new testing laboratory at Purdue, was read by Prof. Smith.

The description of a forty-foot concrete girder bridge, by F. A. Kattman started a very interesting discussion concerning the relative merits of the arch and girder types of bridges for highway use.

A number of other very interesting papers and reports were read, of which lack of space prevents mention. A number of papers and reports were read by title only and will appear in the publication of the society. D. B. Luten was elected president, and Malverd A. Howe vice president. Prof. H. O. Garman and DeWitt V. Moore were elected trustees.

One of the distinctly novel features of the convention was the use of the convertible baloptican. y the aid of this machine the ordinary drawings and photographs were made use of as well as lantern slides. The baloptican feature involves the principal of the mirror projecting the image at an angle through a lens to a mirror which in turn throws the image upon the screen. This produces an image which is erect and identical with the original.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

February 8-9: Topographic draftsman at $1,000 to $1,500 a year, copyist topographic draftsman at $900 to $1,500 a year, aid at $720 a year and deck officer at $900, all in the Coast and Geodetic Survey.

The American Association for Highway Improvement.

This new association is beginning its life in a way which indicates that it will be of great value and influence in the field. A hand-book giving the purposes of the association and its working plan, and constitution will be sent on application to the secretary, J. E. Pennypacker, Jr., Colorado building, Washington, D. C. It also contains a plan for the organization of local road clubs.

The association has under preparation

a legislative hand-book, giving carefully prepared models of acts covering various parts of the field.

Its plan of work is comprehensive and its membership should be large that there may be funds for carrying it on.

The Illinois Society of Engineers and Surveyors.

The Illinois Society of Engineers and Surveyors celebrated its jubilee at its 26th convention, held in East St. Louis, January 25-27. An excellent program was arranged under the presidency of A. N. Johnson, the state highway engineer The evening session of the second day was devoted to the jubilee and included talks from charter members of whom there are still eight holding membership in the society, and past presidents, of whom there are at least ten still members of the society.

Technical Schools.

"Freight Train Resistance: Its Relation to Car Weight," by Edward C. Schmidt, has just been issued as Bulletin No. 43 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of tests made upon freight trains to determine their resistance. The results show that the average weight of the cars composing the trains exerts upon train resistance an even greater influence than is exerted by variations in train speed.

The Carnegie library of Pittsburg has issued two valuable lists of references and magazine articles. The first of these is a select list of books on Industrial Accidents; while the second is a complete list of books and articles on Sewage Disposal and Treatment.

The Iowa Engineer, published by the Iowa State College at Ames, Iowa, contains among other articles, a paper on the Manufacture of Portland Cement, by Geo. P. Dieckman of the Northwestern States Portland Cement Co.

The January number of the Wisconsin Engineer contains a number of articles of interest. Among them are Telephone Service in Chicago, by A. U. Hoefer, and The Utility of the Metallographic Microscope in Engineering, by James Astor.

Technical Organizations.

The eighth annual banquet of the Municipal Engineers of the City New York was held at the Hotel Savoy on January 7. After refreshments had been enjoyed, a number of toasts were responded to. Hon. J. P. Mitchell, president of the Board of Aldermen, made a number of remarks concerning New York's engineering staff and then discussed the subway extension problem, which the city is now facing. Other speakers representing the city government were Borough Presidents McAneny and Miller. Mr. Charles Warren Hunt, secretary of the American Society of Civil Engineers, described the essentials of success in engineering as knowledge, industry and tact; these three; but the greatest of these is tact. He qualified knowledge as technical knowledge, but in a broader sense than it could be acquired in technical schools. Following Mr. Hunt were speeches by Hon. Bourke Cochran, Mr. John J. Murphy and Mr. Louis K. Rourke. At a regular meeting of the society held on January 25, Mr. Henry W. Vogel was elected president and Mr. Clarence D. Pollock, secretary.

The following officers have been elected by the Brooklyn Engineers Club: President, Winfred H. Roberts; vice-president, John M. Steinmetz; secretary, Joseph Strachan; treasurer, William T. Donnelly.

The first annual convention of the Oklahoma Municipal League was held in the city council chamber, Oklahoma City, January 4-6. The following were among the addresses made: "Essentials of a State League of Municipalities,' Frank G. Pierce, Marshalltown, Iowa, secretary of the Iowa League of Municipalities; "Benefits That Should Result From a State Municipal League," Grant Foreman, Muskogee; "Importance of Municipal Accounting Among the Cities of the State," Prof. James H. Sawtell, chair of municipal science, State University, at Norman; "The State, the City and the Riparian Owner—The Sanitary Inter-Relation," Alexander Potter of New York, consulting engineeer for Muskogee and Oklahoma City; "State Laws Governing Public Works in Municipalities of Oklahoma," Charles L. Daugherty, State Labor Commissioner; "Municipal Illumination," A. Larney, Cleveland, Ohio; "Municipal Franchises," Robert L. Williams, associate justice of the supreme court; "Legal Status of the Commission Form of Government Under the Constitution and Statutes of Oklahoma," W. A. Ledbetter, Oklahoma City; "Control of Public Utilities," James E. Ellison, chief engineer Public Service Commission, St. Louis; "Modern Fire Protection," J. Ed Shautz, Dallas, Tex.; "How to Reduce Insurance Rates," C. T. Ingalls, Oklahoma City.

The Engineers' Club of Toronto has elected the following officers: President, C. M. Canniff; first vice president, Willis Chipman; second vice president, A. J. Van Nostrand; treasurer, L. J. Street; secretary, R. B. Wolsey.

The Louisiana Engineering Society has elected the following officers for the year: James C. Haugh, president; A. M. Lockett, vice president; L. C. Datz, secretary; James M. Roberts, treasurer, and Douglas C. Anderson, A. M. Shaw and A. M. Lockett, members of the board.

The American Society of Agricultural Engineers held an annual convention at Purdue University, Lafayette, Ind., on December 28. The questions of farm irrigation, drainage and sanitation occupied the major portion of the program. The following officers were elected: C. A. Ocock, Madison, Wis., president; W. F. McGregor, Racine, Wis., first vice president; J. B. Bartholomew, Peoria, Ill., second vice president; J. B. Davidson, Ames, Ia., secretary; E. A. White, Urbana, Ill., treasurer; councilman, Howard W. Riley, Ithaca, N. Y. Nominating committee for 1911—M. L. King, Ames, Ia., H. J. Podlesak, Moline, Ill.; John Evans, Guelph, Ontario. Research committee, chairman, C. I. Gunness, of Fargo, N. D.

The Engineers' Club of St. Louis has elected the following officers for the ensuing year: President, J. D. Von Muir; vice president, A. S. Langsdorf; secretary, W. W. Horner; treasurer, William E. Rolfe; directors, William E. Zelle and Oliver W. Childs; board of managers of the association of engineering societies, John Hunter, Ernest L. Ohle and W. S. Henry.

At the annual meeting of the New England Water Works Association, held in Boston January 11, 1911, the following officers were elected: President, Allen Hazen; vice presidents, J. Waldo Smith, Leonard Metcalf, M. F. Collins, F. A. McInnes, Irving S. Wood, Morris Knowles; secretary, Willard Kent; treasurer, Lewis M. Bancroft; editor, Richard K. Hale; advertising agent, Robert J. Thomas; additional members of the executive committee, William E. Mayberry, E. A. Fisher, John J. Kirkpatrick; finance committee, George H. Finnerman, Albert L. Sawyer, John H. Walsh.

Calendar of Technical Meetings.

Nebraska Cement Association, Western Cement Exposition, Omaha, Neb. Peter Palmer, Secy., Oakland, Neb. February 1-3.

National Brick Manufacturers' Association. Annual convention, Louisville, Ky. T. A. Randall, Secy., Indianapolis, Ind. February 6-11.

Indiana Sanitary & Water Supply Association, Claypool Hotel, Indianapolis, Ind. F. C. Jordan, Secy., 113 Monument Place, Indianapolis, Ind. February 9-10.

New England Gas Association. Annual convention, Boston, Mass. W. H. Snow, Pres., Holyoke, Mass; N. W. Gifford, Secy-Treas., East Boston, Mass. February 15.

Iowa Engineering Society. Annual Meeting, Iowa City, Ia. S. M. Woodward, Secy., Iowa City. February 15-17.

Cement Products Exhibition Co., Fourth Annual Chicago Cement Show. J. U. C. McDaniel, Secy.-Treas., 108 La Salle street, Chicago, Ill. February 16- (8 p. m.) -23.

Northwestern Cement Products Association. Annual Meeting, West Hotel, Minneapolis, Minn. Harvey B. Smith, 834 Security Bank, Building, St. Paul, Minn. February 28-March 1.

Canadian Cement and Concrete Association. Annual convention, Toronto, Ont. Wm. Snaith, Secy., 57 Adelaide street, East Toronto, Ont. March 6-11.

American Railway Engineering and Maintenance of Way Association. Annual convention, Chicago, Ill. E. H. Fritch, Secy., 962 Monadnock Block, Chicago, Ill. March 21-23.

American Water Works Association. Annaul convention, Rochester, N. Y. J. M. Diven, Secy., 14 George street, Charleston, S. C. June 6-10.

Personal Notes.

Harold Doolittle has been appointed city engineer of North Yakima, Wash.

S. T. Maupin has been appointed superintendent of the water works of Knoxville, Tenn.

L. J. Klug has been put in charge of the department of bridges of the city of Milwaukee, Wis.

M. L. Worrell, at present in charge of the department of public works of Rome, Ga., has been appointed superintendent of the water works of Meridian, Miss.

Mr. Paul D. Sargent has recently resigned as state highway commissioner of Maine to accept the position of assistant director in the United States office of public roads.

J. M. Hancock, mayor of Niagara Falls, N. Y., 1902-4, will be in charge of an industrial bureau to be established by the Cliff Electrical Distributing Company, January 1, for the purpose of locating manufacturing industries at Niagara Falls.

F. W. W. Doane, C. E., city engineer of Halifax, Nova Scotia, in the presidenttial address delivered before the Nova Scotia Institute of Science, gave a very interesting discussion on technical education. This address has recently been published.

Mr. Henry B. Drowne, Assoc. M. Am. Soc. C. E., has resigned as assistant engineer to the state board of public roads of Rhode Island to accept the position of assistant engineer with Arthur H. Blanchard, consulting highway engineer, Providence.

The architectural firm of Vonnegut and Bohn, of Indianapolis, Ind., announces that Mr. Kurt Vonnegut, son of the late Bernard Vonnegut, and Mr. Otto N. Mueller, formerly chief engineer of the Noelke-Richards Iron Works, have become members of the firm.

The firm of D. C. & Wm. B. Jackson, of Boston, Mass., has been retained by the government of Great Britain to advise the postmaster general in regard to the value of the National Telephone Company, which will be taken over by the government this year and made a part of the post office system.

Dr. N. Clifford Ricker, of the department of architecture of the University of Illinois, has been appointed a member of a commission of awards, to judge and report upon the relative merits of the designs and plans submitted in competition for three department buildings to be erected in Washington, D. C.

Col. Robert F. Rodman of Lafayette, R. I., who, since 1902, has filled the office of engineer to the state board of public roads of Rhode Island, has resigned. Col. Rodman has been connected with the board since its organization and has had charge of all the work done since then. Press of business has necessitated his withdrawal.

Mr. Louis C. Kelsey, M. Am. Soc. C. E.,

of Salt Lake City, Utah, and formerly city engineer of that city, has opened an office in Portland, Ore., for the practice of engineering, dealing especially with problems of water supply, water power and municipal work. Mr. Kelsey is at present engaged in the design of water works and sewerage systems for the city of Gresham, Ore.

Louis K. Rourke, formerly street superintendent of the city of Boston, Mass., has been appointed to take charge of the street, water and engineering departments which have been consolidated under one head. J. H. Sullivan, F. A. McInnes and Frederick H. Fay will have charge of the three divisions, streets, water and sewer, and bridges and ferries, respectively.

MACHINERY AND TRADE

Concrete Finishing Tools.

Two concrete finishing tools have recently been put on the market, which are designed to cheapen and improve the usual methods of finishing.

The first of these, the Ross concrete spade, is constructed to meet the requirements of the so-called "spade finish" on wall surfaces. In such work it has heretofore been customary to deposit the concrete mixture containing stone within the form and afterward to insert a common shovel or spade between the form and the concrete, pressing the latter away from the form and at the same time supplying a liquid grouting which solidifies in contact with the face of the form, leaving a smooth even surface.

The blade of the Ross spade is designed to force the stone back from the form, leaving a space which is instantly filled by the freer cement, sand and water. A number of parallel projections are placed extending longitudinally along the blade. The height of these projections is sufficient to give a suitable thickness to the smooth surface for all requirements. The long slope of the cam projections enables the implement to be inserted easily, requiring but little power to push the stones away from the form face, and it is also but little likely to disturb them in witwhdrawing the blade. The frequency of spaces between the projections permits the flow of grouting, without causing suction upon the removal of the implement. The back of the blade is smooth so as to allow its being easily moved along the form.

The second of the implements is a tamper, the purpose of which is to aid in finishing horizontal surfaces.

According to the present practice, where a concrete floor or walk is required to have a smoothly finished top surface, the main body or layer of concrete is first laid with a mixture of stone or other aggregates, sand, cement and water, in proper proportions, and when this foundation layer has partially or wholly set, spreading thereon a surface coating or layer of sand, cement and water, richer in cement than the main body, which finished coating is smoothed off to give the required finish to the top or exposed surface. This procedure involves excessive cost, because of the larger percentage of cement required in the surface or finish coating, as compared with what is needed for strength and body alone in the first layer, and also because of the additional labor involved in making two batches of mixture and separately laying same.

The Andrews concrete tamper has a surface of eight inches, divided on its face with pyramidal projections. These projections are connected at their bases in such a way as to prevent particles becoming wedged between them. For use, after the layer of concrete has been spread and roughly leveled with the customary straight edge, the workman proceeds to tamp, with the result that the freer sand, cement and water come to the surface, leaving the latter in such a condition that it may be easily be finished without the addition of the grout mixture.

Both of these advanced concrete tools are manufactured by the Harold L. Bond Company, 383-391 Atlantic avenue, Boston, Mass.

Open Specifications.

The American Asphaltum and Rubber Co., 600 Harvester building, Chicago, Ill., have printed in a booklet with the title "Open Specifications" what they recommend for waterproof macadam roadways, asphaltic concrete pavement, brick and block pavement filler, sheet asphalt pavement, asphalt mastic floors, coating steel pipe, and waterproofing reservoirs. This document was ready for circulation at the time of the meeting in New York of the Organization of City Officials for the Standardization of Paving Specifications. It refers mainly to the Pioneer brands of asphalt, paint, etc., but very properly recommends that specifications for such other materials as have proved their value be included for competitive purposes.

Fortunately nearly all of the specifications adopted by the above named organization were made sufficiently open to admit all these good materials, including the brands made by this company and, with but one or two exceptions the specifications open the field to the competition of all materials which have proved their value. One of these restrictions as to ductility of asphalt was unintentional and will doubtless be corrected in the specifications as printed. The specifications in the booklet omit all reference to ductility, as good results have been obtained from asphalts without reference to their possession of this quality in large or small degree.

Water Tight Sewer Joints.

The following is an extract from a letter written by W. C. Van Duyne, chief engineer of the East Orange and Ampere Land Company, which is improving the land formerly owned by the water company of Orange, N. J. It gives a bit of experience which will be interesting to many of our readers.

The system we are building at present comprises about 15,000 feet of 8 and 10-inch sanitary sewers. In making the calculations we allow for an infiltration of 33 per cent. Sulphur joints were used exclusively, and we took all precautions possible, even to coating the finished joint with cement.

The property here is that formerly owned by the Orange Water Co., and is that from which East Orange used to pump their entire water supply. Naturally the ground is very water soaked, the water table rising to within two feet of the surface in many points. Our storm sewers are as yet not completed to the point where they will reduce the water table to an appreciable amount.

About a month ago I saw I was going to have an infiltration of over 33 per cent. on the whole system. Some of our sewers were placed within six inches of quicksand. Within the last two weeks we have laid two stretches of 8-inch pipe using G-K Compound in the joints. One in a 12-foot trench and the other in a 2-foot trench. The pipe line in the 2-foot trench has been standing for a week and a half now with about one foot of water over the top of the trench. The late rains converted that section into a pond, and I have not had the water drawn off, since I wished to see what effect it would have on the sewer. As yet I have detected no infiltration. The section in the 12-foot trench is giving equally good results.

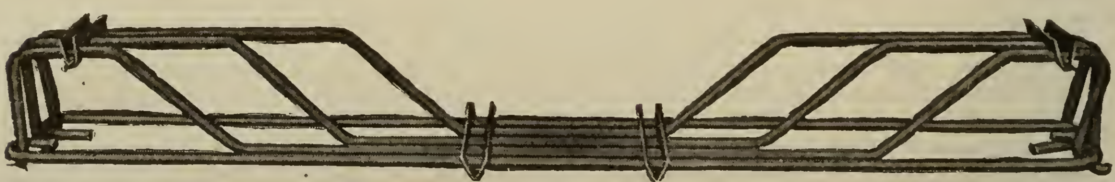
We are taking care to have the G-K compound very hot, probably 500-600 deg. F. before pouring it, as was suggested by Mr. Gillespie. We find that the joints are made more readily and that any moisture which may be in the pipe is driven out and a perfect bond made. The joints are made with much more ease than the sulphur joints are made.

Gurley's Manual.

The most recent edition, the forty-fifth, of Gurley's Manual is a compact little book of about five hundred pages. In its general features it is far superior to the previous editions. It is printed on a heavy gloss finish paper which is particularly adapted to the photographs and drawings which occupy a large proportion of the book. The illustrations of the various surveying instruments shown, are in colors so as to show the different finishes, and details of design.

Full detailed descriptions with drawings of the various instrument parts are given, together with directions for their use, adjustment and care.

The Manual is published by W. & L. E. Gurley, Troy, N. Y.



THE LUTEN TRUSS.

The Luten Truss.

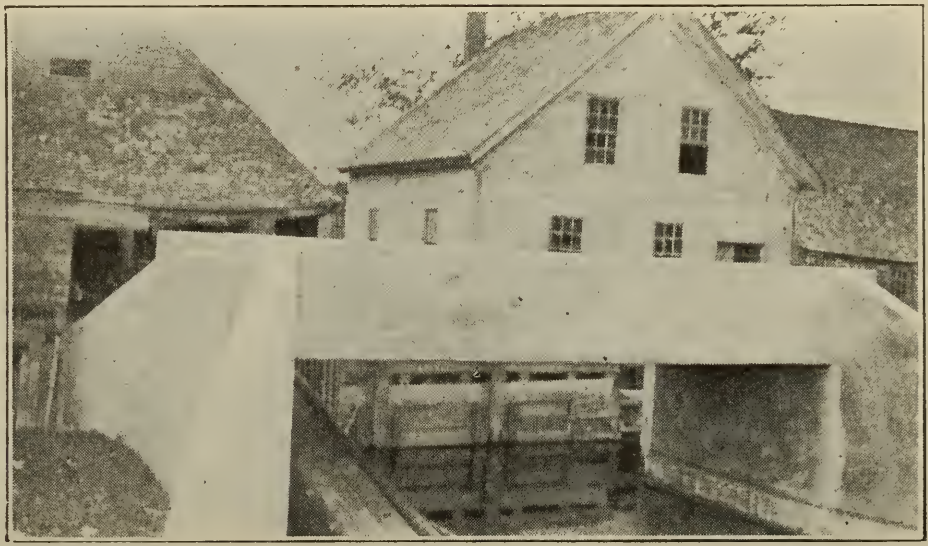
The demand of engineers for a system of reinforcement for short span concrete bridges that will have the advantage of I-beam construction with low cost, has developed a number of unit trusses, among which the Luten truss has been conspicuously successful.

This truss as is shown in the accompanying drawing is a complete unit of reinforcement. It is shipped from the factory in exactly the form as shown. This feature does away with the danger which results from the ignorant or careless placing of the reinforcement. To one familiar with the principles involved in the computing of stresses in reinforcement and the value of accurate observance of the features of design, the value of this feature of the Luten truss will be at once apparent.

The reinforcement consists of a number of steel rods or bars to be embedded near the lower edge of the beam with alternate members bent diagonally upwards across the beam to continue along the upper surface to its ends. The points at which the curved members are bent across the beam are displaced with respect to one another so as to provide diagonal reinforcement through the regions of diagonal tension and of shear in both ends of the beam. By varying the number of bars composing the truss from three to nine or more, any desired degree of reinforcement may be given to the tension regions or shearing regions of the beam, thus reinforcing efficiently beams that are comparatively deep, as well as beams or floors that are shallow. All members are curved at their ends to form a secure anchorage. The bars are rigidly locked together to form the truss by a clamp with a wedge that is self-locking when driven home. This clamp makes of the truss a unit reinforcement that can be transported and placed with no possibility of the bars losing their proper relative positions.

The truss has been extensively used in the Central States for highway bridges of spans from 5 feet to 24 feet in the clear. It has also been used by electric railways and some steam lines.

The photograph shows a new bridge on the new Portland Gray & Lewiston electric railway in Maine. The National Concrete Company of Indianapolis, Ind., are the manufacturers of this truss, and will furnish further information upon application.



INTERURBAN BRIDGE
Portland, Gray & Lewiston R. R., Maine.

A Power Tamping Machine.

A machine which has proved its worth by several years' practical service is the Staley power tamping machine, manufactured by R. U. Staley, Springfield, Ill. A number of minor modifications have been made in the machine, but it remains essentially the same as the original.

The machine consists of two principal parts, a two wheeled truck built of steel, properly braced and with the necessary handles conveniently placed for the operator; on the truck axle is placed the pivot bearing on which is mounted the sweep. The sweep is made up of two 3-inch steel channels mounted on a saddle. Near the center the saddle is supported on the pivot, bearing on truck axle; the rear end of sweep has a sliding bearing on and is yoked to a cross member of the truck. Near the rear end of the sweep are placed the air-cooled gasoline engine, battery box and gasoline tank. At the front end of the sweep is placed the lifting mechanism, which consists of two lifting rolls, mounted on shafts, running in bearings bolted to the steel channels; the lifting rolls are geared together by gears of equal size and are driven by a pulley, shaft and pinion, gearing into one of the larger gears. The tamp is a cast-iron head and a hardwood lifting board; the lifting board slides in steel guides riveted and braced to the steel channels. The fall of the tamp is by gravity; the length of the stroke, also the time of the rise and release of the tamp, is automatically regulated by cutting away a part of the circumference of the lifting rolls, the tamp making one stroke to each revolution of the lifting rolls. The bearings of the lifting rolls are tied together by steel rods, which take the strain; the front roll is pressed against the lifting board by coil springs on the tie rods. The upward movement of the lifting board is limited by reducing the thickness of the board at the lower end, which prevents the rolls lifting it above a fixed point; the fall of the tamp is stopped by releasing a pair of cams or dogs, which grip the board and prevent it falling, but allow the lifting rolls to run it to the upper position where it remains until released by the operator through a small lever placed near his right hand.

The machine has "made good" in all sorts of trench work. Its value and economy may be judged from the following facts:

At 60 blows per minute, and an 8-hour day, the machine delivers 28,800 blows. Subtract 3,800 for lost time, leaving 25,000 delivered on the work. With a tamping head of one-half square foot in area, this is 12,500 square feet per day. On a trench 3 feet wide and 5 feet deep, tamped up in 8-inch layers, this would mean about 700 linear feet of trench per day.

Pile Driving by Steam or Compressed Air.

The Union Iron Works, of Hoboken, N. J., is manufacturing a very efficient type of pile driver known as the Arnott patent. The superiority of the steam or air hammer over the old-style drop hammer is generally recognized. Although it gives a lighter blow, the steam hammer follows up its blows so rapidly that the pile and the ground have no time to settle back into their normal static condition before the next blow. This well-known fact is the root of the reason for the superior effectiveness of the steam hammer, while the fact that the light blow does not split the pile head gives it additional advantage.

The Arnott patent herein described has been designed to place in the hands of engineers and contractors a simple and powerful means for driving piles of all kinds. The principle of operation is the alternate rapidly raising and driving down of a ram of considerable weight by compressed air or steam.

The hammer is a plain cast-iron body, with a cylinder and valve chest in its upper portion, enclosing the ram and valve rod below. The opening is formed at the bottom, with jaws to fit over the top of the wood or steel piling, or with a removable base for round piling. The jaws permit the insertion of pile caps for all makes of steel piling.

The operation of the hammer is as follows:

On opening the inlet valve or throttle, steam or compressed air is admitted to the lower end of the cylinder, raising the ram to the top of its stroke; the valve is actuated by a rod, and steam or air is turned into the upper end of the cylinder, and the lower end open to exhaust, the free fall of the ram being thus accelerated by the steam or air pressure on the back of the piston; the force of the blow is therefore correspondingly increased. On the down stroke, when the ram strikes the pile, the valve is reversed by the rod, and the ram raised as before, and so on in rapid succession. The whole construction of the hammer is solid, simple and self-contained throughout.

Immersion Process for Preserving Wood.

The Cincinnati Wood Preserving Company, a corporation of Cincinnati, O., is operating a wood preserving plant in that city, using Indian timberasphalt as the preserving medium. They use the immersion process and claim to obtain results on all structural timbers very nearly equivalent to those secured in the pressure process.

The plant is designed for the purpose of treating railway ties, flooring, bridge and mine timbers, fence posts, cross-arms, paving blocks, shingles, etc., their capacity being about 12,000 ties, or 36,000 b. m. ft. of lumber per month.

The success of their process is largely in the substitution of the element of time, so valuable to the output of expensive pressure plants, for pressure. Their treatment consists of heating the timber in the timberasphalt above the boiling point of water for 12 hours, in this way expelling the moisture and sap content and expanding the air which is always present in the cellular spaces of the wood. The preservative is then allowed to cool over night, the final temperature being considerably lower than the initial high temperature of the boiling process. As the oil cools the air content and the cellular structure of the timber contract, a vacuum is formed in the cells and atmospheric pressure forces the oil into the wood.

Heretofore this immersion process has not largely been used because the preserving medium was generally the expensive creosote, a large percentage of which evaporated into the air when exposed to atmospheric conditions. Timberasphalt does not evaporate, is much cheaper than creosote. Hence, timbers may be successfully treated by this process at low expense with the first cost of plant erection reduced to a minimum.

Cement Composite Pipe.

The demand for a pipe which will withstand electrolytic and chemical action has led to the manufacture of a cement composite pipe which, by slight modifications, may be adapted to a number of uses. The Composite Pipe Company, of Mansfield, Mass., is manufacturing a number of types of this sort of pipe.

One of these types, the composite hydraulic pipe, is made in the ordinary bell and spigot form. This pipe is machine-made of a mortar of one part of sand to one part Portland cement, thoroughly compacted. The outer shell of this pipe is of metal, inside of which is a layer of cement, then another metal shell and an inner lining of cement. This lining is made of glasslike smoothness, so as to offer a low friction resistance, while its character assures against corrosion and rust. The shell is welded at the ends to cast steel pieces, which form the joints and allow the pipe to be calked like the ordinary cast iron. The cost of this pipe is but little in excess of cast iron, and it will stand an hydraulic pressure of 300 pounds per square inch. The pipes are made in 12-foot lengths and may be shipped the same as the cast iron.

In addition to this type a number of different kinds of pipe are made by this company, and a number of patented non-electrolysis joints are provided.

Some data have been taken regarding the length of life of cement pipe, and cases are recorded in which it has been in the ground for over sixty years. This 263 Summer st., Boston, Mass. was the old style pipe made from Rosendale cement, plastered by hand. By the new process, involving the more perfect compacting of the Portland cement now used, the life of the composite pipe should prove much longer.

History of the Quenner Dry Crusher.

In the northwestern part of Mexico, in the district of Altas, State of Sonora, is a belt of auriferous cement placer ground, containing hundreds of millions of dollars of gold. For centuries this gold has been taken out by the Mexicans and Indians in very small quantities by hand work. The native method employed was to take ordinary flails, mortars or pestles, grind up a small part of the cement, use the ordinary "batea," or dry pan, and take out gold equivalent to perhaps a very low day's wage.

One of our greatest railroad men in the southwest, learning of these rich cement, gold-bearing areas, secured the capital, organized a company, built a large stamp mill, a pipe line sixteen miles in length, pumping plants—in fact, a splendid mining plant, all designed by experts, to take out in enormous quantities this gold.

The plant being completed, they started their initial work, ran several months, and never took out a spoonful of gold.

An old blacksmith, 70 years old, Mitt Quenner by name, saw the failure—in fact, was associated in a sense with it—and when this placer ground was finally given up and abandoned by the big mining company, he quietly set to work and built with his own hands a little revolving cage or screen, about 5 feet long and 42 inches in diameter, which might be compared to a long barrel with iron staves placed about ⅛ inch apart. Through the length of this barrel ran a shaft. The barrel itself rested on trommel wheels. A gasoline engine furnished the motive power. Ordinary steel crowbars were cut up to forge out the steel striking pins or hammers; an old log chain furnished the links which were attached to the hammers, and then clamped onto the shaft spirally, all this work being done by the old blacksmith himself, with his own hands. Finally, this crude machine was started, the forerunner of the Quenner machine of to-day. The first day's run he took out in pure gold $500. The succeeding nine months he took out $180,000 in nuggets, and then the fame of the Quenner machine began to spread.

About ten months ago R. P. Probasco casually met Mr. George D. Stonestreet, an eminent mining enineer of New York City, at the railroad station of Santa Ana, on the line of the new Southern Pacific Railroad, in western Mexico, and was invited to accompany him to see the new and wonderful Quenner machine. Riding fifty-five miles by stage, they came to Baludo, where the original Quenner machine had been in daily, constant operation during the previous nine months, with unvarying success and great profit to its inventor and owner. They watched its perfect action with intense interest. They noted the perfect character of the work it was doing, and contrasted it with the absolute failure of the million-dollar modern stamp mill, standing, silent and deserted, but a few rods away. The contrast was a painful one, from a certain standpoint, showing the slow progress by which humanity works out its evolution of mechanical processes. They further noted the enormous deposits of stone, crushed to perfect sizes, a mountain of rubble, which would have been worth a large sum if it could have been utilized anywhere for ballast or concrete work, and the idea at once occurred to Mr. Stonestreet of the immense value of this machine for crushing stone.

With the initiative and executive energy, for which he is noted, Captain Stonestreet immediately returned to New York, enlisted capital, returned to Mexico and secured the control of the Quenner machine and patents for the world. Tests were soon thereafter made by prominent railroad officials at Nogales, Ariz., in which surprising facts were developed concerning the capacity of this machine for crushing refractory materials at low cost. Succeeding tests were made of the Quenner machine at Los Angeles.

The "Quenner" will be applied to effect great economies in all crushing operations. It should save many tens of millions of dollars annually in the crushing of over 500,000,000 tons of refractory materials in the United States alone. As to its world-wide application, that will surely come in due time.

Good roads mean everything to a country. The roads of continental Europe are marvelous. We lose fifties and even hundreds of millions annually in the United States by reason of poor roads, and the Quenner machine will aid in solving the problem of good roads making, not only by reason of its crushing rock cheaply, but by reason of its portability and adaptability to all local conditions wherever used. Thus poor roads can be rebuilt and made over into good roads, the cost of which would otherwise be prohibitive for the local communities.

The Quenner machine, weighing only four tons, does the work of the average 48-ton standard type crusher. An ordinary truck will haul it. It can be taken along a country road on ordinary trucks. It can be hauled into a quarry. It has the most numerous and adaptable uses, as well as reducing costs.

The Quenner machine now has its headquarters in the Singer building, New York City.

Trade Publications.

The January publication of the Lehigh Portland Cement Co. contains a complete description of the King's Creek Power Station at King's Creek, South Carolina, with photographs of various details of the work.

The Studebaker Co., of South Bend, have issued a very attractive illustrated booklet showing various details of their factory and a number of their saleshouses in various cities.

An unusually artistic booklet is offered by the Union Clay Products Co. of New York. This booklet describes the advantages of the G-K sewer joint compound. A table of quantities of compound per joint should prove of value.

The Weber Chimney Company, Republic Bldg., Chicago, have a valuable booklet on reinforced concrete chimney construction. Illustrations and drawings are given very freely.

Farmers Bulletin 321 of the U. S. Department of Agriculture is devoted to the use of the split log drag on earth roads. The paper is by D. Ward King, of the office of public roads.

Winnipeg Illustrated is the title of a well conceived and executed publication of views and data relative to the city of Winnipeg. Care is shown in the character of the matter used, to give an idea of the industrial as well as the ornamental features of the city.

The annual report of the Massachusetts State Board of Trade contains a number of committee reports and discussions which should prove of value.

The Economy Drawing Table Co., Chamber of Commerce Building, Chicago, have published a book of photographs and descriptive matter on Wisconsin granites. Specifications for granite curbs and pavements are also included in the publication.

"Reactions," the quarterly publication of the Goldschmidt Thermit Co., 90 West street, New York City, contains, among other subjects of interest, a number of photographs with descriptive matter relative to rail welding in various cities.

The Vulcanite Portland Cement Co. have two booklets which are up to the usual standard of excellence of the publications of that company. The first of these, entitled Concrete in the Country, is descriptive of the numerous uses of cement on the farm. The second is Concrete Surface Finishes, by Albert Moyer. Both publications are fully illustrated, the latter named having color plates which bring out the effects of the different color finishes.

Reinforced concrete fence posts are described in an illustrated pamphlet by The Everlasting Fence Post Co. of Bloomington, Ill.

The Trussed Concrete Steel Co. of Detroit, Mich., have a new illustrated catalogue of their United Steel Sash. The standard types of United Steel Sash are shown, as well as complete tables of dimensions and full-sized details at the lintels, sills and jambs.

The Pittsburg Steel Products Co. have some very valuable matter for distribution. This matter includes the design of a typical concrete warehouse of three floors, giving the computations necessary; descriptions and specifications of Pittsburg standardized reinforcement, and a complete set of specifications for reinforced concrete construction.

The Aberthaw Construction Co., of Boston, Mass., have an illustrated publication concerning the design and construction of a concrete warehouse for the Massachusetts Cotton Mills at Lowell, Mass.

Among the features of interest in the monthly publication of the Universal Portland Cement Co. is a short article on the use of concrete in the Chicago city parks. "The Interlocking Tube System of Construction," and "A Reinforced Concrete Building Under Fire," are among other illustrated articles given.

The Troy Wagon Works Co. of Troy, O., has three very attractive pamphlets. The first of these is descriptive of the Troy dump wagons for municipal uses; a photograph illustrates the points of the description. The second is devoted to specifications and illustrations of the Troy dump wagons. The third deals iwth the Troy dump boxes.

The Barber Asphalt Paving Co. has a series of photographic postals dealing with roads constructed with Bermudez asphalt.

"Yourself as a Public Servant" is a leaflet written by Arthur S. Huey and issued by H. M. Byllesby & Co., engineers and managers of public utilities.

"Designing Data II" by the North-Western Expanded Metal Co., of Chicago, will be found of value in the design of all engineering structures excepting buildings. The latter will be found in "Designing Data I" by the above mentioned company.

"Motor Fire Apparatus" is the title of a fifty page illustrated book of the Webb Motor Fire Apparatus Co., of St. Louis, Mo. About ten different types of motor apparatus are described and illustrated.

The Meriwether system of continuous reinforced pipe is fully covered in an illustrated catalogue issued by the Lock Joint Pipe Co., of 165 Broadway, N. Y.

Examples of the use of and points of value in Texaco Paving Cement are given in an illustrated booklet by the Texas Company of Houston, Tex.

Trade Notes.

CEMENT.

Chicago, Ill.—After a severe test, McCormick Waterproof, manufactured by the McCormick Portland Cement Co., St. Louis, has been specified for use in waterproofing over 40,000 barrels of cement to be used in the La Salle street, Chicago, Illinois, subway, 60 feet below the Chicago river; pressure test, 400 pounds per sq. in. without leakage or evidence of penetration after test pieces were broken.

Sandusky, O.—The Medusa Concrete Waterproofing Co. has announced its intention to prosecute all infringers of their patents on dry powder waterproofing compounds, the purposes of which are to render concrete impervious to water. These patents are to S. B. Newberry, issued April 23, 1907, and to H. N. Newberry, issued September 15, 1908.

PURCHASE OF MATERIALS.

Washington, D. C.—The Bureau of Manufactures received a letter from Cuba, requesting correspondence from manufacturers of garbage disposal plants and machinery.

Southbury, (Newton P. O.) Conn.—The town is contemplating the purchase of a road machine.

Washington, D. C.—The Bureau of Manufactures wishes catalogues, prices, etc., on steam rollers and road machinery for use in Spain.

Butte, Mont.—The city is contemplating the purchase of a rock crusher.

Taylor, Tex.—The city is considering the purchase of a road roller for use in paving improvements.

MACHINERY AND SUPPLIES.

Sacramento, Cal.—Special—Clark & Henry Construction Co., 512-516 Ochsner Bldg. are in the market for machinery for unloading rock from cars.

Garrett, Ind.—Special—J. O. Landes, 317 Randolph st. desires to purchase an excavator.

Lyons, Ind.—Special—Fred Carpenter is in the market for a trench ditcher and road tools.

Boston, Mass.—Special—Bids are requested for furnishing 25 h. p. hoisting engine and a Haywood ½ yd. bucket. Peter F. Connolly Co., 70 Perkins st., Jamaica Plains, Boston, Mass.

Canton, O.—Bids will be received for two steam road rollers. Phil H. Weber, cy. civil engr.

New Philadelphia, O.—Bids are requested for cement mixer and road roller by H. P. Knisley.

Youngstown, O.—Special—W. E. Gartland, 414 Ford ave. desires to purchase a ditch digger and sewer machinery.

Salem, Ore.—Special—D. M. Stevenson, Box 52, is in the market for electric rock drills.

Ingram, Wis.—Special—Seward J. Wilbert desires to purchase an air cooled gasoline engine.

South Milwaukee, Wis.—Special—Bids are requested for a drag line excavator by J. H. Whalen.

Millville, Sask., Can.—Special—A. B. A. Cunningham is in the market for cement mixers.

MISCELLANEOUS.

Chicago, Ill.—Bates & Rogers Construction Co., civil engineers and contractors, announce the removal of their Chicago offices, on January 21, 1911, from the Ellsworth building to No. 885 Old Colony building, No. 84 Van Buren street, Chicago. Bates & Rogers Construction Co. are equipped with organization and plant to undertake all classes of construction, including stone masonry, reinforced or massive concrete work, dams, retaining walls, bridges, arches, culverts, foundations, irrigation and hydro-electric power developments, massive building work, pile and timber work, and all classes of railroad construction.

New York.—The Michel-Kurze Co., with offices in the Hudson Terminal buildings, New York, has been organized to do photo retouching and illustrating work of machinery subjects. The business will be managed by A. Eugene Michel, Assoc. Mem. Am. Soc. M. E. and the staff of artists will be in charge of Wm. F. Kurze, who was art director of the Scientific Engraving Co. during the past four years. The extensive engineering and advertising experience of both members qualifies this firm to deliver high grade work to manufacturers of machine tools, steam and electric power plant apparatus and other engineering products.

Walla Walla, Wash.—Gilbert Hunt Co., Walla Walla, has been awarded by its home city a contract for 6,000 feet of 20-inch riveted steel pipe; the price was 97½ cents per foot. This company is unusually well equipped to make a specialty of riveted pipe work.

Patents on Concrete Articles.

859,418. Cement Closet Tank. Joseph A. Washick, Chicago, Ill.

864,022. Facing for Embankments, Dams and the Like. Robert R. L. de Muralt, Zierikzee, Netherlands.

874,922. Vault Light Construction. Julius Baker, Allegheny, Pa.

882,538. Plastic (cement receptacles). Allston Sargent, New York, N. Y.

885,281. Land-Marking Monument (concrete). Robert L. Packard, Tuckahoe, N. Y.

890,968. Process of Treating and Dressing a Bruise or Wound in the Trunk or Branch of a Live Tree (cement). John, Martin L., and James A. Davy, Kent, O.

891,998. Concrete Manifold System. Gerald W. Knight, Pittsburg, Pa.

900,980. Casket Protector. Eugene J. Callahan and Daniel G. Fisher, Reading, Pa.

906,195. Stay or Support with Steps for Producing Concrete Ceilings. Christian Buerker, Josef and Jean Klee, Cologne, Germany.

906,493. Mold Panel. Deith O. Guthrie, New York, N. Y.

915,698. Means for Making Cement Head Gates. Thos. Putz, Porterville, Cal.

918,241. Apparatus for Forming Headstone from Plastic Material. Christopher C. Wingo, Baltimore, Md.

922,651. Apparatus for Forming Cement Boxes. Thos. H. Williams, Utica, Ill.

924,549. Concrete Plant-Protector. Jas. H. Haley, Munith, Mich.

924,704. Machine for Polishing Stone and Concrete Floors. Frank O. Street and L. J. Larson, Minneapolis, Minn.

925,948. Concrete Hog Trough and Valve. Jeremy Robertson, Shelby, Ia.

925,964. Concrete Car. Joseph B. Strauss, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Birmingham, Ala.—Contemplating the laying of 24,700 sq. yds. of asphalt and 1,800 sq. yds. of macadam paving.

Phoenix, Ariz.—Contemplating the laying of 5 miles of bitulithic and 5 miles of oiled macadam pavement. O. A. Turney, cy. engr.

Los Angeles, Cal.—The grading, paving and constructing concrete culverts on the valley road from Whittier to Forthill blvd. in Lamanda Park is contemplated.

Modesto, Cal.—Paving of various streets is contemplated.

Redondo Beach, Cal.—The paving of Hermosa, North Pacific, North and South Guadalupe aves. is contemplated.

Santa Ana, Cal.—The construction of 127 miles of roads is contemplated.

Upland, Cal.—Bids will soon be asked for paving 10th st.

Hartford, Conn.—The paving of Sheldon st. and Farmington ave. is contemplated.

Altapass, Ga.—The construction of a macadamized road from Asheville, N. C., to Altapass, Ga., is contemplated.

Freeport, Ill.—Two miles of brick paving is contemplated.

Peoria, Ill.—Paving with brick portions of Elizabeth and South sts. is contemplated. Estimated cost, $45,334.

Sterling, Ill.—Voted $40,000 bonds for paving Locust st. with brick.

Indianapolis, Ind.—The construction of a boulevard along Pleasant Run from Beecher to Shelby sts. is contemplated.

Laporte, Ind.—Contemplating the construction of a macadam road from Laporte, to the Starke county line.

Richmond, Ind.—Contemplating the paving of various streets.

South Bend, Ind.—Paving about 30,000 sq. yds. on Michigan st. is contemplated.

Corning, Ia.—Paving of the following streets is contemplated: Davis ave. from the railroad right of way to the north line of 9th st., and 8th st. from the alley between Davis ave. and Adams st. to Grove ave. in the city of Corning, Ia.

Des Moines, Ia.—Contemplating the paving of various streets with sheet asphalt and creosote blocks.

Mason City, Ia.—Plans are being prepared for concrete paving.

Topeka, Kan.—The paving of portions of 14th, Huntoon, Polk, 12th and Chandler sts. with brick, and 13th, Mulvane and King sts. with asphaltic concrete, is contemplated.

St. Joseph, Mo.—Laying asphalt coating on 6th and Atchison sts. to the viaduct, is contemplated.

Kearney, Neb.—Contemplating the construction of a road across Buffalo county.

Red Oak, Neb.—Contemplating the paving of 32 blocks.

Rochester, N. Y.—The paving of St. Paul st., is contemplated.

St. Johnsville, N. Y.—Brick paving to cost $36,000 is contemplated.

Akron, O.—Ordinances have been passed providing for the grading, curbing and paving of various streets.

Canton, O.—Ordinances have been passed authorizing the grading, curbing and paving with vitrified paving blocks, various streets.

Cleveland, O.—The paving of 33 streets estimated to cost $600,000, is contemplated.

Columbus, O.—Ordinances have been passed providing for the improvement of various streets.

Dayton, O.—The paving of Britt st. and Santa Clara ave., is contemplated.

Hood River, Ore.—Contemplating the construction of macadam paving, curb and sidewalks to cost $10,000.

Silverton, Ore.—The county court has issued an order for the construction of the Silverton-Marquam macadam road.

Blairsville, Pa.—An ordinance was passed to grade Liberty st. north of Campbell st., to North alley.

Danville, Pa.—An ordinance has been passed providing for the grading, paving with vitrified paving bricks and curbing with stone, various streets.

Sharpsville, Pa.—Contemplating paving about 25,000 sq. yds. with brick, during the present year.

Wilkesbarre, Pa.—An ordinance has been passed authorizing the grading, curbing and paving of Park ave.

Centralia, Wash.—The paving of 10 blocks is contemplated.

North Yakima, Wash.—Asphalt paving amounting to about $400,000 is contemplated.

Puyallup, Wash. — Paving various streets is contemplated.

Seattle, Wash.—Paving and laying sidewalks on various streets is contemplated.

CONTRACTS TO BE LET.

Mobile, Ala.—Bids will be received until Feb. 16 for constructing cement street paving, approximating 11,400 sq. yds., 8,400 lin. ft. curb, 1,000 lin. ft. of vitrified sewer pipe, etc. Board of public works.

Palatka, Fla.—Bids will be received until Feb. 7, 7:30 p. m., for constructing 16,500 sq. yds. of concrete sidewalks. Certified check, $500. City council, Palatka, Fla.

Tampa, Fla.—Bids will be received until Feb. 7, 2 p. m., for paving 1½ miles of roadway southward from six mile creek, with shell. Geo. P. Sullivan, cy. engr.

Atlanta, Ga.—Bids will be received until Feb. 6 for furnishing and setting concrete and granite curbing, laying brick, tile and sheet cement sidewalks, etc. J. P. Foster, cy. clk.

Bloomfield, Ind.—Bids will be received until Feb. 7 for macadamizing the W. W. Clogston road in Washington township. Caswell H. Jennings, audt.

Brazil, Ind.—Bids will be received until Feb. 7, 11:30, for constructing gravel road in Van Buren township. E. A. Staggs, audt.

Crawfordsville, Ind.—Bids will be received until Feb. 7, 2 p. m., for constructing a road in Union township. Bennett B. Engle, audt.

Evansville, Ind.—Bids will be received until Feb. 9 for furnishing gravel and rock, for road construction. County auditor.

Fort Wayne, Ind.—Bids will be received until Feb. 2, 10 a. m., for grading, graveling and macadamizing various highways. C. H. Brown, co. audt.

Frankfort, Ind.—Bids will be received until Feb. 11, 1 p. m., for constructing a gravel road on line between Clinton and Tippecanoe counties. Chas. F. Cromwell, audt.

Franklin, Ind.—Bids will be received until Feb. 18 for constructing a highway on the line dividing Johnson and Shelby counties. Wm. B. Jennings, audt.

Indianapolis, Ind.—Bids will be received until Feb. 3, 10 a. m., for the improvement of Sanborn st. from south curb line of New York st. to north property line of Owosso ave. Board of public works.

Logansport, Ind.—Bids will be received until Feb. 7, 10 a. m., for constructing a gravel road in Tipton township. J. E. Wallace, audt.

Mt. Vernon, Ind.—Bids will be received until Feb. 8 for constructing gravel road in Robb township. Paul Maier, audt.

Portland, Ind.—Bids will be asked until March 1, 12 m., for constructing a road on line beteewn Jay and Randolph counties. W. Lea Smith, audt.

Rushville, Ind.—Bids will be received until Feb. 7, 2 p. m., for constructing a macadam road in Ripley township. Jesse M. Stone, audt.

Tipton, Ind.—Bids will be received until Feb. 6, 10 a. m., for constructing six gravel roads. J. H. Tranborger, audt.

Winamac, Ind.—Bids will be received until Feb. 7, 2 p. m., for constructing 3 gravel roads. W. E. Munchenburg, audt.

Manhattan, Kan.—Bids will be received until Feb. 7, for paving with brick block, wood block, concrete, asphaltic concrete or sheet asphalt pavement various streets. Certified check $1,000. C. T. Gist, clk.

Boston, Mass.—Bids will be received until Feb. 20 for constructing roads, walks and drains at Fort Andrews, Boston Harbor, Mass. Capt. A. M. Miller,

Menominee, Mich.—Bids will be received until Feb. 14, 2 p. m., for constructing a gravel road. County commissioners. Carl A. Anderson, clk.

St. Paul, Minn.—Bids will be received until Feb. 6 for constructing several roads. Geo. J. Ries, audt.

Warren, Minn.—Bids will be received until Feb. 4 for furnishing the following: 25 culverts of 3 ft. diameter; 25 culverts of 4 ft. diameter; 35 culverts of 5 ft. diameter; 15 culverts of 6 ft. diameter. Certified check 10 per cent. County auditor, Marshall Co., Warren, Minn.

Buffalo, N. Y.—Bids will be received until Feb. 6 for repaving Elk and Sycamore sts. and for paving Milton, Sanford and Krupp sts. Francis G. Ward, chairman public works.

Newburgh, N. Y.—Bids will be received until Feb. 7 for paving portions of Grand st. D. J. Coutant, cy. clk.

Cincinnati, O.—Bids will be received until Feb. 3 for constructing culverts on the Kirby road. Fred Dreihs, clk.

Cincinnati, O.—Bids will be received until Feb. 3 for constructing culverts on Kirby road, through lands of Ungruhes and Kirby, in Mill township. Fred Dreihs, clk.

Cleveland, O.—Bids will be received until Feb. 8, for grading, draining and improving Union road. Board of County Commissioners. John F. Goldenbogen, clk.

Portland, Ore.—Bids will be received until Feb. 23 for constructing pavement on Jersey st. J. W. Morris, cy. engr.

St. John, Ore.—Bids will be received until Feb. 23 for hard surface pavement on 13 blocks on Jersey st. Cy clk.

Erie, Pa.—Bids will be received until Feb. 13, 8 p. m., for paving a portion of W. 29th st. F. Hanlon, cy. clk.

Pittsburg, Pa.—Bids will be asked until Feb. 6, 3 p. m., for grading, curbing and paving Goldbach Way, from Brownsville road to Amanada ave. Certified check $200. Borough council, Brownsville Road, Pittsburg, Pa.

Waterville, Wash.—Bids will be received until Feb. 7 for constructing a macadam highway 8 miles in length. Board of supervisors.

Huntington, W. Va.—Bids will be received until Feb. 6, for grading and paving with vitrified brick, bitulithic, sheet asphalt, asphalt block or concrete asphalt. Board of commissioners.

Huntington, W. Va.—Bids will be received until Feb. 20, 1 p. m., for paving alley between Third and Fourth avenues, from Sixth to Eighth streets. John Coon, commr. of streets.

Milwaukee, Wis.—Bids are requested for sand and gravel loading device. Geo. J. Markey, 1150 Kinnickinnic ave., Milwaukee, Wis.

Vancouver, B. C.—Bids will be received until Feb. 7, for supplying road rollers, weighing not less than 16 tons. City clerk.

Winnipeg, Man., Can.—Bids will be received until March 1, for supplying about 1,500 tons of asphalt for street paving. Board of control, M. Peterson, secy.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for laying granitoid pavement on ave. B, from 18th to 20th sts., and on D ave. from 18th to 21st sts., was awarded to McCartin Construction & Contracting Co., Birmingham, Ala., $25,456.

Chico, Cal.—The contract for grading and graveling various streets was awarded to Chico Construction Co., Chico, Cal., for $32,000.

Corona, Cal.—The contract for paving Rimpan st. was awarded to Enos Bruckman & Kroonen, San Diego, Ca., for $20,283.

Coronado, Cal.—The contract for improving A, B and C aves. was awarded to H. G. Fenton, Coronado, Cal., $59,275.

Inglewood, Cal.—The contract for improving Commercial st., grading, graveling, cement curbs and gutters, etc., was awarded to G. H. Oswald, Los Angeles, Cal.

Lankershim, Cal.—The contract for constructing and paving boulevard 1½ miles in length, was awarded to Barber Asphale Paving Co., Central Bldg., Los Angeles, Cal.

Los Angeles, Cal.—The following contracts were awarded: Improving Sutherland st. by grading, graveling, cement curbs and gutters, etc., to Withers & Crites, Los Angeles, Cal., $5,831; constructing Valley road from Downey to American avenues near Long Beach, to Geo. A. Rodgers, Los Angeles, Cal.; improving Hartford ave., to B. C. Nichols, Los Angeles, Cal.; the following street improvements: Blanchard and Cincinnati sts., to H. H. Curtis, Los Angeles, Cal.; Center st., to B. F. Ford, Los Angeles, Cal.; Francis and Normandie aves., to David Joy, Los Angeles, Cal.; constructing 28,000 sq. ft. of cement sidewalks and 8,000 ft. of cement curbing, to Paonessa & Taylor, Los Angeles, Cal.; paving Evergreen ave., to Frank Gillespie, Los Angeles, Cal., $13,206.

Ocean Park, Cal.—The contract for improving Waldo st., was awarded to Jos. G. Braun, Ocean Park, Cal.

San Bernardino, Cal.—The contract for improving E st., was awarded to Ernest Frenzell, San Bernardino, Cal., $10,000.

San Francisco, Cal.—The following contracts were awarded: Grading Beale st. between Folsom and Bryant sts., to Foster Vogt, San Francisco, Cal., $55,-805; substituting asphalt for basalt blocks on O'Farrell st., to City Improvement Co., San Francisco, Cal., $12,050.

Sierra Madre, Cal.—The contract for improving Windsor lane was awarded to G. H. Curtis, Los Angeles, Cal.

Stockton, Cal.—The contract for paving nine streets with macadam was awarded to O. Moreing & Sons, Stockton, Cal.

Woodland, Cal.—The contract for constructing 6,152 ft. of macadam on Ann st., was awarded to Jos. Lawrence, Woodland, Cal.

Denver, Colo.—The contract for grading streets and constructing concrete curb and gutter in East Denver, was awarded to Westcott Doan Investment Co., Denver, Colo., $45,515.

Washington, D. C.—The contract for grading Kearney st. was awarded to E. G. Gummel, Washington, D. C.

St. Petersburg, Fla.—The contract for grading and paving 2nd st. was awarded to Georgia Engineering Co., Augusta, Ga.

Carlyle, Ill.—The contract for grading the roads in the township and keeping them in repair for the ensuing year, was awarded to Sam Cox, Arcola, Ill.

Chicago, Ill.—The following contracts were awarded: Paving as follows: alley, 47th st. to 48th st., Michigan ave., and Indiana ave., to F. K. Shobe Co., 524 W. 63rd st.; alley, 37th st., 38th st., State st. and Dearborn st.; alleys between 26th st. and 28th st., Michigan ave. and Wabash ave.; alley between 42nd st., 43rd st., Evans ave. and Cottage Grove ave.; alley between 42nd st. and 43rd st., Langley ave., and Evans ave.; alleys between 41st st., 42nd Pl., Drexel blvd. and Ellis ave.; alley between 42nd Pl., 43rd st., Ellis ave. and Berkeley ave.; and alley between Bowen ave., 42nd st., Vincennes ave. and St. Lawrence ave., to John A. McGarry & Co., 1001 Security bldg.; alley between 35th st., 37th st., Grand blvd. and Vernon ave., to Parker Washington Co., 920 Chamber of Commerce bldg.; alley between 21st st., 22nd st., Prairie ave. and Indiana ave.; alley between Woodlawn ave., Lake ave. and E. 46th st., to Jno. A. McGarry & Co., 1001 Security bldg.; S. Center ave., W. 21st st. to W. 22nd st., Cullom ave., N. Clark st., to N. Ashland ave., Evans ave., 43rd st. to 47th st., to R. F. Conway, 720 Chamber of Commerce; N. 41st st., Hirsch st. to W. North ave., to Standard Paving Co., W. 50th st.; Ashland ave. and Robey st., Ready & Callahan Co., 47th st. and Halsted st.; W. 52nd st., Loomis st. to Ashland ave., to R. F. Conway Co., 720 Chamber of Commerce; N. Hamlin ave., Dickens ave. to Fullerton ave., Standard Paving Co.; Ellen st. system to Jas. A. Sackley Co., 307 Chamber of Commerce; alley between Hyde Park Blvd., Woodlawn ave. and E. 52nd st. to Jno. A. McGarry Co., 1001 Security Bldg.; N. Campbell ave., Austin ave. to Grand ave., R. F. Conway Co., 720 Chamber of Commerce; W. 53rd st., S. Ashland ave. to S. Robey st., R. F. Conway Co., 702 Chamber of Commerce.

East St. Louis, Ill.—The contract for paving various streets with brick, was awarded to Meyer & Thomas, East St. Louis, Ill., $24,540.

Glencoe, Ill.—The contract for paving with macadam 21,140 sq. yds., was awarded to John A. McGarry & Co., Security Bldg., Chicago, Ill.

Rock Island, Ill.—The contract for paving 38th st. with brick was awarded to Northwestern Construction Co., Davenport, Ia., $51,000.

Bluffton, Ind.—The following contracts were awarded: Constructing various gravel roads to Wilson A. Woodrow, Ossian, Ind, and C. W. Worth, Bluffton, Ind. Total cost, $14,999. Constructing stone and gravel roads, to W. W. Woodward, Ossian, Ind.; Williams road, to Chas. North, Bluffton, Ind.

Covington, Ind.—The contract for constructing county line gravel road, was awarded to Fred Cunningham, Bloomfield, Ind., $10,480.

Huntington, Ind.—The contract for constructing Thomas gravel road, was awarded to Hutsell & Wolfeale, Markle, Ind., $17,997.

Laporte, Ind.—The contract for constructing 14,932 ft. of macadam road in Scipio township was awarded to Jake Ackerman, Laporte, Ind., $21,350.

Michigan City, Ind.—The contract for constructing a macadam road was awarded to Jacob Ackerman, Laporte, Ind., $21,350.

Muncie, Ind.—The contract for constructing 2 miles of brick roadway in Delaware county, was awarded to William Birch, Muncie, Ind., $42,000.

South Bend, Ind.—The contract for constructing pavements on first alley south of Division st. between Main and Michigan sts. with Barr clay brick, was awarded to Hoban & Roach, South Bend, Ind.

Vincennes, Ind.—The contract for constructing J. W. Williams road was awarded to William Bobe, Vincennes, Ind., $9,-200.

Wabash, Ind.—The contract for constructing 2 macadam roads was awarded to Geo. M. Sewell, Laketon, Ind., $9,200.

Washington, Ind.—The contract for constructing 3 miles of road in Daviess county, was awarded to M. H. Wilson, Montgomery, Ind., $10,201.

Williamsport, Ind.—The contract for a gravel road construction, was awarded to W. W. Vrane, Hendrick, Ind., and to D. H. Fatout, Indianapolis, Ind.

Cedar Rapids, Ia.—The contract for constructing various asphalt roads was awarded to McCarthy Improvement Co., Davenport, Ia., $40,000.

Sioux City, Ia.—The contract for paving various streets was awarded to Flinn & Hanlon, Sioux City, Ia., $36,000.

Wichita, Kan.—The contract for paving with brick, portions of Water, 3rd, and 1st sts., was awarded to H. L. Miles, Wichita, Kan.; the contract for paving various streets with Hassam-Woodman, was awarded to Rackliffe-Gibson, Wichita, Kan.

Paducah, Ky.—The contract for constructing concrete sidewalks, granite curbing, etc., was awarded to Geo. W. Ketterjohn, Paducah, Ky., $6,775.

Baltimore, Md.—The contract for paving Patuxent st. with vitrified brick, was awarded to Martin T. Beach, Knickerbocker Bldg.

Crookston, Minn.—The contract for asphalt paving was awarded to General Contracting Co., Minneapolis, Minn.

Minneapolis, Minn.—The contract for furnishing 2,000 sq. yds. of creosoted wood blocks per day during the year 1911, was awarded to Republic Creosoting Co., Minneapolis, Minn., for $200,000.

Sedalia, Mo.—The contract for paving Prospect st. with brick block on 4 in. concrete base, cement filler, was awarded to Jas. W. & Geo. T. Menefee, Sedalia, Mo.

Springfield, Mo.—The following contracts were awarded: Paving as follows: Elm st. with brick, to J. C. Likes, Springfield, Mo., and with Hassam on Mt. Vernon and Commercial sts., to Rackliffe-Gibson Construction Co., Springfield, Mo..

Lincoln, Neb.—The contract for repaving district No. 41 was awarded to Abel & Roberts, Lincoln, Neb.

Salem, N. J.—The contract for grading, graveling and placing oyster shell surface on the Mannington, Pilegrove and Woodstown road was awarded to Tuft & Kelly, Salem, N. J., for $26,441.

Mt. Pleasant, N. Y.—The contract for improving Columbus and Commerce aves. was awarded to Molls & Murray, Yonkers, N. Y.

Wilmington, N. C.—The contract for paving 3,570 sq. yds. of street with gravel, was awarded to Bowe & Page, Charleston, S. C.

Cincinnati, O.—The contract for the improvement of Wilstach st. with granite, from Denman st. to McLean ave., was awarded to Kirchner & Co., Cincinnati, O., $16,255.

Circleville, O.—The contract for paving Court st. with vitrified brick, was awarded to Jas. L. Lynch, Flint, Mich.

Columbus, O.—The contract for resurfacing with tar the N. High st. road, was awarded to J. W. Jewett, Worthington, O., $13,000; the contract for constructing pavement on the Mound st. viaduct, was awarded to A. G. Pugh, Columbus, O., $18,000.

Hamilton, O.—The contract for paving East ave., South B. st. and North 6th st., was awarded to Andrews Asphalt Paving Co., Hamilton, O.

Jefferson, O.—The contract for macadamizing a road in Saybrook township, was awarded to Buckeye Engineering Co., Norwalk, O.

Lakewood, O.—The contract for furnishing material and constructing brick paving on Gladys and Rosewood avenues, Thoreau road and Sloane avenue was awarded to W. S. Pace, 11027 Clifton boulevard, Cleveland, O.

Worthington, O.—The contract for resurfacing North High st. road was awarded to J. W. Jewett, Worthington, $13,000.

Bartlesville, Okla.—The contract for paving E. 3rd st., including curbing, guttering, grading and laying sewers, was awarded to Kraull & Co., Bartlesville, Okla.

Oklahoma City, Okla.—The contract for paving with sheet asphalt on 5-in. concrete base, a portion of Exchange ave., was awarded to Western Paving Co., Olkahoma City, Okla.

Altoona, Pa.—The contract for paving various streets was awarded to Bell, Deckel Co., Altoona, Pa., for $300,000.

Wlikesbarre, Pa.—The contract for grading and curbing Division st., was awarded to Warren Lumber, Syracuse, N. Y.

Dallas, Tex.—The contract for paving S. Harwood st. was awarded to Texas Bitulithic Co., Dallas, Tex., $64,192.

El Paso, Tex.—The contract for paving S. Santa Fe st. was awarded to Texas Bitulithic Co., El Paso, Tex.

Martindale, Tex.—The contract for constructing 3½ miles of gravel road was awarded to Van B. Flowers, Lockhart, Tex.

Wichita Falls, Tex.—The contract for constructing 36,000 sq. yds. of wood block street paving was awarded to Creosote Wood Block Paving Co., Gulfport, Miss.

Norfolk, Va.—The contract for macadamizing a new road was awarded to E. Parke Lindsay, Norfolk, Va., $16,103.

Aberdeen, Wash.—Improvement of Hume st. and others, to Aberdeen Construction Co., Aberdeen, Wash., $6,200.

Everett, Wash.—The contract for grading district No. 237 was awarded to Atlas Construction Co., Everett, Wash., for $22,974. 4

Puyallup, Wash.—The contract for paving Rainier st. and others, was awarded to Warren Construction Co., Portland, Ore., $24,448.

Tacoma, Wash.—The contract for grading S. 49th and 51st sts. between Sheridan ave. and east line of Acme addition, was awarded to N. A. Jones, California Bldg., $7,317; for paving the alley between S. K and L sts., was awarded to Anderson & Liljebeck, 4047 Spokane st., Tacoma, Wash., $4,185.

Kenosha, Wis.—The contract for paving Elizabeth st. was awarded to Chris. Peterson, Kenosha, Wis.

SEWERS.

CONTEMPLATED WORK.

Anaheim, Cal.—The construction of 18 miles of sewer is contemplated.

Lindsay, Cal.—The construction of a sewer system is contemplated.

Rockford, Ill.—Contemplating the construction of a combination storm and sanitary sewer, to cost about $152,000.

Nevada, Ia.—Contemplating the construction of a sewer system.

Hutchinson, Kan.—Contemplating the construction of a sewage disposal plant.

Grand Rapids, Mich.—The installation of a complete sewerage system is contemplated.

Hibbing, Minn.—Plans have been prepared for a sewer system. Estimated cost, $30,000.

Melrose, Minn.—Contemplating the construction of a sewer system in the spring.

St. Cloud, Minn.—Plans are being prepared for the construction of a sewer system.

St. Paul, Minn.—Contemplating the construction of a sewerage system in North st., Anthony Park, to cost about $130,000.

Terry, Mont.—Plans have been prepared for the installation of a sewer system.

Chadron, Neb.—Contemplating the construction of a sewer system.

Madison, Neb.—Plans are being prepared for the construction of a sewer system.

Binghamton, N. Y.—Plans have been completed for an intercepting sewer system and sewage disposal plant.

Dolgeville, N. Y.—Plans are being prepared for the extension of the sewerage system.

East Aurora, N. Y.—Plans have been prepared for the construction of a sewer system and disposal plant.

Oneida, N. Y.—Plans are being prepared for the construction of a sewage disposal plant.

Red Springs, N. C.—Voted bonds for water works and sewer systems.

Wilmington, N. C.—Plans have been

completed for the construction of a sewerage system to cost about $180,000.

Canton, O.—Plans have been prepared for a sewage disposal plant.

Cincinnati, O.—Plans have been prepared for a sewer in Montgomery road from Langdon ave. to the N. & W. R. R.

Cleveland, O.—During the present year $1,000,000 will be expended for intercepting sewer extensions, and $250,000 for the construction of new sewers.

Dayton, O.—Plans have been prepared for the construction of sanitary sewers in parts of districts No. 4 on 2nd st., from Miami to Erie canal.

Sandusky, O.—Contemplating the reconstruction of the sewerage system and an overhauling of the water filtration system.

Urbana, O.—Contemplating the construction of a sewer system.

Duncan, Okla.—Voted $38,000 bonds for the construction of a sewer system, and the erection and maintenance of a sewage disposal plant.

Gresham, Ore.—Contemplating the construction of water works and sewer system.

Bridgewater, Pa.—Contemplating the construction of a sewer system.

Connellsville, Pa.—Plans have been prepared for the construction of a sewage disposal palnt, estimated cost, $150,000.

Grove City, Pa.—Construction of sewers to cost about $15,000 is contemplated.

Norristown, Pa.—Contemplating the construction of a sewage disposal plant.

Pecos, Tex.—Construction of a sewerage system to cost $25,000, is contemplated.

Antigo, Wis.—Plans are being prepared for construction of sewer and sewage disposal plant.

West Minster, B. C.—Plans are being prepared for the 8th st. sewer system, to consist of over 14 miles of vitrified sewer pipe.

Prince Rupert, B. C.—Contemplating the construction of a sewer system, to cost about $200,000.

Simcoe, Ont.—Plans are being prepared for a sewage disposal plant to cost about $60,000.

Toronto, Ont., Can.—Contemplating the construction of storm overflow sewers, to cost about $824,000.

CONTRACTS TO BE LET.

Mobile, Ala.—Bids will be received until Feb. 16 for constructing cement street paving, approximately 11,400 sq. yds., 8,400 lin. ft. curb, 1,000 lin. ft. of vitrified sewer piper, etc. Board of public works.

Riverside, Cal.—Bids are requested for steel and vitrified pipe and all working tools. Shull, Tucker & Co., 985 Walnut st., Riverside, Cal.

Atlanta, Ga.—Bids will be received until Feb. 6 for constructing all sewers that may be ordered during year of 1911; furnishing vitrified pipe, cement and castings needed in the construction of sewers, etc. City clerk.

Savannah, Ga.—Bids are requested for furnishing ditching machinery. Fred M. Clark, Savannah, Ga.

Yorkvile, N. Y.—Bids will be received until Feb. 9, 4 p. m., for constructing a sewer system of the following approximate quantities: 19,000 lin. ft. of sewers, 8 to 15 in.; disposal plant; 33 manholes; and 10 flush tanks. Certified check $500. W. Armstrong, clk., Yorkvil'e, N. Y.

Huntington, W. Va.—Bids will be received until Feb. 20, 1 p. m., for constructing sewers in Adams ave. from 13th to 15th sts. and from Adams ave. in 15th st. to alley between Washington and Virginia aves. Certified check $500. John Coon, com. of streets.

North Milwaukee, Wis.—Bids are requested for furnishing a trench excavator. Otto Sufeld & Co., North Milwaukee, Wis.

Port Hope, Ont., Can.—Bids are requested for furnishing cement, mixing and trenching machinery. W. G. Gibson, Port Hope, Ont., Can.

Toronto, Ont., Can.—Bids will be received until Feb. 7 for laying reinforced concrete overflow pipe for sewage tanks, etc. G. R. Geary, mayor.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for constructing the Northside sewers, including six sections, was awarded to J. W. Gurley Co., Mobile, Ala., $250,000.

Brawley, Cal.—The contract for constructing a sewer system, including a septic tank 24x200 ft., 28 ft. deep, capacity, 85,000 gals.; 200 ft. of 8 in.; 1,542 ft. of 10 in.; 8,250 ft. of 12 in.; 1,700 ft. of 14 in. vitrified pipe; 31 manholes; 3 catch basins, and wooden outfall conduit was awarded to California Ornamental Brick Co., Los Angeles, Cal., $13,201.

Monrovia, Cal.—The contract for constructing a new sewer system, which includes about 30 miles of sewers, was awarded to R. C. Lowell, Los Angeles, Cal., $85,744.

Oakland, Cal.—The contract for sewer extensions was awarded to Mervy & Elwell Co., Oakland, Cal.

Orange, Cal.—The contract for constructing an outfall sewer system was awarded to E. R. Werdin Co., 407 H. W. Hellman Bldg., Los Angeles, Cal., $10,000.

Oroville, Cal.—The contract for constructing sewer system, was awarded to Contra Costa Construction Co., Berkeley, Cal., $90,372.

San Francisco, Cal.—The contract for constructing Sunnyside sewer was awarded to Coast Improvement Co., San Francisco, Cal., $11,250.

Santa Paula, Cal.—The contract for constructing sewer systems was awarded to M. N. Mlagenovitch, 332 Leroy st., Los Angeles, Cal., $28,983.

Jacksonville, Fla.—The contract for laying 1,100 ft. of 15 in. and 200 ft. of 12 in. reinforced concrete pipe, was awarded to Reinforced Concrete Culvert Pipe Co., Jacksonville, Fla.

Palatka, Fla.—The contract for furnishing 4,000 ft. of vitrified salt-glazed pipe from 18 to 24 in. in diameter, was awarded to Southern Sewer Pipe Co., Birmingham, Ala.

St. Petersburg, Fla.—The contract for constructing 4,000 lin. ft. of sanitary sewer was awarded to L. B. Cooper, St. Petersburg, Fla.

Dalton, Ga.—The contract for constructing sanitary sewer system. The work will include about 6 to 9 miles of pipe sewers from 8 to 15 in., and disposal plant complete, was awarded to Kaig & Puryeor, Dalton, Ga.

Shelbyville, Ind.—The contract for constructing a sanitary sewer system was awarded to Julius Keller, Indianapolis, Ind., $45,104.

Louisville, Ky.—The contract for constructing section C of Middlefork sewer, was awarded to Henry Bickel Co., Louisville, Ky., $30,000.

Boston, Mass.—The contract for constructing a concrete surface drain in Western ave., Brighton, was awarded to Antony Cefalo, 220 Devonshire st., $11,942.

Houghton, Mich.—The contract for constructing sewer system in the park addition, was awarded to Chester C. Davis, Houghton, Mich.

Kalamazoo, Mich.—The contract for installing the Fulford st. sewer was awarded to Johnson & Van Dyke, Kalamazoo, Mich.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant, was awarded to National Construction Co., South Bend, Ind., $26,000.

Keewatin, Minn.—The contract for installing storm and sanitary sewers, was awarded to H. L. Bartlett Co., Virginia, Minn.

Marble, Minn.—The contract for sewer construction was awarded to H. L. Bartlett Co., Virginia, Minn., $40,000.

St. Joseph, Mo.—The contract for constructing various sewers, was awarded to E. F. Mignery, St. Joseph, Mo.

St. Louis, Mo.—The contract for constructing sewer in N. Harlan Joint sewer district was awarded to Herman Construction Co., 444 S. Theresa ave., $326,447; the contract for constructing a sewer in Dale ave. in district No. 1 was awarded to John B. Turner, St. Louis, Mo., $21,401.

David City, Neb.—The contract for furnishing sewer pipe was awarded to Abel & Roberts, Lincoln, Neb.

Akron, O.—The following contracts were awarded: Constructing 2nd ave. sewer, to E. McShaffrey & Son, Akron, O., $11,234; constructing Water st. sewer, to H. O. Toole, Akron, O., $3,191.

Portland, Ore.—The contract for the construction of Holgate sewer extension was awarded to Paquet, Giebisch & Joplin, Portland, Ore., $104,353.

Gaffney, S. C.—The contract for constructing two sewage disposal plants, was awarded to Porter & Boyd, Charlotte, N. C., $9,000.

Aberdeen, S. D.—The contract for sewer construction was awarded to Fraser & Danforth, Rochester, Minn.

Beeville, Tex.—The contract for constructing sewer system was awarded to Trueheart & Jackson, San Antonio, Tex.

Corpus Christi, Tex.—The contract for constructing city sewerage system, was awarded to F. H. Lancashire, Houston, Tex., $75,000.

Corsicana, Tex.—The contract for extending sewer system was awarded to Freehart & Jackson, San Antonio, Tex., $17,364.

Dallas, Tex.—The contract for the construction of sewers in South Dallas, from Fair Grounds to Trinity river, was awarded to J. C. Underwood, Dallas, Tex.

San Antonio, Tex.—The contract for installing the Starr st. school sewerage system, was awarded to E. W. Lengs & Co., San Antonio, Tex.

Wichita Falls, Tex.—The contract for constructing sewers in the business district was awarded to I. H. Roberts, Wichita Falls, Tex., $14,000.

Salt Lake City, Utah.—The contract for sewer construction was awarded to A. A. Clark, Judge Bldg., Salt Lake City, Utah.

Chehalis, Wash.—The contract for laying 10 miles of sanitary sewers was awarded to W. J. Murphy, 1214 N. Steel st., Tacoma, Wash., $51,258.

Buffalo, Wyo.—The contract for a sewer system was awarded to Peter O'Brien, Denver, Colo., $37,369.

Vancouver, B. C.—The contract for furnishing material and constructing the first part of the sewer system, including sewers in seven streets was awarded to McDonnell & Gzouski, Vancouver, B. C., $206,000.

WATER WORKS.

CONTEMPLATED WORK.

Bisbee, Ariz.—Contemplating the erection of a 518,000 gallon steel tank 62 in. in diameter by 23 ft. high.

Lordsburg, Cal.—Bids will soon be received for the construction of water works system.

Ocala, Fla.—Contemplating the installation of a new water works system.

Anna, Ill.—Contemplating the construction of a filtration plant.

Atlantic, Ia.—Plans are being prepared for a new pumping and electric light plant.

Boone, Ia.—Voted $180,000 bonds for extensions to water works.

Whittemore, Ia.—Voted $7,000 bonds for construction of water works system.

Woburn, Mass.—Contemplating improvements to the water system, to cost about $200,000.

Holland, Mich.—Plans are being prepared for a pumping station on Maple and 20th sts.

Eveleth, Minn.—Contemplating the purchase of a new pump and the laying of a 16 in. main from the city line to the pumping station at St. Mary's Lake.

Hopkins, Mo.—The construction of a municipal water works system is contemplated.

Helena, Mont.—Voted $650,000 bonds for installation of water works system.

Battle Creek, Neb.—Voted $10,000 to construct water works system.

Bridgeport, Neb.—Contemplating the construction of a water works system.

Lodgepole, Neb.—Voted $10,000 bonds for the construction of a municipal water plant.

Glenridge, N. J.—Contemplating the construction of a municipal water works.

Hillsboro, N. J.—The construction of an electric light plant and water works system is contemplated.

Hornell, N. Y.—Voted $100,000 bonds for water storage reservoir.

Red Springs, N. C.—Voted bonds for water works and sewer systems.

Grand View, O.—Voted to issue bonds

Beaver Falls, Pa.—The contract for for the installation of water works system. Estimated cost, $50,000.

Niles, O.—Plans are being prepared for a filtration plant.

Sandusky, O.—Contemplating the reconstruction of the sewerage system and an overhauling of the water filtration system.

Delaware, Okla.—Voted $25,000 bonds for water works system.

Duncan, Okla.—Voted $12,000 bonds for extending and developing water works system.

Hominy, Okla.—Voted $36,000 bonds for water and sewer systems.

Oklahoma City, Okla.—An election is called to vote on water bonds to the amount of $1,500,000.

Falls City, Ore.—Voted $25,000 for a water works plant.

Gresham, Ore.—Contemplating the construction of water works and sewer systems.

Tarentum, Pa.—Plans are being prepared for municipal water works to cost about $100,000.

Fort Worth, Tex.—Voted $1,500,000 bonds for water works improvements.

Georgetown, Tex.—Improvements to water works and electric light plant are contemplated.

Mayfield, Utah.—Contemplating the construction of water works.

Spokane, Wash.—Bids will soon be

asked for the construction of an auxiliary pumping station at Lincoln Heights reservoir.

New Lisbon, Wis.—Voted bonds for the construction of water works and electric light plant.

Brandon, Man., Can.—Voted $50,000 bonds for improvement and extension of the water works.

Harrison, Ont., Can.—Voted Jan. 2 in favor of municipal water works, probable cost $35,000.

CONTRACTS TO BE LET.

Rippy, Ia.—Bids will be received until Feb. 6, 8 p. m., for constructing water works system. J. A. Haberer, cy. clk.

Hanover, Kan.—Bids will be received until Feb. 6, for furnishing material and constructing a pumping station. Dugall Spence, cy. clk.

Townsend, Mont.—Bids are requested for constructing water supply system. E. H. Goodman, clk.

North Bend, Neb.—Bids will be asked until Feb. 17 for installation of an auxiliary pumping station, including wells, building, pipes, etc. Frank D. Howe, cy. clk.

South River, N. J.—Bids will be received until Feb. 13, 8 p. m., for constructing a suction well, 25 ft. in diameter and 33 ft. deep, of brick and concrete. Chas. Anderson, boro. clk.

Toledo, O.—Bids will be received until Feb. 14, for constructing the purification of water works plant. Bond for 15 per cent required. J. T. Cowell, dir. of pub. serv.

Troy, O.—Bids will be received until Feb. 4 for constructing water mains. A. E. Sinks, audt.

Scottdale, Pa.—Bids are requested for pipe and lead. J. I. Dick, Scottdale, Pa.

Sheridan, Wyo.—Bids will be received until March 6 for constructing water supply main connecting the city reservoir to the city line, including the furnishing of about 7,934 ft. of 1 in. and 760 ft. of 10 in. cast iron pipe, valves and special castings. Arnold Tschirgi, cy. engr.

Winnipeg, Man., Can.—Bids will be received until Feb. 6, 11 a. m., for the erecting two pumping plants, each of a capacity of 1,000,000 gallons per 24 hours. M. Peterson, secy. bd. of control, Winnipeg, Man., Can.

Perth, Australia.—Bids will be received until Feb. 26 for furnishing electric pumping machinery. Minister of public works.

CONTRACTS AWARDED.

Corona, Cal.—The contract for furnishing and laying 4 to 5 miles of 8, 10 and 12-in. reinforced concrete pipe, was awarded to Sanders & Hackett, Corona, Cal.

San Francisco, Cal.—The contract for constructing Twin Peaks reservoir was awarded to Healy-Tibbitts Construction Co., 268 Market st., San Francisco, Cal.

Washington, D. C.—The contract for supplying pumping machinery for naval dry docks at Bremerton, Brooklyn and Pearl Harbor was awarded to Alberger Pump Co., New York, N. Y.

Chipley, Fla.—The contract for constructing water works system was awarded to Moore & Gammon, Chipley, Fla., $20,000.

Pensacola, Fla.—The following contracts were awarded: furnishing 18,000 ft. of 6-in. cast iron water main extension, to American Cast Iron Pipe Co., Birmingham, Ala.; hydrants and lead, to Ahrens & Ott, New Orleans, La.; and for water gate valves, to Fairbanks & Co., New Orleans, La.

Chicago, Ill.—The contract for furnishing four 300 h. p. water tube boilers was awarded to Edgemoor Iron Co., Edgemoor, Del.

Mitchell, Ind.—The contract for constructing water works system was awarded to S. S. Royland, Mitchell, Ind.

Onago, Kan.—The contract for constructing water works system was awarded to W. W. Cook & Son, Junction City, Kan.

Mound City, Kan.—The contract for constructing water works system was awarded to J. S. Worley Co., Reliance Bldg., Kansas City, Mo.

Newton, Kan.—The contract for furnishing 2,500,000 gallon pumping engine, was awarded to Laidlaw-Dunn-Gordon Co., New York, N. Y.

Lawrence, Mass.—The contract for furnishing 300 ft. of 4-in. pipe, 5,000 ft. of 8-in. pipe, 1,000 ft. of 12-in. pipe, 1,300 ft. of 12-in. pipe, for $22.34 per net ton, was awarded to C. S. Miller & Sons, Utica, N. Y.

Lowell, Mass.—The contract for furnishing and installing a new pump for Centralville pumping station was awarded to Allis Chalmers Co., Milwaukee, Wis., $40,700.

Pittsfield, Mass.—The contract for constructing Farnham dam and reservoir; 10 acres clearing; 47 acres clearing and grubbing; 83,200 cu. yds. earth excavation; 9,600 cu. yds. rock excavation; 3,650 cu. yds. mass concrete; 3,900 cu. yds. cyclopean masonry; 3,900 cu. yds. concrete blocks; 4,000 lin. ft. furnishing and laying 12 to 24-in. vitrified pipe; 600 sq. yds. granolithic surfacing; 13,000 cu. yds. paving; 27,000 ft. B. M. furnishing and placing spruce lumber, and gate house superstructure, to Winston & Co., New York, N. Y., $399,600.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant, was awarded National Construction Co., South Bend, Ind.

Brainerd, Minn.—The contract for the erection of a 50,000-gal. steel tank on concrete foundation, was awarded to Kennicott Co., St. Paul, Minn.

Warrenton, Mo.—The contract for constructing water works was awarded to Des Moines Bridge & Iron Co., Des Moines, Ia., $6,220.

Beatrice, Neb.—The contract for constructing water and lighting plants, was awarded to Mathews Construction Co., Kansas City, Mo.

Ft. Crook, Neb.—The contract for constructing reservoir and well was awarded to J. W. Turner Development Co., Des Moines, Ia., $18,500.

Stratton, Neb.—The contract for constructing water works system was awarded to Inter-Mountain Bridge & Construction Co., Tecumseh, Neb., $11,000.

Cimarron, N. M.—The contract for constructing water works was awarded to Cook & Gregory Construction Co., Joplin, Mo., $32,329.

Angola, N. Y.—The contract for constructing and installing water works plant was awarded to Mahoney & Swanson, Jamestown, N. Y., $55,000.

Geneva, N. Y.—The contract for furnishing iron pipe and specials was awarded to Charles Miller & Son, Utica, N. Y., $30,000.

Oriskany, N. Y.—The contract for the construction of a gravity system of water supply was awarded to John Siegrist, Utica, N. Y., $26,794.

Troy, N. Y.—The contract for furnishing 105 tons of cast iron water pipe was awarded to Chas. Miller & Sons Co., Utica, N. Y.

Fayetteville, N. C.—The contract for constructing a filtration plant and two filter units of 500,000 gallons daily capacity, piping, machinery, etc., was awarded to Clarendon Construction Co., Wilmington, N. C., $12,858.

Cleveland, O.—The contract for installing engines at Kirtland Pumping station was awarded to Holly Engine Co., Buffalo, N. Y., $112,769.

Frewater, Ore.—The contract for constructing water works system was awarded to J. H. Jager, St. Louis, o. M

Jacksonville, Ore.—The contract for constructing new water works system was awarded to Jas. J. Mears, Portland, Ore., $50,000.

Klamath Falls, Ore.—The contract for the construction of Lost River division water works was awarded to W. H. Mason, Klamath Falls, Ore., $63,607.

Portland, Ore.—The contract for furnishing 5,972 tons of cast iron pipe ranging from 6 to 30 in. in diameter, was awarded to the United States Cast Iron Pipe & Foundry Co., Chicago, Ill., $178,-972.

Stillwater, Okla.—The contract for constructing water works was awarded to Southwestern Engineering Co., Oklahoma City, Okla., $40,000.

Yukon, Okla.—The contract for constructing water works and sewer system was awarded to N. R. Sherman & Co., Oklahoma City, Okla., $35,000.
constructing dam and reservoir was awarded to L. Adavasio & Co., Youngstown, O., $300,000.

Denison, Tex.—The contract for furnishing machinery for pumping station, was awarded to Briggs Weaver Machinery Co., Dallas, Tex., $11.740.

Fort Worth, Tex.—The contract for furnishing duplicate air compressor for city water works was awarded to Ingersoll Rand Co., St. Louis, Mo., $21,574.

San Antonio, Tex.—The contract for furnishing 1,500,000 lbs. of water mains, consisting of 6, 8, 10 and 12-in. piping,

Stamford, Tex.—The contract for constructing 300,500,000-gallon reservoir, was awarded to W. J. Cox, Stamford, Tex.

North Yakima, Wash.—The contract for constructing about 75 miles of laterals in connection with the Yakima irrigation project was awarded to Nelson Rich, Prosser, Wash., $50,160.

Tacoma, Wash.—The contract for laying water mains was awarded to Lister Construction Co., Berlin Bldg., Tacoma, Wash., $27,290.

Greybull, Wyo.—The contract for constructing water works system was awarded to Garrard Construction Co., Sheridan, Wyo., $31,960.

BRIDGES.

CONTEMPLATED WORK.

Fullerton, Cal.—The construction of a bridge, to cost $10,000, is contemplated.

Hanford, Cal.—The construction of a 600 ft. trestle over Tule river, near Corcoran, is contemplated.

Santa Ana, Cal.—Plans are being prepared for the construction of a highway bridge at Newport Bay.

Denver, Colo.—Contemplating the contemplating the construction of a bridge over Dry creek at 12th ave. and another over the same creek between 6th and 7th avenues.

Jacksonville, Fla.—Contemplating the construction of a reinforced concrete bridge across Hogan's creek at East Bay st.

Rome, Ga.—Contemplating the construction of 240 culverts and 60 steel bridges during tre next two years.

Burley, Ida.—Contemplating the construction of a bridge over Snake river.

Elgin, Ill.—Plans have been prepared for a concrete bridge at Willard ave.

Rockford, Ill.—Reinforced concrete bridge at Morgan st. is contemplated.

Indianapolis, Ind.—Plans are being prepared for a bridge over Fall creek, at Capitol ave. Estimated cost, $80,000.

Cedar Rapids, Ia.—The construction of a bridge on the site of present 3rd ave. structure is contemplated.

Kansas City, Mo.—Bids will be received soon for construction of concrete bridge across the Blue river at 15th st.

New Brunswick, N. J.—The construction of a 60 ft. lift bridge across Cheesquake creek is contemplated.

Fulton, N. Y.—Contemplating the construction of a concrete bridge at Broadway.

Whitehall, N. Y.—Construction of a bridge over South Bay, Lake Champlain, is contemplated.

Castle Hayes, N. C.—Contemplating the construction of a steel bridge across the Northeast river, to cost about $30,000.

Durham, N. C.—Contemplating the construction of a bridge over Eno river. Estimated cost, $12,000.

Williston, N. D.—Contemplating the construction of a bridge across the Missouri at this place.

Bolivar, O.—Plans are being prepared for the construction of a steel bridge 320 ft. long.

Cincinnati, O.—Contemplating the construction of a viaduct 1,400 ft. long at Spring Grove and Dodsworth aves.

Bannsford, Okla. — Contemplating the construction of a bridge over the Cimmaron river a mile north of the city.

Tulsa, Okla.—Bonds to the amount of $185,000 were sold, and the following improvements are contemplated: water works, $100,000; sewer extension, $35,000; incinerating plant, $25,000; viaduct, $25,-000.

Portland, Ore.—Plans have been completed for the new Ellsworth-Meade st. bridge. It will be 4,000 ft. long including approaches, will contain 11 spans, in the clear 60 ft. wide. Probable cost, $1,-000,000.

Pittsburg, Pa.—An ordinance has been passed providing for the construction of the Point Bridge, to cost $850,000.

Reading, Pa.—Plans have been prepared for a reinforced concrete bridge on concrete foundation at the foot of Penn st.

Scranton, Pa.—Contemplating the construction of a viaduct at Mulberry st. to cost about $250,000.

Wyoming, Pa.—The construction of a bridge over the Susquehanna river is contemplated.

Chattanooga, Tenn.—Voted $550,000 bonds for the construction of two bridges across the Tennessee river.

Houston, Tex.—Voted $500,000 bonds for the construction of a viaduct over Buffalo Bayou at foot of Main st.

Seattle, Wash.—The construction of a steel bridge at 12th ave. S. and Dearborn st., is contemplated.

Spokane, Wash.—Plans have been prepared and submitted to the city council for a concrete bridge across the Latah creek at Chestnut.

Zillah, Wash.—The construction of a bridge across the Yakima river is contemplated.

Grantsville, W. Va.—Contemplating the

construction of a bridge across the Little Kanawha river.

Edmonton, Alberta, Can.—Voted $167,000 for the construction of another steel bridge across the Saskatchewan river and $12,000 for a concrete subway.

CONTRACTS TO BE LET.

Ocilla, Ga.—Bids will be received until Feb. 6 for constructing a steel bridge over Alapaha river on Irwinsville and Tifton public roads. G. T. Young, cy. clk.

Columbus, Ind.—Bids will be received until Feb. 6 for constructing a bridge in Rock Creek township. P. J. Sater, audt.

Rushville, Ind.—Bids will be received until Feb. 7 for constructing macadam road in Ripley township. Jesse M. Stone, audt.

Chanute, Kan.—Bids will be received until Feb. 6, 12 m., for constructing bridge across Neosho river. W. F. Sams, cy. Clk.

Minneapolis, Minn.—Bids will be received until Feb. 4 for repairing bridge No. 4. A. F. Ericson, audt.

Salem, N. J.—Bids will be received until Feb. 8 for constructing a concrete floor bridge in the borough of Woodstown. Board of chosen freeholders, Salem, N. J.

Woodstown, N. J.—Bids will be received until Feb. 8 for constructing concrete floor bridge in the borough of Woodstown, N. J. Levi S. Prickett, Woodstown, N. J.

Zanesville, O.—Bids will be received until Feb. 6 for constructing the superstructure of the 5th st. bridge. H. A. Bernhaus, co. audt.

Yankton, S. D.—Bids will be received until Feb. 27, 7:30 p. m., for constructing a steel reinforced concrete bridge across the Rhine creek on Walnut st. John W. Summers, audt.

Bellingham, Wash.—Bids will be received until Feb. 10 for constructing the Palmers bridge. County commissioners, Bellingham, Wash.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for constructing a reinforced concrete girder bridge over the Arroyo Seco at the north end of Prospect Square, was awarded to Andrew Holloway, Pasadena, Cal., $15,000.

Pasadena, Cal.—The contract for constructing a reinforced concrete bridge and retaining walls, north of Prospect Square, was awarded to Andrew Holloway, 16 S. Raymond ave., Pasadena, Cal., $15,000.

San Diego, Cal.—The contract for the construction of five bridges on the new coast highway route from Oceanside to the Orange county line, was awarded to Knight & Hyde, San Diego, Cal., $24,603.

San Francisco, Cal.—The contract for constructing steel bridge over the cut at Harrison st., was awarded to Foster & Vogt, San Francisco, Cal., $31,997.

Cedartown, Ga.—The contract for constructing two steel bridges was awarded to J. W. Honseal, Cedartown, Ga.

Salmon, Ida.—The contract for constructing bridge across Lemhi river at Barracks Lake, was awarded to E. L. Emigh, Salmon, Ida.

East St. Louis, Ill.—The contract for constructing four steel highway bridges over the Cahokia creek was awarded to Joliet Bridge & Iron Co., Joliet, Ill.

Rock Island, Ill.—The contract for constructing bridges over Rock river was awarded to Clinton Bridge & Iron Works, Clinton, Ia., $15,400.

Edwardsport. Ind.—The contract for constructing the Edwardsport bridge was awarded to Vincennes Bridge Co., Vincennes, Ind., $15,548.

St. Paul, Ind.—The contract for constructing a bridge over Flat Rock river was awarded to Kelly Construction Co., St. Paul, Ind.

Corydon, Ia.—The contract for construction of all iron bridges in Wayne county during the year was awarded to Corydon Lumber Co., Corydon, Ia.

Denison, Ia.—The contract for constructing county bridges was awarded to Lana & Co., Harlan, Ia.

Des Moines, Ia.—The contract for constructing Milan bridge was awarded to Clinton Bridge Co., Clinton, Ia., $25,000.

Minneapolis, Minn.—The contract for constructing a steel bridge across the narrows at Lake Minnetonka was awarded to Minneapolis Steel & Machinery Co., Minneapolis, Minn, $38,500.

Red Jacket, Minn.—The contract for constructing concrete bridge was awarded to Marsh Engineering Co., Des Moines, Ia., $12,650.

David City, Neb.—The following contracts were awarded: Wood and steel bridges to be constructed in Butler county, to Nebraska Construction Co., Lincoln, Neb.; all cement culverts, to Wilson Reinforced Concrete Co., Nebraska City, Neb.; all metal culverts, to Nebraska Culvert Mfg. Co., Wahoo, Neb.

Hastings, Neb.—The contract for constructing all bridges during the year, was awarded to Standard Bridge Co., Omaha, Neb.

Omaha, Neb.—The contract for the construction of all bridges in York county, Neb., was awarded to Western Bridge & Construction Co., Omaha, Neb.

St. Paul, Neb.—The contract for constructing new bridges and repairing all old structures during the year was awarded to Nebraska Construction Co., Lincoln, Neb.

Rome, N. Y.—The contract for constructing bridge over Erie canal at South Washington st., was awarded to Henry Tosh & Son, Port Byron, N. Y., $14,777.

Durham, N. C.—The contract for constructing a bridge across Eno river of reinforced concrete, was awarded to Carter Construction Co., Burlington, N. C., $10,500.

Winston-Salem, N. C.—The contract for constructing a concrete bridge to span the Eno river at Christian's Mill, was awarded to Carter Construction Co., Winston-Salem, N. C., $10,500.

Cincinnati, O.—The contract for constructing Cooper ave. bridge was awarded to Gerald W. Knight, 3037 Woodburn ave., Cincinnati, O., $13,971.

Lockland, O.—The contract for constructing a concrete bridge on Cooper ave. was awarded to Gerald W. Knight, 3037 Woodburn ave., Cincinnati, O., $13,971.

Haskell, Okla.—The contract for constructing a bridge over the Arkansas river was awarded to Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $59,250.

Wagoner, Okla.—The contract for constructing a bridge across the Verdigris river at Mingo Ferry was awarded to Canton Bridge Co., Canton, O., $14,000.

Portland, Ore.—The contract for constructing the superstructure of the Broadway bridge was awarded to Union Bridge & Construction Co., New Nelson Bldg., Kansas City, Mo.

Ducktown, Tenn.—The contract for the construction of two steel bridges was awarded to Joliet Bridge Co., Memphis, Tenn.

Cuero, Tex.—The contract for constructing a bridge across Guadalupe river was awarded to Virginia Structural Co., Roanoke, Va., $25,000.

Dallas, Tex.—The contract for constructing the Wilmer, Hutchins and Mallay bridges across Trinity river was awarded to Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $41,780.

Aberdeen, Wash.—The contract for constructing a steel bridge was awarded to Caldwell Co., Savage-Scofield Bldg., Tacoma, Wash.

Seattle, Wash.—The costract for constructing concrete viaduct was awarded to Butler Construction Co., 395 Crary Bldg., Seattle, Wash.

STREET LIGHTING.

CONTEMPLATED WORK.

Modesto, Cal.—Contemplating the improvement of the street lighting system.

Brazil, Ind.—Installation of electric light plant is contemplated.

Columbia City, Ind.—The remodeling and enlarging the electric light plant and installing machinery and equipment for adding a day current service, is contemplated.

Adair, Ia.—Voted $10,000 bonds for the construction of an electric light plant.

Atlantic, Ia.—Plans are being prepared for a new pumping and electric light plant.

Fairfield, Ia.—Improvements to light and water systems are contemplated.

Crowley, La.—Contemplating the purchase of a 110 h. p. engine, 150 k. w. dynamo and a 75 k. w. dynamo and the installation of a two-unit system and 24 hour service of lights and power at electric plant.

Tower, Minn.—The installation of a municipal lighting plant is contempalted.

Utica, Neb.—Contemplating the construction of an electric light plant.

Gibbsboro, N. J.—Contemplating the construction of a municipal light plant.

Hillsboro, N. J.—The construction of an electric light plant and water works system is contemplated.

Mandan, N. D.—Contemplating the installation of a municipal electric light system.

Minot, N. D.—The installation of a municipal light plant is contemplated.

Arlington, Ore.—The installation of an electric light plant is contemplated.

Eugene, Ore.—Contemplating the conconstruction of an electric light plant.

Etna, Pa.—Contemplating the construction of an electric light plant.

Hastings, Pa.—Contemplating the constructioun of a municipal light plant.

St. Lawrence, S. D.—The installation of an electric light system is contemplated.

Ft. Worth, Tex.—Voted $40,000 bonds to extend lighting system.

Georgetown, Tex.—Improvements to the water works and electric light plant are contemplated.

Seattle, Wash.—The installation of cluster lights on Westlake avenue is contemplated .

New Lisbon, Wis.—Voted bonds for the construction of water works and electric light plant.

Waupaca, Wis.—The construction of a municipal lighting plant is contemplated.

CONTRACTS TO BE LET.

Atlantic, Ia.—Bids will be received until March 1 for constructing electric light and power plant. T. E. Nichols, clk.

CONTRACTS AWARDED.

Elmo, Colo.—The contract for lighting streets during the year was awarded to Pacific Gas and Electric Co., Elmo, Colo.

Belvidere, Ill.—The contract for lighting streets for ten years was awarded to Public Service Operating Co., Belvidere, Ill.

Bluffton, Ia.—The contracts for furnishing additional equipment for the municipal electric light plant were awarded as follows: 450 h.p. engine to the Harrisburg Foundry and Machine Co., Harrisburg, Pa.; generator and other electrical equipment, to Ft. Wayne Electric Works, Ft. Wayne, Ind. Total cost, $10,000.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant was awarded to National Construction Co., South Bend, Ind., for $26,000.

Barnum, Minn.—The contract for lighting streets with electric lights was awarded to Cloquet Electric Co., Barnum, Minn.

Beatrice, Neb.—The contract for constructing water and lighting plants was awarded to Mathews Construction Co., Kansas City, Mo.

Portsmouth, N. H.—The contract for street lighting for five years was awarded to Buckingham County Light & Power Co., Portsmouth, N. H.

Rome, N. Y.—The contract for lighting the streets for five years was awarded to Rome Electric Light & Power Co., Rome, N. Y.

Cleveland, O.—The contract for furnishing arc lamps and electricity for street lighting was awarded to Cleveland Electric Illuminating Co., Cleveland, O.

Defiance, O.—The contract for lighting streets for ten years was awarded to Defiance Gas and Electric Co., Defiance, O.

Hoquiam, Wash.—The contract for five year lighting contract was awarded to Grays Harbor Gas Co., Hoquiam, Wash.

FIRE APPARATUS.

CONTEMPLATED WORK.

Long Beach, Cal.—Contemplating the purchase of a combination chemical wagon.

Bridgeport, Conn. — Contemplating the purchase of an auto engine.

Fairfield, Conn.—Contemplating the purchase of a fire engine.

Aurora, Ill.—Fire Chief Rang has recommended the installation of motor-driven vehicles in the fire department.

David, Ill.—The purchase of a chemical engine is contemplated.

East Moline, Ill.—The purchase of an auto truck is contemplated.

Ft. Wayne, Ind.—The mayor has recommended the purchase of an auto combination chemical hose wagon.

Terre Haute, Ind.—Chief Tully has recommended the purchase of an auto patrol wagon.

Davenport, Ia.—The purchase of an additional truck is contemplated.

Chelsea, Mass.—Contemplating the purchase of a rubber-tired combination hose wagon and two coal wagons, and may also equip No. 1 with rubber-tired wheels.

Fitchburg, Mass. — Contemplating the purchase of motor fire apparatus and 1,000 feet of fire hose.

Greenfield, Mass. — Contemplating the purchase of a chemical engine.

Methuen, Mass.—The purchase of auto truck is contemplated.

New Bedford, Mass.—The purchase of an auto combination chemical hose wagon is contemplated.

Springfield, Mass.—The purchase of two aerial trucks is contempalted.

Waltham, Mass.—The purchase of an auto chemical and an auto wagon has been recommended by the mayor.

West Springfield, Mass.—The purchase of an auto engine is contemplated.

Worcester, Mass.—The purchase of two double tank auto chemicals and 5,000 feet of hose is contemplated.

Jefferson City, Mo.—The purchase of 1,000 feet of hose is contemplated.

Kansas City, Mo.—Residents of Mount Washington suburb will purchase a chemical engine.

St. Louis, Mo.—Contemplating the purchase of motor fire engine and hose for the county.

Belleville, N. J.—Contemplating the purchase of an auto engine.

Montclair, N. J.—The purchase of an auto engine and the installation of fire alarm boxes is contemplated.

Nutley, N. J.—The purchase of an auto apparatus is contemplated.

Point Pleasant, N. J.—Contemplating the purchase of a new apparatus.

Albany, N. Y.—Contemplating the purchase of the following: Automobile for the fire chief and combination chemical and hose automobile for steamer No. 4.

Bath, N. Y.—Contemplating the purchase of hose, rubber coats, gloves, modern nozzles, etc.

Truxton, N. Y.—Contemplating the purchase of an engine.

Hood River, Ore.—The purchase of a fire equipment is contemplated.

New Castle, Pa.—Contemplating the purchase of a steamer, two auto combination engines and hose, equipped with two 14-foot ladders and two 35-gallon chemical tanks.

Red Lion, Pa.—The purchase of a chemical engine is contemplated.

West Chester, Pa.—The purchase of a combination chemical hose wagon is contemplated.

Cheney, Wash.—The purchase of a chemical engine is contemplated.

Hanford, Wash.—The purchase of a hose cart and two engines is contemplated.

Random, Wis.—Contemplating the purchase of hose, hose wagon and gasoline engine.

Vancouver, B. C.—Contemplating the purchase of a gasoline pumping engine, chief's auto, water towers, aerial ladders and fire boat.

CONTRACTS TO BE LET.

Washington, D. C.—Bids will be received until Feb. 15 for furnishing a gasoline motor-driven fire engine and hose wagon combined. Commissioners of District of Columbia.

Seattle, Wash.—Bids will be received until Feb. 10 for furnishing 2,000 feet of 3½ in. and 3,000 feet of 3 in. cotton, rubber-lined, double-jacket fire hose. Certified check of 5 per cent. C. B. Bagley.

CONTRACTS AWARDED.

Chico, Cal.—The contract for furnishing second size steam fire engine was awarded to American La France Co., Elmira, N. Y., $5,750.

Stratford, Conn.—The contract for furnishing fire engine was awarded to Locomobile Co., Bridgeport, Conn.

Mishawaka, Ind.—The contract for auto fire truck was awarded to American-La France Co., Elmira, N. Y.

Jersey City, N. J.—The following contracts were awarded: Combination engine and hose motor wagon, to Pope Motor Co., Hartford, Conn., $5,200; 720 ft. 2½ in. 4-ply cotton-jacketed, rubber-lined fire hose, to Eureka Fire Hose Co., New York, N. Y.

New York, N. Y.—The contract for furnishing and delivering two gasoline-propelled pumping engines was awarded to Webb Fire Apparatus Co., 50 W. Broadway, New York, N. Y., $16,500.

Rochester, N. Y.—The following contracts were awarded: Furnishing 5,000 ft. of 2½ in. hose for fire department, to Eureka Fire Hose Mfg. Co., New York, N. Y., $5,000; 750 ft. of 2½ in. hose for streets department, to Chamberlain Rubber Co., New York, N. Y.

Muskogee, Okla.—The following contracts were awarded: Furnishing fire hose, to Eureka Fire Hose Co., Dallas, Tex., and New York Belting and Packing Co., St. Louis, Mo., 250 ft. each; 500 ft. of bi-lateral hose, to Bi-Lateral Hose Co., Chicago, Ill.

Dallas, Tex.—The following contracts were awarded: Furnishing 2,000 ft. of fire hose, to Eureka Fire Hose Co., New York City 500 ft. of Bay State Jacket brand, to Boston Woven Hose and Rubber Co., Boston, Mass.; 500 ft. of Goodrich brand, to Chicago Fire Hose Co., Chicago, Ill.

Ft. Worth, Tex.—The contract to furnish auto fire engine was awarded to Webb Fire Motor Co., Dallas, Tex.

Seattle, Wash.—The contract for furnishing three auto-propelled hose wagons was awarded to Pacific Coast Fire Supply Co., Seattle, Wash.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Napa, Cal.—The city council is considering the construction of a garbage crematory.

Sacramento, Cal.—The purchase of another furnace for the incinerating plant is contemplated.

Boston, Mass.—The installation of an incinerator in North Cambridge is contemplated.

Batavia, N. Y.—Plans for a garbage incinerator plant have been completed and were presented to the board of aldermen on Jan. 11.

Lestershire, N. Y.—Contemplating the construction of a garbage disposal plant.

Akron, O.—Contemplating the construction of a sewage and garbage disposal plant at the junction of the Big and Little Cuyahoga rivers.

Oklahoma City, Okla.—Contemplating the construction of a garbage incinerator.

Tulsa, Okla.—Bonds to the amount of $25,000 were sold to provide funds for an incinerating plant.

Winnipeg, Man., Can.—A garbage destructor with a daily capacity of 100 tons is contemplated.

CONTRACTS AWARDED.

Atlanta, Ga.—Collecting and disposing of city garbage, etc., for a period of 5 years at $153,852 for a year, with a bonus of $10,000 per year for each year. John C. West, 110 Irwin st., Atlanta, Ga.

Cumberland, Md.—The contract for street cleaning was awarded to Frederick Perry, Cumberland, $9,950, and garbage removal was awarded to A. L. Elosser, Cumberland, Md., $6,500.

Philadelphia, Pa.—The contract for the removal of garbage for this year was awarded to Penn Reduction Co., Philadelphia, Pa., $510,000.

Municipal Engineering

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Simplification of Traffic Records for Purposes of Comparison

By Major W. W. Crosby, Chief Engineer to the State Roads Commission, Baltimore, Md.

IN 1903 the writer publicly suggested the advisability of obtaining and recording the important facts concerning the traffic over streets and roads so that a better basis might be had by highway engineers for the solution of many of the then existing problems, and of new questions that it seemed to him probable would arise in the near future. He began to accumulate such records in 1904, and has continued this work as his opportunities permitted. Others have also worked along similar lines, and valuable publications of their work have been made, notably in the cases of Fletcher of Massachusetts; Blanchard of Rhode Island, and Bishop & Armstrong of New York.

In endeavoring to compare traffic records, even when made on identical or similar lines, the writer has been impressed with the amount of labor involved when the written or printed records are spread before one, and with the utter hopelessness now of making a mental comparison when listening to verbal expressions of the records.

The writer suggested the point at a recent meeting of the American Society of Civil Engineers, when a number of traffic records were stated by various speakers and the confusion in the minds of the hearers was apparent, but was at that time unprepared to go further into the subject. He therefore now submits the following for such consideration and discussion as may be had, with the hope that both may be full and that the results may be beneficial to all interested.

Let it be assumed that the road surface is ideal, so far as its construction goes, and that its drainage and foundation are proper in every respect. There will be three agencies of traffic which may destroy it:

A. The shocks of the feet of horses or of the hard tires of vehicles.

B. The crushing effect of loads exceeding a (variable) maximum per unit area of tire.

C. The shearing action of automobile traffic.

A. In the present form of traffic census, count is had (and sometimes reduced to an average-per-hour) of

Led or ridden horses.
Vehicles drawn by single horses.*
Vehicles drawn by two sorses.*
Vehicles drawn by three horses.
Vehicles drawn by four horses.
Vehicles drawn by five horses.
Vehicles drawn by six horses.
Etc.

*Sometimes these items are each subdivided into two classes—"light" and "heavy."

In order to reduce these separate factors to a common denominator, for the purpose of combining them, we may safely start by assigning to the led or ridden horse the value of "one."

To the vehicle and the single horse drawing it, perhaps in many cases (such as all pleasure traffic of this character) no greater value should be assigned. To some commercial outfits, but slightly more would probably be fair. However, as in many cases single carts, heavily loaded, considering the frequent narrowness of their metal tires, will be included in the count, it seems well to the writer to assign a value of "two" to this item. (It may have already been noted, as it should be, that no distinction has been made in the record between light and loaded vehicles, and this omission, the writer thinks, is proper at present, at least, and desirable for the sake of convenience and simplicity.)

For the two-horse vehicle, the value of "four" seems to the writer fair, after careful consideration. And he can see no good reason why a value equal to double the number of the horses should not be taken for each of the succeeding items in the census of horse-drawn vehicles, at least until experience shall have proved this assumption to be too wide of the mark.

B. The writer has, on a number of occasions in the past, publicly referred in detail to this item, and will not repeat his remarks here. Suffice it to say that, in his judgment, sufficient consideration for all ordinary purposes has been given in the foregoing. For extraordinary cases it will be necessary to consider the item separately and with particular care. It seems advisable to record the data, but, except in extraordinary cases, to omit reference to "B" in comparisons of traffic censuses.

C. The shearing strains set up by automobiles vary directly with the momentum, or practically with the products of the weights by the speeds. A weight for various cars is, for practical purposes, easy of assumption. The speed may never be twice alike and is never easy of determination. An assumption may be made for our purposes, and to be proved or disproved as fair by future observations. Such an assumption should be on the facts that ordinary motor traffic at speeds under fifteen miles per hour does little, if any, damage to the road surface; that the probabilities for speed vary largely with the type of car; that abilities or proclivities for speed are, more than speed regulations, to be considered in this connection; and that it is now probably advisable rather to assign too high a value than one too low in the search for the "common denominator" in this problem.

The writer would therefore suggest the assignment of values to motor traffic records, considering those adopted for horse-drawn traffic, as follows:

Motorcycles	2
Runabouts of all kinds (including taxicabs, broughams, etc.)	10
4 or 5-seat touring cars	20
6 or 7-seat cars, limousines, landaulets, etc.	40
Drays	20

Figured thus:

Items.	Weight in Lbs.	Speed Miles pr. Hr.	Product.	Unit Assumed.
Motorcycles	200	40	8,000	2
Runabouts	2,000	20	40,000	10
4 or 5-seat cars	3,000	25-30	80,000	20
6 or 7-seat cars	4,500	35	157,500	40
Drays	12,000	6-7	84,000	20

The last item may seem to many to have been given too low a value. It should, however, be remembered that in addition to their usual low speed and resilient tires, the latter are usually of great width.

Further, their effect, the writer believes, is more for consideration in connection with details of foundation than of the road surface, a separate matter.

No note is made of traction engines. These and motor trucks should be considered under "B," and in matters of foundation.

For illustration, now, may be taken one or two recent records of traffic censuses.

On Park Heights avenue, just out side of Baltimore, the count in November, 1910, was as follows:

7 a. m. to 7 p. m.

Led or ridden horses	30
Single horse vehicles	245
Double horse vehicles	104
Three horse vehicles	10
Four horse vehicles	14
Six horse vehicles	1
Motorcycles	8
Runabouts	26
4 or 5-seat cars	141
6 or 7-seat cars	66
Motor trucks	4

The count in November, 1910, on the Baltimore-Washington road was:

8 a. m. to 7 p. m.

Led or ridden horses	0
Single horse vehicles	255
Double horse vehicles	67
Three horse vehicles	4
Four horse vehicles	2
Five horse vehicles	0
Six horse vehicles	0
Motorcycles	10
Runabouts	5
4 or 5-seat cars	36

6 or 7-seat cars	7
Motor trucks	3

And in January, 1911, on the Easton-Wye Mills road:

7 a. m. to 7 p. m.

Led or ridden horses	0
Single horse vehicles	197
Double horse vehicles	70
Three horse vehicles	0
Four horse vehicles	0
Five horse vehicles	0
Six horse vehicles	0
Motorcycles	1
Runabouts	4
4 or 5-seat cars	2
6 or 7-seat cars	0
Motor trucks	0

This road was built of water-bound macadam and completed in May, 1910, but demanded surface treatment with pitch in August, 1910.

Note the space required for this form of report and the confusion to a reader even, not to mention a listener, when condensed into Table I.

How can further condensation be had for simplicity in comparison?

By applying the suggested values to each item, Table II results.

Which form is preferable?

The New York state authorities have done considerable work, the writer believes, along the lines of the foregoing, and he has examined their work to some extent. Such information as he has, however, fails to convince him of the propriety of some of the factors used by them, although he must admit he has not much physical proof of the incorrectness of the factors referred to.

In 1904 a traffic count gave Table III on Park Heights avenue, reduced to the hour basis.

Now, in 1904, the road had been thoroughly resurfaced with water-bound trap rock macadam.

Until about 1908 it sustained the traffic very satisfactorily, but suddenly it seemed to demand resurfacing (which was begun in 1909) because of the surface condition, which was easily recognizable as due mainly to motor traffic damage. The surface became badly raveled and pitted. It is probable that between 1904 and 1908 the motor traffic rapidly increased, not only in amount but somewhat in its proportion to the whole traffic, though the horse traffic has also considerably increased. The writer has had the local conditions under constant observation, and it is his opinion that the New York units have been proved not to represent the relative values of the different items as well as those suggested by the writer.

Another illustration may perhaps be found in the case of the Easton-Wye Mills road, whose treatment on account of damages by motor traffic was demanded within three months after its completion with water-bound limestone macadam in 1910. Table IV.

TABLE I—TRAFFIC CENSUSES—OLD FORM OF RECORD.

Items.	Park Heights Avenue Section 1.	Baltimore-Washington Road Section **	Boston-Wye Mills Road *
Led or ridden horses	30	0	0
Single horse vehicles	245	255	197
Double horse vehicles	104	67	70
Three horse vehicles	10	4	0
Four horse vehicles	14	2	0
Five horse vehicles	0	0	0
Six horse vehicles	1	0	0
Motorcycles	8	10	1
Runabouts	26	5	4
4 or 5-seat cars	141	36	2
6 or 7-seat cars	66	7	0
Motor trucks	4	3	0

*7 a. m. to 7 p. m. **8 a. m. to 7 p. m.

TABLE II—COMPARISON OF TRAFFIC—NEW FORM OF RECORD.

Items.	Park Heights Avenue City End.	Baltimore-Washington Road City End.	Easton-Wye Mills Road Just Outside of Boston.	Remarks.
Horse traffic	93	74	56	Figures are reduced to hour basis.
Motor traffic	484	104	10	
Totals	577	178	66	

TABLE III—COMPARISON OF NEW YORK AND CROSBY FACTORS, PARK HEIGHTS AVE.

Items.	Number.	New York Factor.	Units Prod.	Writer's Factor.	Units Prod.
Led or ridden horses	3	1	3	1	3
Single horse vehicles	28	2½	70	2	56
Double horse vehicles	10	3½	35	4	40
Three horse vehicles	1	5	5	6	6
Four horse vehicles	1	6	6	8	8
Five horse vehicles	0	0	0	10	0
Six horse vehicles	0	8	0	12	0
			119		113
Motorcycles	2	1	2	2	4
Runabouts	1	2	2	10	10
4 or 5-seat cars	10	4	40	20	200
6 or 7-seat cars	5	7	35	40	200
Motor trucks	1	10	10	20	20
			89		434

TABLE IV—TRAFFIC CENSUS AND UNITS—EASTON-WYE MILLS ROAD.

Items.	No.	New York Factor.	New York Units.	Writer's Factor.	Writer's Units.	Remarks.
Single horse vehicles	197	2½	493	2	394	Count covers
Double horse vehicles	70	3½	245	4	280	12 hours.
			738		674	
Motorcycles	1	1	1	2	2	Motor traffic
Runabouts	4	2	8	10	40	probably at
4 or 5-seat cars	2	4½	9	20	40	minimum of
						year.
			18		82	

The writer believes that if some such system as is outlined above can be generally tried for a period of a few years, it can be worked out to confer a great practical benefit.

The Municipal Asphalt Paving Plant at Detroit, Mich.

By Len G. Shaw, Highland Park, Mich.

IT is seven years since Detroit installed its own asphalt plant, and in a modest way began patching streets where the original guarantees had expired, together with a little resurfacing. To the present time the city has saved in this quarter alone $174,866.18, according to the report of Asphalt Expert Clarence A. Proctor, as submitted to Commissioner of Public Works Jacob J. Haarer. The report covers in detail the operations of the plant during this term, and provides interesting reading matter, particularly in the light of the fact that the Detroit plant was one of the first municipally owned enterprises of this nature in the country, and that from an humble beginning it has grown until now all asphalt paving in Detroit is cared for in this manner.

In setting about determining the saving to the city through the operations of the municipal plant, Expert Proctor pursued a very conservative course. The basis of his calculations was the lowest average contract price for work of this nature in Detroit during the first five years the plant was in operation. Figuring the yardage laid by the city on this basis, it was an easy matter to discover the difference between what would have been paid had the work been done in this manner and what it actually cost under municipal operation, proper allowance being made for maintenance, depreciation of plant and other items that must enter into the calculations if there is to be a fair determination of what has been accomplished. Ten per cent was charged off to depreciation, every other bit of overhead expense was taken care of, labor and material accounted for, liberal allowance made for maintenance, and it was found that on the 1,089,908.23 square yards of pavement dealt with in the report the city had saved exactly $174,866.18, an average of approximately $25,000 per annum since the installation of the plant.

Of course, the saving each year varies, in part according to the amount of work done, although there are other factors that must be taken into consideration, such as increased cost of material and labor. It is worthy of note in this connection that when the municipal asphalt plant was installed asphalt was selling at $22 a ton. Last year the city paid $31.60 per ton, an increase of forty per cent. While the advance in this respect over the figures prevailing during the period when the average contract price was determined has not been quite so pronounced, it is sufficient to show that the average taken in making the computation was well below what the actual cost would have been under contract. During 1910 the city laid 262,964.78 square yards of asphalt, this including paving, repaving, surfacing and patching. This was 10,000 yards more than the plant had ever handled in a single season, and on this work the city saved $41,525.68, the same basis of comparison being used in determining the saving that was employed in determining the saving for seven years.

There has been no attempt on the part of Commissioner Haarer to shut off competition from outside sources. Bids are asked, but the plant has proved so economical in operation that asphalt contractors not only find themselves unable to compete, but have even employed the city to take care of maintenance on streets where their original guarantee has not expired, this proving cheaper than moving a plant and equipment here for the small amount of maintenance that has to be taken care of each year.

The city lays no foundations, nor does it set the curbing on new streets, this being done by contractors under a competitive system. But it does handle all the asphalt paving, repaving and resurfacing, as well as the patching.

It is of interest at this point to note that although liberal provision is made for maintenance on streets laid by the city, the expense therefor has thus far been insignificant. Last year, for example, the total cost of maintenance on 1,089,908.23 square yards, exclusive of patching, on which there is no maintenance, was $251.23, this being based on the patching rate of $0.9313 cents a square yard. Of this amount $162.37 was used in patching a stretch where the trouble was of long standing, disintegration being caused by a leaky gas main, while the rest was spent chiefly on streets laid by the city that had been down seven years.

In determining the comparative cost of paving in Detroit and other municipalities the amount of material used plays an important part. Here more asphalt is used than some cities deem necessary. For repaving and resurfacing there is 1½-inch binder and 2 inches of topping compacted, while patching averages 3 inches, mostly topping, a very liberal allowance.

It will be noticed by reference to the appended tables that the city's profits from the asphalt plant have been considerably swelled as a result of patching done for contractors and private parties, such as public service corporations. In seven years 51,956.83 yards of pavement were laid in this manner, the amount received being $70,826.99. On a basis of $1.03584 per square yard, this work cost the city $53,819.11, leaving a net profit of $17,007.88. Another item of consequence in this connection was $26,453.53 received from contractors and from the park and boulevard commission for paving and repairing. On the 27,542.30 square yards of asphalt laid for the park and boulevard commission there was no allowance for maintenance, this being taken care of by the commission. The same is true of 18,116.56 square yards laid for contractors, who provide for the maintenance.

As it stands today the Detroit plant represents a capital investment of $53,114.81. It has a maximum capacity of 12½ miles a season, and so rapidly has the work increased that added equipment will shortly become necessary.

For the benefit of those interested in such matters, the detailed report of seven years' operation is given herewith, every item having been handled in full by Mr. Proctor and concurred in by Commissioner of Public Works Haarer:

EXPENDITURES, TABLE "A."

Capital expenditures—		
Buildings	$ 2,543.28	
Plant	24,702.55	
Portable plant	9,716.39	
Equipment	12,956.37	
Small tools	2,007.28	
Laboratory equipment, furniture	1,188.94	
Total capital expenditures		$53,114.81
Operating expenses—		
Salaries of expert and assistants	$25,174.51	
Sundry expense items	2,779.82	
Repairs and renewals	17,639.22	
Total operating expenses		$45,593.55
Total expenditures, except for material and labor at plant		$98,708.36

EXPENDITURES, TABLE "B."

Salaries of expert and assistants	$25,174.51	
Sundry expense items	2,779.82	
Repairs and renewals	17,639.22	
		$45,593.55
Less portion of salary of asphalt expert for years 1904-5-6 chargeable to inspection of contract work		3,500.00
		$42,093.55
Loss on sale of portable plant cost	$ 9,716.39	
Less depreciation, 2 years	1,943.28	
Sold for	5,000.00	
		$ 2,773.11
Estimated depreciation on capital expenditure on basis of 10 per cent. per annum—		
First year on $17,969.57	$ 1,796.96	
Second year on $25,923.81	2,592.38	
Third year on $35,238.97	3,523.90	
Fourth year on $42,404.85	4,240.49	
Fifth year on $45,720.72	4,572.07	
Sixth year on $46,846.47	4,684.65	
Seventh year on $48,114.81	4,811.48	
On orrowed equipment for 7 years	2,387.00	
		$28,608.93
Total expenses for 7 years		$73,475.59

CREDITS, TABLE "C."

Square yards of private patching and amount received for same—

Year.	Square Yds.	Amount Received.
1904	10,327.88	$10,241.73
1905	5,188.88	7,340.83
1906	6,162.78	9,170.78
1907	7,387.49	11,115.01
1908	11,055.79	16,009.28
1909	5,481.29	8,048.16
1910	6,352.72	8,901.20
Totals	51,956.83	$70,826.99

Cost to city, $1.03584 per sq. yd.	53,819.11
Net profit to city	$17,007.88
Less demurrage, 1906	139.00
	$16,868.88
Sale of empty oil barrels gravel, use of roller, etc.	2,608.07
Use of plant by contractors	200.00
Paving and repairing for contractors and park and boulevard commission	26,453.53
Sale of mixture to contractors for patching	379.00
Overage Venezuelan asphalt accounted for in former reports	160.03
Allowance for fittings to tank car, extra labor and unloading	28.90
Error in California oil charge, 1906	308.99
	$47,007.40

Cost per square yard—

Repaving and resurfacing, 1½-inch binder, 2 inches topping compacted. Patching average 3 inches, mostly topping.

	Square Yards.	Labor and Material.
Resurfacing	661,864.20	$0.86863
Paving-repaving	233,332.54	.86491
City and private patching	194,711.49	.9635
Total	1,089,908.23	

Overhead Charge, Table "B."	Total Cost, Exclusive of Maintenance.
.06735	$0.93598
.06735	.93226
.06735	1.03085

Total Cost 7 Years Production Exclusive of Maintenance.	Less Credits, Table "C."	Net Cost per Sq. Yd. Exclusive of Maintenance.
$ 619,492.46	$ 8,339.12	$0.9234
217,527.42	19,288.73	.8496
200,715.90	19,379.55	.9313
$1,037,735.78	$47,007.40	

Net Cost Exclusive Maintenance.	Ten Years Square Yards.	Maintenance Estim'd Reserve, 20c Sq. Yd.
$611,153.34	*634,321.90	$126,864.38
198,238.69	**215,215.98	43,043.20
181,336.35	†	
$990,728.38	849,537.88	$169,907.58

Total cost per square yard: resurfacing, $1.1105; paving-repaving, $1.0496; city and private patching, $0.9313.

*Difference 27,542.30 sq. yds. laid for park and boulevard commission, to be maintained by them.

**Difference 18,116.56 sq. yds. laid for contractors, to be maintained by them.

†No maintenance on patching.

Total Cost to City.	Lowest Average Contract Price.	Total Contract Price.	Estim'd Saving to City.
$ 738,017.72	$1.23	$ 814,092.97	$ 76,075.25
241,281.89	1.30	303,332.30	62,050.41
181,336.35	1.12	218,076.87	36,740.52
$1,160,635.96		$1,335,502.14	$174,866.18

Cement Concrete Street Paving in Mason City, Iowa*

By F. P. Wilson, City Engineer

THE past five or six years I have made a broad study of cement paving and have visited a large number of cities in the Northern States where this class of pavement has been laid, and I watched the methods of construction in detail for this class of pavements.

It is my opinion that a Portland cement concrete pavement, properly laid in an up-to-date manner with first-class cement, good clean, sharp sand, and good, clean, hard stone, with proper allowance made for expansion and contraction, certainly warrants the use of the same on account of its first cost, cheapness to maintain, the cleanliness of the streets, and the small expense to repair where it becomes necessary to cut holes.

During the summer of 1909 the city of Mason City, Iowa, laid six thousand square yards of cement paving in the down-town district, where it would have a test under the most severe traffic. At this time, after standing severe test of last winter and heavy traffic last year, also the cold of this winter to date, it is at this time, in as good a condition as the day it was finished.

The past season twenty-five thousand square yards were laid, and at this writing contracts have been let for forty-three thousand square yards, which this city expects to have laid this coming summer.

In constructing a first-class cement pavement, the first requirement is to have strictly first-class material; secondly, to have a first-class up-to-date set of plans and specifications and, lastly, a rigid and close following of those specifications in every detail.

The following are the detail specifications for Portland cement concrete pavement, which I have used in the construction of all concrete paving laid in Mason City, which has proven entirely satisfactory.

Preparation of Roadbed. All streets, prior to laying any pavement thereon, shall be graded that the pavements will be at the established grade when completed. After excavating to sub-grade, unless the Engineer deem the natural ground a proper foundation, excavation shall be continued until solid ground is reached and then re-filled to sub-grade with sand, gravel or broken stone.

The contractor shall be required to remove at his own expense all obstructions, such as trees, old blocks, debris, etc.

Excavation. All excavated material, gutter stones, planks, macadam, crossing-stones, old curbs, surplus earth, etc., shall be the property of the city and be deposited by the contractor in such place and manner as shall be directed by the engineer, the distance not to exceed three thousand feet. No plowing will be allowed within three inches of the bottom of the foundation.

Rolling. When the street shall have have been graded and shaped to its proper form, it shall be thoroughly rolled with a ten-ton roller to a thoroughly compact surface. If the ground is wet, sand or gravel is to be put in before rolling.

Any depression discovered after this rolling, shall be re-filled to sub-grade, re-rolled, and this repeated until a roadbed, perfect as to grade and form, shall have been made.

Tamping. When the use of the roller is impracticable, the foundation must be thoroughly puddled and rammed until compacted to the satisfaction of the engineer.

Concrete Foundation. Upon the roadway thus formed, will be laid Portland cement concrete five inches thick, to be made as follows: one part by measure of Portland cement; two parts by measure of clean sharp sand, and five parts by measure of broken stone.

The sand and cement shall be thoroughly mixed dry, on a tight floor, and then made into mortar at the proper consistency and thoroughly mixed over with hose or shovels, or a batch mixer approved by the engineer. Broken stone, thoroughly cleaned of dirt, drenched with water but containing no loose water in the heap, shall then be added to the mortar in the proper proportion. The concrete will then be turned and mixed until each fragment is thoroughly coated with mortar, a strictly wet mixture being required. The concrete thus mixed shall have such a consistency that when rammed the mass will not

* A paper before the Iowa Engineers' Society.

shake like jelly, but will when struck, compact within the area of the face of the hammer without displacing the material laterally.

The concrete thus prepared shall be placed immediately in the work. It shall be spread and thoroughly compacted by ramming until free water appears on the surface, which shall be made smooth and parallel to the surface of the finished pavement. The whole operation of mixing and laying each batch of concrete shall be performed in an expeditious and workmanlike manner and be entirely completed before the cement has begun to set.

No re-tempering of concrete will be permitted, and concrete in which the mortar has begun to set will be rejected.

The thickness of this concrete to be five inches after the same has been compacted.

Extreme care should be taken that the sub-grade is kept moist while this concrete is being put in place.

No concrete shall be laid when the temperature at any time during the day or night falls below thirty-five degrees above zero, Fahrenheit.

Wearing Surface. Upon the concrete heretofore specified shall be immediately laid a wearing surface two inches in thickness to be made as follows: One part by measure of Portland cement, two parts by measure of coarse, clean, sharp sand; the sand and cement shall be thoroughly mixed dry, on a tight floor, and then made into mortar of the proper consistency and thoroughly mixed over with hose or shovels or a batch mixer approved by the engineer.

The mortar thus mixed will be immediately laid upon the concrete heretofore specified.

Before this mortar has begun to set it will be finished off to a smooth surface and corrugated according to the plans.

Corrugations. After the wearing surface has been completed the same shall be corrugated at an angle of ninety degrees with the curb, said corrugations to be nine inches apart. The corrugations to be three-eighths of an inch in depth and shall be formed with proper tools made for the purpose, and when the pavement is complete the corrugations shall present a slightly rounded upper edge so as to provide a firm and substantial foothold for the horses, no sharp corners to be left.

Where the street has a flat grade, the city council may, if they deem it advisable, omit the corrugations, and the wearing surface shall be finished with a wood float and before it has completely hardened it shall be roughened by brushing with a stiff vegetable brush or broom.

The curvature and cross sections of the pavement to be made according to the plans governing the same.

Requirements of Materials. The cement used in the work will be submitted to the tests approved and recommended by the American Society of Civil Engineers, which it must stand to the satisfaction of the engineer.

All Portland cement used in the work shall be Northwestern States Portland Cement or other Portland cement equally as good, which shall be protected from the weather, free from exposure to air slaking and from moisture until used.

The sand shall be clean, sharp sand.

The stone used for the concrete shall be of the best quality of hard limestone, or other stone equally as good, and shall be broken to such a size that the fragments shall not be larger than will pass through an inch and one-half ring and not smaller than a hazel nut. It shall be free from dust, dirt, loam or other objectionable material and shall be screened when necessary over a one-half inch screen to eliminate dust and small particles.

Expansion Joints. An expansion joint one inch in width shall be left next to the curb on each side of the street or alley, also an expansion joint one-half inch in width will be left every twenty-five feet across said pavement at right angles to the curbs. Said expansion joints are to be filled with an asphalt paving filler of proper quality and consistency approved by the engineer. It will be applied while heated to a temperature of about four hundred degrees Fahrenheit, and shall be so applied that said expansion joints shall be thoroughly filled clear to the top of surface of said pavement.

All forms for expansion and contraction joints shall be made of iron or steel in the form of a template, cut to the desired shape of the street according to the plans, and of sufficient strength to resist springing out of shape. All mortar and dirt shall be removed from forms that have been previously used. The forms shall be well staked to the established lines and grades.

Contraction Joints. Contraction joints shall be made entirely through the pavement every twelve and one-half feet at right angles with the street.

The edges of all expansion and contraction joints shall be rounded to a radius of about one-half inch with proper tools.

Care shall be taken to obtain a surface free from ridges, at expansion or contraction joints, and depressions or unevenness in the surface, that will detract from its appearance, or cause water to lay on the pavement.

Any section having such inferior surface will be rejected, and shall be rebuilt by contractor at his own expense.

Care shall be taken to make the expansion joints in such a manner that they are practically the same width throughout their depth.

Extreme care must be exercised in removing templates or divisions used to make expansion or contraction joints; the breaking out of any portion of the pavement in removing such templates and forms will not be tolerated, and such damaged portions of the work shall be torn out and replaced in good condition by the contractor at his expense.

The contractor shall keep pavement sprinkled for one week after it is laid or longer if deemed necessary by the engineer.

The contractor shall keep the streets barricaded where pavement has been laid at least two weeks after the completion of the same.

The above specification was followed very closely in every detail.

In this work twelve thousand barrels of Northwestern States Portland cement were used; from every car ten samples were taken, tests were made for fineness, tensile strength and specific gravity, also boiling tests were made.

In the construction of this work a mechanical batch mixer with a twenty-five foot boom, with a traveler on the same, was used. This mixer is manufactured by the Koehring Company of Milwaukee.

After the sub-grade had been thoroughly rolled the material was distributed along the street, the rock on one side and the sand on the other. The mechanical mixer was set up at the end of the street twenty-five feet from the place of beginning. In the first section, twelve and one-half feet by thirty feet, the concrete was placed. Immediately the wearing surface was placed upon the concrete, not to exceed twenty minutes elapsing between the time the concrete was placed and the wearing surface was put on the same. Then following the next section of twelve and one-half feet by thirty feet was put in. Then the mixer propelled itself backward twenty-five feet and proceeded as before.

Parallel with the curb and ten feet out from the same the wearing surface was cut through into the concrete, these parallel cuts being ten feet apart so that our actual blocks of concrete are only twelve and one-half feet by ten feet.

Some of the streets where the cement paving was laid were very soft and swampy. To obtain a dry and well drained sub-grade a trench parallel with the curb on each side of the street and eighteen inches out from the curb and eighteen inches below sub-grade was excavated and a four-inch drain tile laid in the same and said drain tile connected with the sewers. The earth excavated from said trenches was hauled away and said trenches were re-filled with good, clean, hard, burned cinders, making a thorough drainage for the sub-grade.

The contract price for these cement pavements, including excavation, was $1.25 per square yard.

The cost to property owner was five cents a square yard in addition to the contract price, which includes the cost of engineering, inspection, advertising and levying the assessment, making a total cost of $1.30 per square yard to the lot owners abutting on said paving.

The Garbage Crematory at Houston, Texas*

By David M. Duller, C. E., Houston, Texas

Of all the methods of destroying garbage and refuse, that by fire is by far the most effective, as thus all accompanying bacteria are killed and the organic matter is completely oxidized into gases and only ashes are left behind. The destruction of garbage, or, what is more correct, its reduction to ashes, in crematories especially built for this purpose, is therefore now in almost universal use.

The design of a furnace for the burning of garbage, street sweepings, rubbish, etc., is, however, by far more difficult than it appears to one unacquainted with the problem. This is due to the ever-changing composition of the materials to be destroyed and to the difficulty of securing complete combustion. Garbage, street sweepings, etc., contain a great amount of moisture, often from 30 to 72 per cent., which must be evaporated either in the process of burning or by preliminary drying, and a very high temperature and an excess of air must be maintained in the furnace at all times, as otherwise the chimney gases will be extremely offensive.

There have been put into service a number of different furnaces or garbage crematories, but most of them have only been successful in larger cities, where the different kinds of refuse are collected separately and where continuous operation can be maintained. Most of these large crematories need auxiliary fuel, and with some of them a special apparatus for preliminary drying of the refuse had to be connected. Both cost of construction and cost of operation have been very high, and even for larger cities of 100,000 inhabitants and over, a garbage crematory plant up to this time has been a heavy burden. There was no furnace which met the demands of smaller cities, and, although the necessity of a crematory has been felt everywhere, even in the smallest country towns, the city authorities were unable to install such a plant on account of its excessive cost.

Even a great number of larger cities have, after careful investigation, decided not to utilize the crematory heat for steam production on account of the following reasons:

1. If the refuse is not collected separately, its fuel value is very low, and, as these plants have to use a large percentage of auxiliary fuel with the garbage, the cost of steam production is often greater than if good fuel were burned alone.

2. The boilers must be about twice as large per horsepower generated as would be required in an ordinary plant. If fuel is reasonably cheap in the locality where the plant is to be built, the economy effected by using the waste heat from the crematory will not pay interest on the increased investment.

3. The temperature and the volume of gases from the crematory vary so much that the generation of steam is very unsteady. It is, therefore, always necessary to employ an additional boiler, fired separately, to generate enough steam to make the power steady. This again increases the cost on construction and operation, and, therefore, even at its best, the utilization of the waste heat is a doubtful economy.

4. There is, as a rule, a great increase in cost of the hauling of the refuse to the power plant. In order to use the steam to the best advantage, the location of the plant can not be decided upon from the standpoint of economical transportation alone, and very often the increased cost of hauling dissipates all the savings which possibly could be effected by steam generation.

There are, however, conditions in certain localities where, on account of some manufacturing concerns, large public institutions, homes, trades, or the like, a great amount of combustible refuse is produced, and where in connection therewith, for the reason of high prices of fuel in such locality, the generation of steam by burning this refuse will be economical. These, however, are very rare instances, and even then very careful investigation by experts should be made before any decision is reached to install such steam plants.

The Thompson crematory for the city of Houston is not designated to utilize the waste heat for steam generation. The crematory is, however, designed so that a water-tube-grate, in which sufficient steam can be produced for driving a blower to increase the

* A paper before a convention of Health Officers of Texas.

draft, if such should become necessary for certain purposes, may be installed. In all ordinary cases, however, where mixed refuse is burned, natural draft alone is used, no blower or other machinery is attached, and therefore the Thompson crematory is a model of simplicity and economy, and is by far the most economical furnace ever designed for this purpose.

A careful study of the subject and investigation of the local conditions and the results of garbage disposal plants in a great number of other cities, and a series of very exhaustive experiments, resulted in the design and installation of a crematory plant for the city of Houston which has now been in successful operation for over three years.

There has hardly ever been any other crematory plant used as hard and for so many different purposes as this one, but it stood all the tests to the fullest satisfaction, and the results of the most severe tests have been excellent in every instance.

In one test there were twenty-three dead dogs cremated in one day without the slightest trouble, no auxiliary fuel, except the regular trash and garbage was used, and no offensive odors of any kind were noticeable.

This crematory is located in the center of a well-built section of the city, and has done its work without any objectionable effect. For over three years this crematory was the only method that the city of Houston used for destroying its garbage, refuse, the smaller dead animals, etc.

In the Mayor's annual message and department report the following statement is made:

"The operation of the garbage crematory has been satisfactory. This plant has a capacity of sixty-five cubic yards, and is sufficiently large to care for all the garbage removed from the business center of the city. Not only is it a benefit from a sanitary standpoint, but by reason of the fact that the haul is shortened, it is possible to clean the business center of the city earlier, with less equipment, than would otherwise be required. No fuel is necessary for the furnace, as the lighter material is made to serve as fuel to consume the heavier substances. The smaller animals dying in the city limits are cremated here, and last summer the 563 dogs destroyed by the dog catcher were disposed of in this manner."

As a consequence of the excellent results obtained, the city of Houston has now replaced this plant by a new Thompson crematory of a larger capacity.

In reply to our inquiry we received a letter from the city engineer of Austin, Texas, commenting on the satisfactory working of their Thompson crematory, which had been in use for several months.

The construction of the Thompson crematory is very simple, and therefore the cost of its maintenance and operation is reduced to a minimum.

The furnace consists in the main of a vertical cylindrical combustion chamber, which by a series of grates is horizontally divided into four different compartments. The lower compartment is the ash-pit, which is provided with a clean-out door through which the ashes are removed and by which also air can be admitted. For this purpose special air regulators are also provided.

The second compartment is the room between the secondary and main grate. Here the cinders and ashes which have passed the fires above and have dropped through the main grate are reburned before they finally pass into the ash-pit, and therefore absolute combustion must take place. This chamber is also provided with all the necessary regulators.

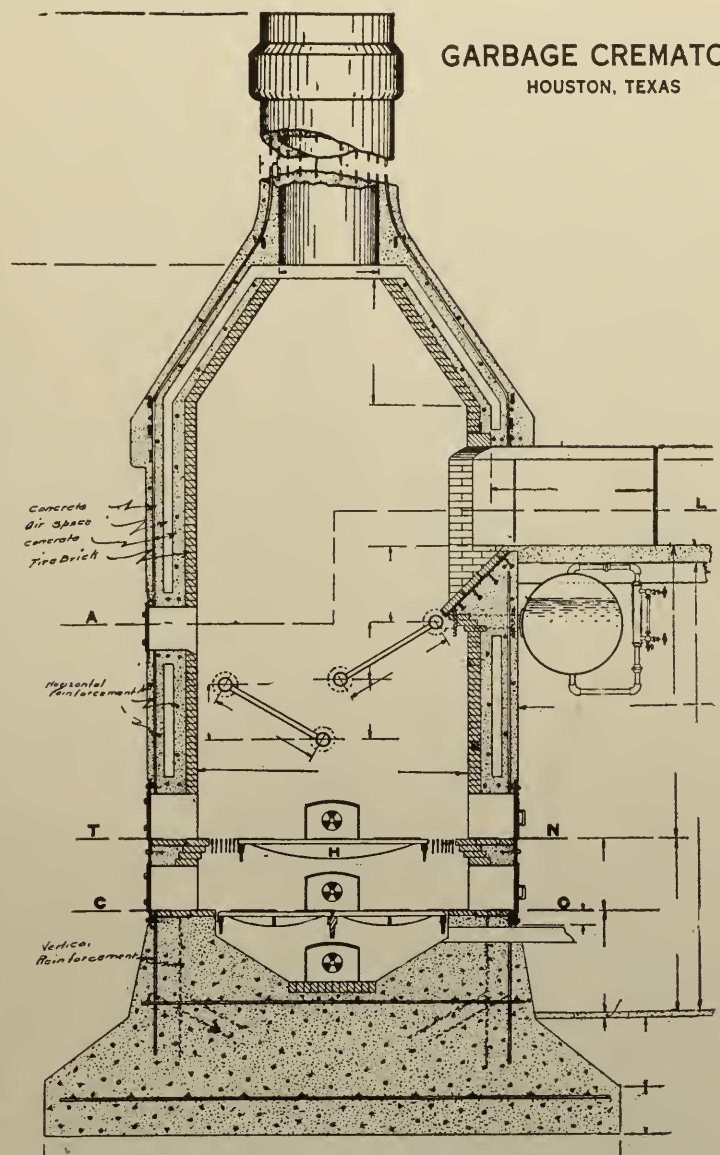
The third compartment is the room above the main grate, and, as the name implies, the hottest fire is maintained here on this grate. Stoke holes, air inlets and clean-outs are also provided here.

The fourth compartment is the room above the water-tube grate, and this compartment is connected with the chimney, which is built directly over it, thus securing the best possible draft conditions.

The furnace is charged through the feeding chute, which empties above the water tube grate. This grate is so arranged that it holds the garbage like a basket, and allows it to drop on the main grate only after a preliminary drying has taken place and after the more bulky materials have been partly reduced. In this manner any clogging of the main fire is most effectively prevented, and odorless combustion is possible at all times.

The water tube grate is connected with a water tank, which is located under the charging floor, and a free circulation of the water through the tube grates is accomplished. All the steam generated in the tubes accumulates in this tank, and if necessary sufficient steam can be drawn from it to drive a fan or blower. If no use is made of the steam it will either escape through a steam pipe connected with the chimney, or it can be condensed by a small condenser and the water can thus be saved. The water grates are so constructed that they can easily be cleaned in all parts, all main connections of same being located at the outside of the furnace.

The Thompson crematories are built of two strongly reinforced concrete forcement and the arrangement of air isolation chambers, which are provided to protect the outer concrete walls against excessive heat from the furnace within. All manholes, stokeholes, air regulators, charging chute, grates, dampers, water tanks, etc., are made of cast or wrought iron, as best adapted for their purpose, and only first-class materials are used in every in-



VERTICAL SECTION.

walls, with an air space between, and heavily lined with fire brick. The chimney is of reinforced concrete, built according to the Weber system, which today, without any doubt, represents the most advanced type of chimney construction and has proved its superiority by long years of hard use in almost all civilized countries. The figure herewith shows the details of construction, the location of the rein- stance, together with best possible workmanship.

The operation of the crematory is very simple. After a small fire has been started on the main grate with easily combustible materials, selected from the refuse, the plant is charged through the chute. Care must be taken to have the water tank filled before starting the fire, in order to prevent burning of the tube grates.

On the water tubes the garbage, etc., is suspended until it is dried and sufficiently charred to fall through them directly upon and into the main fire, where it is fully consumed. The cinders falling through the main grate are retained on the secondary grate below, and only after they are completely incinerated they can pass into the ash-pit.

Tin cans, bottles, wire, iron, flower pots and similar materials are taken from the garbage by the man on the charging floor and thrown directly into the ash pile.

There are only three men necessary for operating a twenty to thirty-ton crematory. One of these men, who acts as a foreman, should have some intelligence and must understand the operation of the plant in every detail. The two others can be common laborers, as their work consists only of feeding the furnace, removing the ashes, stoking, etc. There is no other expense connected with the operation of this furnace, and therefore the Thompson crematory is the most economical in operation.

The Thompson crematory has the following advantages over any other type of furnace known for the reduction of solid wastes:

1. The cost of construction is very low; in fact, it costs less than one-tenth of some plants built heretofore by several other crematory builders. For this reason even the smallest town can afford to own such a plant and to secure for its citizens all the benefits derived from its operation.

2. The Thompson crematory requires no auxiliary fuel for its operation. On account of its ingenious construction and the arrangement of the grates, one directly above the other, drying and burning of the trash takes place in the same furnace.

3. On account of the excellent natural draft obtained by placing the chimney directly over the furnace, without any horizontal flues, absolutely perfect combustion takes place, and a high temperature is maintained in the furnace at all times.

4. There are no objectionable odors of any kind connected with the operation of the plant. The Thompson crematory can be located within any part of the city. By this arrangement the cost of collecting and hauling of the refuse is greatly reduced, and this reduction alone more than pays the cost for the operation in most instances.

5. No continuous operation is necessary to obtain best results. The crematory can be used for several hours per week only if so desired. This is of highest importance for smaller towns, where only one collection per week is all that is required. This is also an important point in large cities, where, in order to reduce the cost of collecting and hauling, a small furnace is built for each district. When there is not enough garbage in each district to keep a crematory in continuous operation, the same men can be used to operate the different furnaces alternately.

6. On account of its compact construction and the arrangement of building the furnace and chimney on the same foundation, a minimum of space is occupied by the Thompson crematory. The whole plant can be erected on a small lot, and, in fact, no other garbage crematory can be compared with this type in that respect.

This crematory is designed in different sizes, in accordance with the requirements, from the smallest type for large private residences, hospitals, hotels and other institutions, to the largest sizes for large municipalities, military camps, etc.

The smaller types can easily be built within a basement, and if they can be connected to an existing chimney of sufficient size, the cost will be greatly reduced.

The larger sizes are capable of consuming from twenty to one hundred tons and more of garbage per ten-hour shift, in accordance to the grate areas and composition of the waste to be burned.

The cost of construction depends largely upon local conditions, prices of building materials, subsoil for foundation, etc.

Sewerage at Orlando, Fla.

By S. H. McMullen, C. E., Anderson, Ind.

ORLANDO is a city of 5,000 population in the east central part of Florida. It is a modern, up-to-date city. Its principal street is paved with brick and most of the others are made of a marble clay found near the city. This clay packs hard, making beautiful driveways for the streets and surrounding country.

The sewerage system is very peculiar. Inside the city limits there are thirteen lakes. The largest is about half a mile across. All these lakes drained into what was known as the Sink. All the surface drainage of the city passes to the nearest lake and from there to the Sink. A few years ago this Sink, from some unknown cause, suddenly closed and the water around the Sink began rising till it covered some two hundred acres of surrounding territory. The citizens were at a loss what to do, but finally summoned an expert engineer, who, after examining the territory drained, decided there must be an underground river or cavern of some sort. So an eight-inch pipe was driven near the Sink, and at a depth of 400 feet there seemed to be an empty space. Water arose within a few feet of the top. As Orlando is 135 feet above sea level, this space is 265 feet below sea level. The pipe was cut off four feet below the level of the surface water and as soon as the obstructions were removed the back water poured in with a roar. An eight-gallon tin bucket turned upside down over the pipe had the bottom torn out as though it was paper. After draining this surface water all off, the fire engines were brought and six lines of hose with 2½-inch nozzles put into the pipe, and with all running in at once, they could not fill it up.

The principal business blocks of the city and many residences are connected with the sewer system for house drainage. The smaller business houses and most of the residences have out-houses with galvanized buckets. These buckets are emptied and washed each week. The city is clean and their system of sewerage seems well adapted to the place.

Modern Sewage Disposal

By F. W. Kerns, C. E., San Francisco, Cal.

THE question of the best method of sewage disposal for inland cities is so largely a matter of local conditions that the last word cannot be said without a thorough investigation of each particular case. Besides the local physical conditions and characteristics, there must also be considered the sanitary laws and regulations, which, in the United States, are not yet as well crystallized as in England or on the continent, where the greater density of population earlier forced the consideration of such matters.

The principal methods that have been or may be used to advantage in interior cities are:—disinfection, electrolysis, irrigation, screening, filtration, septic or sedimentation tanks, and various combinations of these.

The disinfection method of disposal, in certain cases, may be useful, but at present, it is expensive, and somewhat in the nature of an experiment. Proper disinfection requires previous treatment to remove solids of any considerable size, as disinfectants do not penetrate solids to a sufficient depth to destroy disease germs.

Another method yet in the experimental stage and needing verification under other and varying conditions before its worth is fully proved, is the electrolytic process, for which great success is claimed at Santa Monica, California. The claim is made that practically all bacteria are destroyed and that the effluent is a colorless, odorless liquid containing only an inoffensive flocculent matter or coagulum. This plant, however, is essentially a combination of methods, the preliminary treatment only being electrolytic, the final treatment being dilution in the waters of the Pacific.

The method proposed as ideal, ever since the inception of the sewage disposal question, is the irrigation method, which, under ideal conditions, should return all waste matter to the soil as fertilizer. But like most ideals, this has never been realized. Only in arid localities, where the water is of more value than the fertilizing matter, does there seem to have been even partial success. The extreme dilution of sewage renders the plant-food elements practically negligible and a large part of the soluble elements drain through the soil. Cold, the constant flow of sewage, the absence of crops in certain seasons and the lack of certain soil elements or of aeration and oxidation unless the process is intermittent, all combine to prevent the formation of plant-food elements in an assimilable form. An inherent prejudice, not without reason, against the products of sewage farms, and the necessity for nitrifying plants, confines the crops that may be raised to a few varieties. Where preliminary treatment, resulting in the production of sludge, is used, certain elements are retained in the sludge which may have a small value as a fertilizer, but it is not as efficient as an artificial fertilizer. While a profit is shown for the sewage farm at Pasadena, California, and also at Melbourne, Australia, the profit seems to be due to the increase in the value of the land in the former place, and to the omission of the proper capitalization charges in the latter.

Screening devices of nearly every form imaginable have been built and tried, particularly in Germany, but even here they are being replaced by sedimentation tanks, which are found to give better results for the removal of suspended matter. The field of usefulness for screens seems to be limited to the removal of only the coarser material that might interfere with pumping or other subsequent treatment.

Land filtration is undoubtedly one of the best and most economical methods to be employed, where land of sufficient area with suitable character and location is available, a combination which is rarely to be had. The experiments of the Massachusetts State Board of Health have furnished results that enable the adaptability of land for filtration to be determined, and if this be favorable, the principal points requiring attention are a proper distribution and drainage system. Where a tract of suitable character or size cannot be obtained, an artificial filter may be constructed, which may be either of the percolating or contact type. In the former type, the sewage percolates or trickles through the filter continuously, and on account of the better aeration, it gives more satisfactory results and is superseding the contact type, which is filled and emptied intermittently. To prevent clogging of filter beds, preliminary treatment, such as screening, sedimentation or septic tanks is usually necessary.

The advent of the septic tank was heralded some years ago as the panacea for all sewage disposal ills. Popular articles described the complete destruction of all matter (both organic and inorganic) by bacteria, that in their greed finally destroyed each other, the sole survivor dying of starvation, in a tank from which light and air were absolutely excluded, lest nature be disturbed in her secret and wonderful process, and from which an effluent as pure and sparkling as drinking water issued.

Cameron's patent claim, made in 1896, was that "the sludge portion of crude sewage is entirely thrown into solution," and that the gases produced would be a source of revenue. Investigation soon demonstrated that septic action did not liquefy and gasify all matter and that the sludge question must be seriously considered. Claims for the percentage of sludge digestion in the tank dropped from 100 to 50 per cent, then to 33 per cent, and recent reports place it as low as 10 per cent, while some authorities question any digestion at all, attributing apparent digestion to deposition and concentration. It was found that nature did not require a "dark room," but that action took place as well in an open as in a closed tank; and that the escape of hydrogen sulphide, having the odor of spoiled eggs, rendered the treatment far from inodorous, as had been claimed. The following is an extract from a report, recently made for the Chief Engineer of the New York Board of Estimate, on the septic and filtration plant at Columbus, Ohio, one of the most modern in the United States: "The fact that a strong wind was blowing almost continuously was advantageous. * * I caught the odor from the purification works suddenly and strong at a distance of about three-fourths of a mile from the works. There was no doubt about the character and offensiveness of this odor. It was characteristic of the septic tank and, for the moment, was nauseating. For the distance of three-eighths of a mile, this odor was dully sickening; from this point, it decreased in intensity and intolerability until a point to the windward of the septic tanks and in the vicinity of the filter beds was reached, where it was not so intensively offensive. * * The universal testimony (of various persons) was to the effect that under certain conditions, intolerable odors were appreciable to the limit of from three-fourths of a mile to one and one-half miles from the works, and the plant might be honestly considered a nuisance up to these limts."

Continued experiment showed that the septic tank gave an effluent that was not only offensive to smell, but that was putrescible; the fact was overlooked that a clear liquid could contain material that would putrefy; that is, organics, capable of putrefaction, could be dissolved in the clear effluent the same as ordinary sugar or salt is dissolved. It thus became evident that the septic tank was but one-half of the purification process, and that subsequent treatment was necessary.

And finally, experiments made by the Massachusetts State Board of Health ten years ago, and others, showed that the filter bed results were often better from raw than from septic sewage; and that if allowed to go too far, the septic action introduced poisons into the effluent that injured, rather than aided, the filter-bed results.

Though the septic tank has been clung to most tenaciously in England, its home, it is slowly but surely losing ground even there. Experiments convinced Mr. Mawbey, Engineer, of Leicester, England, "that advanced septic action certainly retarded, rather than faciliated the purification both in the beds and upon the land" and that the best treatment is sedimentation short enough to avoid septic action. Mr. Mr. John D. Watson, in charge of the tank at Birmingham, England, states that if he were starting anew, he would avoid septic action.

Rudloph Hering sums up the situation regarding the septic tank in Europe in the quotation: "The septic tank has gone; we have no further use for it." Dr. Dunbar, of Hamburg, Germany, in his work written in 1907, summarizes on the septic tank as follows: Advantages: (1) the separation of the solids; (2) the uniform mixture to be obtained from sewage very variable in composition; (3) the preparation of the sewage for biological after-treatment; (4) the utilization of the gases from the septic tank; (5) the diminution of the amount of sludge; (6) the septic sludge is more easily drained; and (7) the injurious action on pathogenic organisms. Disadvantages: (1) The foul smell of the effluent; (2) the increased difficulty of biological after-treatment; (3) the corrosive action of the septicized sewage on cement; and (4) the injury caused to fish life, due to the large quantity of sulphuretted hydrogen present in the effluent from septic tanks. Of the advantages, (5) is of small utility and (4) of none; (7) is of little value, as the principal danger from pathogenic germs is in drinking water, which can be purified enormously cheaper than can sewage; while (3) is accomplished better, and (1) and (2) as well, by the smaller and cheaper sedimentation tank. Of the disadvantages, none can be urged against the sedimentation tank.

Plain sedimentation tanks, which are simply settling chambers built only large enough to retain the sewage one or two hours, and from which the sludge is removed at intervals frequent enough to avoid septic action, are gaining ground as surely as septic tanks are losing. In Germany, the tendency is toward only a preliminary screening or sedimentation of sewage that can be discharged into streams under water. That movement in America is along the same lines, is indicated by the recent series of reports and subsequent discussion concerning the discharge of the sewage of the city of Rochester into Lake Ontario, 50 feet under water and 7,000 feet from the shore, the preliminary treatment being screening and sedimentation only. The outcome of the discussion and reports by some of the most prominent sanitary engineers of the United States was the recommendation that the original plans be changed so as to provide for future extension and multiple instead of single discharge, doubling the size of the sedimentation tanks, and the addition of scum boards for the retention of grease. At times, when the full capacity of the system is reached, the time of retention in the tanks, after being doubled in size, will be but ten minutes, so that they are in reality little more than grit chambers. The summary by the Chief Engineer of the State Health Department was that the preliminary treatment by screening and settling, followed by dilution, oxidation and digestion in the Lake, would remove the larger and most of the suspended matters, that no traces of matter offensive to the senses would appear along the lake shore, and that there would be little danger of pollution reaching the water supply intake, three miles distant. For Toronto, practically this scheme of disposal is being followed, the point of discharge in the lake being 4¾ miles from the water supply intake.

A combination of septic and sedimentation tanks, retaining the good and eliminating the bad features of both, has been recently developed by Dr. Karl Imhoff in Germany. In this tank, the liquid portion of the sewage is allowed to remain only long enough to deposit practically all matter removable by sedimentation, passing on through the tank before becoming septic. The solid matter sinks to the bottom of the tank, where it remains long enough to undergo complete septic action, being separated from the upper portion of the tank by an overlap. This overlap prevents the passage of gases, carrying small particles of sludge, through the upper portion, so that there is no escape of sludge with the effluent. It is claimed that there is little, if any, hydrogen sulphide generated (the principal products being inoffensive carbon monoxide and methane) and that the complete bacterial action transforms the sludge into inodorous humus, resembling loam, that drains and dries rapidly, the drainage water being clear and inoffensive. A few of these tanks have been installed in America, that are said to be fulfilling the expectations aroused by foreign results, and Atlanta, Georgia, is now preparing to treat all sewage in Imhoff tanks.

A comparatively recent development in sludge handling machinery, is the Schaefer-ter Meer centrifugal machine, that is in operation in Germany and in one or two places in the United States. This machine dries from 70 to 140 cubic feet of sludge per hour, effecting a reduction in volume to 14 to 20 per cent of the original. No manual labor is required except in removing the dried sludge, which is automatically ejected from the machine, but the cost of the machine is too high to be borne except by cities having a large amount of sludge to treat.

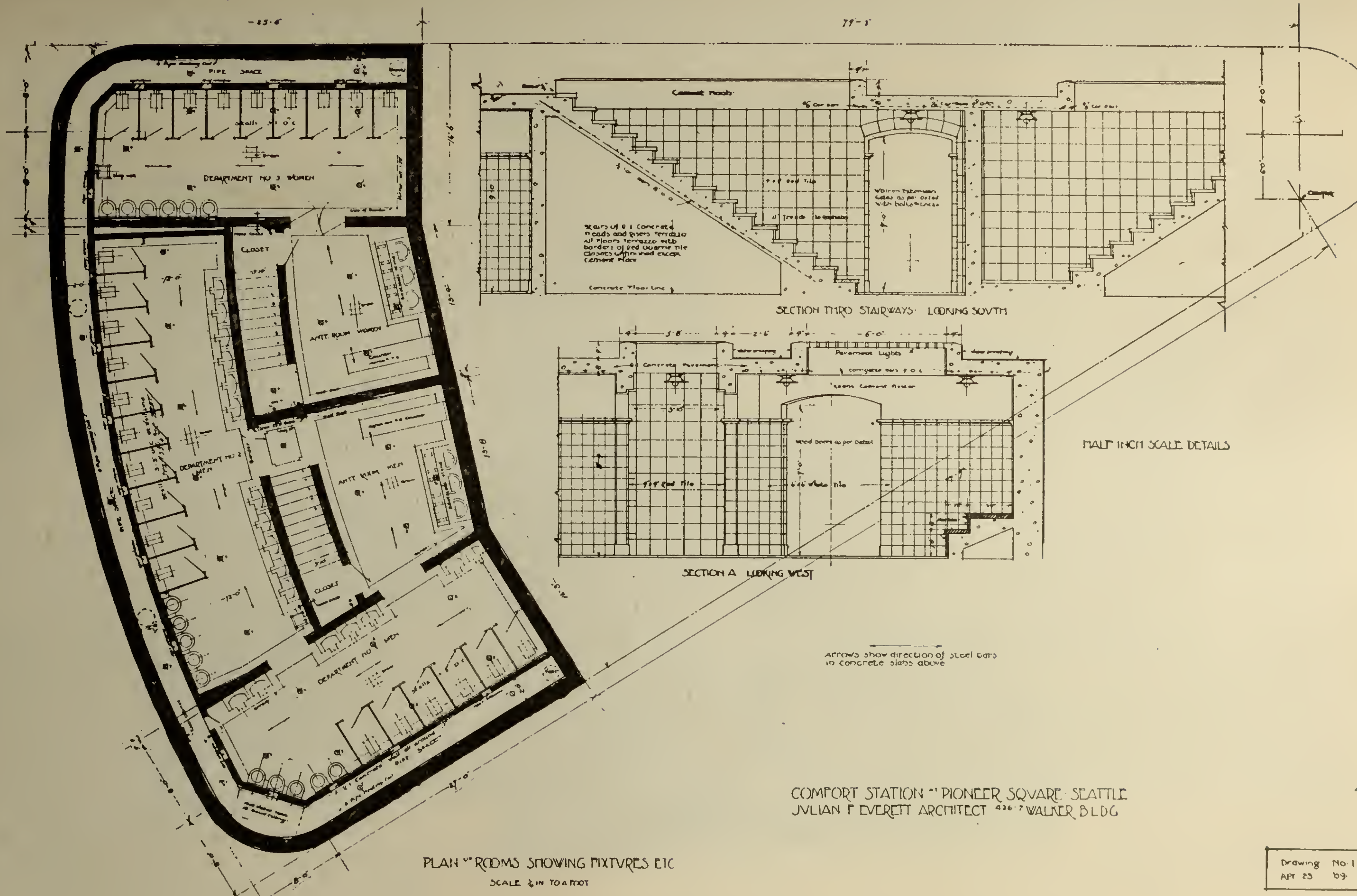
Public Comfort Station at Seattle, Wash.

WITH advanced ideas characteristic of the great Northwest, Seattle has constructed a public comfort station in which is embodied all that is best in sanitary construction. This station, which was completed about a year ago, is described in the *Pacific Builder and Engineer*. A short abstract of this description is given herewith.

When the movement to obtain the station was instituted some of the local papers mistakenly opposed the matter, and a slight opposition was made to its construction. Ferdinand Schmitz, the president of the park board, under whose direction the matter was placed, offered to build the station; and in event that it should not prove satisfactory, to have it removed at his own expense. No further opposition was encountered and the work was allowed to proceed to completion.

The station was constructed, as is shown in the accompanying diagram, so as to occupy the base of the triangular plot, known as Pioneer Place; and upon the apex of which is located the Totem Pole, so well known in connection with Seattle. The location, First avenue and Yesler way, is at the intersection of two of the city's main thoroughfares. Three of the four nearest street corners are occupied by banks, and the fourth by the city ticket office of one of the transcontinental railroads. Two of the crosstown and the Tacoma interurban car lines terminate within a block of it; it is also passed by a large majority of the Puget Sound and coastwise steamship passengers.

In the design of the station the first consideration was given to sanitation and ventilation; but that the ideas of beauty were not neglected is evidenced by the accompanying photograph of the canopy which forms the above ground portion. The entrances to the women's and men's sections of the station are at opposite ends of the canopy and are protected by heavy grill railings. The approaches are over concrete, and the stairs are of concrete. The stairway walls are of red tile. The floor of the entire station is laid with a heavy foundation of solid concrete, draining to the center of each room. The walls are laid up to a height of six feet with white tiling, six inches square. All stalls are di-



I. FLOOR PLAN. SEATTLE PUBLIC COMFORT STATION.

vided by large slabs of gray-streaked white Alaskan marble mounted on nickel-plated brass sanitary legs; the same quality of marble is used in the finish of the shine stands. The walls above the tiling and the ceilings are finished with Keene's cement in an ivory tint.

The problems of heat and ventilation have been handled in a unique manner with highly satisfactory results. The apparent absence of any special features connected with either system is certainly the strongest detail of the design. This has been accomplished by a 2-foot air space running around three sides of the station. First a 12-inch area wall of plain, solid concrete was constructed, and inside of this a false wall 6 inches thick and of reinforced concrete. On each of the three sides of the area wall is mounted a 6-coil pipe supplied with steam from the central heating station of the Seattle Electric Company. The air space is connected with the main room by bronze gratings located about 8 inches above the floor level and at 6-foot intervals. The desired temperatures throughout the station are thus secured by indirect radiation. Each of the ante-rooms is secured against too low a temperature by 9 feet of direct radiation.

Every toilet is ventilated from beneath the seat by a pipe which leads to the foot of the vent posts, of which there are four. Individual motor-driven fans with a capacity of 12,000 cubic feet per minute are installed at the foot of each vent post, and there pick up the foul air, discharging it at an elevation of 11 feet above the pavement.

The air space is further utilized for the installation of all flush tanks to the toilets; for a suspended cylindrical 300-gallon galvanized iron hot water storage tank; for the cooling coil and steam traps; for the indirect connections of the two catch basins which receive the roof water and discharge it into the sewer; and for the connections with the combined trap and back water valve that is installed on each floor drain.

II. IRON AND GLASS CANOPY AND ENTRANCES.

Plenty of sunlight is always a requisite of cleanliness and perfect sanitation, and in a surface station it can easily be secured by adequate window space, which is out of the question with an underground installation. One would hardly believe it, yet the generous use of prismatic sidewalk lights with the white tile, marble, and ivory ceilings makes the interior of the station seem brighter than the outside. At night the rooms are abundantly lighted by electricity through ceiling globes.

The fixtures throughout are of the

III. MAIN ROOM WOMAN'S SECTION.

IV. ANTE ROOM WOMAN'S SECTION.

most approved sanitary types, being constructed of porcelain, vitreous china and nickel-plated brass. This principle of cleanliness is carried out even within the ante-rooms of the two sections, where the marble shine stands are furnished with oak and brass arm-chairs. A noteworthy feature of the station is the fact that shine stands are provided in the ante-room of the woman's section, a convenience which is much appreciated.

The station complete cost $24,505.85. It was designed to accommodate an attendance of 10,000 per day of 18 hours, from 6 a. m. to 12 o'clock midnight. The average attendance has been found to be about 5,000. The care of the station is given over to a man and his wife, who have the assistance of three others, all under the supervision of the superintendent of parks.

The extreme cleanliness and apparent sanitary condition of the station are attested by the photographs here reproduced. The fact that these photographs were made entirely by time exposures testifies to the excellent light within the station, despite the fact that it is entirely beneath the surface of the ground.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Construction of Plant and Selection of Electrical Equipment

IN the last article the readers were taken through the program of preparing for and selecting and designing the recommendable development plant. The present article will complete the presentation of this topic by considering the construction of the works and the selection of the suitable generating and transmission equipments.

The preparation of detail plans, specifications and estimates is necessary before construction negotiations can be approached. Each part of the works, spillway, dam, diversion conduit and power station requires separate treatment. The plans consist of spillway, dam and dam location, general elevation and typical sections; foundation, with details for cut-off, anchorage and apron; sub and superstructures and details of dimensions, shapes and joints; abutments in plan, elevation and sections with details of cut-off connection and drainage: silt and waste sluices, log chutes, fish ladders, flashboard supports; gates in elevation, section and details; canal or conduit location plans and sectional profiles; canal sections with structural details of lining, culverts and spillways; pipe line benches, trestles, anchorage, mud and air valves and stand pipe; intake and forebay plans, typical sections, construction details; headgate plans and details; power house plan, elevation, sections; foundation, sub and superstructure, wall and floor sections and structural details; door and window plans and details; roof plan and details; tail race details. It is good practice to make plans of uniform dimensions and details of like scales and each plan of details should contain a bill of material required. All dimensions should appear on plans and sections and weights in material bill.

Specifications should clearly describe the intended constructions and specify the methods of operations which may influence the efficiency and cost of the structures. Estimates should be made in detail of operations and materials with ample allowance for delivery and handling.

Operations which cannot be specifically laid down because of unknown conditions or uncertainties are preferably carried on under a cost and per cent. contract. This applies to the control of flow during construction and excavation for foundations below a stated plane. All others may be safely contracted for on lump sum, which carries with it the advantage of fixing the total cost, provided the construction contract is secured by sufficient bonding, safe retained per centage and a binding time clause.

However it is true that it is now more generally the custom to construct such works on cost and per cent., cost and fixed sum, or by the development company themselves. Each case pre-

V. PAY ROOM MEN'S SECTION

VI. FREE ROOM MEN'S SECTION.

sents conditions favoring one or the other of these construction programs as guaranteeing the greatest economy and these should be carefully weighed before the final decision is made. Development companies know that contractors must capitalize their operations, charge interest on investment, depreciation and maintenance of plant, liability and accident insurance for personnel, and a profit from fifteen to twenty-five per cent., and that they must discount uncertainties with safety to themselves. The most rapid completion of the contract may not be of greatest advantage to the contractor, his construction equipment may not make such a result possible and it may not be to his interests to invest in what would be needed. An old adage runs "if you want a thing done well do it yourself" and this applies with a great deal of force to this subject of constructing a hydro-electric plant. The development company has capitalized the undertaking, why should they double up on the interest? Whoever designed and planned the works for them knows more about them than anybody else; construction operations and their execution are planned by men whose services are on the market; construction plant has to be purchased, of course, and after completion represents little salvage, but what of it, the contractor would add its value in his tender. The development company's interests are for most rapid completion to reduce interest during construction period and to put plant in commission and take in revenue and this they can control absolutely. Considering all these points, it is quite possible that the development company may themselves carry on the construction and secure a considerable saving in first cost, most rapid completion and a plant as planned. When plant construction is made a part of the development financing plan, neither efficiency or economy are seriously considered, it is then only a question of successful promoting from the promoter's point of view.

The equipment of a hydro-electric development is wholly apart from its construction, though the designs of the power station must be specifically planned for it. The operating equipment embraces those devices which are needed to control flow, head, floatage, silt, and to handle machinery. They may be gate and flashboard operating machinery, mechanical or electrical, trash-rack clearing tools, pipe-line mud and air-valves, and traveling cranes. Diversion booms may prove serviceable for the intercepting of float timber or ice.

The generating equipment consists of hydraulic turbines and governors, electric dynamos, exciters, regulating and measuring devices. Hydraulic turbines convert water power into mechanical energy and dynamos into electric current. Turbines are of reaction, pressure and impulse type in accordance with the characteristic action of water on them, and this same classification indicates their most efficient application for low, medium or high head developments. A turbine differs from a water wheel in this essential, that it utilizes the potential and kinetic energies of flowing water, while the latter wastes either one or the other of these factors. Water wheels could deliver, under favorable conditions, sixty per cent of the natural energy, while turbines have realized ninety and better. Water wheels are limited to low head developments, turbines may be constructed to utilize water under any head at which it can be conducted to them.

A reaction turbine consists of a movable wheel or "runner" having a hub and shaft with curved vanes or buckets fastened to it, which is placed in a stationary case or tube enclosing it on three sides. The wheel case has rectangular openings on the end or around its shell, filled with movable valve shutters or gates through which the water passes into the interior of the case and the spaces between runner buckets, escaping through the open end. The inflowing water impinges on the convex face of the buckets while entering and passing through, and reacts on the concave face when it escapes from the runner and thus delivers all its energy to the wheel. The opening areas in the wheel case determine the quantity of water which, under the velocity due to the effective head, may pass into the runner and impart to it its inherent energy as rotary motion, and the diameter of the runner determines the speed with which the runner may be revolved. The created rotary motion is transmitted through the wheel shaft as mechanical energy. Energy of flowing water is expended whenever its course is deflected or its velocity impeded. The first may be caused when water enters the gate openings or runner buckets, the second by friction against the entrance, passage and exit-opening walls. These represent theu navoidable losses of the natural energy, to which may be added loss of volume due to leakage between runner and case and friction in shaft bearings. A properly designed, constructed and installed reaction turbine may return eighty per cent of the available energy. The limitations of the reaction type as regards head are caused by velocity of flow and rotations as exceeding the safe resistance of metal and permissible shaft speeds.

The pressure turbine consists of a runner and case, but the water finds entrance to the wheel through a feed channel of gradually decreasing diameter surrounding the runner, with openings on its interior periphery. The water delivers its energy by pressure against the concave face of the runners upon entering them. The pressure turbine's efficiency may be somewhat higher than that of the reaction. The losses are due to like causes given for the reaction type.

The impulse turbine is a wheel which carries on its periphery cup shape buckets in pairs. The water issues from a nozzle, the jet striking the partition between buckets and delivering to their concave interiors all its energy. Two or more jets may thus be played on one impulse wheel.

In reaction and pressure turbines the water passes from the upper level into the turbine as a continuous water column, which is exposed to the pressure of air only at its origin, and in like manner it may be conducted from the turbine to the lower level at some depth below the turbine through a closed conduit, draft tube, and in that event be free from air pressure from origin at upper to destination at lower level, and in this manner the energy due to the physical difference in upper and lower pool elevations may be utilized in the development of the power. In impulse wheels however, the water passing from the nozzle strikes the air and therefore only the head from upper pool to turbine elevation becomes effective. The turbine equipment is primarily selected to utilize the available fall and flow most efficiently, the former determines the type, the latter the size of turbines. Reaction turbines may be single or coupled in multiples to vertical or horizontal shaft, pressure and impulse turbines single or in units of pairs on horizontal shafts. Draft tubes may have a length of twenty feet. The unit arrangements are based chiefly upon electric output requirements and these latter should be best adapted to service conditions and high resourceful efficiency or great waste may result from faulty generating units.

Turbines are regulated by governors of hydraulic or mechanical type which regulate the water supply or by air governors which regulate the effective head. Hydraulic governors act through a separate fluid pressure relay upon valves, pistons and rods connected to turbine gate riggings; mechanical governors act through friction discs upon turbine gate actuating mechanism; and air governors operate vents in draft tubes, thereby reducing the effective head. The type of governor which meets the requirements most efficiently must be determined from the degree of regulation which is required for the electric service. There is a considerable difference in their first and operating cost. Turbine governors are belt driven from turbine shafts.

The electric dynamos may be of direct or alternating type as regards the characteristics of the generated current; the first is self-contained as an electric generator, the second requires excitation from a direct current machine. A dynamo consists of two principal parts, one stationary, the stator or field, the other movable, the rotor or armature. The first has fixed to it magnets wound with connected insulated conductors, their poles facing the armature, the second contains evils of conductors facing the field poles and interconnected to a final conductor outlet. The magnetized poles are surrounded by zones or fields of electric waves, lines of force, through which the armature coils, when rotating, pass, and absorb from them electric energy in the ratio of number of force lines cut by number of armature coils within a unit of time, the thus collected electric energy being accumulated into two exit conductors. The electric output therefore depends upon number and size of field poles and armature coils and upon speed of rotation. The resultant current (in amperes) acts in the conductors under an inherent pressure (or volts), their product being the useful electric energy or watts. The commercial rating of a generator's output is by thousands or kilowatts.

For reasons hereafter stated the direct current is not well adapted for transmission, and the electric generating equipment consists therefore of alternators and exciters. Generators should be coupled to turbine shafts; exciters may be belt driven from them or by separate turbines. The selection of generator units should be based upon service requirements and as best suiting the available hydro-power sources, and speed of generators is one of the most essential features to be considered.

The generated current passes to a switchboard, where all its characteristics are indicated and measured and from which it may be regulated. When the output of several generators is to be accumulated on one set of conductors, it is necessary that it be of like characteristics or synchronous from all units, as regards phase frequencies and voltage, and this is secured by aid of the regulating devices on the switchboards.

This finds the generated product product ready for transmission to the distant market point. Electric energy may be transmitted to any distance on a continuous and closed conductor system, but like other transmissions of energy it involves some losses. Those in transmission of electric energy are due to the causes analogous to the piping of fluids, that is friction, and therefore depend upon the size of the conductor, the volume transmitted and the pressure which acts upon the current. In properly proportioned electric transmissions the product may be delivered with a total loss of ten to fifteen per cent, but the pressure or voltage required to secure such a result exceeds the economical generating limit. The voltage of the generated current must therefore be increased before it is put upon the transmission line, which is affected through static or step up transformers. These consist of primary and secondary conductor coils of size and windings in ratio of the desired transformation, all placed in a metal case, and as this process of transforming voltage creates more or less heat, transformers are artificially cooled by chilled fluids or air. Transmission lines consist of supports and conductors, the latter being secured to the supports on arms or brackets and isolated by being fastened to insulators. Supports may be wooden or steel poles or towers, concrete-steel poles are beginning to be utilized. The proper placing and construction of the transmission plant and line is of no less importance to a final resourceful issue than any of the preceding features, in fact a hydro-electric development consists of a number of links which make up a completed chain and this is no stronger than its weakest link.

Labor Saving Devices in Water Works Plants*

By Frank C. Jordan, Secretary Indianapolis Water Company

AT a meeting of the Executive Committee of our Association suggestions were made of various timely topics which might be discussed with profit at this meeting, and one of our committee suggested the advisability of a paper on "Labor Saving Devices in Water Works Plants," and I was requested to prepare a short paper along this line.

It has occurred to me that a paper on that subject would be of considerable value if it were presented in such a way that it would be productive of thorough discussion, for the reason that many valuable points would be brought out by the members of our association when careful consideration was given to a matter of such vital interest to those present.

Letters in reference to the subject were addressed to quite a number of the leading water works superintendents throughout the country, and several very interesting replies were received. These were referred to a committee of practical water works men and from the various letters suggestions were selected which seemed to contain some merit.

In the line of development in the office or administration department of a company, it seems to the writer that Mr. Pollard, of Cincinnati, has stated a well-known truth in very forcible terms, and I desire to quote one paragraph of his letter:

"In my opinion one of the most important factors in keeping down or reducing the cost of operating a water works is the establishment and maintenance of a complete and accurate set of records, both financial and statistical, and the use of recording gauges or other like instruments wherever they can be installed. These rec-

*A paper before the Indiana Sanitary and Water Supply Association.

ords should be kept strictly up to date and should be easily accessible to the superintendent for his information and guidance."

While the truth of this statement is readily admitted by all superintendents, yet it might be inferred from its lack of application that they have in fact not reached a true realization of the value to the department of a complete record of all lines, service connections, etc., as well as a comprehensive record of financial and administrative operation. Reference is made in the replies to the automatic cashier, the addressograph, complete card indexes and loose leaf systems, the adding machine with electric power attachment, outlook envelopes, etc. It would seem that every plant would be equipped with these various labor-saving devices, but apparently such is not the case.

I am indebted to the Louisville water plant for a suggestion which I picked up in their office a couple of years ago which has proven of value. I refer to a notice which answers the purpose of a delinquent notice as well as a water bill, and which can be sent through the mail under one cent postage. The value of this as a labor-saving device and an economical measure is apparent. Meter cards containing the record and operation of the various meters in use, with a record of the cost of repairs, etc., will be found very valuable. A number of forms have been submitted covering the work of the various departments and their value as time-savers is apparent. It is probably not possible to prepare a set of forms which would suit all companies, but with the aid of the adding machines, the typewriters and sensible record forms, the office work in the average department can be materially decreased.

In the distribution department will be found a number of labor-saving devices as well as a number of opportunities for the introduction of new devices which will materially decrease the cost of operation and construction. Mention should be made of the detectorphone by the aid of which it is possible to locate a leak with a reasonable degree of accuracy. Our company has found this instrument of considerable value. The expansion joint used in the setting of large meters or all meters from size 1½-inch and upward is very good. Our Mr. A. B. Helfrich, foreman of construction, has perfected an attachment for the Smith tapping machine whereby it is not necessary to use the ordinary ratchet but the operation of the machine from the surface of the street is made possible. This attachment consists of a windlass, cog wheels and shaft; the cog wheels being connected with a belt chain operating on the cogs. This attachment not only saves considerable time, but also causes a substantial saving in the expense of repairing the pavement, as it is only necessary to cut a hole of sufficient size to admit the tapping machine. A 4-inch power pump to be operated by gas engine or other power for use in case of breaks or in connection with pipe laying, is a very economical appliance. A meter testing device such as the Mueller is not only a time saver but is valuable as a check on the loss on account of slow meters, etc.

Mr. Lyons, of Buffalo, refers to his "waste and leak gang" as being productive of a very large saving in water and states that through the aid of this gang, they have found at least $10,000 worth of water a year which had been used by persons not entitled to it. Similar tests, if carried on with a pitometer, would probably be somewhat more accurate than the tests made by Mr. Lyons, although his method probably would be somewhat less expensive. Reference is made by some of the water works superintendents to the asbestos roll used in pipe laying; the pneumatic hammer for chipping and calking, the steel bar resembling a stone point for taking plugs out of mains; lead wool for calking, to be used where it is not feasible to use lead; the heavy rooter plow for digging the first 24 inches of a ditch; the straight-blade scraper used for backfilling, and the long nozzle made of 2-inch pipe approximately four feet in length used in flushing ditches, by the use of which it is possible to slush the ditch to such a degree that there will be very little subsequent settling. Reference is also made to a pipe derrick so arranged that with its aid four men are able to handle pipe up to 24-inch.

We are impressed with the fact, however, that there is still considerable room for added improvements which will decrease the cost of operation and construction in the distribution departments of the water companies. Among these might be mentioned the following: Maps kept up by the city engineer or other designated authorities on such a scale as to show the exact location of all lines of the various public service corporations such as gas companies, water companies, telephone and telegraph companies, heating and lighting companies, as well as the public sewers. Such a map would be of great value not only to the city, but to any company desiring to install lines in the congested district of a city. It is unfortunate that the importance of this cannot be realized by the smaller towns and a proper start be made when the matter is a comparatively simple proposition.

There is also room for improvement in the care of the stop and waste cocks in the residences as well as the care of the stop boxes and valve boxes controlling the shut-offs for both the private and public lines. With the growing scarcity of labor in our cities there is a demand for a reliable ditch-digging device built along such lines that it can be economically handled on short lines and in narrow streets. In the pumping deparement the value of a gravity oiling system is apparent and it is a matter worthy of note that with the aid of a well equipped gravity oiling system, the Cincinnati department was able to reduce its oil consumption from a total of 15,000 gallons in 1908 to 4,000 in 1910, with the significant comment that with the oiling system in operation the bearings were always flooded and warm bearings were unknown. The installation of electric or hand-power cranes is also highly recommended. The value of the hydraulic elevator for all large pumping engines is also apparent. Electrically operated valves are of such value as time and labor savers that it is surprising that they are not installed to a greater extent. It will be found that under certain conditions the use of electricity for power in the small plant is a very economical measure, in one plant with which the writer is familiar a booster station pumping approximately three quarters of a million gallons per day, being operated by one man and the only matter of concern is to provide this man with employment whereby he can occupy his time in a profitable manner. Electrically-operated booster pumps are solving the problem of the water supplies of our tall buildings or sky scrapers. A well-equipped machine shop is also an economical measure as well as a valuable time-saver.

In connection with the filtration department, mention is made by the Wilmington, Del., water department of the Blaisdell sand-washing machine, which does away with the necessity of scraping the sand beds by hand, and therefore, eliminates the gang of men usually required for this purpose. The machine which they have in their plant consists of five units mounted on a crane and cleans a swath twenty feet wide. In connection with our filtration plant, we have found that the handling of our sand and other granular materials with ejectors is productive of great saving in labor and time. This method does away with the necessity for a gang of laborers with wheel-barrows.

Many other labor-saving devices have been perfected in connection with the filtration and pumping departments, but they have been reviewed in various engineering papers and it is probably not worth while to again mention them at this time.

It doubtless occurs to us once in a while that the plant in which we are interested is being operated along the most economical lines, but if history properly repeats itself the year 1916 will find us carrying on our work on a much more scientific basis, and that man will serve his community well who perfects devices both large and small which will in their operation tend to the production of a good, reliable supply of water at a minimum cost of production.

A Municipal Pumping Plant Using Producer Gas

By Raymond C. Allen, C. E., Manchester, Mass.

THE equipment of the New Gravel Pond Station of the Manchester, Mass., water works consists of two 65 h. p. gas producers of the suction type. These are manufactured by the Smith Gas Power Co., of Lexington, Ohio. They are provided with mechanical scrubbers for cleansing the gas and are fitted for use with anthracite or bituminous coal. They consist essentially of an upright iron cylinder 10 feet high and 5 feet in diameter, lined with suitable fire brick, into which coal is fed from the top. The apparatus is carefully constructed so that it can be made air-tight while in operation. In operation the producer is kept filled with coal for practically the entire depth, the depth of the fire above the grate being comparatively thin. The gas generated by the combustion of coal passes up from the producer through various pipes and traps to the scrubber, where it is washed and cleansed and passes thence to the engine. The fires are cleaned by use of long poke bars introduced at the top of the producer passing down close to the lining to the bottom of the grate. Upon the skill of the operator in cleaning the fire each morning depends in a considerable degree the economy to be obtained through practice, and our engineers have noticed a rapid improvement in their results after a few weeks' experience.

The prime movers consist of two 65 h. p. Nash Gas Engines, manufactured by the National Meter Company, of New York. These engines are of the vertical, three cylinder, four cycle type and are built of good material. They are guaranteed to deliver 65 brake h. p. upon a consumption of 10,500 B. t. u. at full load and 260 revolutions per minute.

The pumping equipment consists of two 9x12 triplex power pumps of double acting type, furnished by the Goulds Manufacturing Co., of Seneca Falls, N. Y. They each have a capacity of 1,000,000 gallons in 24 hours, with the engine running at the speed above stated.

The equipment is in duplicate throughout, reducing the possibility of a shut down through injury to machinery to a minimum.

This, however, entailed considerable hard work and required the constant attention of one man. To obviate this difficulty, and to give the operator opportunity to attend to other duties while the fire was being "blown," a Backus water motor was installed and belt-connected with a blower fan which was piped to each producer. The water motor takes its supply from the main and has worked efficiently and cut down the manual labor of the operation of the plant to a very large degree.

The air is compressed by means of two air pumps which are belt-connected to shafting run from the engine. There is also an emergency connection between one air pump and the water motor above referred to so that in the event of a complete loss of compressed air with the engines idle, a fresh supply can be quickly compressed into any tank. In addition to the belt and shafting for the air pumps there is also a line of shafting and belting to operate the scrubbers and producers, and a line of shafting and belting which operates a small Goulds pump, whose function is to pump all dirty water and sewage from a tight concrete cess-pool to a filter basin about a quarter of a mile from the pumping station and off of the water shed of Gravel Pond. All this belting and shafting and gas piping is so arranged that either engine may be operated from either producer.

The pumps are set in motion by opening the by-pass of the pump and pulling in the clutch between the pump and the engine. This sets the pump in motion, but not against its full load and not forcing water through the mains. The by-pass is then gradually closed. By this means the pump and engine receive their load just as gradually as may be desired. The full load is given to the machinery when the by-pass is entirely closed. The pumps are connected with a common suction line and a common force main. They are made independent of the force main and each other by check valves close to each pump and the current of water is further checked by a large check valve on the main line.

The force main is also provided with an 18-inch Premier meter within the building. This meter reads directly the number of gallons pumped, upon a properly graduated dial, and together with the pipe is laid in a roomy conduit through the station and is readily accessible for reading. The suction line extends from the pump, running to a pump well near the pumping station and close to the shore of the Pond. This well consists of concrete structure below the ground, surmounted by a small brick building with concrete roof. The well is 10 feet square and carried to a depth of 12 feet.

The suction pipe extends to within 2 feet of the bottom of this well and is provided with a foot-valve, having a wire screen of 4 meshes to the inch. The well itself is divided by two sets of screens extending its entire depth. These screens are made in sections light enough to be readily handled and are made of cypress frames and copper wire having six meshes to the inch. These being in duplicate, it is always possible to remove a set for cleaning without allowing any objectionable matter to enter the suction main. From this well the main extends about 130 feet into the pond and terminates with an upturned end having its top about 9 feet below the surface of the pond. This end is covered with a screen having 1 inch meshes. At the well is provided a gate controlling the inflow of water. The sub-structure of the well and intake pipe were constructed by Charles N. Taylor. The outer 70 feet of the intake pipe were laid by making up the pipe upon the ice directly over the location it was intended to occupy, closing the ends and after sawing away the ice from it lowering the pipe to the bottom. This operation was successfully performed. The balance of the pipe from the well to the end of that sunk through the ice was laid in sections by the construction of a coffer dam.

Plans were prepared and bids obtained for the construction of a concrete dam between Gravel Pond and Round Pond to control the flow of water from them and to isolate Gravel Pond. Messrs. Morley, Flatley & Co., of Manchester were the successful bidders, and the dam was constructed by them. It consists of a concrete wall 2 feet in thickness and extending through the muck into a bottom of hardpan. A channel way is provided near the center with wing walls, and a 24-inch gate is set in the dam between these wing walls at a suitable depth below the surface. The crest of the spill way was made at an elevation of 50.82 feet above mean low water, which raised the level of Gravel Pond by one foot over its normal high water level. This adds about 15,160,000 gallons to the storage capacity of the Pond.

Work was commenced on the concrete standpipe by Simpson Brothers Corporation, about the middle of March and after the construction of a cable railway from the base to the top of the hill and the erection of sheds, equipment, etc., the work on the concrete structure was commenced. This was carried on as rapidly as possible and with great care. The structure is 50 feet in diameter and 72 feet 6 inches from the inside base to the top of side walls. It is surrounded by a balcony and railing at the top and covered with tile roof built by the Guastavino people under their letters patent. There is a circular iron ladder on the outside of the structure and a galvanized iron ladder on the inside. The walls are 20 inches thick at the base and 12 inches at the top. The structure is reinforced by round steel rods laid horizontally in the walls. These are so designed and placed in the structure that with the standpipe full of water, the tension on them shall not exceed 12,000 pounds per square inch. This is in accordance with conservative design and allows a liberal factor of safety. The standpipe is designed to be filled with water to a depth of 70 feet and when full contains 1,028,090 gallons of water. It contains for each foot 14,687 gallons of water. Water is forced into the standpipe through a 16-inch pipe which extends to within 10 feet of high water. Near the base of the standpipe are provided three 10-inch check valves opening into the rising pipe. Water entering the standpipe closes these check valves and passes up through the rising pipe and is there discharged into the tank. This, as well as giving a chance for aerating the water, gives a constant head against which the pumps must work and also makes it possible, should the standpipe be empty or nearly so, to provide the high pressure due to 60 feet of water in the standpipe. When the pumps are not in operation the check valves at the bottom are opened by the pressure of water. Supply is thus taken from the bottom after entering at the top. This is practically the same method as has been employed in the old iron standpipe for the last eighteen years, and which has given entirely satisfactory results. The standpipe was first filled with water July 23-25, 1909, and was closely watched for evidences of leaking. The structure showed considerable dampness on being filled but no leaks of any consequence appeared until the middle of August, when small leaks appeared on the southwest portion. These were mainly at points about 30 inches from the base and about 12 feet from the base. By the 31st of August they had so increased, that, while not wasting water to any appreciable extent, it was deemed advisable to empty the tower and ascertain the cause. This was done and, beyond fine hair cracks on the inside of the tower opposite the leaks, nothing was found. A temporary treatment was given this area and the standpipe again filled in about ten days. The same leaks appeared again and the lower one increased considerably, but inasmuch as the consumption of water was at its height and a great deal of inconvenience would be caused to houses on the higher hills by the emptying of the new standpipe at this time, and furthermore, inasmuch as in the opinion of the contractors and the engineer, no damage was being done to the structure, it was decided to keep the tower in operation until such time as the Home plant should be remodelled and in operation, when permanent repairs would be made. This course was agreed upon, and on October 30 the new standpipe was again emptied and carefuly examined and repairs were made by Simpson Brothers Corporation, and the standpipe again filled with water on November 24. At that time and since then, it appears to be practically water-tight. It is not an unusual thing for structures of this character to develop slight leaks at the commencement of their use, but after having been in use for some period of time they generally become to all practical purposes water-tight. I consider the structure to be an excellent piece of work with the exception of the above leaks, and this trouble I have not the slightest doubt has been practically overcome. It may be of interest to know that this standpipe contains 1,327 tons of concrete and 120 tons of steel.

High service was turned on to the mains on the 2d of August, and beyond a few leaks in the mains due to some weak pipe and a few breaks in service due to worn out pipe in every case, there have been, contrary to general expectation, no serious results. The high pressure has been tried by the firemen and the results would seem to indicate that the high service had added very measurably to the fire fighting assets of the town. It also makes available the higher hills of the town for building purposes, and present indications are that many of these hills will in the course of a few years be built upon.

Work was commenced in the early part of August upon the dismantling of the Home station and refitting it with the new type of machinery. The equipment of this station is similar to that at Gravel Pond with the exception that the producers and engines in the Home plant are of 50 h. p. and pumps have a capacity of 750,000 gallons. The same general arrangement is followed here as at Gravel Pond, and the same equipment for "blowing" fires and pumping air has been provided. The building has been provided with new concrete floors and an elevated reinforced concrete floor has been constructed in the old boiler room at the height of the top of the producers. An elevated roadway has been built from the driveway to the Superintendent's house upon which coal is carted directly onto this coal floor. By this means the handling of the coal is reduced to a minimum.

Outside the building and in a concrete subway a 12-inch Premier meter has been set. The operation of this plant is identical with that at Gravel Pond.

The guarantees of fuel economy from the three contractors for machinery were such that at full load and on a ten-hour run with the plant lying idle or "standing over" for fourteen hours, a brake horse power could be generated at an expenditure of one pound of coal, of a heat value of at least 12,500 B. t. u.

The brake horse power used at the Pond upon high service, allowing an efficiency of 80 per cent. for the pumps, is 55 brake horse power. This is about 85 per cent. of the full load and as the plant runs at its greatest economy at full load, the full economy of the guarantee is not obtained.

The plant, however, has as a result sufficient reserve power to save in the depreciation due to wear and tear.

We have not, as a rule, made ten-hour runs continuously, and as a shorter run means a longer "standover" and consequent consumption of coal without use of power, the economy is still further reduced from that of the guarantee.

Taking these two facts into consideration, it is my opinion that for an eight-hour run at 85 per cent. of full load, and consistently with the guarantee, the Pond plant should do its work at a coal consumption of about 1.25 to 1.30 pounds of coal per brake horse power.

Upon low service, the load is but about 40 brake horse power or only a little over half load and upon the basis of the guarantee it is my opinion that a fuel consumption of not over two pounds of coal per brake horse power should be obtained.

As the plant at the Pond has been run for the entire season and the Home plant for several weeks, it seems to me that if the results as to fuel economy obtained by our own operatives, new to the work, should be found to equal the guarantee made by the manufacturers, a fairer result would be obtained than if a very careful test were run by experts for the manufacturers, using the utmost refinements. It is true that the results of such a test would show far greater economy than the results obtained by us, but the conditions resulting from actual running seem to be more fairly indicative of the actual everyday results which we may expect.

The fuel consumption at the Pond has varied from 1.8 to 2.4 pounds per brake horse power, at half load, and upon full load, from 1.25 to 1.65 pounds, including standover loss. The average fuel consumption for the summer, under all conditons, has been about 1.6 pounds per brake horse power, including standover losses and losses due to the many and various causes resulting from the inception of a new plant and the instruction of new men.

Whenever continuous runs have been made, however, where conditions of water consumption have been favorable, the fuel consumption has been kept within the limits of the guarantee.

The full load at the Home plant is but little less than the horse power supplied by the engine. Here the consumption has varied from 1.28 to 1.35 pounds per brake horse power, after the first two weeks of operation by our operatives.

I have not the slightest doubt that a careful and painstaking test would show that the two plants can be operated within the limits of the guarantee. With comparatively inexperienced operatives, we have obtained results in actual practice within the limits necessary for compliance with the guarantees. As the operatives become expert I think the fuel economy will be very satisfactory.

It is the desire of the various manufacturers of our equipment to make a most detailed and exhaustive test of one or the other of our plants, as they all state that our equipment is the most complete and well arranged of any of their similar installations, and they are very sure the results of such a test would establish a remarkably high record and be of considerable interest and value. The expense of such a test would be considerable and I do not consider it necessary for the acceptance of the machinery as, in my opinion, the results promised have been obtained in our actual practice.

The installation of Premier meters at each station makes it possible to measure exactly the amount of water sent into the mains at each station, and by comparing the total of these two meters, with the returns of the service meters, a valuable check and indication of waste may be obtained.

They are also excellent checks upon the performance of pumps, giving a quick and certain indication of slip.

It is of interest to note that up to the last of October, when the Pond plant was shut down, there had been pumped 46,332,000 gallons of water, partly into the old standpipe, and partly into the new, at an expenditure of 44 tons 651 pounds of coal, while in the year ending February 1, 1909, there were pumped at the Home plant, by the old machinery, 92,840,337 gallons into the old standpipe at an expenditure of 275 tons 400 pounds of coal. It is thus seen that we have this year in four and one-half months, pumped at Gravel Pond, about half of all the water pumped last year at the old Home plant, at an expenditure of about one-sixth the coal. Neglecting the fact that about one-half the water pumped from Gravel Pond was pumped to a higher elevation and against 35 pounds more pressure, it is seen that our new machinery has done its work at about one-third the fuel expense of the old.

In these two installations, the town has, without question, two of the best equipped and most efficient gas producer plants in this section of the country. They are of the best construction and well installed and should give excellent service.

With a double supply of water, each excellent, with pumping plants in duplicate, each plant in itself in duplicate, and with two water towers, it seems to me that Manchester is favored above any town of its size of which we know.

[Editorial Note. The above description of the new pumping plants at Manchester, Mass., is taken from Mr. Allen's last report. Some data concerning the plant, obtained from other sources and not credited to him therein, were published in the December number and the report itself, for which we are indebted to Mr. Allen, is so excellent that it is given almost in full.

The Evolution of a Pumping Station*

By Theodore A. Leisen, Louisville, Ky.

The title of the paper to be presented may seem somewhat ambiguous, and a word of explanation at the beginning will not be amiss. It is the intention of the writer to give a brief description of a pumping station built in the fifties, and equipped with what was then considered the highest development of the pumping engine, and also to describe the new pumping equipment which it is proposed to install in the same station, together with the necessary alterations to be made to the building to accommodate the newer type of engine. Considering this as a natural process of evolution, furnishes the reason for the title.

The pumping station under consideration was the first station built for the Louisville Water Company, Louisville, Ky., on the southerly bank of the Ohio River, in 1856-60. It was designed by Mr. T. H. Scowden, the first engineer of the Louisville Water Company, assisted by Mr. Charles Hermany, then assistant, and afterwards chief engineer of the company, and, as an example of classic architecture, it has never been surpassed in a structure of a similar nature. It is symmetrical in form and proportions, the pumping station proper occupying the central portion of the building, with wings at either end for the boiler houses. The central facade is of classic design, with four massive Corinthian columns extending from the portico to the pediment of the roof. The two boiler-room wings harmonize perfectly with the main building, and in a semi-detached position beyond those wings are the two brick stacks, seemingly also a part of the building. Every feature and detail of the station is in perfect accord and harmony with the building in its entirety.

Special emphasis is laid on the architectural features of this station for the reason that this is a characteristic too frequently found wanting in structures designed for such utilitarian purposes as an engine and boiler house. It is greatly to be regretted that the underlying principle exhibited in the design of this station, if not the design itself, should not be more universally applied in the construction of buildings of this class.

The pump room is 52 feet long by 42 feet in width, and the pump-well, occupying the northerly end of this space, is 22 feet by 39 feet, and extends to a depth of 45 feet below the main floor, and three feet below the extreme low-water level of the Ohio River at that point. Within this well the water rises and falls with the varying stages of the river, completely submerging the pump end of the engine at high water. Taking the low stage of the river as zero, the elevation of the main floor of the station is 43.0, and as the highest record of flood stage is 45.6, the whole main floor has been submerged at times to a depth of over 30 inches. All of these conditions had to be taken into consideration in the designing of the contemplated alterations.

The present mechanical equipment consists of two Cornish pumping engines, designed to operate singly or in unison, each having a rated capacity of six million gallons in twenty-four hours, against a total dynamic head of about 190 feet. The dimensions of the principal parts of the engines and pumps are as follows: Steam cylinder, 70 inches diameter and 10 feet stroke; two pairs of walking beams, 32 feet long by 6 feet 9 inches deep at the center, weighing 42 tons per pair; pump plungers, 36 inches in diameter and 10 feet stroke; weight of counterweights on one plunger, 49 tons.

The boiler plant is in duplicate, each set consisting of a battery of three internally-fired, single-flue Cornish boilers, 72 inches in diameter by 30 feet in length, with a flue 46 inches in diameter the full length of the boiler.

The cost of the station and engines, including amounts expended for alterations and improvements during the early years of their operation, was as follows:

Engine and boiler house and chimneys	$120,000.00
Engines and boilers	150,000.00
Total	$270,000.00

The erection of these pumps and boilers was completed in 1860, and up to 1893 they were practically the sole dependence of the city of Louisville for its municipal water supply, and they

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remained in regular service until 1909, with occasional interruptions for repairs and alterations. They are still capable of service in an emergency.

As the Cornish pump is an antiquated and almost obsolete type of pumping engine, with which engineers of this generation are not generally familiar, a brief description is here ventured:

These engines are of the vertical type, having long overhead walking beams, at one end of which are attached the connecting rods of the steam pistons, and at the other end the connections to the pump plungers. The steam cylinder is single acting, the steam being admitted at the upper end only. As the piston is forced down by the steam pressure the pump plunger is raised, filling the pump chamber on the up stroke. The downward stroke is accomplished by the dead weight of the heavily counterweighted plunger, which is massive enough to overcome the resistance of the given volume and pressure of water, and to force it up through the pump main against the given dynamic head. The sole function of the steam pressure is to raise the weighted plunger, the force of gravity accomplishing the rest, except in so far as it may be aided by the vacuum produced by condensation.

There can, of course, be no variable cut-off, the steam being supplied for the full length of the stroke, and in consequence the resultant efficiency can not come within the category of "high duty."

The average duty developed by these pumps during the last year's operation was 45 million foot-pounds per hundred pounds of coal. The boilers were operated under twenty-eight pounds gauge pressure.

The two engines occupy practically every square foot of available floor space in the engine room, and each battery of boilers takes up the space in the boiler room from wall to wall, with a limited portion remaining in front for firing room.

The average daily consumption of water in Louisville is about twenty-three million, and the maximum twenty-seven million gallons. In the new pumping station, which is now the one in constant use, there are two modern pumping engines, one a sixteen-million-gallon Leavitt and the other a twenty-four-million-gallon Allis-Chalmers. Should either of these pumps be thrown out of commission for any extended time, the other would not have sufficient capacity to keep pace with the requirements of the city, and in consequence a safe and efficient reserve is desirable. The only reserves at present are these old Cornish pumps in the station which it is proposed to remodel, and, as they are inefficient, uneconomical and of insufficient capacity, it becomes necessary either to replace them or construct and equip an entirely new station. After mature consideration the former course was adopted, for reasons which will be fully outlined hereafter.

When this question of additional pumpage capacity was broached, a problem was presented as to the type of pumping engine to be considered and the means for housing it. The foundations of the old station were not believed to have the requisite stability for a vertical triple-expansion engine, and neither was the available space sufficient for a thirty-million-gallon engine of this type, this being the capacity considered advisable. On the other hand, the deep and somewhat contracted pump pit lent itself admirably to a vertical shaft centrifugal pump, having the motive power on the main floor forty-odd feet above the pump.

After a careful comparison of the initial cost, cost of operation and relative efficiency of a new pumping station equipped with one thirty-million-gallon vertical self-contained triple-expansion crank-and-fly-wheel pumping engine (with space for a second unit), and the utilization of the old station, with necessary alterations for adapting it to a multi-stage centrifugal pump, the latter proposition appeared to have so much in its favor as to leave no doubt as to the expediency of its adoption.

The next points for consideration were, the form of pump best suited to the conditions encountered in the old station; the motive power to be used in operating the pump, and the character of the alterations to make the station conform to the requirements of the new machinery.

In order to convert the pump pit into a dry well, it was decided to fill with concrete the bottom of the pit from its present depth of three feet below datum (extreme low water) to a level of eight feet above, making a mass of concrete over the whole bottom eleven feet thick, and also to interline the walls with concrete eighteen inches in thickness, reinforced where necessary, and thoroughly tied into the old structure through the various openings in the walls, which will be filled up also. The use of this apparently excessive quantity of concrete was resorted to in order to increase the stability of the whole structure and provide against the added upward pressure of the water due to preventing its admission into the well. To guard against the possibility of the station ever being flooded, the main floor will be raised three feet, bringing it to a level six inches higher than the highest flood stage of the Ohio River in fifty years.

For the purpose of further future development, it was decided to make the layout so as to provide for duplicating the proposed installation, particularly as the suction openings and discharge pipes for two pumps already existed, and on this account, and also because of the desire to maintain above the possible range of high water all portions of the machinery which might be rendered inoperative by excessive floods, the vertical type was found to be the only one which would meet these conditions and fit the limited space available.

Having definitely decided on a vertical-shaft pump, the choice of motive power for driving it was confined to either an electric motor or a vertical steam turbine, and after due consideration of all the points at issue the steam turbine was selected.

The plant as finally laid out consists, briefly, of a vertical trirotor centrifugal pump, having a 42-inch suction and a 36-inch discharge, with a capacity of 30,000,000 gallons in 24 hours, placed at the bottom of the remodeled dry pump pit, the center of the suction end of the pump being 12 feet above extreme low water. The vertical steam turbine will be placed on the main engine floor of the station, at an elevation of 46 feet above datum, or three feet higher than the present floor, and six inches above the highest recorded flood stage of the river, and the shaft of the turbine will be direct-connected to the pump, the length of the shaft between the turbine and pump couplings being 26 feet.

The turbine is rated at 1500 k.w., and it and the pump are designed to operate at a maximum speed of 1500 revolutions per minute when delivering 30,000,000 gallons of water in 24 hours against a maximum head, including suction and friction, of 190 feet. It may be noted here that future low stages of the river will probably be six to eight feet above former extreme low water, on account of the new government dam recently brought into service, and the maximum suction lift of the pump, therefore, will seldom exceed six feet, and for the greater portion of the time there will be no suction lift at all.

A surface condenser of the water works type will be placed on the suction line, through which the full volume of water must pass to reach the pump, the exhaust from the turbine being carried down in an almost vertical line to the condenser. The water of condensation will be conveyed from the condenser hot-well to a hot-well in the boiler room by means of a small steam-turbine-driven pump. A rotative dry vacuum pump will be placed on the main engine floor, and this, with the turbine proper, will be the only machine parts visible on this floor.

A marked contrast is presented between the space occupied on the floor of the station, and also overhead and underneath, by the old Cornish engines and the new turbine-driven units, and the comparison is still more striking when it is realized that the two Cornish pumps are rated to pump 12,000,000 gallons, while the two turbine-driven centrifugal pumps, if a second one should be installed, would have a capacity of 60,000,000 gallons, or five times greater than the old pumps.

The boiler plant will consist of one nominal six-hundred-horsepower Stirling boiler, in single setting, equipped with the new Jones underfeed stokers, and an induced-draft apparatus which is designed to supplement the old stack, it being too small to take care of the gases of combustion from a boiler of this size. A suspended superheater will be installed also, of sufficient capacity to increase the temperature of the steam 100 degrees above boiler temperature. The steam pressure will be 190 pounds at the gauge.

Plans and specifications were prepared and bids received on the above described equipment on October 11, 1910, and contracts were executed shortly thereafter. The contract prices were as follows:

One 30-000,000-gallon vertical steam-turbine-driven pump, including condenser, hot-well pump, dry vacuum pump, and all piping and connections	$40,000.00
One 600-horsepower boiler, in single setting, equipped with new Jones underfeed stoker, superheaters, induced draft apparatus, and enameled brick setting	15,880.00
Total	$55,880.00

The contract for the pump and turbine was let to Henry R. Worthington, although the turbine will be built by the General Electric Company. The boiler contract was made with the Babcock & Wilcox Company for a Stirling boiler.

It is estimated that the cost of remodeling the station and installing certain auxiliaries will amount to about $15,000, so that the total cost of the new equipment and station may be assumed at $70,000.00.

The specifications call for a guaranteed duty of not less than 100,000,000 foot-pounds per 1000 pounds of dry steam, to be delivered at the throttle at 180 pounds gauge pressure and 100 degrees superheat. The vacuum shall be not less than 38 inches, and the combined boiler and stoker efficiency not less than 72 per cent. The builders of the pump and turbine confidently expect to develop on trial a duty of 110,000,000 foot-pounds.

In making calculations to determine the relative advantages between a new pumping station fitted with the best type of high-duty engines, and the old station equipped with the centrifugal pump, several facts were self-evident: If a new station were built, it should be large enough to accommodate a second unit at some future time, and if so built would cost approximately $400,000, basing this estimate on the cost of the present Station No. 2, which cost over $400,000, although considerably smaller than would be required for two thirty-million pumps. On the other hand, the old station already exists, and could be remodeled for about 4 per cent. of the cost of the new station, and the cost of the centrifugal pump would be about one-fourth that of the high duty engine.

Starting with these facts, the following tabulated statement was prepared, showing the comparison when interest and depreciation are taken into consideration:

Cost of Installation.	High Duty Pumping Engine.	Centrifugal Pump.
Pumping station and boiler house	$400,000.00	$14,120.00
30,000,000-gallon pump	175,000.00	40,000.00
Boilers	15,000.00	15,880.00
Total	$590,000.00	$70,000.00
Conditions of Operation.		
Duty per 1000 lbs. steam	165,000,000 ft. lbs.	99,000,000 ft. lbs.
Net water horsepower	1,000 h. p.	1,000 h. p.
Steam per horsepower-hour	12 lbs.	20 lbs.
Coal consumed per year (320 days)...	5,100 tons	8,520 tons
Cost of Operation.		
Interest on investment, 4 per cent.....	$23,600.00	$2,800.00
Depreciation H. D. pump, 3 per cent...	5,250.00	....
Depreciation Cent. pump, 4 per cent...	....	1,600.00
Depreciation boilers, 4 per cent........	600.00	600.00
Coal per year at $1.25 per ton.........	6,375.00	10,650.00
Oil and supplies	1,075.00	550.00
Labor	12,600.00	12,000.00
Total	$49,500.00	$28,200.00

Assuming that these figures are reasonably correct as an estimate, it shows a balance in favor of the centrifugal pump of over $21,000 per year—an amount which if deposited in a sinking fund would be nearly sufficient at the end of three years to repay in full the original investment.

It is not intended at this time to advance the general theory that the centrifugal pump will supplant the high-duty pumping engine, although some arguments along this line may be set forth later. At present it is merely the desire to demonstrate the special advantages which the centrifugal pump possesses for this particular case, and to trace the history of this pumping station from its beginning.

Ornamental Street Lighting at Cincinnati, Ohio

By an Editorial Correspondent

PODUNKTOWN on Bear Hollow Creek and Cincinnati on the Ohio are "sisters under the skin" when the questions of advanced street lighting are brought before the citizens. The abstract proposition of improved street lighting is one which is acknowledged by all cities to be for the best interests, both financially and otherwise, of the municipality. But with the question of what constitutes the best mode of lighting or who shall pay for its attainment, comes disagreement, dissension, and often failure for the entire proposition. With few exceptions the average business man, commercial club, or civic improvement league will commend the cause of better street illumination, dwelling on its value as an advertising factor for the city, and its elevating effect on the whole cause of civic beauty; and with a correspondingly few exceptions all the "sound and fury" of the "booster" movement is brought to bear on the local "grasping corporation" which controls the lighting field. They offer, with few exceptions, no mode of attaining the new system, and, in fact, seldom even have in mind a definite idea of what they most desire as to type of light. They are of one mind only in the fact that they desire something better.

Cincinnati faced the same problem as have other cities, and as many others will do in the future; but with the result that through an application of business principles, the proposition was satisfactorily solved. The installation of the boulevard lighting system in Indianapolis brought the matter to the attention of the Cincinnati Business Men's Club, and it was decided to obtain the best in street illumination that was to be had. Here all unity of action ceased. There were almost as many ideas of types and forms of lights and standards as there were individuals concerned in the movement; and the proposed steps towards acquiring the lights were also various and varied. In the latter case, however, it was commonly held that the Union Gas and Electric Company should "be made" to make all experiments and bear the responsibility of the movement. Up to this point the case of Cincinnati is identical with that of hundreds of others with a like object in view. It remained for one man to devise the means of handling the situation.

This man, Mr. H. L. Linch, a local attorney, realized that the public service corporation would be only too glad to accede to any reasonable business proposition which would give the city what it desired. That the Union Gas and Electric Company held this attitude has since been proven by its action in meeting the city more than half way and by the aid and assistance rendered by Mr. Norman G. Keenan, its general manager.

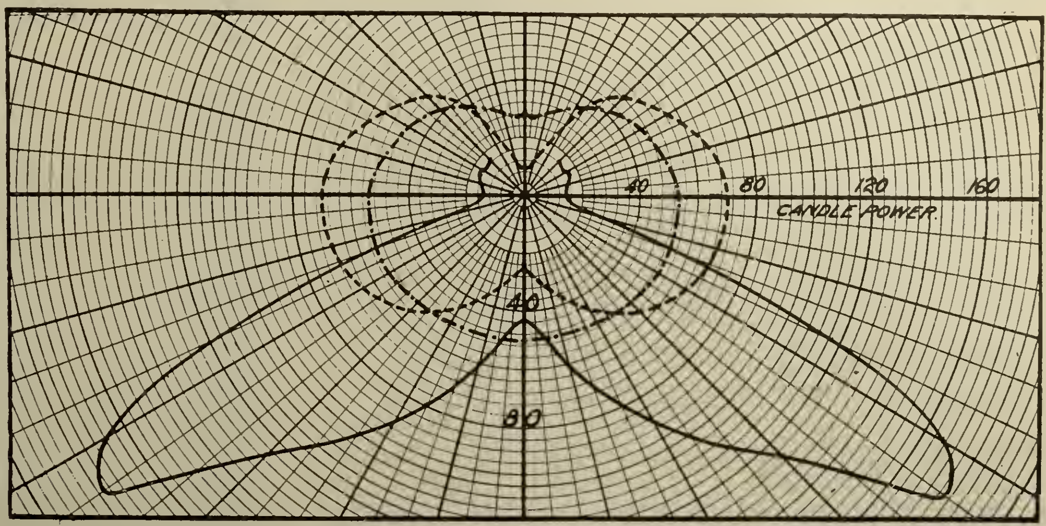
The proposition which Mr. Linch offered was for the business men and merchants to conduct the experiments, with a view to determining the best system to be adopted, and then, after the most approved type had been adopted, to proceed with its extension. In other words, he did not plan to approach the lighting company with the proposal that they should summarily adopt the new illuminating factors or bear the expense of their trial; but, rather, he offered to have the lights installed in a number of blocks on trial, the same to be paid for by subscription among the owners and lessees along the frontage lighted. Realizing the soundness of his plan, the Business Men's Club placed Mr. Linch in sole charge of the movement, and to his energy and business ability is due the credit for the success of the undertaking.

When the matter of procuring subscriptions to the new system was started, the case of Cincinnati was again identical with that of other cities, both large and small. The ever-present practical business man, who was glad to shout with the crowd when the subject was discussed in the abstract, subsided into silence or disapproval when he was asked to pay his portion of the expense. In some cases the aforementioned practical business man insisted that unless the ornamental standards were located so as to give him the benefit of a larger share of illumination than his neighbors, he would refuse to subscribe. These troubles, which are by no means peculiar to Cincinnati, were finally satisfactorily adjusted, and a number of different systems of boulevard lights were installed and given a thorough trial, it being agreed that the latter system was by far the best for

ORNAMENTAL LIGHTING, RACE STREET, CINCINNATI, O.

that portion of the city known as the "underground district," which is practically the business section.

As a result of these trials a standard light has been adopted, which will, no doubt, be extended throughout the "underground" district." The accompanying photograph shows the Race Street experimental installation of Holophane lights on posts of the Electric Railway Equipment Company of Cincinnati, Ohio, which has proven so entirely satisfactory. It is as great an advancement over the ball globe boulevard system as the latter was over the corner arc lamps. For the development of this improved boulevard light all credit is due to Mr. Arthur J. Sweet, a widely known illuminating engineer and an authority on street lighting.



1. COMPARATIVE CURVES OF LIGHT DISTRIBUTION.

Mr. Sweet describes his research work which led to the perfection of the present light in a paper given before the Franklin Institute in May, 1910. In speaking of the ideal which he seeks to attain, Mr. Sweet says:

"There are two results to be achieved in adequate street illumination, which are both of such paramount importance that it is properly a matter for individual opinion as to which should be ranked first. These are the avoidance of glare effect and the obtaining of an approximately uniform degree of illumination at all points along the course of the street, with higher intensities at street corners. These two results can only be obtained, the one by the correct solution of the allied problems of intrinsic brilliancy, total light flux and shadow contracts, the other by the correct solution of the problem of distribution."

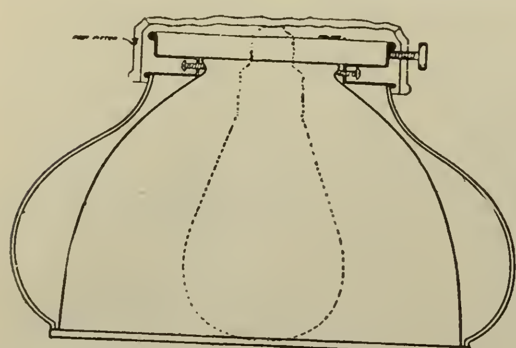
That this solution of the problem of distribution has been attained will be seen by a reference to the accompanying authenticated curves shown in Figure 1. The first curve, as is noted in the legend, shows the candlepower measurements at various angles about a 100-watt tungsten light with an opal ball reflector. Note the amount of diffusion above the angle of about 55 or 60 degrees which may be assumed to be the "useful angle" for the usual spacing. The second curve is that of a 100-watt tungsten in a sand-blasted ball. Here again, though directed to a certain extent, the light is not properly distributed. The third curve shows the same lamp mounted in the new Holophane reflector, such as is shown in the Race Street installation. Here, as will be noted, the light is distributed so as to give the greatest intensity at the useful angle.

The result of this distribution is shown by Table I, in which the column "Horizontal Illumination" indicates the amount of light emitted in a horizontal direction—that is, along the surface of the street; and the column headed "Lumens" refers to the quantity of light. As will be noted, the horizontal illumination shows very little difference; in other words, there is an approximately uniform degree of illumination along the street surface.

Data on Holophane street lighting unit No. 591. General Electric clear multiple, 100 watt, 80 candlepower. Mounting height, 12 feet.

Distance from Lamp Post Feet.	Angle Deg.	C. P.	Horizontal Illumination.	Lumens.
0	0	32.2	.223	......
1.1	5	34.9	.24	2.21
3.3	15	52.2	.326	14.77
5.5	25	70	.361	32.41
8.4	35	90	.343	56.52
12	45	116	.285	89.78
17.6	55	146	.191	130.96
25.6	65	112	.058	111.10
45	75	60.8	.073	64.32
136.8	85	20.1	.001	21.92

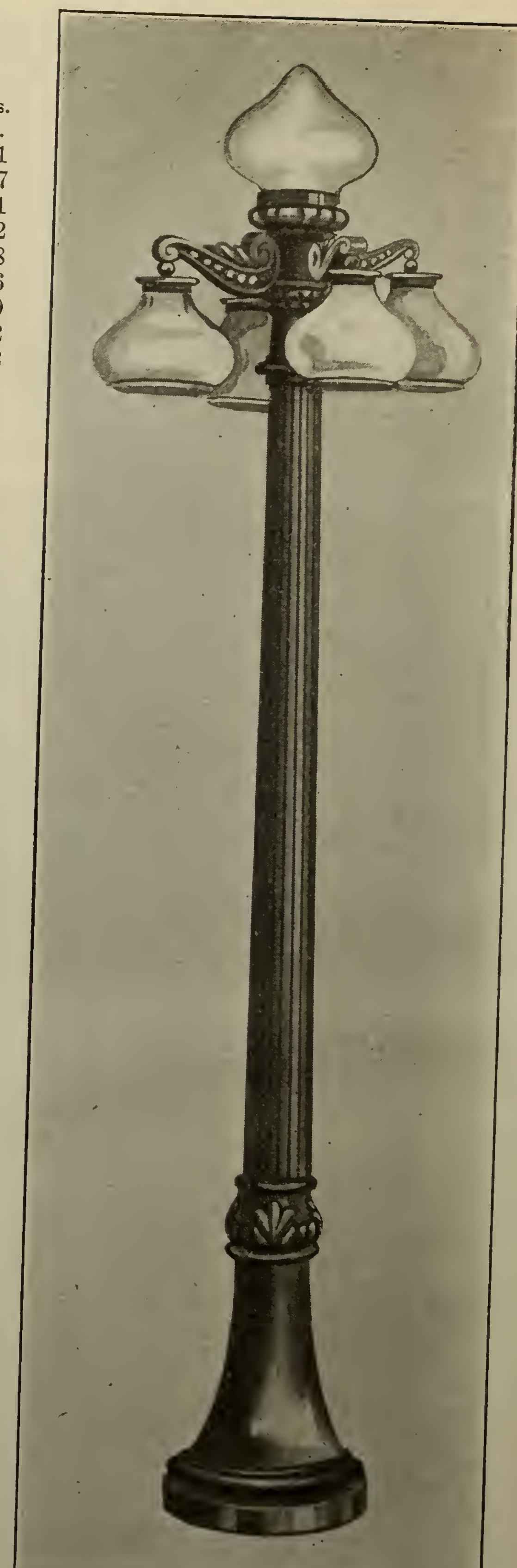
This uniformity of distribution is obtained by the use of a specially designed reflector shown in Figure 2.



2. HOLOPHANE STREET LIGHTING UNIT.

The inner of the two casings shown is of crystal prism glass. It embodies the same principles of directed distribution of light, so well known in the Holophane reflectors, which are in common use in interior illumination. The rays from the lamp at the center are reflected from prisms which are scientifically designed to direct it at angles which will give the maximum of efficiency with the minimum of loss by absorption or diffusion. The crystal glass by reason of its low absorption factor is particularly adapted to this use, and the careful adjustment of the prisms gives a distribution curve approaching the ideal. Covering the reflector is a protecting envelope of opal glass, which is flanged to the reflector so as to prevent the entrance of any dust or water, which would tend to distort the effect of the prisms in the reflector, and which gives an even more pleasing artistic effect than the ball globes.

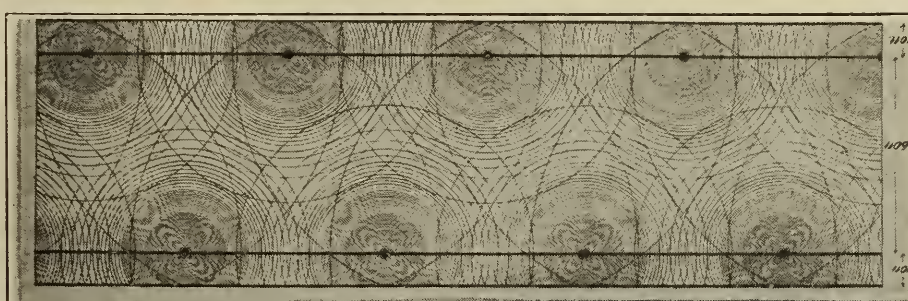
The Race Street, Cincinnati, installation, the first of the improved systems, was lighted for the first time on February 6th, and the evident superiority of this over all previous lighting units has assured its early extension to

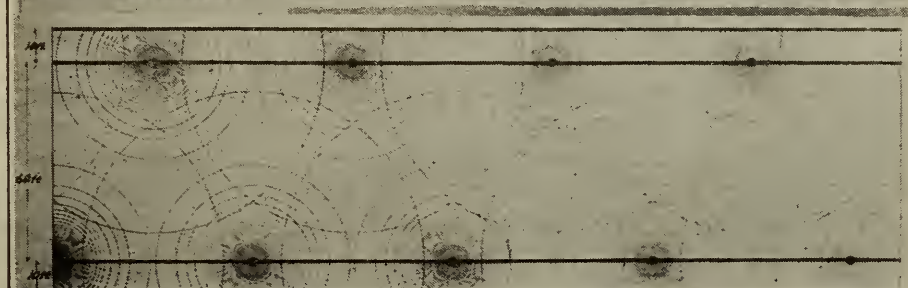


3. ORNAMENTAL STREET LIGHT STANDARD
Race Street, Cincinnati, O.

other streets. The good taste shown in the selection of standards which were consistent with the shape and relative size of the reflectors, may be noted from the accompanying photograph. The broad base tapering gracefully toward the top gives a most pleasing effect to the cluster of inverted reflectors and the melon shaped center globe. The wiring to these poles is all contained within the hollow shaft; and a switch is provided near the base, operated by a special key, allowing each unit to be cut off from the rest of the system at will. The general effect of the Race Street system is very pleasing, and is superior in every particular to anything that has yet been devised. The clusters are placed above the street at a height that does away with the "squat" appearance sometimes noted when the arms are so inverted as to make the globes pendant. The filaments of the lamps contained within the reflectors are practically invisible except when directly beneath them, and the opal envelopes give only a soft white glow which gives to the street the "White Way" effect without the excessive discomfort of the glare effect. This glare effect is not entirely eliminated but it is reduced to a degree making it practically negligible. In this connection it may be noted that research work is being carried on with a view to eliminating the glare entirely without sacrificing proper distribution. It is stated that with the present type of incandescent lamp, the entire elimination of glare is impossible. When the glare is entirely overcome perfection in street lighting will have been obtained.

ILLUMINATION CONTOURS FOR HOLOPHANE UNIT.





ILLUMINATION CONTOURS FOR BALL GLOBE UNIT.

One very noticeable feature of the Race Street system is the fact that objects beyond the lights and along the line of the street among them may be noted with distinctness. In addition to this, objects in darkened store windows may be viewed by the aid of the street lights alone. Along the line of the street there are no shadows, which would naturally be expected midway between two sources of light directing the rays downward by the aid of reflectors. Instead of this succession of excessive light and shadow, there is a uniformity of light along the entire street surface, of intensity sufficient to make newspaper print plainly visible at the greatest distance between lights. The greater intensity attained by the new lights as compared to the old ball globe may be noted from the accompanying photograph, which is practically a contour map of intensities, the circles being drawn through points of equal intensity of illumination, as shown by actual measurement. These diagrams were obtained from measurements made on a dirt street in Newark, Ohio, the same post and lamps being used in both instances, and the ordinary ball globes being replaced with Holophane reflectors in the second case.

That the new lights are satisfactory in Cincinnati is attested by the fact that specifications have been adopted and the contract let for forty blocks of the Holophane units.

EDITORIAL COMMENT

The Construction Number

THE CONSTRUCTION NUMBER.

This number of Municipal Engineering speaks for itself as the largest and most comprehensive number of a municipal publication ever issued, both in the editorial and advertising sections. The call for material for both has been answered with equally gratifying results and the editor is glad to step aside for one issue to give place for the valuable and interesting data and information so fully supplied by our readers and correspondents. Indeed the wealth of material is so great that much must be held over for publication in future numbers.

The tables of data regarding public improvements in the cities of the country are unusually large and the information contained in them is fresh and authentic as it has all been gathered within the past six weeks and is received directly from the city engineers, superintendents of public works, of sewers, of water works, of electric light and other plants. Our thanks are due to these gentlemen for their contributions to the completeness of these tables, and we believe that the publication of these data will result in equal benefit to the industries and the municipalities with which they are connected.

We are equally well pleased with the contributions to the records of practical work, materials and apparatus which will be found throughout this number, but particularly in the departments "From Workers in the Field" and "Machinery and Trade." Engineers and others have taken time to give these descriptions of their work as contributions to the science and art of construction and receive their return several times over from the study of the records contributed by others in the same field. So many of these have been received that some are crowded over into next month's magazine, and we trust that now the ice is broken more of our readers will contribute to these collections of experiences so that all may profit equally thereby.

The usual departments may be somewhat restricted although the size of the magazine has been materially increased in an attempt to furnish in one number all the material so generously supplied. There are limits to the capacity of printing plants as well as to editorial office hours, however, and they insure that the following monthly numbers will not fall back from the high mark set by this special number.

Some editorial discussion of the data given in the tables will be found in connection with them. They are held until the last forms so that belated reports may be included up to the last minute. Doubtless many reports must wait for publication next month.

We congratulate our readers on the results to them of the generosity of our correspondents and fully appreciate the good opinion in which Municipal Engineering must be held, that its requests for these contributions should be so fully met. It will continue to put forth all its efforts to keep its position at the head of the procession and to supply its readers with the latest and best information and discussions of engineering and construction problems.

All this points to a most prosperous year, and Municipal Enngineering will do its share towards extending the influence of the good times as far as possible by bringing news of the work to be done to the knowledge of those who can do it. While this March number is exceptional, in that it gives estimates of work for the whole year, the following numbers will supply the details as projects are prepared for submission to bidders.

THE QUESTION DEPARTMENT

Names of City Building Inspectors.

I am anxious to secure the names and addresses of the Inspectors of Buildings of all American and Canadian cities where there is a Department of Buildings. Can you furnish these, and if not can you inform me where I may find them?

R. F. D., Louisville, Ky.

The writer knows of no such list and inquiry of the secretary of the International Society of State and Municipal Building Commissioners and Inspectors, 4200 Piney Branch Road, Washington, D. C.,. brings the information that that organization finds it best to address mail not to individuals who may be on the lists as building inspectors, but to "The Building Inspector," changes being so frequent that no list can be up to date for any length of time.

Ordinances Concerning Fireworks.

We would be pleased to receive a copy or copies of ordinances prohibiting fireworks in municipalities, or in other words, providing for a sane Fourth of July.

W. E. Archer,
City Attorney, Horton, Kan.

Section 4 of Article IX of the police regulations of the District of Columbia reads as follows: "No firecracker, squib or other fireworks of any kind shall be sold and delivered, discharged and set off within the city of Washington or the fire limits of the District of Columbia, or in the more densely populated portions of said District; provided, however, on occasion of public celebration and exhibition, fireworks may be discharged or set off on special permits issued by the commissioners, defining the time, place, storage, and such other conditions as they may deem necessary to the public safety. No gun, air gun, rifle, air rifle, pistol, revolver, or other firearm, cannon or torpedo shall be discharged or set off within the city of Washington or the fire limits of the District of Columbia without a special written permit therefor from the mayor and superintendent of police, nor within 500 yards of the Potomac river, Eastern branch of Anacostia river, Rock creek or any public road, highway, schoolhouse, building or buildings, shed, barn, outhouse, public park, reservation, graveyard or burial place, playground, golf course, tennis court, picnic ground, camp ground, or any place where people are accustomed to congregate, inclosure for stock, railroad tracks, outside of such fire limits for the District of Columbia, without the written consent of the owner or occupant thereof and a special written permit from the mayor and superintendent of police. Provided, that this section shall not apply to licensed shooting galleries, between 6 o'clock a. m. and midnight of the secular days of the week, nor to discharge of firearms or explosives in a performance conducted in or at a regular licensed theater or show." Passed in 1908.

Cleveland, O., has an ordinance, passed by the city council in 1908, Section 1 of which provides "that no person, firm, or corporation shall within the city sell, offer for sale, or have in his or its possession or custody any toy pistol, squib, rocket, cracker, or roman candle, or fire balloon, or other combustible fireworks, or any article for the making of a pyrotechnic display; provided that nothing in this section contained shall be construed as to prohibit the board of public service from giving pyrotechnical displays of fireworks in the public parks whenever said board is thereunto directed by resolution of council." Section 2 provides "that any person violating any of the provisions of (sections named) shall on conviction thereof be fined in any sum not exceeding $100 or imprisoned in the workhouse not exceeding 30 days, or both, at the discretion of the court." Section 3 repeals sections of previous ordinances and Section 4 prescribes time of taking effect.

An ordinance of Indianapolis, Ind., passed in 1910, makes similar provisions but excepts the Fourth of July from 4 a. m. to midnight from the provisions of the ordinance, which makes the city safe and sane for all the year except that one day.

The board of aldermen of Springfield, Mass., passed an order in January, 1910, providing that fireworks may be sold "on the two week-days prior to Independence Day, between the hours of 4 a. m. and 11 p. m., and that they may be sold from 4 a. m. to 10 p. m. on Independence Day. They may be used on Independence Day between the hours of 4 a. m. and 9 a. m. and from 6 p. m. to 7:30 p. m., provided also that this order shall not prevent the use of fireworks from 7:30 p. m. to 10 p. m. intended for display, spectacle or illumination only. And it is hereby further ordered that no explosives of any kind whatever shall be used or placed on the tracks of any railway company, and that no explosives of any character shall be used or discharged within 500 yards of any concert, exhibition or exercises being conducted at the time under the auspices of the Independence Day Association. It shall be unlawful for any person at any time to discharge or set off anywhere within the limits of the city, or to have in his possession for such purposes, any toy pistol or gun requiring or in which may be used any blank cartridge or caps other than small paper caps or firecrackers; any toy cannon requiring or in which may be used explosives other than firecrackers or small paper caps; any detonating canes, blank cartridge, firecrackers exceeding 3½ inches in length and one-half inch in diameter, any firecrackers containing any explosives more powerful than black gunpowder, any torpedo exceeding three-quarters of an inch in diameter, any substance consisting of chlorate of potash and sulphur, or containing picric acid or picrates or any device for discharging or exploding such substance. It shall be unlawful for any person, firm or corporation to sell, offer or expose for sale, to loan or give away to any retail dealer, consumer or user, located within the city, any firearm or explosive whose use is prohibited in the preceding paragraph. No provision in this order shall be construed to prohibit the discharge of a pistol or other firearm necessary or proper in carrying out any part of the Independence Day Association program, or to prohibit the necessary or proper use of pistol or firearm at any theatrical performance."

Form of Grade-Book for Small City.

What would be the best way to make a grade-book for a town of about 5,000 people, showing the grades at the street corners and alleys?

SUBSCRIBER, Northumberland, Pa.

Will our readers send sample pages and descriptions of such books? They will be reproduced with due credit and will help many engineers in the smaller cities.

In order to lay out grades intelligently a contour map of the city should be made. This may be based on lines of levels run along the centers of the streets with points every 50 feet or 100 feet, according to the uniformity of slope, and intermediates at every change in slope. If there is much slope across the street levels should also be run along each curb or property line or both, or cross-sections may be made at each of the points on the center line. Some points in the lots each side of the street may also be necessary in order to fit the street grades to the adjoining property. Profiles of all these streets will be made, and the contour map and profiles must be studied together to locate the elevations of streets at each intersection and at each change in gradient.

When the grades of the streets are established, they should be recorded on the contour map with the detail possible on the scale of that map, and the lines of the new grades should be drawn on the profiles. In addition the figures designating the elevations at intersections of streets and at changes of grade shauld be recorded on the profiles.

In many cases these maps and profiles can serve as the records of grades, and in such case should be mounted on cloth and cut into convenient lengths for binding in books or filing in drawers.

Where the ground is rough, or where property owners put in their own sidewalks or curbs or both, these records will not be sufficient. They should be supplemented by detailed maps of the streets, which will give not only the record of the grades along the center of the street, but the grades along the curb lines and along the property lines. These elevations should be given at each station along the center line and at each intersection of a property line with the side line of the street. Ordinarily these elevations on the side and curb lines of the streets are not put on the record until the sidewalks or curb has been ordered in or stakes have been set for it, so that the record shows the work actually done rather than the plan on which it should be set out. This is the best method, if the profiles and maps by which the system of grades was laid out are sufficiently detailed to enable a new engineer to determine easily the proper elevation for any property owner's curb or property line.

These plats of the streets must be on large enough scale to show all the data, and may also contain cross-sections where there are special difficulties. The scale depends upon the amount of data required, being much less in a level city with regular sized blocks and lots than in a city with many changes in slopes, steep side and longitudinal slopes and consequent irregularities in alignment and width of streets, lengths and areas of blocks and lots.

When such detailed grade maps or plats are desirable they can be filed or bound in books of size sufficient to show on each sheet at least one long block with the street intersections at each end. By cutting the street into such sections, repeating, if desired, the intersections on the consecutive sheets, and indexing by names of cross streets or by house numbers, any desired section can be found easily and the records can be kept accurately and fully. If bound in books the leaves should be removable with little difficulty so that unusual changes, requiring complete revision of a sheet or more, can be made on new sheets and inserted in their proper places.

Another method of keeping these details would be to place them on cards without plats or with small plats of the fronts of lots only, showing on each card the details of elevations of lot lines, curbs, crown of streets, etc., for a single lot. The data for this information would be obtained from the contour map and profiles and cards might be made for each lot showing what should be done, with notations made when the work is actually done. There would be less useless work if the cards were made out only when the work is ordered or is done, though there might be more danger of errors if the records were kept in this way than if all the cards on a given block were made out at the same time, whether the work indicated had been done or not. These cards may be filed in order along the street, by house numbers, by lot numbers, by owners' names, or by two or more methods with cross references to the card containing the full information, as would be most in conformity with local customs.

If the city does all the improvement work, including grading, laying sidewalks, setting curb, paving streets, etc., such detailed records are not ordinarily necessary. The completed records on plats of the completed work are then sufficient. These should be made on sheets of standard sizes, filed systematically and thoroughly indexed, and will then be sufficient records for all ordinary purposes.

Books on City and Township Planning.

Do you know of any publication that treats of the designing of cities and laying out of town sites.

It would be quite a favor if you would kindly send me the address.

G. H. M., New Westminster, B. C.

The following books will be found of interest: Robinson's "Improvement of Towns and Cities" ($1.25) and "Modern Civic Art" ($1.25); Zueblin's "American Municipal Progress" ($1.25); Baker's "Municipal Engineering and Sanitation" ($1.25); Goodhue's "Municipal Improvements" ($1.50). The most satisfactory publication in this line is *The Town Planning Review*, the quarterly journal of the department of civic design of the school of architecture of the University of Liverpool, which is published by the university at 2 shillings 6 pence per number.

Breed's, Johnson's or Gillespie's "Surveying" (each about $3) will give methods of doing the field work and preparing for the layout.

Articles on Municipal Ownership and Operation of Public Service Utilities.

I would like to have you give me a record from your files and also other papers that deal with such matters in which I may find articles for and against municipal ownership and operation.

R., Macon, Ga.

The most extensive and detailed study of this question is contained in the three large volumes of the report to the National Civic Federation of its commission on public ownership and operation, entitled "Municipal and Private Operation of Public Utilities." These volumes can probably be obtained from the secretary of the Federation at 281 Fourth avenue, New York.

Wilcox's "Municipal Franchises," the first volume of which has appeared ($5), discusses the terms and conditions of franchises for private corporations operating public service utilities, the first volume being devoted to pipe and wire franchises, i. e., electric light, heat, and power, telephone, messenger and signal service, conduits, water works, sewers, central heating, refrigeration, pneumatic tubes, oil pipe lines, artificial and natural gas. It should be of much value in the study of the problem of ownership of such industries. It is reviewed in MUNICIPAL ENGINEERING, vol. xxxix, p. 231.

Brief chapters on the subject are given in Zueblin's "American Municipal Progress," ($1.25); Wilcox's "The American City," ($1.25); and Fairlie's "Municipal Administration," ($3).

It is difficult to select from the large number of articles in MUNICIPAL ENGINEERING those which are the most valuable. In vol. xxxviii, p. 347, will be found a list of the articles in vols. xxxvii and xxxviii, and on p. 324 of the former volume will be found a list of earlier articles. Later articles are as follows: In vol. xxxviii: "Factors That Should be Considered in Making Street Lighting Contracts," p. 393; "Relative Efficiency of Day Labor and Contract Systems of Doing Municipal Work," p. 408; "Valuation of Water Works System of Richmond, Ind.," p. 410; "Should City Contract for Electric Power," p. 416; Expediency of a Municipal Electric Light Plant," p. 416; Cost of Operating Arc Street Lighting Systems, p. 417; "Excessive Rates for Water and Electric Light, p. 417; "Day Labor vs. Contract Work on Los Angeles Aqueduct," p. 425.

In vol. xxxix: "Best Form of Water Works Franchise," p. 35; "Sewers on the Franchise Plan," p. 40; "Bill to Control Gas Companies in the District of Columbia, p. 51; "Municipal Abattoir and Reduction plant at Paris, Tex."; several brief news articles on pp. 129, 130, 131, 132, 133, 135; "The Municipal Electric Lighting Plant at Richmond, Ind.," p. 173; "Indebtedness for Public Service Plant May Not Be a Municipal Burden," p. 198; "Valuations of Public Service Corporations," p. 200; "Effect of Limitation of Indebtedness on Municipal Acquisition of Water Works," p. 219; "Determining Minimum Charge for Gas," p. 222; "Decree in Omaha Water Case," p. 300; "City Owned Car Line Pays," p. 302; "Maryland's Public Service Commission," p. 303; "The Municipal Lighting Works of Pasadena, Cal.," p. 311; "Some Modern Features of City Government and Legislation," p. 380; "Some Provisions in Modern Franchises for Municipal Service Utilities," p. 456; "Information About Franchises for Public Utility Corporations," p. 473.

In vol. xl: "State Regulation of a Massachusetts Telephone Company," p. 26; "Specifications for Electric Lighting Contract," p. 37; "Electric Light Franchise," p. 37; "Gas Processes and Rates," p. 38; "Influence of Indeterminate Franchises on

Sales of Bonds of Public Service Corporations." p. 46.

Many of these later articles are particularly valuable for the side-lights which they throw on the question.

Books on Foundations.

Will you kindly advise me the last date upon which Fowler's "Ordinary Foundations," and Patton's "Foundations" have been revised?

A. J. S., Winnipeg, Man.

The present edition of Fowler's "Ordinary Foundations" ($3.50) is the second revised and enlarged edition of 1907, and Patton's "Foundations" ($5) is also in its second edition, dated 1909.

Books on Reinforced Concrete.

In MUNICIPAL ENGINEERING, perhaps a year or more ago, in reply to a question concerning reinforced concrete work, you recommended to some one, a pocket book on the above named subject. I would like to get the book, and in description of same think it is 16 mo., contains 600 or 800 pages and priced $10.

L. G. M., Reno, Nev.

The book referred to is Mensch's "Reinforced Concrete Pocket Book" ($10). A review of it will be found on page 142 of the February number of MUNICIPAL ENGINEERING.

Edison Poured Concrete Houses.

El numero de Diciembre de la revista *American Comercial* de Philadelphia (The Philadelphia Commercial Museum) refiere copiandola de la Revista que del 14 al 20 Diciembre ultimo se celebra en Madison Square Garden una Exposicion de Productos de Cemento, en la cual habia expuesta alguna casa vaciada de Hormigon segun el plan de Mr. Edison.

Podria Vd. facilitarme datos para la construccion de dichas casas sistema Edison? M. F., Barcelona, Spain.

Mr. Edison has for some years paid considerable attention to the exploitation of a method of making houses by pouring concrete into molds, put in place, apparently for the purpose of pouring the whole house at one operation. There has been much talk about the method in the newspapers, which has been renewed every time Mr. Edison claimed the overcoming of some practical difficulty. Thus far the only apparent advance which has been made is the demonstration that under certain circumstances concrete can be transferred from place to place through pipes. But the practical necessity for heavy cast iron molds, which cost much money and can be handled only by heavy machinery, has made the cost of the operation of casting a single house quite beyond reach.

Below is given one of the latest articles in the daily press on the subject. It should be noted that 144 houses per year of the same or practically the same design is scarcely a probability, from the standpoint of the land-owner building houses, unless in a new manufacturing town, such as Gary, Ind.; that this allows but two and one-half days for each house, which is a practical impossibility, when the time necessary to take down the molds from one house and put them up for another is considered, even neglecting the four days given as the time necessary to complete the house after the molds are up and the unstated time necessary for the setting of the concrete, which is delivered to the molds wet enough to flow readily to place; that the aggregates have a great tendency to separate from a concrete so wet as this; that the excess of water must be disposed of, and that a considerable portion of cement will escape with this water; that the molds must be water-tight, or the water and cement will escape where it is not wanted, and the process of stopping all the cracks between the sections of the castings must add materially to the time necessary to set up the molds. If further inconsistencies in the printed descriptions or further insurmountable difficulties, at least at reasonable cost, are asked for they can be pointed out.

Mr. Edison is very persistent and is not discouraged by difficulties in his way, but we must wait same time yet before he makes his $1,200 poured concrete house a practical commercial possibility, even for a large town made to order.

Following is the article referred to:

Mr. Edison announces that he has perfected his plan for molding a concrete house complete, "all in one solid piece, including the cellar, partitions, floors, roof, veranda, in fact, everything except the windows and doors, which are of wood and the only parts of the house which are combustible." Cement men say that the practical difficulties are insuperable, but Mr. Edison has a way of overcoming insuperable difficulties by "finding a way around" them.

The typical house would contain six rooms and a bath and would cost only $1,200, and would give a man for $10 a month a better home than he now rents for $25. The advantages would be exemption from fire risk and sanitary qualities, since should a case of contagious or infectious disease take place the walls would afford no harbor for germs and could readily be disinfected.

The disadvantages are that the house, which can be completed in four days, must be built in large numbers and on adjacent areas, since the cast iron molds are very heavy and must be handled by a derrick. The moving of the molds and derrick to any one locality would be a matter of considerable expense, which, if divided among fifteen or twenty houses, would amount to little. Besides, after taking down the molds an interval of four days must elapse before the walls set, during which time the workmen must erect others. For these reasons the house can not be cheaply constructed on a single vacant lot.

Mr. Edison's figures for building 144 houses a year are for each house:

Labor and superintendence........	$ 150
Interest and depreciation on construction plant	140
Cement, 220 barrels, at $1.40.......	310
Steel reinforcement rods...........	125
Bath and heating..................	150
Windows, doors and finishing......	325
Average a house	$1,200

These items are ample except that for bath, and the others are high enough to make the total a safe estimate. The house will be prettier and more comfortable than the wooden or brick house at twice the cost.

Aside from cheapness and durability, the great point is the elimination of the fire risk. Such a house would be good for five hundred years. Double the size of the house and the cost is not doubled, and the man earning $100 a month can easily own or rent a commodious home. Mr. Edison's estimates, however, are for Long Island and New Jersey, for he expects to use the sand removed in excavating the cellar to make his fluid concrete. Further, he must be near an ample supply of water.

Information About Concrete Silos.

The secretary of the Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, Pa., calls attention to Bulletin No. 21 of that association, which is devoted to "Concrete Silos" and should be added to the list of sources of information on that subject, given on p. 44 of the January number. The bulletin will doubtless be sent on request to anyone interested, on application to the secretary.

How to Make Poles for Wire Lines.

I should like to get a method of making dimensions, reinforcement used, etc., for concrete light and power poles. I shall greatly appreciate any information you or your readers may give me.

V. H. F., Kingfisher, Okla.

Will our readers report their experiences?

The following is a description by Wallace Marshall, of Lafayette, Ind., of a pole, designed by him as a test pole, and the changes which he would recommend:

In November, 1905, I made a box form of three sides, leaving the top open, for a test pole. It was 35 feet long. The lower 5 feet was 10 inches square; commencing at that point, it tapered on all sides to 5 inches at the top. From the 5-foot point I put a triangular piece in each corner of the form about 1½ inches wide at the bottom and 1 inch at the top, to chamfer the corners of the pole. At proper places of a standard line pole, for line bracket, cross-arms and telephone box, I bored holes through the forms, put machine bolts through it and let them extend about 2 inches in the forms, screwing the nuts the full length of thread. In the top of the form, which was brought to a round point, I placed a 1½-inch pin in the center to leave a hole or an insulator pin. I then filled the form with concrete mixed by hand, consisting of 1 part cement to 6 parts ordinary gravel, except a facing of about ½ inch of cement and sand, 1 to 3. After covering the bottom of the form about 1½ inches, I laid in the large end two ¾-inch Thacher concrete bars 25 feet long, and in the top part two ½-inch Thacher bars, lapping them about 4 feet. I left them in the form six days. At the expiration of thirty days we tested it as follows: We planted it firmly in the ground 5 feet deep. At 25 feet distance we planted a large cedar telephone pole. At the level of 21 feet from the ground we fastened a wire cable from one pole to the other, which is about the height of a trolley wire. In the center of this cable we suspended a barrel. Into this barrel we loaded steel rivets gradually and watched results. The two poles began to bend as the load was applied. When the two were deflected about 21 inches each toward the other I observed a small check come in the concrete pole about 10 feet from the ground, and simultaneously they appeared from the cable to the ground. We immediately stopped loading, took off the ballast, weighed it and calculated the horizontal strain, and found it to be 975 pounds. The maximum moment would be at the ground, but the guess at size we made was about right, since the concrete cracked from ground to cable at almost the same time. When the load was removed the pole resumed its plumb position, and remains so to-day, although being used for heavy guy wires. The bolts were unscrewed before moving them, leaving the nuts imbedded in the pole. After concrete set we screwed the bolts into the nuts and could not loosen them with an ordinary wrench. It took several heavy blows with a sledgehammer to break out the top socket. My conclusions were, however, that a wire ring or two of reinforcement should be placed about the pin for safety. Careful estimates were made as to cost of such a pole 35 feet long, if made in quantities in proper forms, with material at the then market price and gravel in pit, at $7 actual cost. Comparing that cost with present price of pine poles and add to the latter the cost of trimming, chamfering, framing and painting, the concrete pole can be made for less money than the wood, provided no profit is paid a contractor. Figuring the moments on the pole tested, I found the concrete failed at just about the time the limit of elasticity of the steel was reached, proving that it would be of no value without the steel. I believe that the concrete pole is practicable, and the only reason I have not put them to a practicable use has been the lack of time to do so.

In the fall of 1906 one of the western lines of the Pennsylvania railroad erected a mile of concrete poles on their right of way near Maples, Ind., in order to test them out in actual service. They were built by Mr. Herman Tapp, and were hauled out on cars to the point of erection. The profile of the ground being somewhat uneven, the lengths of the poles were varied from 25 to 34 feet, in order to keep the tops of the poles as nearly as possible on a continuous grade. The poles were 8 inches square at the bottom and were tapered to a 6-inch square at the top, the corners being chamfered 2 inches, making the pole appear octagonal above the ground.

Holes were left for the brace and cross-arm bolts and also for the steps. The reinforcement consisted of twenty-four ¼-inch wires running the full length of the pole. The conditions under which the poles were erected were not of the best, as the work was rushed in order to have the pole line complete for the date of a certain inspection trip. Because of this fact some of the poles were moved from the point of building and were erected within five days after they had been made. Notwithstanding this hurried method of construction and the severity of the wind-storms of the past winter, the poles show up at present in almost perfect condition. The alignment is of the best and the condition of the individual poles is very good, as no check marks or other signs of failure have appeared. The poles were set 4 feet under the ground and were bedded in stone screenings, giving a solid foundation.

There are several patented poles on the market.

Those traveling to New York from points west to visit the cement show, December 14 to 20, were interested in observing a new reinforced concrete pole line built by the Pennsylvania railroad on the left of their new right of way going into New York City. This pole line is for the purpose of carrying sixty telegraph and telephone wires, the poles varying in length from 35 feet to 65 feet. They were designed and built by the Pennsylvania railroad, and are a striking example of this comparatively new use of concrete.

Small Concrete Arch vs. Girder.

I want to ask if you can tell me where I can find anything about small concrete arches, span about 12 feet, to be artistic. It has occurred to me that it would be cheaper built as a girder with a curtain arch at either end. I think this possible because it is not visible from below at any place, and the cost ought to be less.
READER, Denver, Colo.

Tyrrell's "Concrete Bridges and Culverts" ($3) gives the discussion desired. The general conclusions are that a simple slab is economical up to 12 feet span; slabs supported on longitudinal beams are probably the most economical between 12 and 25 feet span, and arches are probably most economical for spans above 35 feet. These statements will be modified by conditions of foundation, abutments, etc. Probably, with the curtain arches spoken of, the two forms will be nearly the same cost. Usually on bridges of small size the ornamental work is a large share of the cost, if it is of any real value, and can not be estimated without detailed plans.

Consumption of Water by Cities.

Will you kindly refer us to some of your monthly numbers containing data as to how much water is used per capita in different cities.
W. A. HENSON,
Vicksburg, Miss.

In vol. xxxvii, pp. 258 and 330, will be found some "Valuable Data Regarding Water Supplies," in cities of 25,000 to 50,000 population. Included therein are statements of the daily consumption of water by the cities, from which, with estimates of the population in the year 1908, the consumption per capita can be computed. In vol. xxx, p. 18, is an article on "Consumption of Water in Small Cities," giving figures for cities of 2,000 to 5,000 population.

Turneaure and Russell's "Public Water Supplies" ($5) gives the consumption of water per capita in a number of cities for the year 1905.

The consumption in the city of Chicago for the past year has varied but little either way from 204 gallons per capita per day.

Companies Operating Several Water Plants.

We would like to ask you for some information about water works companies. In our town here of about five thousand inhabitants there is a water works company doing business, but their franchise expired some five years ago, and there is some agitation on foot at the present time looking toward granting this same company a franchise, or some other company one, apparently with the odds in favor of another company. If possible, it is the intention to submit the franchise at the spring election.

What we would like to know is the names of some companies that make it a business to install and maintain water works, in order that we may take the matter up with them and see if anything can be done with them. If you can give us the names and addresses of several of these concerns we will be greatly obliged to you, and shall be glad at any time to give you any information possible from here.
C., ———, Mo.

The writer knows of no company which answers the description exactly. The American Water Works and Guarantee Co., Bank of Savings building, Pittsburg, Pa., own a large number of water works plants, but whether they would be willing to invest in another small plant under the circumstances described is questionable. There are other large investors in water works plants not so thoroughly organized as the company named, who own companies operating under local names. Names of any such persons will be referred to our correspondent of they are sent us for that purpose.

The writer does not believe that the course outlined is the proper one to pursue. He has found that water companies are perfectly willing to accept franchises based upon equitable terms and the only question is as to the method of determining what such terms shall be. This is a question for experts and a proper solution is worth all it costs.

There is no such thing as real competition in the supply of water, especially for so small a city, and the consumers must ultimately pay the extra cost of unwise duplication of plants. Such a commission as that outlined in the articles in MUNICIPAL ENGINEERING in vol. xxxviii, p. 335, on "Co-Operative Franchises for Municipal Public Service Corporations"; vol. xxxvi, p. 247, on "An Outline of a Contract Between a City and a Water Works Company," and vol. xxxix, p. 456, on "Some Provisions in Modern Franchises for Municipal Service Utilities," should secure the desired results, on the one hand of good service at reasonable rates, and on the other hand of ample provision for depreciation and renewal and reasonable return upon the capital invested in the works.

Life of Bolts in Machined Cast Iron Pipe Joints.

We have been using some "Universal" cast iron water pipe and have had no trouble on account of bolts rusting on pipe that has been in the ground three years, but are not certain that bolts will last indefinitely. Please give what information you can about the useful life of bolts used for connecting machined joints of cast iron water pipe, as compared with the life of the pipe. Information about results of using bolts for "Hammond" or "Dresser" joints on underground pipe lines will serve just as well.

W. O. M., Ottawa, Kans.

Will our readers give their experience for the benefit of our correspondent and other readers?

Some information in this line will be found in papers on wooden stave pipe by A. L. Adams in the transactions of the American Society of Civil Engineers, vol. xxxvi, p. 1; vol. xli, p. 27, and vol lviii, p. 65. This information is not exact; as regards the bands, used for holding the staves together, and the nuts used in tightening them, they could be and were used again in repairs made in 1905 on pipe laid in 1895. Another pipe laid in Manchester, N. H., in 1874, was reported as needing no repairs in 1899. In correcting some trouble in the piping system of the hot-water heating plant in Mattoon, Ill., both pipes and bolts were found to be practically useless after three years. The circumstances are, of course, different from those in a water supply, both as to temperatures and the presence of insulating materials.

Electrolysis of Water Mains.

We have electrolysis in our water mains here caused, evidently, by improper equipment of the electric railway. They are using an ordinary 60-pound T-rail on our paved streets, while the city ordinance calls for Shanghai rails. We have had water meters completely destroyed and several service pipes so badly damaged that they have had to be replaced. We have tried to get our city council to take some action towards forcing the railway company to relieve this situation, but they evidently do not see the seriousness of it. What do you consider the situation? Would it warrant a law suit to compel these people to change their equipment? Do you consider electrolysis in water mains an extreme bad condition? We are trying to get together information on this particular condition and would appreciate an early reply from you.

A. E. W., ———, Mich.

This matter of electrolysis of water and gas mains by stray currents in the earth is one which is in some cases very serious. It is one which has a number of legal and economic phases aside from the actual damage done to the pipes. That this damage can be serious and expensive has been demonstrated many times, and that it is due to insufficient conductors for the return currents of the electric railway system is equally certain. Much of the trouble can be prevented by proper bonding of the rails. There may also be trouble on account of insufficient size of rails. The damage occurs at the points where the current, having run along the pipes, leaves them to go to another conductor, through an intervening medium of less conductivity. The difference of potential, showing the strength of this tendency, can be ascertained by measurement, and will show the extent of the danger and give some indication of where the changes must be made to prevent damage.

The question of responsibility for the damage is one which has been under discussion for some years. The case of the Peoria Water Co. against the Peoria Gas and Electric Co. has been in court for a dozen years, and many other cases and prospective suits have been awaiting the decision in this case. The reports of the special master appointed by the court to collect evidence in the case were made in 1901, reported in MUNICIPAL ENGINEERING, vol. xxi, p. 34, and in 1909, reported in vol. xxxvii, p. 174. These were both very favorable to the water company. The preliminary decision of the court, made in 1910, differed quite materially from the master's reports. It is reported in vol. xxxix, p. 465. It recognizes the fact that both street railway and water company have rights in the streets which must be respected, and recommend cooperation of the two in eliminating the danger. Apparently the expense is to be distributed, but the basis of the distribution is not stated. Probably it will appear in the final order when it is made.

The nature of suits and the decisions regarding them in other cities were reported in MUNICIPAL ENGINEERING as follows: Dayton, O., vol. xxii, pp. 299 and 322; vol. xxi, p. 38; St. Paul, Minn., vol. xxii, p. 317; St. Louis, Mo., vol. xxi, p. 101; Indianapolis, Ind., vol. xx, p. 47.

Other interesting articles are the following: "British Legislation Relative to Electrolysis, vol. xxxix, p. 220. "Electrolysis of Underground Structures in American Cities," giving the conditions and what has been done to correct bad conditions in 113 cities, vol. xxxix, p. 206. "Electrolysis and Prevention of Its Effects," vol. xxxvii, p. 107. "Books on Electrolysis," vol. xxxvi, p. 244. "Electrolysis in Reinforced Concrete," vol. xxxiii, pp. 111, 183. A long list of prior articles on electrolysis, covering the period of most active discussion of the question, will be found in vól. xxxii, p. 19. See also the article in this number giving information about several cities.

It would seem that a municipally owned water plant would be in somewhat different position, with respect to the responsibility of the street railway company, since the city has granted the right of way for the street railway and presumably has the right to insist that its property shall not be damaged by the construction and operation of the railway. It is quite probable that the street railway franchise contains such a clause, covering the case in general terms, though not specifically mentioning electrolysis.

The course proper for the city would seem to be to determine first the cause and amount of the damage, preferably with the co-operation of the street railway company, and the rights of the city under the existing legal and franchise conditions, and then to make or force a settlement as may seem most desirable and feasible.

Location of Water Pipe in Street.

Please accept my thanks for the answer to my question on p. 119 of the February number of MUNICIPAL ENGINEERING. The situation of the water pipes on the Concourse should be explained to you more clearly. The Concourse is an avenue of 150 feet or more in width and consists of two outside strips for general traffic and a center strip for light roadsters. The water main goes down the roadway. It is proposed to install two service pipes, one on each side of the Concourse, and it is regarding these service pipes that the contractor makes the request to be allowed to put them in the roadway. We take the view that they should be under the sidewalk.

CYRUS C. MILLER,
President of the Borough of the Bronx.

The writer would, in this case, strongly recommend the location of the two service pipes for each side of the street for each block within the space set apart for the sidewalk and lawn. The service pipes should be preferably taken off the mains in the cross streets at the ends of the blocks, and may be connected to such branch mains at each end if the conditions warrant. Thus they can be kept down to minimum size and give each house full pressure, even if the distance between cross streets should be much greater than is usual. Whether these two service pipes should be located under the sidewalks or lawn must be decided from knowledge of the particular conditions of the case, and in consideration of the principles discussed in the article referred to.

Wood Block Paving and Street Railway.

We intend to pave one of our main streets next spring with creosoted wood block. Width of street between curbs is 41 feet. The street railway company contemplates putting down a double track on same. Their tracks will take up 17 feet, leaving 12 feet on each side between the ties and curb. What kind of rail, in your judgment, would be the best to use, the girder or T-rail? What style of rail is used in Indianapolis? The T-rail is used here at present, but we find that it causes trouble to vehicles in crossing.

What slope should there be between the track and curb? The grade of the street is 1 per cent.

W., ———, Wis.

The question of the form of rail to use is one on which there is much difference of opinion. Both girder and T-rails are used in Indianapolis, and they seem to give about equal satisfaction. The space between tracks and for 18 inches outside is paved with brick, and special forms of brick are used next to T-rails on the inside to give the space for the flanges on the car wheels, which are somewhat deeper for interurban cars than for city cars. The T-rail lines are laid for the use of the interurban cars. There seems to be little or no more difficulty in crossing the groove made by the special-formed brick than the groove formed by the girder rail, whether the top of that rail is flat or grooved. The form of rail is really not of very great importance if the design of the pavement surface next to the rail is made to conform to the conditions fixed by the form of the rail.

The important things with reference to the rails and tracks are solid foundation under ties and rails and depth enough of rail to insure stiffness and stability. A 7-inch rail seems to be an essential to good pavements and a 9-inch rail is desirable if heavy interurban cars are carried.

The slope across the pavement from rail to curb should be as slight as possible on a 1 per cent. longitudinal grade. The rules in vogue in various cities vary from 2⅞ to 7¼ inches for the 12 feet between track space and curb. The minimum should be sufficient in this case. The center of the tracks should be enough higher than the line between the street railway and street pavements to give the track space as good drainage as possible. The groove will interfere with this drainage somewhat, and they should be water-tight, so that the water will not get down under the pavement along the rail.

History of Los Angeles Water Supply.

Will you indly advise us where we can procure a brief history of the Los Angeles Water Works Project and very greatly oblige.

H. MUELLER MFG. CO.,
Decatur, Ill.

The Los Angeles water works have been treated in the following recent articles in MUNICIPAL ENGINEERING: "Day Labor vs. Contract Work on Los Angeles Aqueduct," vol. xxxviii, p. 425; "The Los Angeles Aqueduct," vol. xxxvii, p. 289. It has also in preparation for early publication an article giving the history of the water supply of the city prior to the development of the new system.

Best Pavement for Steep Grade.

What, in your opinion, is the best material for a street improvement from a safety point of view, with a grade of 10 per cent?

What is your opinion of bituminous macadam pavement for a grade of this kind? Do you think it would have a tendency to wash?

W., ———, O.

This question cannot be answered definitely without full knowledge of all the local conditions. For heavy traffic a stone pavement is probably safest. On some of the country roads outside of Cleveland a brick with one edge beveled is being used. This bevel gives a chance for the calbs of the horses' shoes to catch on the edge of the brick next below or the cement of the joint and thus give him foothold in climbing the hill and prevent sliding in going down hill. These roads promise well, but have not been in use long enough to show whether they are better than roads laid with ordinary forms of brick. Brick pavements as ordinarily laid are as satisfactory as any on such steep grades. It is difficult, if not impossible, to haul heavy loads up such grades unless there are projections or depressions with which the shoes of the horses can engage.

For light weight traffic other kinds of paving material can be used, provided the surface retains a somewhat roughened appearance and does not wear so smooth as to become slippery. The writer has seen horses trot up and down a 7 per cent. grade on a wet bitulithic street without any fear of slipping. There was every indication that if the graae had been 10 per cent. they could have traveled with equal ease, except that the steeper gradient would reduce the speed of pulling up the hill. Bituminous macadam is an indefinite terms which covers many ways of building streets. If there is an excess of bituminous material at or near the surface the pavement will probably become slippery when the surface dressing of stone chips has worn off. Some pavements are laid with bitumens so soft that they work to the surface and produce slipperiness under common conditions of temperature and moisture. A bituminous macadam pavement with proper proportions of stone, bituminous cement and sand or stone dust, should be satisfactory on the steep grade named, and if the materials are as good as they should be and are properly mixed and laid, the road should retain its non-slippery quality. Under such conditions it will not wash unless it is permitted to get badly out of repair.

Formula for Asphalt Floor.

I have a building in charge specifying asphalt floors on top of concrete, the asphalt floor to be one inch thick, warranted not to crack or run in warm weather. As I have never put down an asphalt floor I wish you would give me a formula for such floor, as to the amount of pitch, flux and sand that is required, portions of building to be at a temperature 28 to 32 and 34 to 38 degrees Fahrenheit.

L. M., Evansville, Ind.

Will our readers engaged in asphalt construction give their experience in this line?

Such firms as the Sicilian Asphalt Paving Co., 41 Park Row, New York, supply asphaltic mastic ready to lay, to fit any floor specification. All that is necessary is to heat it, put it in place and compact it. The proportions of any mixture for a floor depend upon the quality of the asphalt. The dealers in the various kinds of asphalt will give the formulas directly applicable to their products. Names of such dealers will be found in the "Business Directory," published in each number of Municipal Engineering, under the various headings containing the word "Asphalt."

It should be noted that an asphalt floor probably requires asphalt to be used and that pitch is a term frequently applied to certain tar products which might be excluded by the terms of the specifications.

Chemical Clarification of Water.

I wish you would kindly give the names of the cities in the Central States who use sugar sulphate, etc., to clarify water. We mean water departments of the different cities.

S., St. Louis, Mo.

The writer knows of no city using sugar sulphate to clarify water, and indeed, knows of no such substance. The usual substances used for clarifying, softening and sterilizing water are lime, soda ash, sulphate of iron, sulphate of alumina, hypochlorite of lime, hypochlorite of soda, sulphate of alumina being the one most commonly used for clarifying water, as it fits the chemical condition of nearly all waters requiring clarification. Nearly all mechanical filter plants use it, alone or in combination with one or more of the others named.

Cities Owning Their Asphalt Paving Plants.

Have you a list of the towns in the United States owning their own asphalt paving plants which you could furnish us?

A., Chicago, Ill.

Following are the cities owning their own asphalt plants, many of them being used for repairing asphalt pavements only, but some being used for both repairs and new construction: San Francisco, Cal.; Denver, Col.; Bluffton and Indianapolis, Ind., and Marion, Ind., a small portable repair plant; New Orleans, La.; Detroit, Mich.; Kansas City, Mo.; Brooklyn, N. Y.; Cincinnati, Columbus and Dayton, O.; Pittsburg and Allegheny, Pa., with one ordered for Erie, Pa.; Nashville, Tenn., for bitulithic, and Chattanooga, Tenn., a small portable repair plant; Houston, Tex.; Seattle and Spokane, Wash.; Milwaukee, Wis. There are also plants at Winnipeg, Man., and Hamilton and Toronto, Ont.

Cost of Street Paving.

If it lies within your knowledge, please inform me about how much per square yard of completed work other cities or townships are paying for macadam, asphalt, brick, stone, granite and wood block paving.

A. M. A., Oregon, Ill.

Prices vary so much according to local conditions and specifications that definite figures cannot be given in answer to so general a question. In Municipal Engineering, vol. xxxvii, p. 177, will be found a collection of current prices for the various kinds of pavements, made from the prices quoted in the monthly numbers of this magazine. They range as follows, per square yard:

Macadam, 50 cents to $2.13;
Asphalt, $1.45 to $3.24;
Brick, $1.21 to $3.63;
Sandstone block, $3.10;
Granite block, $3 to $3.96;
Wood block, $1.75 to $3.72.

In the same number, on page 152, will be found a collection of prices paid for pavements, made by a committee of the Illinois Society of Engineers and Surveyors. According to this collection, which covers much of the United States, Illinois prices for pavements were about as follows, per square yard:

Macadam, 12 inches thick, 98 cents; 9 inches thick, $1.28; 8 inches thick, 40 cents. Material differences in specifications are evident from the variations in prices.

Asphalt, $2.03 to $2.10.

Brick, $1.40 to $2.55, the latter being a Chicago price which is nearly 50 cents above the maximum price outside the city.

Granite block, $2.77 to $3.89.

Wood block, $2.60 to $3.49.

Sandstone block cost in Michigan $3.85.

Similar figures for 1910 can be gathered from the monthly numbers of MUNICIPAL ENGINEERING, in vols. xxxviii and xxxix, by consulting the department of "Improvement and Contracting News," under "Paving," "Contracts Awarded."

Flushing Street Sewers.

We are very desirous of getting a copy of your journal, in which was published an article on the flushing of street sewers, by Mr. Andrew Rosewater. We do not know the exact date of this article, but of you have on hand a spare copy of the issue in which it was contained, we would appreciate having you send us this at once, and will remit immediately.

E. B. B., Camden, N. J.

No article by Mr. Rosewater on flushing street sewers has been published. Some data derived from experiments made by Mr. Rosewater have, however, been published in MUNICIPAL ENGINEERING, as follows:

Vol. xi: "Automatic Flush Tanks on Sewers," p. 34, giving data as to waste of water by flush tanks in Omaha, Neb.

Vol. xii: "Velocity of Discharge of Automatic Flush Tanks," p. 92, giving data as to effect of discharge from flush tank.

Vol. xiii: A review of Adams' "Sewer Flushing Diagrams," p. 170, compares the data given on the diagrams with those obtained by Mr. Rosewater.

Vol. xiv: "A Point on the Design of Flush Tanks," p. 217, an editorial giving a table of data as to capacities of tanks, gradients of sewers, velocities of discharge of tanks and of flow in sewers as observed for 8 and 10-inch pipes, derived from the manuscript record of Mr. Rosewater's experiments.

Other articles giving data on the subject, some not obtainable elsewhere are the following:

Vol. xi: "Waste of Water by Automatic Flush Tanks," p. 102, an editorial containing estimates of maximum and minimum discharge of flush tanks per day.

Vol. xiv: "Sewer Flushing," p. 190, an editorial giving brief statement of methods and apparatus for sewer flushing other than flush tanks; "Efficiency of Flushing Sewers with Flush Tanks," p. 208, giving some data procured by Prof. A. N. Talbot; "Some Sewer Flushing Experiments," p. 285, giving results of experiments made by Prof. H. N. Ogden.

Vol. xvi: "Flushing Devices for Small Sewers," p. 24, giving data and diagrams and tables based thereon, which were derived from experiments made in Washington, D. C., by Asa E. Phillips.

Vol. xvii: "Flush Tanks and Water Waste," p. 305. An editorial giving data from Newport, Ky.

Vol. xviii: "Use of Large Flush Tanks for Cleaning Outlet Sewers," p. 310, collecting a few data on this phase of the subject.

Vol. xix, pp. 23, 93 and 412, brief articles giving some further information.

Vol. xx, pp. 24 and 165, two articles giving further information on flushing large sewers and on frequency of discharge of flush tanks, the latter giving data from Highland Park, Ill.

Vol. xxxiv: "Special Designs for Flush Tanks," p. 368, giving forms used in Great Falls, Mont.

Vol. xxxix: "A New Sewer Cleaning Device," p. 237, with a description of a test in vol. xi, p. 69.

Information About Flow of Sewage.

What is a fair estimate of flow of sewage in a sanitary sewer system, stated in gallons per capita per diem? First, where water is sold by meter? Second, where water is not metered?

Is there any record of storm sewers having been destroyed by excessive scouring action due to steep grades?

What is regarded as the minimum grade (feet per hundred) for 6, 8 and 10-inch sewers without flush tanks?

C. E., Okla.

The estimates for flow of sewage vary somewhat according to the size of the city, the use of water apparently increasing more rapidly than the population. The local conditions must be studied carefully and possible changes in conditions must be considered. It is common to assume 100 gallons per capita per day as the flow of sewage for a small city, when there is not enough information on which to base a more careful estimate. If water is metered the meter records give the amount used. It is probably 25 to 35 per cent. less than if not metered.

Sewers on steep grades are not infrequently badly worn and sometimes the bottoms are scoured away completely. Omaha, Neb., has had some sewers in this condition, and doubtless all cities on side hills or bluffs can report similar troubles. Paving brick are recommended sometimes for inverts of sewers under such conditions. Concrete sewers have have been designed with paving brick inverts to resist such wear.

The minimum gradient for sewers running half-full may be assumed as 0.4 foot per hundred for 6-inch pipe, 0.25 for 8-inch and 0.2 for 10-inch. These gradients give fair velocities, though not self-cleansiing under all conditions. If there are no flush tanks and the separate system is used, large parts of the small branches, 8-inch for street lines and 4 and 6-inch for house and larger building connections, will never run half-full, and the self-cleansing velocity will never be attained. On steep gradients, say 4 or 5 feet per hundred, the water may run away from the solids carried and thus produce deposits, not ordinarily troublesome to any appreciable extent. It is doubtful if the upper ends of branch sewers can ever be kept entirely clean without occasional flushing with tanks or hose. The lower end of such a line a half-mile or more long will probably keep itself clean if laid on gradients say 50 per cent. greater than the minima quoted.

Patents on the Septic Tank.

I would like to know whether or not the courts have upheld the Cameron patents on septic action.

W. W. S., Choctah, Okla.

An extract from a circular of the Cameron Septic Tank Co., giving their statement of the decision in their favor of the Saratoga Springs case will be found in the September number of MUNICIPAL ENGINEERING, vol. xxxix, p. 238. Later articles giving information and opinions on the subject will be found in vol. xxxix, p. 439, "The Present Use of the Septic Tank"; p. 390, giving references to many earlier articles on the use of the septic tank and the patents thereon; vol. xl, p. 1, "Sewage Disposal Plans of Atlanta, Ga.," containing a statement of the position of the company regarding the Imhoff tanks.

Storage Batteries for Individual Lighting Plants.

Will you kindly refer me to some book wherein I can post myself on storage batteries for furnishing light?

We would like to install a gasoline engine at our farm and with it pump water, furnish light, and do other work needed about the place.

C. C. H., Eureka, Kan.

Foster's "Electrical Engineers' Pocket Book" ($5) has 30 pages of fine type concerning storage batteries, which give some good information on the particular problem stated. "The Theory of the Lead Accumulator" ($2.50) is a translation of a German book by Dr. Dolezalek on the storage battery. Elementary treatises on the storage battery are Marshall's "Small Accumulators" (50 cents) and Niblett's "Portative Electricity" ($1). Lyndon's "Storage Battery Engineering" ($3), Wade's "Secondary Batteries" ($4), Treadwell's "The Storage Battery ($1.75), are the more recent books on the subject.

Rates for Ornamental Street Lighting.

We are designing a new system of street lighting for the business section of our city, and in order to present the subject properly to our city council it is necessary to have the cost of similar systems in other cities.

The proposed system consists of iron lamp posts or standards, placed every 100 feet along both sides of the street, and directly opposite. At the street corners the standards support a cluster of five tungsten lamps, and between the corners a cluster of three lamps. Each lamp consists of a globe of diffusing glass, with a single 60-watt tungsten lamp in the center.

Our electricity is furnished by a private company, and they have agreed to furnish the electricity as cheap as any other city is getting it under the same circumstances.

If you can give us any information as to the cost per lamp, or post, or rate per k. w. for the electricity as paid by other cities for similar systems it will be greatly appreciated. We are more particularly interested in the rate per k. w. If this cannot be furnished, possibly you can give us the names of a number of cities that have such a system, so we can write them.

A. J. M., Webb City, Mo.

In the January number of MUNICIPAL ENGINEERING, vol. xl, p. 37, will be found a list of articles on electric lighting contracts which should aid in the solution of the problem stated. In particular: The article in vol. xxxix, p. 50, gives the Indianapolis contract between lighting company and business men, whereby the price is set at $1.05 per front foot of property or store per year. For the layout of lamps, hours of lighting provided for and kind of lamps used, this apparently figures out about 1.8 cents per k. w. hr. The articles in vol. xxxviii, on "The Tungsten Lamp and Its Relations to Central Stations" on p. 166, on "Central Stations for Towns of 1,000 Population," on p. 169, give some valuable information directly applicable to this case, and that on "Rate for Tungsten Street Lamps" on p. 330 will also be of interest, as the minimum rates there given are about the same per lamp per year, $14, as the cost of the nIdianapolis light when reduced to the same basis.

Reference may be made also to the recent articles on ornamental street lighting in vol. xxxix, p. 416, p. 132, giving list of cities adopting the plan, and elsewhere in this number, giving details of the new Cincinnati plan for ornamental lighting and the progress in a number of other cities. The Cincinnati ornamental lights give three times the illumination for the same current, using the same meter rate as for former standard street lighting.

Gas Processes and Rates.

(Continued from page 125.)

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
MISSISSIPPI.						
Hattiesburg, coal	....	....	1.50	1.40	....	....
MISSOURI.						
Brookfield, Lowe	....	....	1.60	1.50	1.35	1.25
Cape Girardeau, coal	....	....	1.00	....	....	....
Chillicothe, Patton, oil	....	....	1.40	1.00	1.40	1.00
Clinton, coal	3.05	....	....	1.80	....	1.50
Columbia, coal	....	....	2.00	1.75	2.00	1.75
Excelsior Springs, Lowe	10.00‡	2.5	....	2.00	....	1.50
Lexington, coal	2.62	to 6	1.50	1.25	1.50	1.25
Louisiana, coal	4.35	....	....	1.25	....	1.25
Macon, Patton, oil	2.50	4.5	2.50	1.90	2.50	1.25
Marshall, coal	....	....	1.50	1.35	1.50	1.35
Mexico, Lowe	....	....	1.50	1.25	1.50	1.25
Nevada, coal	....	....	2.00	1.50	2.00	1.50
Trenton, Moses-Lowe	....	....	1.50	1.425	1.50	1.425
NEBRASKA.						
Fairbury, Tenney	7.25‡	3.4	1.50	1.42	1.50	1.42
Kearney, Lowe and Tenney	7.00	4.125	1.75	1.575	1.75	1.575
Nebraska City, coal	5.50	....	1.60	1.50	1.60	1.50
Norfolk, Tenney and Springer	....	....	1.70	1.60	1.70	1.60
Plattsmouth, Lowe	6.35‡	3	1.75	1.50	1.75	1.50
York, practical, water	7.50	4	1.80	1.62	1.80	1.62
NEW HAMPSHIRE.						
Claremont, Lowe	....	....	1.80	1.60	1.80	1.60
Exeter, coal	5.00	....	2.10	2.00	2.10	1.50
Franklin Falls, oil	....	....	5.00	....	....	....
Laconia, Lowe	....	3.4	2.00	1.80	2.00	1.80
Portsmouth, coal	3.95	....	1.50	1.35	1.50	1.35
Somersworth, Kendall, oil	....	....	....	2.00	....	1.50
NEW JERSEY.						
Hammonton, Logan-Janeway, water	....	....	1.50	....	1.35	....
Keyport, coal	3.85	....	2.00	1.75	2.00	1.75
Lambertville, coal	3.50	....	2.00	1.50	1.75	1.50
Newton, coal and Lowe	**	4.375	1.75	1.60	1.35	1.20
Princeton, coal	....	....	1.80	1.60	....	....
Ridgewood Junction, W. G. C. Co	....	....	....	1.15	....	....
Salem, coal	3.35	....	1.60	1.36	1.60	1.36
South Amboy, coal	....	....	1.60	1.50	1.60	1.50

**Anthracite, $6.25; bituminous, $4.15.

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
NEW YORK.						
Albion, coal	3.00	....	1.50	1.25	1.50	1.25
Bath, coal	....	....	....	1.50	....	1.50
Brockport, coal	3.15	....	1.60	1.50	1.60	1.50
Canandaigua, coal	3.80	....	....	1.50	....	1.25
Catskill, coal	....	....	2.00	1.50	2.00	1.25
Dansville, Lowe	5.00	3.5	1.75	1.65	1.75	1.45
Fredonia, coal	....	....	1.75	1.50	1.25	1.00
Fulton, coal and Lowe	3.07	3.25	1.35	1.25	1.35	1.25
Glen Cove, Lowe	....	....	....	1.50	....	....
Haverstraw, Boecklin	....	3.5	1.50	1.50	1.50	1.50
Hoosick Falls, coal	4.07	....	1.60	1.50	1.60	1.50
Hudson, coal	3.90	....	1.75	1.60	1.50	1.35
Huntington, Lowe and Sutherland	5.50	4.8	2.20	2.00	1.60	1.50
Lyons, coal	3.29	....	1.80	1.40	....	....
Malone, coal	4.00	....	2.00	2.00	1.50	1.50
Mechancisville, Lowe	5.00	3.5	2.00	1.50	2.00	1.50
Medina, coal	3.20	....	....	1.75	....	1.25
Newark, coal	3.14	....	1.60	1.40	1.60	1.40
Norwich, Lowe	5.25	3.45	1.80	1.30	1.80	1.00
Nyack, Lowe	....	....	1.60	1.50	1.60	1.50
Ogdensburg, coal	....	....	2.25	1.90	2.00	1.50
Oneida, coal and Lowe	....	....	....	1.75	....	1.50
Oneonta, Lowe	4.75	3.75	1.50	1.50	1.50	1.50
Owego, coal	3.21	....	1.80	1.40	1.80	1.40
Patchogue, Lowe	....	....	1.50	1.50	1.50	1.50
Penn Yan, coal	4.50	....	1.80	1.60	1.80	1.40
Port Jervis, Lowe	....	....	....	2.00	....	1.50
Saugerties, coal	4.20	....	2.00	1.90	2.00	1.60
NORTH CAROLINA.						
Fayetteville, coal	....	....	....	2.00	....	1.50
Washington, Lowe	4.55	4	1.60	1.50	1.35	1.25
NORTH DAKOTA.						
Jamestown, oil	....	....	2.00	1.80	1.65	1.45
OHIO.						
Bucyrus, Lowe	....	....	1.80	1.50	1.80	1.35
Defiance, coal	2.95	....	1.40	1.30	1.40	1.10
Greenville, coal	3.00	....	1.50	1.40	1.50	1.30
Hillsboro, coal	2.25	....	1.50	....	1.35	1.00

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Electrolysis of Underground Structures in American Cities.

The following information regarding electrolysis in pipe systems of water works plant may be added to that given in vol. xxxix, p. 206, regarding 113 cities in the United States:

Alameda, Cal.: Tests are made every 4 to 6 months; rail bonding has been improved and return circuit improved by bonding rails to mains in some places; no recent trouble has been observed.

Berkeley, Cal.: Similar conditions. Same water and electric companies.

Oakland, Cal.: Similar conditions. Same water and electric companies.

Sacramento, Cal.: No tests made; bonding good; mains and rails connected in a few places and return metallic circuits from rails to power house; no recent trouble from electrolysis.

San Francisco, Cal.: Systematic survey of electric conditions made by water company, and arrangements for observation of conditions, on one street; maximum difference in voltage is 5 between pipe and rail there and a flow of 100 to 200 amperes along the pipe; no tests made by city; street railway company is rebuilding lines and using heavy, well-bonded rail; water mains are bonded to the returns to the street railway power house at present; serious results from electrolysis, especially on wrought-iron water pipe; considerable length of large wrought-iron pipe damaged or almost destroyed on Harrison street near Eleventh, and Eddy near Devisadro, and cast-iron pipe destroyed at Bryant and Seventeenth streets; conditions improving; conduit companies report no trouble from electrolysis.

San Jose, Cal.: No recent surveys, telephone company reports reading as high as 75 volts on its underground cables; rail bonding poor; return circuits not well taken care of; electrolysis considerable, e. g., 2 miles of 5-inch pipe and many house connections destroyed; formerly three railway systems, now two consolidated, interurban power house moved out of city, all have improved conditions; also relaying and properly bonding of one system is helping; rails and mains are connected in several places and house services are used for grounding; gas company reports considerable trouble from electrolysis which is still showing occasionally.

Colorado Springs, Col.: No surveys; telephone company makes annual tests, no recent damage; street railway company made test of bonds in 1909, replacing broken ones; water mains bonded to rails at one palce; on one line 12 feet of 8-inch pipe destroyed within last two years, with considerable current running in mains; many house services have been destroyed.

Waterbury, Conn.: Telephone and street railway companies make regular tests; no apparent electrolytic action and no damage reported by water works.

Fort Wayne, Ind.: Telephone companies make regular investigations, bond their cables together and to street railway rails; damage at one point caused improvement of rail bonding there; rails are return circuit; no recent damage to water mains, sometimes shows on house service pipes.

Butte, Mont.: Electrolysis survey made 13 years ago, street railway makes semi-annual tests and improves bonding where current is escaping; telephone company makes regular tests and bonds cables together at manholes; little damage reported in past eleven years, 6-inch pipe destroyed two years ago, telephone company has had several cable lengths seriously injured.

Great Falls, Mont.: Telephone company makes semi-annual tests; no damage reported by them or by water works.

Helena, Mont.: No tests; water pipe bonded to rails at one point; telephone cables bonded together at manholes; no damage reported but actual condition of water mains is unknown.

Missoula, Mont.: Traction line is new and no electrolysis troubles have yet developed.

Elmira, N. Y.: No tests; telephone cables bonded to water mains in two places; no trouble reported.

Hornell, N. Y.: No tests; rails rebonded since electrolysis was discovered on two streets; 6-inch main burst last summer on account of electrolysis. Condition of other mains not known.

Jamestown, N. Y.: Tests in 1908 showed positive currents of ½ to 22 volts and negative of ½ to 39 volts in western part of city; heavier rails have been laid since; no breaks from electrolysis.

Niagara Falls, N. Y.: One telephone company makes periodical tests and bonds or grounds as is found necessary; water company and city make no tests; little known of conditions; a 4-inch cast-iron main was destroyed by electrolysis some 6 or 7 years ago; no damage reported by water company since.

Portland, Ore.: Efficiency of bonding system tested by street railway under ordinance every three months, gradually rebuilding system; no return except connections between rails and negative bus bars; gas and telephone companies report practically no trouble; trouble with water mains in eastern section of city, wrought-iron mains being affected somewhat, but none in western section recently.

McKeesport, Pa.: No tests by city; telephone companies make frequent regular tests, grounding cable sheaths when necessary; no damage reported to either water or telephone systems.

Woonsocket, R. I.: No recent tests; a few service pipes slightly pitted, but no evidence of foreign current.

Beaumont, Tex.: Telephone company makes irregular tests, and have bonded cables at each manhole to an overhead return feeder to the street railway power house; formerly had trouble but none now; about two years ago a piece of 6-inch water main was found badly pitted by electrolysis; street railway tracks not adequately bonded and may cause future trouble.

Spokane, Wash.: Telephone company makes regular tests, city does not; one street railway company has both riveted and soldered bond and is connected with underground return feeders, other company has copper-bonded rails only; telephone cables bonded to return feeders of street railway; no damage reported to gas or water mains and to a few service pipes near the power house, only; greater future damage anticipated with increasing traffic and weight of rolling stock.

Record of City Improvements.

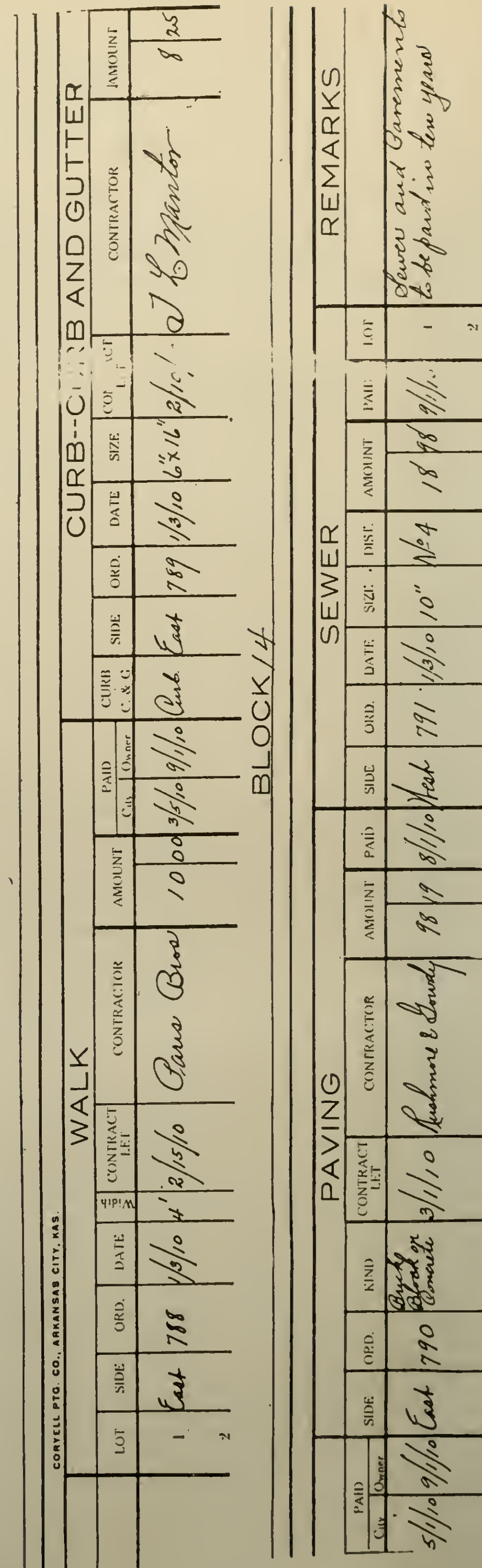
To the Editor of MUNICIPAL ENGINEERING:

Sir: I am enclosing a sheet out of my "Improvement Record Book" which I think will explain itself, and I thought it might be of use to some other engineer. I find it very handy. If a man comes in and wants to know if there has been any improvement ordered in on his property, it only takes a few moments to tell him when it was ordered in, name of contractor, amount it will cost, and how long he has to pay for it.

I want to take this opportunity to tell you that I think MUNICIPAL ENGINEERING is the best publication for the city engineer. I have been a reader of the magazine for a great many years and have always found you ready to give reliable information on almost any subject that pertains to engineering.

J. H. TITUS, City Engineer,
Arkansas City, Kan.

The record is all on one side of one sheet. The accompanying cut reproduces the heading of the columns, which have been separated into two groups for convenience in the reproduction. One line is filled in to show how it is operated in practice.



BLOCK 14

WALK: LOT	SIDE	ORD.	DATE	Width	CONTRACT LET	CONTRACTOR	AMOUNT	PAID City	PAID Owner	CURB-CURB AND GUTTER: CURB C. & G.	SIDE	ORD.	DATE	SIZE	CONTRACT LET	CONTRACTOR	AMOUNT
1	East	788	1/3/10	4'	2/15/10	Paris Bros	10 00	3/5/10	9/1/10	Curb	East	789	1/3/10	6"x16"	2/10/	J. L. Manton	8 25
2																	

PAVING: PAID City	PAID Owner	SIDE	ORD.	KIND	CONTRACT LET	CONTRACTOR	AMOUNT	PAID	SEWER: SIDE	ORD.	DATE	SIZE	DIST.	AMOUNT	PAID	LOT	REMARKS
5/1/10	9/1/10	East	790	Brick Block or Concrete	3/1/10	Richmond & Lowdy	98 19	8/1/10	West	791	1/3/10	10"	No 4	18 98	9/1/10	1	Sewer and Pavement to be paid in ten years
																2	

CORYELL PTG. CO., ARKANSAS CITY, KAS.

The left-hand column has printed numbers of lots to correspond with the custom of numbering lots in vogue in Arkansas City. Printed along the side of the column of "Remarks" is the following:

"NOTE—This system installed by J. H. Titus, City Engineer, Sept. 1, 1910. All notes prior to April 1, 1910, were taken from old records in office."

The sheets are perforated at the left-hand end for binding in a loose-leaf binder.

Reinforcement for Concrete Pavements or Floors.

Charlton H. Sayre, of Camden, N. J., sends a description of a method of holding the upper or wearing surface of a concrete floor, walk or pavement in tight engagement with the lower or foundation layer, from which the following is abstracted, showing one of the principal points in his inventions: When the foundation or lower layer of the pavement or floor is laid, its upper surface is scored crosswise and longitudinally by grooves running in squares with diagonals across the squares, which are V-shaped Over this surface is laid coarse-mesh woven wire, and on top of this is laid the top layer or wearing surface. The intention of this construction is to hold the two layers together and to prevent the cracking of the top layer by excess of expansion in it over that in the lower layer.

Wood Pavement Specifications Should Be Investigated.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Kindly permit me to use your valuable and unprejudiced publication to ask a few questions regarding the wood block pavement specifications proposed by Mr. George W. Tillson, Chairman, and his committee of the Organization of City Officials for Standardizing Paving Specifications, at the convention of City Engineers, etc., from about 32 of the 992 cities of the United States, held in New York in January, 1911.

When we remember that all the cities of our country expend about $80,000,000 annually on their streets, and that a large part of this is assessed directly against abutting property holders, we realize the importance of publicity, efficiency, economy and the adoption of contracts and specifications requiring good work and open competition.

While the specifications for asphalt, brick and other groups of pavements than wood, suggested at the convention, seem to be open to wide competition, careful study of what the above committee proposed for wood, suggests some very important questions, the answer to which in each case seems possibly to be in the affirmative.

1. Do the specifications in question exclude the use of regular, commercial, genuine creosote oil of standard specific gravity between 1.03 and 1.07, in successful use for many years, and provide for a product of coal tar of a specific gravity between 1.10 and 1.14, which necessarily contains an excess of free carbon or coke and relatively little creosote?

2. Does the excess of free carbon, coke, etc., prevent the oily part of the coal-tar product from properly saturating the wood?

3. Are the oily portions of the proposed tar product a poorer preservative of wood than regular creosote oil used and in wood pavements still in good condition after eight or ten years' use?

4. Are the specifications in question relatively new and untried as compared with many old and successful ones in our country and Europe?

5. The title of the committee being "Creosoted Block," does the omission of the word creosote oil from the specifications, and the substitution of such words as "coal-tar product," indicate that the specifications are not in accord with the title of the committee or with the specifications intended?

6. Did the chairman and his committee overlook the success of many other kinds and preparations of wood block pavements in many cities, existing for many years, and prevent the repetition of those very successes in our cities; provided the cities adopt the specifications in question?

7. Did the committee sit with closed doors at all of its sessions and under the guidance of its chairman or otherwise, admit, one at a time, only such persons as it desired and exclude from being heard several engineers from several cities, well qualified to give valuable information? Did the committee thus exclude facts and evidence?

8. Is a "coal-tar product," coming within the requirements of the proposed specifications, practically controlled through by-products of a patented or two patented processes, under contract with one firm?

9. Is regular, genuine creosote oil obtainable in small and large quantities, to suit any buyer, and with reasonably prompt deliveries?

10. Are there several competing sources of production of regular creosote oil in the United States and Europe?

11. Is the opposite of Questions 9 and 10 practically true as the coal-tar product suggested in the specifications under investigation?

12. Is it a fact that the heavy, carbon or coke-filled coal-tar product, called for by the said specifications, is cheaper to produce and sold at a higher price than genuine creosote oil to be had everywhere?

13. Were some of the men and experts appearing before the said committee in the pay of or influenced by interests desiring the specifications in question?

14. Are the wood preserving plants, which make paving blocks, as well as the

paving contractors in each city and the taxpayers, all possible victims of a special kind of tar products, where wood block pavements may have been constructed under said specifications suggested in 1910 and 1911, and which might be laid in any city adopting the said specifications?

15. Was the committee composed of public officials, under public pay, traveling and meeting at public expense?

16. Were permanent stenographic records of names and statements of persons called or permitted to be heard by the committee, made at public expense, and a copy furnished each of the members and not given to the public, and are such records public property?

17. Are these and other specifications, by order of the "Executive Committee" of said Association of Public Officials, to be "copyrighted" against general public use?

18. Will this copyrighting mean that the employes of the public will copyright, against the public itself, the work for which they are paid by the public?

19. Have unknown influences or methods been employed so that any members of said convention were led to unknowingly approve that which some of them now say they do not really approve and are ready to oppose?

20. In view of the possibility of the specifications of 1910 and 1911 of said organization tending to, if not creating a monopoly, is it not wise to observe if political bosses and venal politicians, not engineers, favor said specifications so as to share in undue profits at the expense of taxpayers?

21. Is it not good policy, right and best, for each city to independently and openly investigate wood pavements and wood pavement specifications, before adopting the ones referred to of 1910 and 1911?

22. Would it not be wise to carefully study the following specification for regular, commercial, genuine creosote oil obtainable from many sources for many years which meet the requirements of the first part of Question 1 and Questions 9 and 10, as follows?

The creosote oil shall be a prepared dead oil of coal tar. It shall not contain more than 3 per cent. of water, and if it does not contain this amount of water a corresponding correction must be made so that an equivalent additional amount of creosote is forced into the blocks. It shall contain only traces of acetic acid and acetates. Its specific gravity at 100 deg. F. (38 deg. C.) shall be at least 1.03 and not more than 1.07, so as to assure its thoroughly penetrating the wood blocks. The residue insoluble by filtration with benzol and chloroform must not exceed 3 per cent. of the weight of the creosote oil. Fractional distillation of 100 grams of the creosote oil shall produce percentages of dry oil by weight within the following limits:

Up to 150 deg. C. (302 deg. F.), not to exceed 2 per cent.

Between 150 deg. C. (302 deg. F.) and 170 deg. C. (338 deg. F.), not to exceed 1.5 per cent.

Between 170 deg. C. (338 deg. F.) and 235 deg. C. (455 deg. F), not to exceed 35 per cent.

Between 235 deg. C. (455 deg. F) and 300 deg. C. (572 deg. F.), not to exceed 35 per cent.

The residue remaining shall be soft and adhesive. The creosote oil shall contain about 25 per cent. of crystallizable naphthalene and at least 15 per cent. anthracene oils. At least 95 per cent. of the creosote oil shall be soluble in carbon-bisulphide and equally in a solute alcohol.

Conclusion.—The foregoing questions are submitted with a belief that a full public discussion through MUNICIPAL ENGINEERING will bring out just the facts and results which the city engineers really desire and which cannot be determined at conventions, meeting at long intervals and then only for a few days.

PROGRESSIVE.

The above communication is from a well-known engineer who has made a close study of the subject, and is presented for the purpose of arousing discussion. MUNICIPAL ENGINEERING cannot of its own knowledge answer all the questions in the affirmative, hopes that no one can so answer some of them, and regrets that anyone should think it advisable to ask those referring to individual or collective motives other than the promotion of the public welfare.

Brick Rattler and Brick Specifications.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In order that you may understand fully the attitude of the National Paving Brick Manufacturers' Association regarding the rattler, we are enclosing you herewith a general letter, such as we are sending to many engineers throughout the country, and enclosed with the same is the rattler specification as explained, any and all of which you are at liberty to publish.

WILL P. BLAIR,
Secretary, Indianapolis, Ind.

The letter referred to is as follows:

We are pleased to enclose you a copy of the plans and specifications for the rattler, which is offered to the municipalities of this country by the National Paving Brick Manufacturers' Association, together with the explanation for its development and comment as to its use and purposes which is further explained by the following resolution, adopted by this Association at its annual meeting at Louisville, Ky., under date of February 7, 1911:

"Resolved, That the National Paving Brick Manufacturers' Association condemns the action of the Organization of City Officials for Standardizing Paving Specifications in specifying a three-point increase in the abrasion test to take care of the greatly increased severity of the new standard rattler developed by the National Paving Brick Manufacturers' Association. The old machines were so erratic, one with another, as to make it impossible to ever state the loss sustained in the new machine as an arbitrary amount over that sustained in the old. Any comparison must of necessity be based upon some definite old machine. Such comparisons as are now available show an increase from five to ten points, varying with the different old machines. It will be necessary for city officials to determine by investigation for themselves what rattler loss they will allow in their specifications."

Calling your attention further to the general recommendations of the Organization of City Officials for Standardizing Paving Specifications which were adopted by that organization at their meeting January 10-14 inclusive, in New York City, we very much regret that the organization saw fit to exclude all discussion from associate members except through committees. The brick committee itself allowed us but one-half hour upon matters which we regard as of the utmost importance to ourselves as well as to the taxpaying public. It was impossible, therefore, to go into the discussion of details which were obviously of so much interest to us. As a result we believe that there were reported to the convention, by the committee, matters with which our own association would have to differ and which perhaps would not have been adopted by either the committee or by the organization itself in the light of full and complete discussion of the same.

The allowed time did not permit any discussion in detail of our No. 1 Directions for Laying Brick Street Pavements. of directors has appointed a committee to carefully consider and revise for a new edition our No. 1 Directions, setting out in explanation more fully our views in all these matters.

It may be that many points are covered in detail which are not expressed as clearly and concisely as should be, and their value was therefore not appreciated to the fullest extent and could not well have been without careful consideration, such as a careful discussion would accomplish.

With the view, however, of correcting anything of this sort and with the hope of having these detailed matters carefully considered in the future, our own board

In the meantime we believe that it will be proven of utmost importance for municipalities to follow as closely as possible the suggestions that are found in our No. 1 Directions, sincerely believing such a course will conserve great economy and satisfaction to the taxpayer and user, as in every case where these specifications have been fully complied with entire satisfaction has resulted.

For your information we are enclosing you a copy of proposition, cost, etc., from Messrs. Hetherington & Berner, who are equipped to furnish rattler and shot.

The rattler specification is practically that published in the February number of MUNICIPAL ENGINEERING, vol. xl, p. 91. Following is the description and price list of parts of rattler, enclosed with the specifications:

	Weight.	Selling Price.	
14—6″x15-lb. channel staves, 35 lbs. ea.	492 lbs.	$21.25)	
14—⅜″x5½″ plate liners, 11.5 lbs. ea.	162 lbs.	8.40)	
2—Heads, No. 1529, 218 lbs. ea.	437 lbs.	23.75)	
2—Head liners, No. 1577, 170 lbs. ea.	340 lbs.	16.25)	
64—¾x2½″ machine bolts		)	Barrel
64—¾″ hex. nuts		6.00)	$75.65
1—C. I. pinion 6.8″P. D.	32 lbs.	$ 3.20	
1—Gear 32⅝ P. D.	190 lbs.	11.00	
1—Clutch pulley 6″x18″	58 lbs.	5.50	
1—Clutch block	14 lbs.	2.65	
2—Side frames, 140 lbs.			
2—End frames, 230 lbs.			
2—Boxes and cap, 51 lbs.			
2—Caps, 20 lbs.			
1—Gear guard, 45 lbs.			
1—Shaft 1 15/16x5.2″, 53 lbs.			
1—Clutch lever and plate, 20 lbs.			
Screws, bolts, etc., 5 lbs.	564 lbs.	52.00	
Totals	2275 lbs.	$150.00	
25—Large spheres, approximately	187.5 lbs.		
325—Small spheres, approximately	325.5 lbs.		
Total	500 lbs.	at 4½c.	$22.50

Monument for Locating Sewer Connections.

In your magazine for February, 1911, I notice a description of a monument for sewer connections. In the smaller places I have used a device which is much cheaper than the one described, and which I believe will work as well, if not better.

My plan is to leave in the ditch at each connection, where the connections are not run out to the curb line, a piece of cedar 2x2 inches, which extends from the bottom of the trench to within six inches of the surface of the ground.

The inspector locates these strips of cedar from the last manhole passed, entering the measurements in a notebook kept for the purpose. The original tracing is corrected from this notebook, and filed with the city clerk.

When a property-holder wishes to locate his "Y," he obtains from the clerk the location of the cedar strip, and digs for it. As it is but six inches under the ground, a mistake of a foot or two is not expensive; and when he finds the strip, he has but to follow it down to the connection.

W. H. ALLEN, Assoc. M. Am. Soc. C. E.,
Chehalis, Wash.

Cost of Surface Oiling and Asphalt Macadam Roadways.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Following are some data on the cost of treating roads with oil and laying asphalt macadam which will be of interest to your readers:

1. Surface oiling Van Buren and Sixth streets, Fort Smith, Ark., using Texaco road oil; 13,000 square yards area of street.

Method of Work: The dust on the surface of the road was swept aside thoroughly and the streets sprinkled with Texaco road oil. The dust mixed with a little fine gravel was thrown back over the road oil and rolled.

Time taken on the work was four days; the number of gallons of oil used was 6,000; the amount of oil per square yard, 0.45 gallon; total cost per square yard, $0.048.

2. Oiling Nine Streets in Kingston, Pa., with Texaco Road Oil.—Ridge, Pierce, South Wyoming, Myers, Maple, Hoyt, Slocum, Centre and Payne streets and avenues.

Total length, 5,000 feet; amount of oil used, 75 barrels; total square yards, 9,333 1/3; number of gallons used, 3,936 at 5 1/5 cents per gallon; cost, $204.67; cost of application, 79 yards at 20 cents, $15.80; cost of hauling from car, $8.40; total cost, $228.87; cost per square yard, $0.023; oil used per square yard, 0.42 gallon.

3. Laying Asphalt Macadam, Cold Mixing Method, at Pawtucket, R. I.—Total yardage of work, 1,847 square yards. Built on three grades, 14.63, 1 and 8 per cent. respectively. Six inches of broken stone macadam laid on sub-grade and surface mixture of three inches of stone mixed cold with Texaco macadam binder.

The mixer used on this work was a batch concrete mixer set up on the work.

The stone was dumped into the mixer from barrels and Texaco macadam binder, previously heated, drawn from the kettle and dumped into the mixer at a temperature of about 300.

Average time of mixing, three minutes.

The following men were employed on the work:

1 kettle man	$2.00
1 helper	1.75
2 men drawing asphalt, each	1.75
2 men wheeling crushed stone to mixer, each	1.75
2 men wheeling mixed material to street, each	1.75
1 raker	3.00

The stone used on this work was crushed by the city and was hauled about three miles to the work at a cost of about $2.00 per cubic yard.

The concrete mixer was capable of turning out one-sixth of a cubic yard to the batch. A mixer capable of turning out four or five times the amount of work could be operated with practically the same working force.

The work was done by city employes and there was no deduction from the labor on account of delays due to wet weather.

The average working day was only six hours during the whole of the work.

H. T., New York City.

Binder for Highway Construction.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I have been a street and road builder in this State for a number of years past, making a special study of this subject. The road commissioner and county officials are now face to face with a serious problem. The immense automobile traffic across this State is cutting into the macadam roads at a terrific rate. Hundreds of miles of roads are now badly in need of repairs.

The road commissioner has been experimenting with oil as a dust binder, but it has proved to be a failure, being wet and sticky all winter.

I have advocated asphalt sand and stone as a durable and satisfactory binder. Has anyone a better one to offer?

T. J. MCGOVERN, Trenton, N. J.

Sewage Plant at LaGrange, Ill.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The sewer and disposal plant at LaGrange, Ill., bids for which were received February 1, 1911, will be a very interesting piece of work. The sewer, 72 inches in diameter, will take the place of an old one, the flow of which will have to be taken care of during construction. The 15-inch tile sewer is to be encased in concrete alongside of the 72-inch sewer and will carry the sewage under pressure. The sewage is carried under the bed of a creek and empties into two automatic dosing chambers which discharge onto the filter beds.

EDWIN HANCOCK, JR.,
2047 Ogden Ave., Chicago.

Water Works of Phelps, N. Y.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We have three reservoirs in use, fed from springs: fire reservoir, 50x100x16 feet; domestic reservoir, 20x30x5 feet, and Basset reservoir, 35x35x6 feet, all in use.

We have no new work in contemplation except development of additional springs, with a possibility of driving one or more wells. All springs are above the reservoirs, and the pressure is from 65 to 90 pounds or over, depending upon location in the village and the reservoirs in use, the first two mentioned giving 10 pounds' pressure more than the third or Bassett reservoir.

CORLISS MCKINNEY,
Supt. Water Works.

How to Find Area of Segment of Circle.

I notice an inquiry in your February number, from "M. G. H.," Memphis, Tenn., asking for some short method of ascertaining the approximate area of a segment.

The result obtained from the following is in error, 1 part in about 175.

$$\text{Approx. area of segment} = \frac{2hc}{3} + \frac{h^3}{2c}$$

in which H equals mid. ord., and C equals chord.

H. B. Murdock,
Oakland, Cal.

Some Varieties of Sanitary Science.

To the Editor of Municipal Engineering:

Sir—Sanitarians and engineers have made wonderful progress in the science and art of water purification during the last ten years. Many cities taking sewage polluted streams for their source of water supply and applying modern scientific methods of purification and sterilization have some of the lowest typhoid fever death rates in the country. The same is true of many cities in Europe. Purification plants such as those installed at Washington, D. C.; Philadelphia, Pa.; Pittsburg, Pa.; St. Louis, Mo.; Cincinnati, Ohio; Albany, N. Y.; Indianapolis, Ind.; McKeesport, Pa.; Columbus, Ohio, and many others, all put in by the foremost engineers and sanitarians in this country, can no longer be considered as merely in their experimental stages. Proved statistics and scientific analyses are daily showing what these systems are accomplishing in the way of reduced death rates in these cities.

When we consider all that has been accomplished by purification installations in the way of reduced typhoid fever death rates in the many cities in this country, the making of such statements as those made recently by state officials of Oklahoma seems almost past believing.

Some six months ago the writer was called in by the cities of Muskogee and Oklahoma City to design for them adequate and improved water supplies, and in the case of Muskogee improved sewerage facilities and garbage disposal. In Oklahoma City the contract included the investigation of every possible source of water supply for that city, and the recommendation of that source and plan, which in the engineering judgment seemed wisest, best and most economical for the city to adopt.

Oklahoma City has for many years been obtaining its water from the North Canadian river, the average flow of which throughout the year is somewhere in the vicinity of three hundred cubic feet per second. After a careful consideration of every other possible and impossible source of supply suggested by citizens and other engineers, the plan recommended by the writer included the construction of a dam upon this river, impounding about 8,000,000,000 gallons of water, sufficient to carry the city of Olahoma City over a period of over a year's drought, and a complete water softening, purification and sterilization plant.

About one hundred miles up stream, measured along the meanderings of the North Canadian river, is situated the town of El Reno, with a population of about 8,000 people; approximately fifty or sixty miles further up is another small town of about 2,000. Neither of these towns have complete sewerage systems, the average discharge of sewage at El Reno being one-third of a cubic foot per second, as compared with an average stream flow of 300 cubic feet per second. The town of Yukon (population 1,000), situated at a river distance of sixteen miles, is at the present time installing a sewage disposal plant. Although the plans provided for a complete and thoroughly up-to-date filtration and softening plant, including sterilization, the writer took the precaution to point out the advisability of the city's taking immediate action to see to it that the towns above were compelled to adopt some rational method of sewage purification before discharging the sewage effluent into the North Canadian river.

The question of voting a million and a quarter dollars of bonds to carry out the proposed plan for an improved water supply was before the people of Oklahoma City for seven weeks, and received the endorsement of the Chamber of Commerce, a citizens' committee, appointed to investigate the entire proposition, the Oklahoma State Engineering Society, and most of the most reliable men of the community. The need of the city was very great, for during two or three months of the years 1902 and 1903, the river went practically dry; but the population of Oklahoma City at that time was only about 10,000 people. The present population of Oklahoma City is about 65,000 people, and during the past summer the flow of the river was not sufficient to supply the ordinary demands made upon it, and for many hours the pumps had to be shut down and the city left without any fire protection whatever. Nor has the city a present supply sufficient to offer water to new industries, or to extend its mains.

The campaign of opposition to the bond issue was opened by state officials in a letter published in the *Daily Pointer,* from which the following sample sentences are quoted:

> It is proposed that Tuesday we shall vote a million and a quarter dollars' bond issue for a water supply, and up to a few days ago the most of us supposed we were going to get water. Since then some frightful facts have been disclosed to us, facts in regard to this water, which means devastation and death unelss somebody puts a stop to it; and because no-

body else seemed willing to undertake to warn the people, I have accepted this grave responsibility and unpleasant duty.

Now, Mr. Voter, I wish to ask you some questions. Do you wish to drink liquid sewage? Do you wish to have the offal and filth from the sewers of El Reno and Yukon dumped into the water you drink?....Do you wish the death rate of Oklahoma City to increase until it drives the tenants from your buildings and frightens investors away?....I am perfectly willing, personally, and I am a taxpayer, to pay twenty dollars a year for forty years for clean, wholesome water; but not one cent have I for sewage and filth. And while I live it shall be over my protest that any engineer, for any amount of money, be permitted to feed liquid sewage to the helpless poor.

Signed by Kate Barnard, who is State Commissioner of Charities and Corrections. Again:

I told them if they would wait ten days and pass a law through the legislature, compelling the use of sewage farms, such as they have in Europe and many states of America, thus removing the sewage from our water supply, I would then stand for the bonds.

A letter of the State Health Commissioner was published in the *Daily Times*, in part as follows, including misused words:

Replying to your request for my opinion as a health officer as to whether or not a stream like the North Canadian river, that is now sewerage polluted and continually receiving every day additional sewerage pollution, can be dammed up and the water from the same be made a good and wholesome water for domestic purposes and used without endangering the health of those who use it for drinking purposes, I beg to advise, that personally my opinion would be that it could not be sufficiently purified, unless the sewers were removed and the river policed, so as to prevent a continuation of the contamination. In Ohio, Indiana and Kansas an aggressive fight is being waged against the further contamination of the running streams of water now used by municipalities for domestic purposes.

Signed by C. H. Mahr, State Commissioner of Health.

Concerning the El Reno and Yukon sewage entering the river, the state chemist, Dr. De Barr, made the following statement:

After entering the stream no treatment that will make the water safe as a drinking water for Oklahoma City can be applied to remove the evil effects of this sewerage. The only way is to not allow this sewerage to enter the reservoir, if you expect a pure water for Oklahoma City.

In view of the above statements, made by the scientists of the State of Oklahoma, it is interesting to remember that the water entering the Columbus, Ohio, storage reservoir, is polluted by a tributary population of 70 persons to the square mile; while the tributary pollution at the proposed reservoir at Oklahoma City is at the present time not more than five persons per square mile. The water shed of the Scioto river, from which Columbus draws its water supply, is 1,035 square miles, and that of the North Canadian river is 15,000 square miles. In others words, the proportion of pollution in the Columbus reservoir to that of the proposed Oklahoma City reservoir is as 16 to 1.

The state geologist, Charles N. Gould, added his word to this controversy. In speaking of the proposed reservoir and purification and softening plan he says:

The quality of the water will not be materially improved. The people of Oklahoma City will continue to drink the sewerage of El Reno and other towns. The dead horses and cattle from the hundreds of farms and Indian allotments in western Oklahoma will still be dumped into the river, and many of them will wash down into the reservoir. The water will always be hard and will require the constant use of chemicals.

According to government statistics on file in the office of the state board of health, Oklahoma leads other large cities in the percentage of typhoid cases. Bacteriologists tell us that no stream or reservoir will purify itself, and that no filter so far designed will take out all the typhoid germs. The fact that the people of other cities, such as Pittsburg and Wheeling drink sewerage and die of typhoid is of itself no reason why the people of Oklahoma City should do the same thing.

ALEXANDER POTTER, New York City.

The above is printed as a contribution to the information regarding the necessity of education in safe and sane sanitation. Can any of our Oklahoma readers or others having local knowledge add anything of value? No personal controversy can be permitted, but it is evident that some void must be filled if the highest principles of economy and of sanitary science are to be followed in this rapidly growing state.

An Automatic Sewage Pumping Station.

The city of Indianapolis has just installed a small automatic sewage pumping apparatus to pump into the large intercepting sewer, on the southeast side of Fall Creek, the sewage from a small intercepting sewer and a small separate system of sewers. The accompanying cut shows the whole installation except the extension of the 5-inch pipe across the Fall Creek bridge and down into a manhole, and a connection with the White River Intercepter.

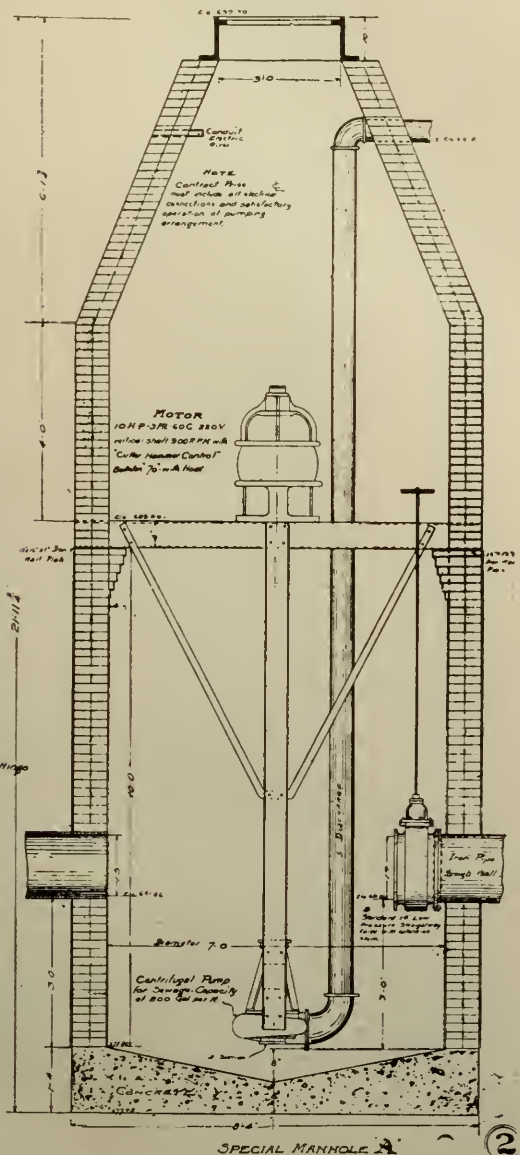
The inlet, as shown, is a 15-inch pipe, which is fitted with a wire basket to catch sticks and large refuse which might injure the pump.

The 16-inch centrifugal pump has a capacity of 800 gallons a minute. It is run by a 10-h. p. 3-phase, 60-cycle, 220-volt motor, running the vertical shaft at 900 r. p. m. The motor has the Cutler hammer control, operated by a float, balanced by a weight, this apparatus not being shown in the drawing.

The apparatus is set in a manhole 7

feet in diameter and 22 feet deep, on a steel framework, as shown.

There is an overflow from the last previous manhole on the 15-inch sewer into Fall Creek, for use in case there is difficulty with the pump, and the 15-inch iron pipe, shown through the wall opposite the inlet, has a gate valve, which can be opened to make another connection with Fall Creek directly from the pump manhole.



AUTOMATIC ELECTRIC SEWAGE PUMPING STATION, INDIANAPOLIS, IND.

There are about 300 feet of 5-inch iron pipe from the pump to the sewer on the opposite side of the creek. This pipe has four vertical T's with plugs, removable in case of stoppage in the pipe for purposes of cleaning. This 5-inch pipe discharges into a short horizontal 10-inch vitrified pipe, which in turn discharges into the White River Intercepter near its crown.

The pipe and placing cost, $238; the pump and motor cost, $610, and the total cost of the installation, including all connections, manholes, pipes, valves and relaying 878 feet of 12-inch vitrified pipe sewer to new grade, was $2,400.

At a recent visit, with a full discharge of very dilute sewage, into the manhole, the pump operated automatically one minute in every three minutes. There is not much more than 2 feet difference between high and low water in the manhole, the depth from flow-line of inlet to base of pump being 3 feet. There being no flap or check valve on the outlet pipe, some 100 feet or more of the pipe was emptied back into the pump manhole each time the pump stopped. This caused the pump to run backward for nearly one minute in each three, and this water must be pumped back into the pipe each time the pump starts.

With somewhat different setting the same pump could be used for a deeper well, and the storage chamber could be larger if necessary.

The Electrolytic Sewage Treatment Plant at Santa Monica, Cal.

To the Editor of MUNICIPAL ENGINEERING:

Sir: The magneto-electrolytic sewage purification plant at Santa Monica, Cal., the only one in practical operation in the United States, having been in successful use for a year and a half, continues to be the subject of inquiry on the part of the Boards of Health throughout the United States and all parts of the world. An inquiry has just been received from Calvin S. White, State Health Officer for the state of Oregon, who says: "The matter of sewage disposal is one of the many problems that this state has to serve, and we are exceedingly anxious to construct a working model fashioned after the one in use in your city. Please send me every detail alnd explicit directions for constructing a model such as you have in use that we may be able to conduct it experimentally here in the laboratory and perhaps advise its use in some of the inland cities of our state."

City Engineer James has furnished the following information, as the result of the practical experience of Santa Monica:

Replying to your inquiry relative to the magneto-electrolytic plant for treating crude sewage within our city, I would say that the plant is giving good results and is kept in constant operation, excepting for a period of about one hour of each twenty-four on account of flushing the flumes and washing off the plates by the use of water from a common pipe and hose. The actual time required to attend to the plant would be about three to five hours per day. Everything is practically automatic, excepting for the exchange of pumps. We use a No. 4 centrifugal pump most of the time, also a No. 6 Byron Jackson slime and sewage pump, low pressure, is put in operation at certain intervals of time to lift all of the sludge or silt within the receiving basin.

The receiving basin is concave in form and of a capacity of 30,000 gallons. The forebay, or conduit, used as an equalization chamber has a capacity of 7,000 gallons. The sewage is never allowed to come to absolute rest. The forebay has a gradient of 0.444 per cent. and is constructed in a sealed manner, excepting at the gates. The only vent necessary at the plant is in proximity to the weir for discharge of the effluent after treatment. At this point hydrogen gas is released and a vertical 6-inch galvanized pipe takes care of it and it is carried to a height of about 60 feet above the surface of the street.

We are now treating about 550,000 gallons per twenty-four hours. The depth of flow within the flumes is usually about 15 inches, or about 2 inches over the top of the electrodes.

The estimated expense of treating the sewage by the magneto-electrolytic process, exclusive of pumping said sewage, for a city of 75,000 population, would be about $5,000 per annum, which includes renewals of plates, etc. The best results are obtained in the treatment for deodorization of sewage in accordance to my judgment and practical knowledge by arranging it in some way so that the sewage is thoroughly churned, either by being allowed to flow within a pipe for a distance of about one mile beyond the last discharge into the sewer mains of house service pipe, or a rotary agitator could be placed within the receiving basin.

Our monthly expense for conducting the plant, including the pumping of sewage, is about $400; providing 1,000,000 gallons had to be treated and pumped the cost would be about $600 per month. We pay a flat rate of 3 cents per kilowatt hour for electric energy, which is about 40 per cent. above the average price paid in most cities. The original cost of installing the plant, including the forebay and buildings, was about $18,000.

C. B. IRVINE,
Santa Monica, Cal.

Electric Centrifugal Pumps for Great Falls, Mont.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The growing demand for water for domestic and street irrigation purposes, and the deterioration of the city's steam plant brought the question of better pumping facilities to an issue. Accordingly, in March, 1910, the city council ordered the installation of two centrifugal pump units, each of 2,000,000 gallons daily capacity. This was the beginning of the change over from steam to electric-driven pumps. The completion of the large electric plant of the Great Falls Power Company, at Rainbow Falls, made an uninterrupted service practically certain. The work involved consisted of the removal of two Gordon compound steam pumps and the building in the same location of a pit 22x40x14 feet deep, designed to accommodate five two-million-gallon centrifugal units.

The building of this pit was rendered difficult because of the fact that two of the side walls were built under and supported the main building walls. Another wall was six feet from and extended eleven feet below the boiler room wall, while the other wall was adjacent to and extended below the large Holly pump foundation, which apparently had been very loosely built. No interruption of service or trouble was experienced, and the two Worthington 2-stage pumps, with 150 h. p. General Electric motors, were put into service September 20, 1910. On the test run these pumps showed a delivery of 30 per cent. above specifications at the required pressure, and a pressure 16 per cent. above specifications at the required discharge.

Two additional pumps of the same type were ordered by the city council on February 6, 1911, and when installed the water service will be on a more economical basis than ever before.

The betterment of the water supply is being urged, and although a number of propositions have been suggested, the indications point to a filtration plant as the best solution of the matter.

Plans have recently been adopted to be followed out in future water main extensions, which provide finally for a complete gridironing and cross mains of 8, 12 and 16 inches in diameter.

H. C. ALLEN, City Engineer,
Great Falls, Mont.

Cost of Oiled Macadam.

Following is the detailed actual cost per square yard for treating a road two miles long with standard macadam binder A. No allowance is made for rental or depreciation of machinery. The average haul for oil and sand was 1½ miles. Two applications of oil, each ¼ gallon, were made about a week apart. The figures are supplied by Arthur W. Dean, M. Am. Soc. C. E., chief engineer of the Massachusetts Highway Commission. The figures given are the average cost per square yard for the whole work.

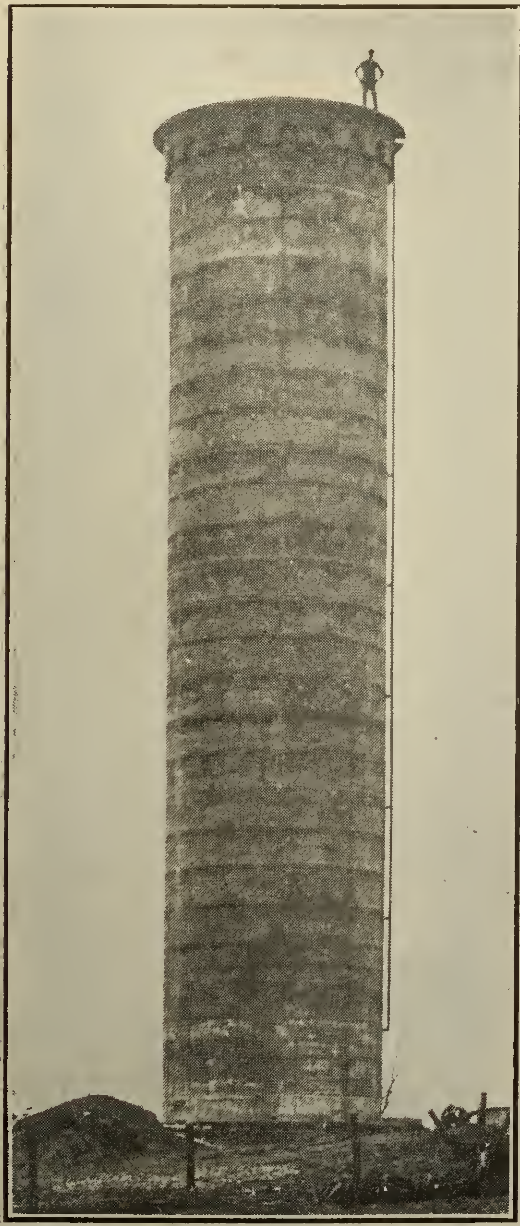
Cleaning and sweeping	$0.0056
Patching old surface	.0016
Cost of oil	.0319
Heating oil	.0031
Delivering oil	.0038
Distributing oil	.0029
Furnishing sand beside road	.0165
Spreading sand	.0073
Watering	.0012
Rolling	.0002
Supervision	.0025
	$0.0766

Reinforced Concrete Standpipe.

I enclose you a photograph of the standpipe just completed for the city of Waverly, O.

It is of steel concrete, 82 feet from top of foundation to cornice, and the roof, including thickness of cornice, is 4 feet, making a total height of 86 feet. The outside diameter of shell is 18 feet. The first 9 feet of shell is 12 inches thick; then 45 feet 9 inches thick, and balance of height is 6 inches thick. The foundation is 7 feet deep, octagon, and 22 feet in diameter. Capacity, 120,000 gallons.

The structure was built by J. L. H. Barr, of Batavia, O., under the direction



REINFORCED CONCRETE STANDPIPE AT WAVERLEY, OHIO.

and in accordance with the plans of H. C. Babbitt, of Lockland, O., consulting engineer. The cost was about $4,500.

J. L. H. Barr,
Contractor, Batavia, O.

Information for Contractors.

Accompanying the printed detailed advertisement for bids for paving, curb and gutter in Creston, Ia., is the following interesting and valuable information for contractors, supplied by the engineer in charge:

I enclose herewith advertisement for bids for paving at Corning, Ia., of which I am in charge.

Brick specifications require a 24 per cent. rattler test and 3 per cent. absorption test on rattled brick. There is no local prejudice as to brick or any other material.

Some producers of other material required are: Crushed stone—Peru Sand and Cement Co., Peru, Ia.; McManus & Tucker, Keokuk, Ia.; National Stone Co., Omaha, Neb.; C. W. Hull Co., Omaha, Neb., and C. B. Havens Co., Omaha, Neb. Sand—Des Moines Sand Co., Des Moines and Red Oak, Ia.; Cline & Shaw Fuel Co., Creston, Ia.; Ottumwa Sand Co., Ottumwa, Ia.; Coon River Sand Co., Des Moines, Ia.; Lyman Sand Co., Omaha, Neb., and I. Q. Gibson, Red Oak, Ia. Sand for cushion layer can probably be secured locally. Gravel—Coon River Sand Co., and Des Moines Sand Co., both of Des Moines, Ia.; also I. Q. Gibson, Red Oak, Ia., and Platte Gravel Co., Omaha, Neb. Portland Cement—Local representatives of various standard brands.

The following approximate outline of local conditions is given for your convenience:

Unskilled labor, 20 cents an hour; man and team, 40 cents an hour. Labor unorganized.

Average haul from tracks to work, one-fourth mile, up moderate grade.

Grading haul, practically all down hill.

Surface soil, black loam; subsoil, joint clay; no rock or gravel.

Certificates worth 95 cents to par. Probably can be placed locally.

City Council harmonious.

Water supply municipally owned and available at all points of the work.

Engineer will exercise no preference as to source or brand of material. Any material complying with the specifications will be acceptable.

Complete plans and specifications are on file with the city clerk at Corning, Ia., and with the undersigned at this place. Copies will be mailed by the undersigned on receipt of $2.00 per copy.

Bidding blanks will be furnished by the city clerk.

Corning has a local exchange of the Mutual telephone and a toll office of the Iowa or Bell system. Creston has a Mutual exchange and a toll office of the Bell system. Please use the system having local exchange in the place called whenever possible in making long distance calls.

Trusting that we may have the pleasure of considering your bid, I am,

Yours very truly,

Theo. S. DeLay,
Engineer in Charge.

MUNICIPAL IMPROVEMENTS 1910-1911

CONSTRUCTION REPORTS FROM CITIES AND TOWNS

Streets, Sidewalks, Curb and Gutter, Sewers, Sewage Disposal, Water Works, Electric Light, Gas, Garbage, Fire Apparatus and Buildings

Believing that the prospects for work in the line of municipal improvements this year are better than they have ever been, MUNICIPAL ENGINEERING considers it a part of its duty to give as full a report as possible of the work actually done during the past year and that which there is probability of doing during the coming year.

With the intention of making the information as authentic as possible, requests were made of city officials in the principal cities in all the States for statements of the work completed in 1910, the work for which contracts were let in 1910 and which is not yet completed, and the work which is possible for the following year. As to the first two items there can be no difference of opinion. Some engineers may omit the small jobs which amount to but little and are done by local contractors, and so the reports may not cover every particle of work done, but they do cover all of any importance. As to the work in prospect for the next season, some engineers do not report because budgets are not yet complete, or because councils or boards have not yet determined upon the exact contracts to be let. Some report such contracts as are now pending and omit those which may come up later, but are not yet in the official line, while others report all the work which has been petitioned for, whether there is any prospect for construction or not. The report nearest the probabilities is, of course, the one which gives the engineer's best judgment of what work will be started during the year. Some engineers have made this kind of report. Unfortunately, there can be no certain way of determining which sort of report has been made. Therefore, as regards any single city, the results of the year may not have been accurately forecast. But for the cities reported upon as a whole a summary of the reports will give a very close approximation to the total amount of work to be done.

This special construction number of MUNICIPAL ENGINEERING is so pre-eminently a practical number that no theoretical discussion of the result of this collection of data will be attempted.

Our indebtedness to the municipal officials of the country has been doubled since acknowledgment of it was made in "Editorial Comment," for the number of reports received has doubled, and still they come, and the stream can only be cut off by putting the forms on the press. This miscalculation of the generosity of our correspondents has caused such an extension of the space demanded for the reports that everything except the tabulations has been relegated to second place and crowded to the rear or out of sight entirely. This material has not been lost, however, for such as is not put out of date by a month's delay will be given later.

The tables following have been derived from reports made by city engineers, city clerks, boards of public works with various forms of title, superintendents of streets, sewers, electric light, gas, water, garbage disposal and other plants, full acknowledgement of the courtesies of whom can only be made in this general but none the less hearty and sincere manner.

They are arranged in the following order:

Street pavements,
Sidewalks,
Curb and gutter,
Sewers,
Sewage disposal and pumping plants,
Water distribution systems,
Water supply systems, including special items connected with the service to consumers,
Electric lighting systems,
Gas lighting systems,
Garbage collection and disposal,
Street signs,
Fire department buildings, apparatus and supplies.

It is, of course, impossible even for the census department of the United States government to obtain reports from all cities, but the response has been unexpectedly generous, and, while there will be disappointment at the failure of certain cities to respond, even to the final telegrams to hurry up reports, the cities which have supplied information are so numerous and so well distributed over the country that one can well estimate the probabilities of a district, and even of the missing cities, from a study of the data given.

STREET IMPROVEMENTS

Official Reports of Street Improvements Made to Municipal Engineering by the Municipal Officials of America

Arranged alphabetically by states and cities. In the line "1910" under each city is given the number of linear feet of each class of pavement laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of pavement in process of construction.

In the line "1911" is given the number of linear feet of each class of pavement proposed for construction during 1911, printed in heavy type so that it can be distinguished readily.

The reports have been reduced to the same unit of linear feet. When the area of streets was given in square yards it has been reduced to linear feet by assuming the average width of street as 30 feet.

Under "Asphalt" are included the few reports of block asphalt as well as the sheet asphalt. Under "Granite" are included Belgian block as well as the ordinary granite blocks. Under "Concrete" are included Blome concrete, granitoid, Hassam and trappoid pavements. Under "Wood" are included wooden block and plank. Under "Bituminous Macadam" are included asphaltic concrete, asphaltic macadam, bitumen, bituminous macadam, filbertine, Ford macadam, gravel and oil, mineral rubber asphalt or concrete or Sarco mineral rubber, oileroid, oiled macadam, petrolithic, siliciamma, slag tar macadam, surface oil with and without surface coat of gravel, tar macadam, tarvia, westrumite and doubtless others whose trade names were not given in the reports.

ALABAMA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Birmingham—									
Progress	16,969	16,666	4,848	....	....	....	5,666	15,151	....
1911	....	**21,212**	**12,121**	....	....	....	....	**15,151**	....
Dothan—									
1910	....	....	5,400	....	....	....	....	....	....
1911	....	....	**180**	....	....	....	....	....	....
Jasper—									Clay
1910	....	....	....	....	....	....	....	....	5,280
1911	....	....	....	....	....	....	....	....	**15,800**
New Decatur—									
1910	....	....	....	....	....	....	....	3,000	....
Progress	....	....	....	....	....	....	....	9,000	....
1911	....	....	....	....	....	....	....	**6,000**	....

ARKANSAS.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Batesville—									Gravel
1910	....	....	....	....	....	....	....	....	3,000
Ft. Smith—									
1910	....	....	18,500	....	....	31,700	....	....	....
1911	....	....	**29,000**	....	**9,000**	**10,560**	....	....	....

CALIFORNIA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Alhambra—									
1910	2,500	....	....	....	....	18,500	....	10,560	....
Progress	....	....	....	....	....	7,900	....	9.200	....
1911	**13,300**	....	....	....	....	**35,600**	....	**7,900**	....
Antioch—									
1911	....	....	....	....	....	....	....	**15,800**	....
Coalinga—									
1911	....	....	....	....	....	....	....	**4,100**	....
E. San Jose—									
1910	....	....	....	....	....	....	3,960	....	....
Progress	....	....	....	....	....	....	2,640	....	....
1911	....	....	....	....	....	....	**31,700**	....	....
Emeryville—									
1910	....	....	....	....	....	2,700	....	3,700	....
Lodi—									
1911	**3,600**	....	....	....	....	....	....	....	....
Long Beach—									
1910	5,280	....	....	....	....	....	....	48,700	....
1911	....	**9,000**	....	....	....	....	....	....	....
Los Angeles—									
1910	94,200	....	2,710	....	....	19,200	....	64,500	....
Progress	60,900	....	....	....	....	....	....	47,600	....
1911	**132,500**	....	....	....	....	....	....	**79,400**	....
Oakland—									
1910	37,000	5,280	690	....	....	118,500	950	23,100	....
Progress	16,900	....	....	....	....	62,500	....	26,400	....
1911	**52,800**	....	....	....	....	**132,000**	....	**52,800**	....
Palo Alto—									
1910	3,820	7,200	....	....	....	....	....	....	....
1911	**666**	**2,000**	....	....	....	....	....	....	....

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Pasadena—									
1910....	5,100	....	....	....	....	16,700	....	70,000	....
Progress	960	....	....	....	....	25,800	....	5,400	....
1911....	....	**7,970**	**2,200**	....	....	**17,500**	....	**10,600**	....
Portersville—									
1910....	4,000	....	....	....	....	....	....	....	....
1911....	**10,800**	....	....	....	....	....	....	....	....
San Bernardino—									
1910....	7,920	....	....	....	....	....	....	39,600	....
Progress	....	....	....	....	....	....	....	5,280	....
1911....	....	....	....	....	....	....	....	**10,560**	....
San Jose—									
1910....	340,000	....	....	....	....	....	....	....	....
Progress	4,200	....	....	....	....	....	....	....	....
1911....	**18,500**	....	....	....	....	....	....	....	....
San Mateo—									
1910....	20,000	....	....	....	....	....	....	....	....
1911....	**3,300**	....	....	....	....	....	....	....	....
Santa Clara—									
1911....	**5,280**	....	....	....	....	....	....	....	....
Santa Cruz—									
1910....	....	....	....	....	....	14,500	....	....	....
Progress	....	....	....	....	....	....	....	1,320	....
1911....	....	....	....	....	....	**1,550**	....	....	....
Selma—									
1910....	....	....	....	....	....	....	....	18,800	....
1911....	....	....	....	....	....	....	....	**3,000**	....
S. Pasadena—									
1910....	....	....	....	....	....	....	....	26,400	....
Progress	....	....	....	....	....	....	....	5,280	....
1911....	**5,280**	....	....	....	....	....	....	....	....
Visalia—									
1910....	....	....	....	....	....	....	....	3,960	....
Progress	....	....	....	....	....	....	....	5.530	....
Watsonville—									
1910....	....	....	....	....	....	2,600	....	....	....
1911....	....	....	....	....	....	**5,200**	....	....	....

CONNECTICUT.

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Ansonia—									
1910....	....	....	....	240	....	5.500	....	....	....
1911....	....	....	....	**1,000**	....	**5,280**	....	....	....
Hartford—									
1910....	2,640	....	....	....	....	....	....	....	......
1911....	**2,640**	....	....	....	....	....	....	....	....
Meriden—									Gravel
1910....	....	....	....	....	....	520	....	....	15,800
New Britain—									Indefinite
1910....	....	6,900	....	....	....	....	....	....	....
1911....	....	....	....	....	....	....	....	....	**5,400**
New Haven—									
1910....	....	....	....	820	2,640	10,100	8,300	6.300	......
Torrington—									
1910....	....	....	....	2,914	....	14,173	3,202	520	....
1911....	....	....	....	**2,914**	....	....	....	**1,200**	....
Wallingford—									
1910....	....	....	....	....	....	....	....	3.000	....
1911....	....	....	....	....	....	....	....	**3,000**	....

DISTRICT OF COLUMBIA.

Washington—
$60,000 work in progress.
$79,500 work to be done.

FLORIDA.

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Miami—									
1910....	....	....	....	....	....	99,000	....	....	....
Pensacola—									Unsettled
1910	....	....	24,000	....	24,000	....	....	....	....
1911....	....	....	....	....	....	....	....	....	**48,000**

GEORGIA.

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Americus—									
1910....	....	....	2,500	....	2,000	....	....	....	....
Atlanta—									
1910...	....	10,560	....	5,280	11,035	36,960	....	....	....
1910....	....	**10,560**	....	....	**1,320**	**52,800**	....	....	....
Brunswick—									
1910....	....	....	4,500	....	....	....	....	....	....
1911....	....	....	**2,100**	....	....	....	....	....	....
Valdosta—									Gravel
Progress	....	....	....	....	....	....	....	....	180,000

IDAHO.

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Payette—									
1911....	....	....	....	....	....	**5,280**	....	....	....

ILLINOIS.

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Aurora—									
1910....	23,000	....	1,850	....	....	....	....	....	....
1911....	**18,450**	....	**5,280**	....	....	....	....	....	....
Canton—									
1910....	....	....	4,000	....	....	....	....	....	....
1911....	....	....	**6,000**	....	....	....	....	....	....
Chicago Heights—									
1910....	....	....	2,640	....	....	5,280	....	2,640	....
Progress	....	....	5,280	....	....	7,920	....	....	....
1911....	....	....	**15,840**	....	....	**13,200**	....	**10,560**	....
Collinsville—									
1910....	....	....	2,800	....	....	....	....	3,690	....
1911....	....	....	....	....	....	....	....	**6,600**	....
Danville—									
Progress	....	....	5,280	....	1,320	....	....	2,640	....
1911....	....	....	**15,800**	....	....	....	....	**5,280**	....
Decatur—									
1910....	....	....	15,840	....	....	....	....	....	....
1911....	....	....	**7,920**	....	....	....	....	....	....
Downers' Grove—									
1910....	....	....	2.640	....	....	....	....	....	....
E. St. Louis—									
1910....	....	....	21,100	....	....	....	....	....	....
Progress	....	....	10,650	....	....	....	....	....	....
1911....	....	....	**64,500**	....	....	....	....	....	....
Edwardsville—									
1910....	....	....	4,820	....	....	....	....	....	....
1911....	....	....	**5,280**	....	....	....	....	....	....
Elgin—									
1910....	....	....	6,700	....	....	....	....	....	....
1911....	....	....	**6,894**	....	....	....	....	....	....
Eureka—									
1910....	....	....	7,920	....	....	....	....	....	....
1911....	....	....	**2,640**	....	....	....	....	....	....
Freeport—									
1910....	....	....	7,900	....	....	3,960	....	....	....
1911....	....	....	**10,650**	....	....	....	....	....	....
Galena—									
1910....	....	....	300	....	....	26,400	....	....	....
Galesburg—									
1910....	....	....	3,900	....	....	....	....	....	....
1911....	....	....	**3,500**	....	....	....	....	....	....
Granite City—									
1910....	....	....	2,400	....	5,100	....	....	....	....
1911....	....	....	**3,500**	....	....	....	....	....	....
Harvey—									
1910....	....	....	8,400	....	....	1,540	....	....	....
1911....	....	....	**5,700**	....	....	....	....	....	....
Jacksonville—									
1911....	**13,200**	....	....	....	....	....	....	....	....
Joliet—									Undetermined
1910....	....	....	2,100	....	....	1,100	....	....	4,000
Progress	....	....	350	....	....	....	....	....	....
1911....	....	....	....	....	....	**2,700**	....	....	**3,000**
LaGrange—									
Progress	....	2,640	....	....	....	....	....	....	....
Lake Forest—									
1911....	....	....	....	....	....	**10,560**	....	....	....
Mattoon—									
1911....	....	....	**10,560**	....	....	....	....	....	....
Moline—									
1910....	....	....	9,000	....	....	....	....	....	....
Progress	....	....	4,750	....	....	....	....	....	....
1911....	....	....	**25,350**	....	....	....	....	....	....
Mt. Carmel—									
1911....	....	....	**5,280**	....	....	....	....	....	....
Oak Park—									
1910....	5,400	....	10,500	....	....	4,500	....	....	....
Progress	....	....	7,920	....	7,920	2,640	....	9,200	....
1911....	....	....	....	....	....	**2,640**	....	**7,920**	....
Ottawa—									
1910....	....	....	5,280	....	....	....	....	....	....
Progress	....	....	3,980	....	....	....	....	....	....
1911....	....	....	**17,150**	....	....	....	....	....	....
Paris—									Gravel
1910....	....	....	460	....	....	....	....	....	4,000
1911....	....	....	**1.350**	....	....	....	....	....	....
Paxton—									
1910....	....	....	....	....	....	2,640	....	....	....
Peoria—									
1910....	16,232	....	60,000	....	6,666	1,818	....	....	....
1911....	**22,722**	....	**60,000**	....	**3,000**	....	....	....	....
Rockford—									
1910....	....	....	....	....	....	11,110	....	....	....
1911....	....	....	**2,100**	....	**450**	**10,000**	....	....	....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Rock Island—									
1910			2,143						
Progress			5,280						
1911	**700**		**1,200**						
Streator—									
1910			13,240						
1911			**5,280**						
Taylorville—									
1910			29,000						
Waukegan—									
1910			10,800			1,988		950	
Progress						355			
1911								**10,500**	
Wheaton—									
1910								7,920	

INDIANA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Anderson—									
1910			9,800				160		
Auburn—									
1910	14,700								
1911			**300**						
Butler—									Gravel
1910			10.560						
1911									**700**
Columbus—									
1910			1,620						
1911			**25,100**						
Converse—									Gravel
1910			2,640						21,100
Crawfordsville—									
1910			5,400						
1911			**4,000**						
E. Chicago—									
1910	1,500		10,000						
Progress	5,800		6,550		1,250				
Evansville—									Undetermined
1910	7,958		6,935						
1911									**14,000**
Ft. Wayne—									Asphalt Block
1910	17,000		7,400			1,500			4,250
Progress			1,900			7,650			
									Undetermined
1911									35,000
Hammond—									
1910			3,590			1,220		15,670	
Huntington—									
1910	2,029							2,600	
1911	**3,000**							**4,000**	
Indianapolis—									Gravel
1910	10,243	1,298	10,349		609			781	10,560
Progress	15,840								
Kokomo—									
1910	4,200		5,200						
1911	**2,500**		**6,500**			**2,500**			
Lebanon—									Gravel
Progress			966						
1911			**966**						**2,640**
Logansport—									Gravel
1910									3,000
Progress	7,700	1,500							
1911	**8,000**	**1,400**							
Marion—									
1910			2,140			2,100			
Martinsville—									
1911			**10,560**						
Michigan City—									
1910			2,300						
Mishawaka—									
1910		2,700							
Muncie—									
1910			6,600			5,280			
1911			**10,560**			**17,200**			
Newcastle—									Gravel
1910		1,380	760			2,920			1,818
Progress			1,006			1,030			1,093
1911			**2,730**						
Peru—									Gravel
1910		2,640	1,760						
1911			**2,640**			**2,640**			**4,230**
Remington—									
1910						31,600			
1911						**52,800**			
Richmond—									Gravel
1910			1,110			4,750			1,790
1911			**3,920**			**15,700**			

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Rushville—									
1910			5,280						
1911			**10,560**						
South Bend—									
1910	3,520		9.908					8,351	
Veedersburg—									Gravel
1910			400						2,500
1911			**2,000**			**15,840**			
Wabash—									
1910									1,640
1911									**3,000**
Warsaw—									
1910	7,920								
Progress	10,560								
1911	**5,280**								

IOWA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Albia—									
1910			2,700						
Ames—									
1910		2,400	400		7,200				
Belle Plaine—									Undetermined
1911									**9,600**
Burlington—									
1910			7,141					1,800	
Carroll—									
1911			**4,500**						
Centerville—									
1910			8,000						
Progress			1,000						
Charles City—									
1911			**7,900**						
Clinton—									
1910			600		1,500	800			
1911			**3,000**		**2,000**				
Corning—									
Progress			3,600						
Creston—									
1910								7,550	
Des Moines—									
1910	29,800		26,900		4,850		230		
1911*									
Eldora—									
1910							400		
Progress							4,400		
1911							3,200		
Ft. Dodge—									
1910	36,900						7,920		
1911	**10,560**								
Glenwood—									
1910			3,200				1,800		
Grinnell—									
1910		26,400							
Indianola—									
1911				**5,100**					
Knoxville—									
1910							3,000		
1911							**3,000**		
Mason City—									
1910			1.700				6.500		
Progress							4,000		
1911							**10,400**		
Osceola—									
1910			4.000						
Osage—									
1910							4,000		
Pella—									
1911			**7,920**						

*Probable increase in 1911 over 1910.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Red Oak									Undetermined
1911									**9,000**
Villisca—									
1911			**5,100**						
Washington—									
1910			3,500						
Waterloo—									
1910	19,000								
1911	8,000								

KANSAS.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Abilene—									
1910								8,000	
Argentine (now Ward 7, Kansas City, Kas.)—									
1910	2,640	2,640	2,640						
1911			**3,960**						

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Arkansas City—									
1910....			3,800		10,600				
Progress					5,280				
1911....	**2,640**		**10,600**		**15,900**		**1,220**		
Chanute—									
1910....			7,920					2,640	
Progress			2,640						
1911....								**7,920**	
Cherryvale—									
1910....			4,300						
Emporia—									
1910....	9,250								
1911....	**10,560**								
Hutchinson—									
1910....			12,000						
1911....				**900**			**1,800**		
Lawrence—									
1910....			15,840						
1911....			**10,560**						
Manhattan—								Undetermined	
1911....									**6,900**
McPherson—								Undetermined	
1911....									**6,000**
Newton—									
1910....			1,200						
1911....			2,000						
Olathe—									
1910....			1,900						
Pittsburg—									
1910....			6,021						
Progress			1,787						
1911....			**10,480**						
Salina—								Undetermined	
1910....			5,280					7,920	
1911....									**5,280**
Topeka—									
1911....	**7,492**		**15,608**						
Wellington—									
1910....	10,560								
KENTUCKY.									
Ashland—									
1910....		10,400	9,300						
1911....			**6,600**						
Louisville—									
1910....	25,200		23,300	2,590	1,380				
1911....	**27,700**		**25,100**	**1,056**					
Maysville—									
1910....			2,100			1,320			
1910....			**2,100**						
Newport—									
1911....			**18,000**						
Owensboro—									
1910....						4,800			
1911....						**3,500**			
Pineville—									
1911....						5,280			
Winchester—									
1911....			**4,000**						
LOUISIANA.									
New Orleans—								Gravel and chert	
1910....	70,110	20,300		39,350	500			*13,250	5,950
Progress	14,240	9,695		15,300				*1,630	
1911....							**750**		
*Mineral rubber.									
MAINE.									
Lewiston—									Gravel
1910....								3,780	13,200
1911....								**3,780**	**13,200**
MARYLAND.									
Annapolis—									
1910....			8,200					1,860	
MASSACHUSETTS.									
Easthampton—									Gravel
1910....						1,100			2,300
1911....						**3,000**			
Everett—									
1910....			230	1,250		6,400			
Greenfield—									Gravel
1910....						8,500		4,400	4,200
1911....						**10,000**		**5,000**	
Lawrence—									
1910....				15,588					

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Lowell—									Gravel
1910				1,450		10,000			2,640
Medford—									
1910						17,300		650	
New Bedford—									
1910		3,707		4,160		38,898			
1911				**5,000**		**36,000**			
Quincy—									
1910				4,019		4,699			
Progress						10,560			
Webster—									
1910						5,280			
MICHIGAN.									
Alpena—									
1910							1,100		
Battle Creek—									
1910			6,600						
1911			**5,280**						
Benton Harbor—									
1910			2,500			870			
1911			**1,000**			**360**			
Bessemer—									
1910						1,000			
Cadillac—									
1910		600				3,300			1,200
1911						**9,200**			
Flint—									Undetermined
1910	4,900		15,000						
1911						**8,000**			**8,800**
Gladwin—									
1910						3,000			
1911						**3,000**			
Grand Rapids—									
1910	3,504	12,029	13,120					1,047	21,093
Progress		697							17,156
Greenville—									
1910			2,300						
1911			**4,000**						
Highland Park—									
1910	3,500				10,560		1,780		
Progress	1,780								
Jackson—									Gravel
1910	2,640		2,640						
1911			**7,920**						**10,560**
Kalamazoo—									
1910	2,042		3,067						
Lansing—									
1910			1,500						
Manistique—									
1910						5,280			
Negaunee—									
1911					**11,000**				
Norway—									
1911								**2,000**	
Port Huron—									
1910			1,500						
Saginaw—									
1910	6,700		7,900						
1911	**14,500**								
Sault Ste. Marie—									
1910						4,340		1,525	
Whitehall—									Gravel
1910						1,800			3,960
1911						**3,960**			
Wyandotte—									
1911			**3,000**						
MINNESOTA.									
Bemidji—									
1910							800		
1911							**1,600**		
Cloquet—									
1910						2,640			
1911						**5,280**			
Crookston—									
1911	**3,650**							**3,600**	
Faribault—									Sandstone
1910			3,466		84				611
Mankato—									
1910			6,300						
1911			**6,000**						
New Ulm—									Gravel
1910									2,640
Progress									1,320
1911									2,640

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Redwing—									Sandstone
1910....			1,000		1,320				550
1911....									**5,280**
St. Cloud—									
1910....								2,640	
1911....								**1,500**	
St. Paul—									Sandstone
1910....	11,669		2,218			23,602			2,165
Two Harbors—									Gravel
1910....						2,820			10,750
Virginia—									Undetermined
1910....		9,200			10,560				
1911....									**23,700**
Winona—									
1910....			995						
1911....			**2,800**						

MISSISSIPPI.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Hattiesburg—									
1910....						7,920			
1911....						**10,560**			
Yazoo City—									Gravel
1910....									4,000
1911....									**2,900**

MISSOURI.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Aurora—									Undetermined
1911....									**200**
Brooksfield—									
1910....			6,900						
1911....			**6,600**						
Cape Girardeau—									
1910....			1,800		180	6,000			
1911....			**1,400**						
Clinton—									
1911....		**27,300**							
Fulton—									
1910....						243			
1911....						**5,000**			
Independence—									
1910....							12,400		
1911....		**2,400**					**9,000**		
Kansas City—									
1910....	73,967		3,937	6,292	1,355	19,604			
Lexington—									
1910....			760				2,640		
Libertyville—									
1910....			3,000						
1911....			**9,000**						
Moberly—									
1910....			7,960						
1911....			**5,280**						
Oregon—									Undetermined
1911....									**2,640**
St. Joseph—									Sandstone
1910....	6,235		6,543			161	22,536		665
Progress	2,971						2,227		
1911....	**4,974**		**557**				**1,208**		
Sedalia—									
1910....			6,300						
1911....			**10,800**			**3,960**			
Tarkio—									
1911....							**2,400**		
Webb City—									Gravel
1910....			350					8,287	5,387
1911....			**500**					**5,500**	

MONTANA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Billings—									
1910....			9,750		11,000		1,100		
1911....					**3,000**				
Bozeman—									
1910....							1,000		
Butte—									
1910....			850	220					
1911....			**1,200**						
Great Falls—									
1910....					5,700		3,000		
1911....					**7,500**				
Helena—									
1910....			550						
1911....			**1,000**				**1,200**		

NEBRASKA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Hastings—									
1910....			5,280						
1911....			**15,840**						

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Lincoln—									
1910....	7,910		3,232						
1911....	**8,000**		**3,000**						
Norfolk—									Undetermined
1910....			6,900						
1911....									**15,000**
Seward—									
1910....			9,000						
S. Omaha—									
1910....	6,100	12,000	4,600		4,400				
Progress			3,600						
1911....		**20,400**	**24,700**				**5,000**		
University Place—									
1911....			**1,600**						

NEVADA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Reno—									
1910....	5,360					6,000		6,900	
1911....								**10,560**	

NEW HAMPSHIRE.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Keene—									
1910....			2,000			2,400			
Littleton—									
1910....						800			

NEW JERSEY.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Bayonne—									
1910....	10,560	3,800	2,500						
Progress	3,000		3,200						
Beach Haven—									Gravel
1911....									**105,600**
Bloomfield—									
1910....						4,300			
1911....				**2,640**		**10,560**			
Dover—									
1911....			**1,500**						
Elizabeth—									Sandstone
1910....			5,000						6,065
Progress			1,236						
1911....			**1,537**						
Garfield—									
1910....						5,280			
Irvington—									
1910....			1,650					1,800	
Progress			750					3,900	
Jersey City—									
1910....	3,200		2,000	16,400	1,400	2,000			
Progress	1,000		3,800	9,900	2,640	3,700			
Millville—									Gravel
1910....									5,280
									Undetermined
Nutley—									
1910....						10,560			
Ocean City—									Gravel
1910....						5,280			21,120
1911....						**15,840**			
Passaic—									Gravel
Progress			2,400						
1911....									**2,800**
1911....									**7,000**
Plainfield—									
1910....						7,100			
Progress						10,600			
1911....						**5,000**			
Rahway—									Undetermined
1911....									**1,680**
Rutherford—									
1910....						6,850		2,640	
1911....						**7,920**		**5,280**	
Westfield—									
1910....						10,560		1,320	
Progress								5,280	
1911....						**5,280**			

NEW YORK.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Amsterdam—									
1910....			2,465						
1911....			**2,100**						
Binghamton—									
1910....			7,400						
1911....			**9,600**						
Brockport—									Gravel
1910....									2,100

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Buffalo—									
1910....	62,256		17,888			1,734			Stone 14,923
1911....									Undetermined **63,360**
Catskill—									
1910....		1,500	2,100						
Corning—									
1910....			2,750						2,750
1911....			**2,960**						
Dunkirk—									
1910....	5,500		3,600						
1911....	**7,500**		**7,500**						
Elmira—									
1911....									Undetermined **2,000**
Frankfort—									
1911....									Undetermined **3,960**
Herkimer—									
1910....		1,170	520						
Hoosick Falls—									
1910....			5,280	500				7,920	
1911....								**3,500**	
Jamestown—									
1910....			900						
Kingston—									
1910....			7,500						
1911....			**3,000**	**3,500**		**1,200**			
Little Falls—									
1910....		2,500				2,000			
1911....		**4,000**				**4,000**			
Middletown—									
1910....			4,500						Gravel 26,400
New York City (Borough of Brooklyn)—									
1910....	243,550			39,500		42,400			Iron Slag 3,000
Progress	5,500			11,690					
1911....	**82,200**			**19,800**	**4,200**				
New York City (Borough of The Bronx)—									
1910....	37,018			5,760					
Progress	15,840			15,840					
New York City (Borough of Manhattan)—									
1910....	85,100			36,700	18,700				
Progress	210			3,520					
Niagara Falls—									
1910....	5,725	3,576		372			3,577		
Progress	7,870						6,870		
1911....									Undetermined **8,300**
Norwich—									
Progress								2,600	
1911....				800					
Ogdensburg—									
1910....						900			
Olean—									
1910....			5,280						Gravel 10,560
Progress			1,320						
1911....			**15,840**						
Oneida—									
1910....			410						
1911....			**1,600**						
Plattsburg—									
1910....							2,900		
1911....							**1,000**		
Salamanca—									
1910....			3,700						
1911....			**2,640**						
Solvay—									
1910....						31,700			
1911....						**21,100**			
Syracuse—									
1910....	12,600		17,900						
Progress	1,226		1,983						
1911....									Undetermined **12,000**
Troy—									
1910....	22,600		10,000	85,500		23,200			
Utica—									
1910....	15,700		320						
Progress						5,280			
Watertown—									
1910....					2,640	23,760		2,640	
1911....		**2,640**	**5,280**		**2,640**	**21,120**		**2,640**	
NORTH CAROLINA.									
Asheville—									
1910....		17,535				4,584			
1911....		**4,000**							
Greenville—									
1910....			3,500						Sand-Clay 10,560

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Hendersonville—									Gravel
Progress									52,800
1911		**10,560**							
Raleigh—									
1910	5,400							1,000	
1911								**5,280**	
Wilson—									
1910						5,000			

NORTH DAKOTA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Grand Forks—									Undetermined
1910		5,950			5,280		*17,800		
1911									**21,000**

*Blome concrete and tar macadam.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Minot—									Gravel
1910									7,940
Progress									5,280
1911									**15,800**

OHIO.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Akron—									Medina
1910			45,000						2,600
Progress			4,200				1,180		
1911			**42,000**						
Alliance—									
1910			11,200						
Progress			5,300						
Ashtabula—									Stone
1910			4,232						
Progress			1,436						
1911			**7,215**						**1,458**
Bellefontaine—									
1910			5,280			2,640			
1911			**2,640**						
Bowling Green—									
Progress						1,500			
1911						**5,000**			
Bucyrus—									
1910			10,638				1,115		
1911			**1,100**						
Canal Dover—									Undetermined
1911									**10,560**
Canton—									
1910			5,828						
Progress			1,718						
1911			**4,000**						
Carrolton—									
1910			8,540						
Progress			1,580						
1911			**7,500**						
Celina—									
1910			1,500			21,100			
Cincinnati—									Cobble
1910	2,200		16,470	29,570	13,560	13,500	500		1,000
Progress		5,000	650	25,000	15,000	5,000			
Cleveland Heights—									
1910						15,800			
1911	**10,560**		**10,560**			**10,560**			
Columbus—									
1910	9,500		54,500			2,270			
Progress	10,300		34,000						
1911	**10,560**		**79,200**			**5,280**			
Coshocton—									
1910			3,000						
1911	**3,400**								
Delaware—									
1910			2,250						
Progress			1,100						
1911			**1,100**			**500**			
E. Cleveland—									
1910			1,320			3,960			
1911			**18,480**						
E. Liverpool—									
1910			12,100						
1911			**9,500**						
Euclid—									
1910						2,640			
1911			**1,320**						
Findlay—									
1911			**750**						
Fostoria—									
1910			5,854						
1911			**2,680**						
Galion—									
1911			**12,000**					**3,000**	

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Greenville—									
1910			1,400						
Progress			2,640						
1911						**300**			
Ironton—									
1910			1,920						
1911			**3,800**						
Lancaster—									
1910			6,100						
Leetonia—									
1910			2,817						
Lorain—									
1910								4,000	
Progress								9,580	
1911			**540**						
Marietta—									
1910			10,416						
Progress			2,300						
Massillon—									
1911			**7,500**						
Miamisburg—									Gravel
1910									5,280
Millersburg—									
1911								**1,320**	
Nelsonville—									
1910			5,700			17,200			
New Lexington—									
1910			4,165						
1911			**3,065**						
Niles—									
1911			**400**						
Norwalk—									
1910			2,970					1,350	
Progress			1,000					900	
Norwood—									
1910						18,500			
1911	**1,000**			**2,640**	**2,640**	**15,800**			
Oberlin—									
1910			390			600			
1911						**600**			
Pomeroy—									
1911			**5,940**						
Ravenna—									
1910			3,500						
Progress			3,600						
1911			**700**						
Steubenville—									Ligonier
1910			13,200						2,640
Progress			5,280						
1911			**15,840**						
Toledo—									Undetermined
1910	8,030		22,620			4,700			
Progress		7,920							
1911									**26,400**
Wadsworth—									
1910			26,025						
1911			**2,915**						
Wauseon—									
1910	1,300								
1911								**7,920**	
Youngstown—									Undetermined
1911									**10,560**
Zanesville—									
1910			1,250						
1911			**9,000**						

OKLAHOMA.

Bartlesville—									
1910		4,650	5,280						
Progress		1,500							
1911			**5,280**						
Chandler—									
1910								10,560	
Clinton—									
1911									**21,120**
Enid—									
1910	31,700								
El Reno—									
1911	**26,400**								
Guthrie—									
1910	31,600		3,960						
1911	**10,560**		**1,320**						
Lawton—									
1910	10,560								
1911	**39,500**								

City	Asphalt	Bitu-lithic	Brick	Granite	Wood	Ma-cadam	Con-crete	Bitum-inous	Others
Muskogee—									
1910....	30,610	1,350	4,201	....	....	7,440	....	....	....
Progress	9,020	....	2,640	....	....	2,890	....	....	....
1911....	**35,000**	**3,800**	**3,000**	....	....	**9,000**	....	....	....
Norman—									
1910....	5,280	....	1,600	....	....	....	....	....	....
1911....	**10,560**	....	....	....	....	....	....	....	....
Shawnee—									
1910....	52,800	....	11,560	....	....	....	....	....	....
1911....	**26,400**	....	....	....	....	....	....	....	....
Tulsa—									
1910....	56,500	....	4,800	....	....	....	....	....	....
1911....	**24,000**	....	**6,300**	....	....	....	....	....	....
Vinita—									
1910....	....	....	4,700	....	....	....	....	....	....
1911....	....	....	**6,000**	....	....	....	....	....	....
				OREGON.					
Cloquille—									
1910....	....	....	....	....	2,000	....	....	....	....
1911....	....	....	....	....	....	**7,920**	....	....	....
Marshfield—									
1910....	....	....	....	....	21,100	....	....	....	....
Progress	....	....	....	....	2,640	....	....	....	....
1911....	**8,000**	....	....	....	**5,280**	....	....	....	....
Portland—									
1910....	147,629	122,021	....	8,554	....	22,123	56,654	....	Gravel 15,312
The Dalles—									
1910....	....	10,560	....	....	....	....	....	....	....
1911....	....	**10,560**	....	....	....	....	....	....	....
				PENNSYLVANIA.					
Bellefonte—									
1910....	....	....	810	....	....	....	....	1,900	....
Progress	....	....	....	....	....	....	....	4,252	....
Bellwood—									
1910....	....	....	....	....	....	2,400	....	....	....
1911....	....	....	....	....	....	**2,400**	....	....	....
Carbondale—									
1911....	....	....	**2,640**	....	....	**7,920**	....	....	....
Chambersburg—									
1910....	....	....	....	....	....	5,817	....	....	Red Shale 300
Chester—									
1910....	51,600	....	18,500	22,200	....	17,200	....	....	....
Progress	....	....	....	....	11,000	....	....	12,300	....
Corry—									
1910....	....	....	2,269	....	....	....	....	....	....
Doyleston—									
1910....	....	....	....	....	....	5,000	....	....	Cinder 8,000
Progress	....	....	....	....	1,000	....	....	....	....
1911....	....	....	....	....	....	**2,000**	....	....	....
Erie*—									
1910....	16,900	....	16,400	....	....	26,600	....	....	....
1911....	....	....	**15,000**	....	....	....	....	....	....
*Cobble 6,300 ft., slag 16,600 ft. in 1910.									
Franklin—									
1911....	....	....	**7,940**	....	....	....	....	....	....
Gallitzin—									
1910....	....	....	3,700	....	....	....	....	....	....
Harrisburg—									
1910....	6,350	....	....	....	....	....	....	....	....
Progress	1,003	....	....	....	....	....	....	....	....
1911....	**121,440**	....	....	....	....	....	....	....	....
Luzerne—									
1910....	....	....	1,700	....	....	....	....	....	....
1911....	....	....	**1,600**	....	....	....	....	....	....
McKees Rock—									
1910....	....	....	4,800	....	....	....	....	....	....
Progress	....	....	2,700	....	....	....	....	....	....
1911....	....	....	**10,000**	....	....	....	....	....	....
Minersville—									
1910....	....	....	2,676	....	....	....	....	....	....
Newcastle—									
1910....	....	....	6,600	....	....	....	....	....	....
1911....	....	....	**10,560**	....	....	....	....	....	....
Norristown—									
1910....	....	....	....	....	....	1,000	....	....	....
1911....	....	....	**25,200**	....	....	....	....	....	....
Northeast—									
1910....	....	....	7,920	....	....	....	....	....	....
Northumberland—									
1911....	....	....	**1,360**	....	....	....	....	....	....
Oil City—									
1910....	....	....	17,816	....	....	....	....	....	....
Progress	....	....	3,000	....	....	....	....	....	....
1911....	....	....	**8,400**	....	....	....	....	....	Undetermined **1,500**

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Port Allegany—									Undetermined
1911	......	......	......	......	......	......	......	......	**21,100**
Pottsville—									
1910	......	......	......	2,030	4,650	6,000	......	......	......
Reading—									
1910	......	......	3,290	......	300	......	4,200	......	......
Progress	......	......	4,900	190	......	......	......	......	......
Sharpsville—									
1911	......	......	**3,600**	......	......	......	......	......	......
Somerset—									
1910	......	......	3,160	......	......	......	......	......	......
Swissvale—									
1910	......	......	1,700	......	......	......	......	......	......
Tyrone—									
1910	......	......	380	......	366	......	......	......	......
Waynesboro—									
1910	......	......	......	......	......	......	......	1,500	......
Wilkes-Barre—									
1910	3,090	......	2,730	350	......	......	......	......	......
Wilkinsburg—									Ligonier
1910	2,640	......	124,040	......	......	......	......	......	10,560
Progress	......	......	1,320	......	......	......	......	......	......
1911	......	......	**2,640**	......	......	......	......	......	......
Williamsport—									
1910	......	......	2,100	......	......	......	......	......	......
1911	......	......	**3,000**	......	......	......	......	......	......

RHODE ISLAND.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
E. Providence—									
1911	......	......	......	**1,800**	......	......	......	......	......
Pawtucket—									Gravel
1910	......	......	......	......	......	8,250	......	3,960	1,320
Providence—									Gravel
1910	......	......	160	2,420	......	......	......	......	15,300
Progress	320	......	......	1,000	......	......	......	......	......
1911	......	......	......	**3,490**	......	......	......	......	**12,100**
Woonsocket—									
1910	......	......	......	350	......	......	......	......	......

SOUTH CAROLINA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Chester—									
1910	......	......	......	......	......	3,000	......	......	......
Florence—									
1911	......	......	**5,280**	......	......	......	......	......	......
Greenville—									
1910	2,400	......	1,800	......	1,200	......	......	1,500	......
Progress	1,200	......	11,700	......	......	......	......	......	......
1911	**3,600**	......	**7,500**	......	......	......	......	**12,000**	......
Union—									
1910	......	......	......	......	......	13,200	......	......	......
Progress	......	......	......	......	......	2,640	......	......	......
1911	......	......	......	......	......	**2,640**	......	......	......

SOUTH DAKOTA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Lead—									
1910	......	......	......	......	......	......	......	400	......
1911	......	......	......	......	......	......	......	**2,000**	......
Mitchell—									Gravel
1910	......	......	......	......	......	2,640	......	......	5,280
Pierre—									Gravel
1910	......	......	......	......	......	......	......	......	7,920
Progress	......	......	......	......	......	......	......	......	2,640
1911	......	......	......	......	......	......	......	......	**5,280**
Rapid City—									
1910	......	......	......	......	......	5,280	......	......	......
1911	......	......	......	......	......	**10,560**	......	......	......
Sioux Falls—									
1910	......	......	......	1,042	......	......	......	......	......

TENNESSEE.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Columbia—									
1910	......	......	......	......	......	18,480	......	......	......
1911	......	......	......	......	......	**5,280**	......	......	......
Knoxville—									
1910	......	......	......	......	......	25,100	......	......	......
1911	......	......	......	......	......	......	......	......	**18,000**
Memphis—									Gravel
1910	36,643	4,963	14,203	......	......	......	*9,240	51,955	46,675
Progress	19,744	......	4,753	......	2,323	......	7,603	20,255	528
1911 Not yet known.									
*Concrete, cobble and shell.									
Paris—									Gravel
1910	......	......	......	......	......	......	......	......	15,800
1911	......	......	......	......	......	......	......	......	**10,560**

TEXAS.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Denison—									
1910....	....	....	2,640	....	....	....	....	....	....
1911....	....	....	**3,960**	....	....	**42,300**	....	....	....
El Paso—									
1910....	....	....	16,400	....	....	....	....	6,700	....
1911....	....	....	**150,000**	....	....	....	....	....	....
Greenville—									
1911....	**31,700**	....	....	....	....	....	....	....	....
Texas City—									
Progress	....	....	....	....	....	....	....	10,560	....
1911....	....	....	....	....	....	....	....	**37,000**	....

UTAH.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Ogden—									
1910....	5,280	....	....	....	....	....	....	....	....
1911....	**15,000**	....	....	....	**600**	....	....	....	....
Salt Lake City—									
1910....	45,400	....	....	....	....	....	....	....	....
Progress	2,640	....	....	....	....	....	....	....	....
1911....	**26,400**	....	....	....	....	....	....	....	....

VERMONT.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Barre—									
1910....	....	....	....	....	....	4,811	....	....	....
Bellows Falls—									Gravel
1910....	....	....	....	....	....	....	....	....	2,640
1911....	....	....	....	**1,200**	....	....	....	....	....
St. Albans—									Gravel
1910....	....	....	....	....	....	7,650	....	1,300	3,900

VIRGINIA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Chatham—									
1911....	....	....	....	....	....	**10,560**	....	....	....
Danville—									Cobble
1910....	....	5,500	9,900	....	....	12,400	....	....	39,600
Fredericksburg—									Undetermined
1911....	....	....	....	....	....	....	....	....	**300**

Richmond—

1910.... $14,000 work being done.

1911.... Prospects will not be known until the budget is approved and adopted by the Council.

WASHINGTON.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Bellingham—									Gravel
1910....	7,565	....	2,196	....	3,297	....	....	....	9,819
Progress	....	....	....	....	....	....	....	....	4,320
1911....	**1,100**	....	....	....	**1,200**	....	....	....	....
Colfax—									Gravel
1911....	....	....	....	....	....	**9,100**	....	**4,300**	**3,200**
Everett—									
1910....	9,945	....	2,280	....	....	....	....	....	....
Progress	4,320	....	....	....	....	....	....	....	....
1911....	**12,536**	....	**2,612**	**380**	....	....	....	....	....
Hoquiam—									Gravel
1910....	1,180	....	3,800	....	....	....	....	....	16,000
Progress	....	....	....	....	....	....	....	....	15,300
1911....	**5,800**	....	....	....	....	....	....	....	**10,000**
Kent—									
1910....	....	....	....	....	....	....	5,280	....	....
1911....	**2,640**	....	....	....	....	....	....	....	....
Pullman—									
1910....	....	....	....	....	....	....	....	5,280	....
Seattle—									Sandstone
1910....	212,253	....	32,200	5,000	260	....	106	....	12,200
S. Yakima—									
1910....	10,560	....	1,200	....	....	....	....	....	....
Progress	....	....	1,200	....	....	....	....	....	....
1911....	**10,560**	....	....	....	....	....	....	....	....
Spokane—									
1910....	63,500	....	16,700	5,900	....	....	9,200	12,210	....
Progress	32,100	....	21,600	12,600	....	....	5,280	12,080	....
1911....	**52,800**	....	**31,400**	**21,100**	....	....	**15,840**	**21,120**	....
Tacoma—									Sandstone
1910....	76,560	....	6,019	....	14,837	528	1,795	....	4,858
Progress	1,901	....	317	....	....	....	3,062	....	2,798
Walla Walla—									
1910....	15,000	....	....	....	....	4,000	....	....	....
1911....	**26,400**	....	....	....	....	....	....	....	....

WEST VIRGINIA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Appleton—									
1910....	7,700	....	....	....	....	....	5,750	....	....
1911....	**6,000**	....	....	....	....	....	**900**	....	....
Charleston—									
1910....	....	18,200	10,700	....	....	....	....	4,200	....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Fairmont—									
1910			3.480						
1911			**1,740**						
Middlebourne—									
1911			**5,800**						
Wheeling—									Gravel
1910			13,000			1,000			1,000
Progress			1,000						
WISCONSIN.									
Beloit—									Gravel
1910			13,100						
1911			**6,000**						**3,000**
Berlin—									
1910						300			15,840
Burlington—									Gravel
1910			3,760						1,260
1911			**1,480**				**3,200**		
De Pere—									
1910							3,580		
Eau Claire—									
1910						1,600			
1911						**4,000**			
Fond du Lac—									
1910							14,772		
1911			**2,100**				**3,700**		
Hartford—									Gravel
1910									11,817
La Crosse—									
1910			366						
Manitowoc—									
1910			10,000						
Milwaukee—									Concrete
1910	28,420		25,160	4,197	9,070	34,470			
1911	**45,000**			**7,510**				**45,000**	**15,000**
Oshkosh—									Undetermined
1910	6,600		800		2,100	2,640	1,400		
1911									**8,000**
Portage—									
1910						5,280			
Watertown—									
1910			3,550						
1911			**1,900**						
Waupaca—									
1910						2,800			
1911						**3,960**			
Wausau—									
1910						71,500			
1911					**2,800**				
WYOMING.									
Laramie—									Gravel
1910									15,840
1911									**37,660**
CANADA.									
Kingston, Ont.—									
1911	**1,000**					**10,560**			
Toronto, Ont.—									
1910	62,830	32,000	1,100		500		5,700		
1911	Approximately same as 1910.								
Winnipeg, Man.—									
1910	48,700				5,600	3,300		1,330	

SIDEWALK IMPROVEMENTS

Official Reports of Sidewalk Improvements Made to Municipal Engineering by the Municial Officials of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each class of sidewalk laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of sidewalk in process of construction.

In the line "1911" is given the number of linear feet of each class of sidewalk proposed for construction during 1911, printed in heavy type so that it can be distinguished readily.

The reports have been reduced to the same unit of linear feet. When the area of sidewalks was given in square feet or square yards it has been reduced to linear feet by assuming the average width of sidewalks as 5.5 feet.

The column headed "Cement" includes cement walks laid in place, concrete flags and concrete blocks.

ALABAMA.

Cities	Cement	Brick	Wood	Others
Birmingham—				
Progress.	7,500	....	....	....
1911	**15,000**	....	....	....
Dothan—				
1910	4,150	....	....	....
Progress.	63,500	....	....	....
1911	**63,500**	....	....	....
Jasper—				Clay
1910	....	....	....	10,560
1911	....	....	....	**15,800**
New Decatur—				
1910	42,300	....	....	....
Progress.	37,000	....	....	....
1911	**26,300**	....	....	....

ARKANSAS.

Cities	Cement	Brick	Wood	Others
Batesville—				
1910	5,000	....	....	....
Ft. Smith—				
1910	21,100	....	....	....
1911	**31,400**	....	....	....

CALIFORNIA.

Cities	Cement	Brick	Wood	Others
Alhambra—				
1910	29,000	....	....	....
Antioch—				
1910	2,000	....	....	....
Coalinga—				
1910	31,400	....	....	....
Progress.	5,280	....	....	....
E. San Jose—				
1910	10,560	....	....	....
1911	**10,560**	....	....	....
Long Beach—				
1910	26,400	....	....	....
Los Angeles—				
1910	161,000	....	....	....
Oakland—				
1910	218,500	....	....	....
Progress.	185,000	....	....	....
1911	**158,000**	....	....	....
Palo Alto—				
1910	5,007	....	....	....
1911	**10,000**	....	....	....
Pasadena—				
1910	101,500	....	....	....
Progress.	5,280	....	....	....
Portersville—				
1910	15,840	....	....	....
Progress.	26,400	....	....	....
San Bernardino—				
1910	26,400	....	....	....
San Jose—				
1910	138,228	....	....	....
San Mateo—				
1910	109,000	....	....	....
1911	**18,200**	....	....	....
Santa Cruz—				
1910	10,560	....	....	....
Progress.	900	....	....	....
Selma—				
1910	15,800	....	....	....
1911	**15,800**	....	....	....
S. Pasadena—				
1910	5,280	....	....	....
Visalia—				
1910	300	....	....	....
1911	**6,500**	....	....	....
Watsonville—				Bituminous
1910	10,900	....	....	4,880
1911	**10,000**	....	....	**5,000**

CONNECTICUT.

Cities	Cement	Brick	Wood	Others
Ansonia—				
1910	1,000	....	....	....
Bristol—				
1910	10,000	....	....	....
Meriden—				*
1910	....	....	....	53,828

*Bluestone and concrete.

Cities	Cement	Brick	Wood	Others
New Britain—				Bluestone
1910	18,500	....	....	3,300
1911	**15,800**	....	....	**3,960**
New Haven—				
1910	729,000	....	....	....
Torrington—				†
1910	....	....	....	12,808

†Cement and tar.

Cities	Cement	Brick	Wood	Others
Wallingford—				
1911	**500**	....	....	....

COLORADO.

Cities	Cement	Brick	Wood	Others
Florence—				
1910	10,560	....	....	....
1911	**69,000**	....	....	....

FLORIDA.

Cities	Cement	Brick	Wood	Others
Pensacola—				
1910	163,000	....	....	....
1911	**238,000**	....	....	....

GEORGIA.

Cities	Cement	Brick	Wood	Others
Americus—				Art tile
1910	....	....	....	5,600
Atlanta—				
1910	189,024†	....	....	....
1911	**184,800†**	....	....	....

† Cement and brick.

Cities	Cement	Brick	Wood	Others
Brunswick—				
1910	....	....	....	15,640
1911	....	....	....	**5,280***

* Eight-foot hexagon tile.

Cities	Cement	Brick	Wood	Others
Cordele—				Tile
1910	3,050	1,520	....	5,250
Valdosta—				
1910	162,000	....	....	....
1911	**45,000**	....	....	....

IDAHO.

Cities	Cement	Brick	Wood	Others
Payette—				
1910	7,920	....	....	....
1911	**10,560**	....	....	....
Pocatello—				
1910	36,700	....	....	....

ILLINOIS.

Cities	Cement	Brick	Wood	Others
Canton—				
1910	2,640	3,960	....	....
1911	**7,920**	**7,920**	....	....
Chicago Heights—				
1910	43,000	....	....	....
Progress.	36,900	....	....	....
1911	**26,300**	....	....	....
Collinsville—				
1910	9,800	....	....	....
1911	**4,550**	....	....	....
Danville—				
1910	26,400	....	....	....
1911	**26,400**	....	....	....
Decatur—				
1910	42,300	....	....	....
Dekalb—				
1910	5,280	....	....	....
Downers Grove—				
1910	....	2,640	....	....
Edwardsville—				
1910	8,000	....	....	....
1911	**10,000**	....	....	....
Elgin—				
1910	20,226	....	....	....
Galena—				
1910	21,100	....	....	31,700
1911	**3,960**	....	....	....
Granite City—				
1910	20,000	....	....	....
Harvey—				Cinders
1910	12,880	....	....	2,000
Joliet—				
1910	31,700	....	....	....
1911	**26,300**	....	....	....
Lagrange—				
1910	2,640	....	....	....
Lake Forest—				
1911	**5,000**	....	....	....
Mattoon—				
1910	3,200	....	....	....
Moline—				
1910	6,350	....	....	....
Progress.	15,800	....	....	....
Mt. Pulaski—				
1910	800	5,280	....	....
1911	**1,200**	**5,280**	....	....
Oak Park—				
1910	29,700	....	....	....
Ottawa—				
1910	6,000	....	....	....

Cities	Cement	Brick	Wood	Others
Paris—				
1910.....	13,200			
Paxton—				
1910.....	10,560			
1911	**5,280**			
Peoria—				
1910.....	105,600			
1911.....	**105,600**			
Petersburg—				
1910.....	1,600			
Rock Island—				
1911.....	**8,700**			
Streator—				
1910.....	5,280	10,560		
Taylorville—				
1910.....	25,600			
1911.....	**43,200**			
Waukegan—				
1910.....	3,960			
Progress.	2,220			
Wheaton—				
1910.....	10,560			
1911.....	**10,560**			

INDIANA.

Cities	Cement	Brick	Wood	Others
Anderson—				
1910.....	12,350			
Auburn—				
1910.....		5,280		
Brazil—				
1910.....	5,280			
1911.....	**10,560**			
Columbia City—				
1910.....	2,640			
1911.....	**2,640**			
Columbus—				
1910.....	2,640			
1911.....	**1,320**			
Converse—				
1910.....	26,400			
Crawfordsville—				
1910.....	5,000			
1911.....	**2,500**			
E. Chicago—				
1910.....	31,600			
1911.....	**110,100**			
Evansville—				
1910.....	23,000	5,280		
1911.....	**23,000**	**5,280**		
Ft. Wayne—				
1910.....	71,000			
Progress.	12,680			
1911.....	**35,400**			
Hammond—				
1910.....		93,562		
1910.....	15,134			
Huntington—				
1910.....	5,400			
Indianapolis—				
1910.....	93,562			
Kokomo—				
1910.....	21,300			
1911.....	**14,000**			
Lebanon—				
1910.....	1,320			
1911.....	**5,280**			
Logansport—				
1910.....	8,000			
1911.....	**3,000**			
Marion—				
1910.....	735			
Martinsville—				
1910.....	5,280			
1911.....	**5,280**			
Michigan City—				
1910.....	13,200			
Mishawaka—				
1910.....	35,200			
Muncie—				
1910.....	2,000			
1911.....	**600**			
New Castle—				
1910.....	15,909			
Progress.	4,958			
1911.....	**4,060**			
Peru—				
1910.....	5,280			
Progress.	8,400			
Richmond—				
1910.....	2,900			
1911.....	**37,000**			
Rushville—				
1910.....	5,000			
1911.....	**6,000**			
South Bend—				
1910.....	19,136			
Sullivan—				
1910.....	18,500			
1911.....	**7,920**			
Terre Haute—				
1910.....	69,000			
Veedersburg—				
1910.....	7,000			
1911.....	**6,000**			
Wabash—				
1910.....	12,224			
1911.....	**6,000**			
Warsaw—				
1910.....	2,640			
Wolcottville—				
1910.....	3,000			
1911.....	**1,500**			

KANSAS.

Cities	Cement	Brick	Wood	Others
Abilene—				
Progress.	52,800			
1911.....	**105,600**			
Argentine—				
1910.....	2,640			
1911.....	**2,640**			
Arkansas City—				
1910.....	38,400			
1911.....	**45,500**			
Cherryvale—				
1910.....		1,000		
Clay Center—				
1910.....	3,000			
1911.....	**2,500**			
Emporia—				
1910.....	13,200			
1911.....	**15,800**			
Holton—				
1910.....	13,200			
Hutchinson—				
1910.....	25,000	1,000		
1911.....	**25,000**	**1,000**		
Lawrence—				
1910.....	15,800	5,280		
Manhattan—				
1910.....	15,800			
1911.....	**15,800**			
Olathe—				
1910.....	3,000			
Pittsburg—				
1910.....		2,685		
Progress.		3,178		
Pratt—				
1910.....	10,560			
Salina—				
1910.....	2,640	5,280		

KENTUCKY.

Cities	Cement	Brick	Wood	Others
Ashland—				
1911.....	**21,100**			
Louisville—				
1910.....	11,070	6,180		
1911.....	**12,500**	**2,500**		
Maysville—				
1910.....	10,560			
1911.....	**5,280**			
Paducah—				
1910.....	110,900			
Pineville—				
1910.....	1,400			
1911.....	**200**			

IOWA.

Cities	Cement	Brick	Wood	Others
Ames—				
1910.....	18,500			
Burlington—				
1910.....	26,400			
Cedar Falls—				
1910.....	26,400			
Centerville—				
1910.....	5,280			
1911.....	**5,280**			

Cities	Cement	Brick	Wood	Others
Charles City—				
1910.....	26,400	....	....	....
Clinton—				
1910.....	63,400	....	....	....
1911.....	**31,700**	....	....	....
Creston—				
1910.....	3,900	....	....	....
Progress.	1,800	....	....	....
Des Moines—				
1910.....	5,400	7,150	....	....
1911.....	**5,900**	**7,900**	....	....
Eldora—				
1910.....	2,120	....	....	....
1911.....	**3,000**	....	....	....
Ft. Dodge—				
1910.....	15,800	....	....	....
1911.....	**15,800**	....	....	....
Glenwood—				
1910.....	800	....	....	....
Grinnell—				
1910.....	....	17,600	....	....
Independence—				
1910.....	12,375	....	....	....
1911.....	**12,000**	....	....	....
Indianola—				
1910.....	44,000	....	....	....
1911.....	**5,280**	....	....	....
Mason City—				
1910.....	21,100	....	....	....
Newton—				
1910.....	5,000	....	....	....
Pella—				
1910.....	13,200	....	....	....
Washington—				
1910.....	1,000	....	....	....
Waterloo—				
1910.....	21,600	....	....	....

LOUISIANA.

Cities	Cement	Brick	Wood	Others
Morgan City—				
1910.....	26,400	....	....	....
1911.....	**10,560**	....	....	....
New Orleans—				
1910.....	....	23,548	....	....
Progress.	....	4,500	....	....
Opelousas—				
1910.....	2,260	....	....	....
1911.....	**23,500**	....	....	....

MAINE.

Cities	Cement	Brick	Wood	Others
Lewiston—				
1910.....	2,500	6,000	....	....
1911.....	**2,500**	**6,000**	....	....

MASSACHUSETTS.

Cities	Cement	Brick	Wood	Others
Easthampton—				Tar
1910.....	....	....	....	2,000
1911.....	....	....	....	**2,000**
Everett—				Tar concrete
1910.....	8,800	1,050	....	1,800
Greenfield—				Tar
1910.....	5,600	....	....	3,500
1911.....	**5,000**	....	....	**2,000**
Lawrence—				Tar concrete
1910.....	5,741	....	....	29,986
Lowell—				*
1910.....	548	....	....	....
Medford—				Tar
1910.....	890	690	....	280
New Bedford—				
1910.....	13,476	....	....	....
1911.....	**14,000**	....	....	....
Quincy—				Tar
1910.....	2,640	....	....	15,840

* Tar concrete, 2,387 feet; cinders, 12,071.

Cities	Cement	Brick	Wood	Others
Webster—				
1910.....	4,000	....	....	....

MICHIGAN.

Cities	Cement	Brick	Wood	Others
Alpena—				
1910.....	10,560	....	....	....
Battle Creek—				
1910.....	85,000	....	....	....
1911.....	**7,300**	....	....	....
Benton Harbor—				
1910.....	4,000	....	....	....
1911.....	**3,000**	....	....	....
Bessemer—				
1910.....	2,860	....	....	....
Cadillac—				
1910.....	9,100	....	....	....
1911.....	**4,360**	....	....	....
Flint—				
1910.....	48,200	....	....	....
Gladwin—				
1910.....	5,000	....	....	....
1911.....	**5,000**	....	....	....
Grand Rapids—				
1910.....	49,750	....	....	....
Hancock—				
1910.....	23,100	....	....	....
Highland Park—				
1910.....	16,400	....	....	....
Jackson—				
1910.....	13,200	....	....	....
1911.....	**18,500**	....	....	....
Kalamazoo—				
1910.....	14,142	....	....	....
1911.....	**15,000**	....	....	....
Lake City—				
1910.....	1,000	....	....	....
Manistique—				
1910.....	6,876	....	....	....
Marine City—				
1910.....	5,488	3,400	....	....
1911.....	**450**	....	....	....
Negaunee—				
1910.....	45,000	....	....	....
Port Huron—				
1910.....	10,560	....	....	....
1911.....	**5,280**	....	....	....
Rochester—				
1910.....	6,000	....	....	....
1911.....	**3,620**	....	....	....
Saginaw—				
1910.....	51,750	....	....	....
1911.....	**45,500**	....	....	....
Sault Ste. Marie—				
1910.....	11,500	....	....	....
1911.....	**9,100**	....	....	....
Three Rivers—				
1910.....	2,640	....	....	....
Whitehall—				
1910.....	7,640	....	....	....
Wyandotte—				
1911.....	**4,000**	....	....	....

MINNESOTA.

Cities	Cement	Brick	Wood	Undetermined
Bemidji—				
1910.....	5,280	....	....	....
1911.....	....	....	....	**5,280**
Cannon Falls—				
1910.....	600	....	....	....
Cloquet—				
1910.....	5,280	....	....	....
1911.....	**10,560**	....	....	....
Crookston—				
1911.....	**11,400**	....	....	....
Faribault—				
1910.....	5,875	450	....	....
1911.....	**3,500**	**350**	....	....
Madelia—				
1911.....	**2,000**	....	....	....
Mankato—				
1910.....	1,320	....	....	....
Montevideo—				
1910.....	5,800	....	....	....
1911.....	**5,000**	....	....	....
New Ulm—				
1910.....	5,800	....	....	....
1911.....	**1,320**	....	....	....
Red Wing—				
1910.....	37,500	....	....	....
1911.....	....	....	**26,400**	....
St. Cloud—				Tile
1911.....	....	....	....	**5,280**
St. Paul—				
1910.....	125,717	....	5,702	....
St. Peter—				
1910.....	2,700	....	....	....
1911.....	**1,500**	....	....	....
Two Harbors—				
1910.....	7,600	....	....	....
Winona—				
1910.....	7,111	....	....	....
1911.....	**10,000**	....	....	....

MISSISSIPPI.

Cities	Cement	Brick	Wood	Others
Clarksdale—				
1910	10,560			
Progress	2,000			
1911	**5,000**			
Hattiesburg—				
1910	12,000			
1911	**13,200**			
Yazoo City—				
1910	2,500		3,425	
Progress	1,044		800	

MISSOURI.

Cities	Cement	Brick	Wood	Others
Brookfield—				
1910	31,700			
Fulton—				
1910	4,650			
Independence—				
1910	23,300			
1911	**18,200**			
Kansas City—				
1910	65,000			
Lebanon—				
1910	5,280			
1911	**26,400**			
Lexington—				
1910	2,000			
1911	**1,000**			
Libertyville—				
1910	2,640			
1911	**2,640**			
Moberly—				
1910	21,100			
1911	**15,800**			
Nevada—				
1910	8,000	6,000		
1911	**20,000**	**4,000**		
St. Joseph—				
1910	29,638	3,566	5,289	
Progress	1,019			
1911		**225**		
Sedalia—				
1910	31,700			
1911	**52,800**			
Tarkio—				
1910	300			
Webb City—				
1910	30,365	251		
1911	**40,000**			

MONTANA.

Cities	Cement	Brick	Wood	Others
Billings—				
1910	84,500			
Progress	36,400			
1911	**18,200**			
Bozeman—				
1910	6,650			
1911	**47,500**			
Butte—				
1910	20,024			
1911	**7,940**			
Deer Lodge—				
1910	35,000			
1911	**15,800**			
Glasgow—				
1910	2,200			
1911	**9,100**			
Great Falls—				Earth
1910	41,000			17,550
1911	**45,500**			**20,000**
Helena—				
1910	30,600			
1911	**20,900**			
Lewiston—				
1910	7,920			
1911	**10,560**			

NEBRASKA.

Cities	Cement	Brick	Wood	Others
Chadron—				
1910	690			
1911	**1,900**			
Hastings—				
1910	26,400	5,280		
Lincoln—				
1910	69,000	5,280		
1911	**69,000**			
Norfolk—				
1910	21,200			
1911	**21,200**			
Red Cloud—				
1910	5,280			
1911	**5,280**			
S. Omaha—				
1910	10,560	7,900		
University Place—				
1911	**3,000**			
Wymore—				
1911	**7,920**			

NEVADA.

Cities	Cement	Brick	Wood	Others
Reno—				
1910	14,605			

NEW JERSEY.

Cities	Cement	Brick	Wood	Others
Bayonne—				Bluestone
1910	43,400			
Progress				3,160
Beach Haven—				
1911..Cement walks throughout borough.				
Bloomfield—				Bluestone
1910	14,500			13,300
1911	**15,840**			**21,150**
Elizabeth—				Flagstone
1911				**2,600**
Garfield—				
1910	21,100			
Irvington—				
1910				21,800
Progress				10,900
Millville—				
1910	15,840			
1911	**21,150**			
Nutley—				
1910	29,000			
Ocean City—				
1910	21,150			
1911	**10,560**			
Passaic—				Bluestone
1911				**16,296**
Plainfield—				
1910	31,100			
1911	**20,000**			
Rutherford—				Bluestone
1910	13,700			22,700
1911	**10,560**			**13,200**
Westfield—				
1910	43,250			

NEW MEXICO.

Cities	Cement	Brick	Wood	Others
Silver City—				
1910	26,400			

NEW YORK.

Cities	Cement	Brick	Wood	Others
Amsterdam—				
1910		3,000		
Batavia—				
1910	16,000			
Binghamton—				
1910	26,744			
1911	**26,744**			
Brockport—				
1910	300			
Buffalo—				
1910	131,400			
1911	**132,200**			
Corning—				
1910	11,950			
1911	**10,560**			
Dunkirk—				
1910	20,100			
1911	**15,800**			
Elmira—				
1910	25,000			*
1911	**25,000**			†

* Tar, 1,440 feet; stone, 1,740 feet, completed in 1910.

† Tar, 1,000 feet; stone ,1,700 feet, in prospect for 1911.

Cities	Cement	Brick	Wood	Others
Herkimer—				
1910	15,700			
Hoosick Falls—				
1910	19,100			
1911	**6,400**			
Kingston—				
1911	**1,670**			
Little Falls—				
1910	7,920			
1911	**10,560**			

Cities	Cement	Brick	Wood	Others
New York City, Borough of Brooklyn—				
1910	135,000			
Progress.	64,000			
1911	**210,000**			
New York City, Borough of The Bronx—				Bluestone
1910				83,952
Niagara Falls—				
1910	509			
Progress.	2,850			
1911	**2,500**			
Olean—				
1910	18,500	2,640	5,280	
1911	**26,400**			
Ogdensburg—				
1910	4,460			
1911	**4,000**			
Oneida—				
1910	2,640			
1911	**2,640**			
Potsdam—				Sandstone
1910	500			700
Plattsburg—				
1910	14,000			
1911	**10,000**			
Salamanca—				
1910	7,000	800		
1911	**6,000**			
Solvay—				
1910	63,500			
1911	**42,200**			
Syracuse—				
1910	48,900			
1911	**47,600**			
Watertown—				
1910	39,600			
1911	**31,700**			
White Plains—				Bluestone
1910	2,500			3,000

NORTH CAROLINA.

Cities	Cement	Brick	Wood	Others
Asheville—				
1910	6,000			
Greenville—				
1910	3,000		1,000	
1911	**5,000**			
Hendersonville—				
1910	15,800			
1911	**21,000**			
Raleigh—				
1910	2,000			
Wilson—				
1910	21,120			

NORTH DAKOTA.

Cities	Cement	Brick	Wood	Others
Bismarck—				
1910	2,000			
Grand Forks—				
1910	15,800			
1911			**10,600**	
Jamestown—				
1910	10,560			
1911	**5,280**			
Mandan—				
1910	21,100			
1911	**21,100**			
Minot—				
1910	5,000			
1911	**6,000**			
Wahpeton—				
1910	4,000			
1911	**2,500**			
Williston—				
1910	10,026			
1911	**23,800**			

OHIO.

Cities	Cement	Brick	Wood	Others
Akron—				
1910	6,350			
Progress.	3,280			
1911	**31,800**			
Bellefontaine—				
1910	1,340			
1911	**1,600**			
Bowling Green—				Flagstone
1910	3,000			3,000
Progress.				1,300
1911	**2,000**			**2,000**
Bucyrus—				Stone
1910	2,353			15,259
Carrolton—				
1910	2,000	6,000		
1911	**2,500**	**10,000**		
Chillicothe—				
1910	13,200			
1911	**10,560**			
Conneaut—				
1910	6,600			
1911	**5,280**			
Cleveland Heights—				Stone
1910	7,920			10,560
1911	**2,640**			**13,200**
Delaware—				
1910	2,640			
E. Cleveland—				Stone
1911				**2,640**
Cincinnati—				
1910	146,000	2,100	34,400	
Defiance—				
1910	15,800			
Euclid—				Stone
1911				**2,640**
Findlay—				
1910	7,920			
1911	**7,920**			
Galion—				
1910				5,280*
1911				21,100*
* Stone, flag and cement.				
Greenville—				
1910	5,000			
1911	**8,000**			
Ironton—				
1910	18,800			
Lancaster—				
1910	782			
Leetonia—				
1910	1,500			2,000
Progress.	150			800
1911	**2,000**			**3,000**
Lorain—				Sandstone
1910				12,000
1911				**21,800**
Miamisburg—				
1910	7,920			
Millersburg—				
1910	500			
Progress.	1,200			
Napoleon—				Flag
1910	1,270	180		180
1911	**1,090**			
Niles—				Stone
1910	2,000			6,000
1911	**8,000**			**12,000**
Norwood—				
1910	7,920			
1911	**5,280**			
Oberlin—				Stone
1910				2,720
1911				1,820
Pomeroy—				
1910	1,000			
Port Clinton—				
1910	5,280			
Steubenville—				
1910	10,560			
1911	**15,800**			
Toledo—				Flag
1910	59,664			112,200
1911	**59,664**			**112,200**
Wadsworth—				
1911				**15,800**
Warren—				Sandstone
1910	2,640			2,640
1911	**2,640**			2,640
Youngstown—				
1910	26,400			

OKLAHOMA.

Cities	Cement	Brick	Wood	Others
Bartlesville—				
1910	21,200	400		
1911	**10,560**			
Chandler—				
1910	15,800	15,800		
1911	**21,100**			
Clinton—				
1910	79,400			
1911	**79,400**			

Cities	Cement	Brick	Wood	Others
El Reno—				
1910.....	63,500	15,800	....	....
Progress.	10,560	....	....	....
1911.....	**43,200**	....	....	....
Enid—				
1910.....	105,600	....	....	....
1911.....	**79,400**	....	....	....
Lawton—				
1910.....	15,800	....	....	....
Progress.	6,600	....	....	....
1911.....	**26,400**	....	....	....
Muskogee—				
1910.....	46,280	880	....	....
Progress.	3,400	....	....	....
1911.....	**40,000**	**1,000**	....	....
Norman—				
1910.....	21,100	2,640	....	....
Progress.	10,560	....	....	....
1911.....	43,200	....	....	....
Shawnee—				
1910.....	52,800	5,280	....	....
1911.....	**52,800**	....	....	....
Tulsa—				
1910.....	18,200	....	....	....
1911.....	**13,600**	....	....	....
Vinita—				
1910.....	105,600	....	....	....
1911.....	**26,400**	....	....	....

OREGON.

Cities	Cement	Brick	Wood	Others
Cloquille—				
1910.....	500	....	1,000	....
1911.....	**2,000**	....	....	....
The Dalles—				
1910.....	21,170	....	....	....
1911.....	**26,400**	....	....	....
Marshfield—				
1910.....	....	....	31,700	....
Progress.	....	....	5,280	....
1911.....	....	....	**10,560**	....
Portland—				
1910.....	611,318	....	35,387	....

PENNSYLVANIA.

Cities	Cement	Brick	Wood	Others
Bellefonte—				Flagstone
1910.....	1,900	....	....	400
Bellwood—				
1910.....	1,000	1,000	....	....
1911.....	**2,000**	....	....	....
Carbondale—				Stone
1911.....	....	....	....	**26,400**
Chambersburg—				
1910.....	9,667	....	....	....
Corry—				
1910.....	3,670	452	....	....
Doylestown—				
1910.....	600	....	....	....
Gallitzin—				
1910.....	2,640	....	....	....
1911.....	**1,320**	....	....	....
Homestead—				
1910.....	....	276	....	....
1911.....	....	300	....	....
Luzerne—				
1910.....	1,320	....	....	....
McKees Rock—				
1910.....	13,200	....	....	....
1911.....	**20,000**	....	....	....
Minersville—				
1910.....	300	....	....	....
Newcastle—				
1910.....	23,360	....	....	....
Northeast—				
1910.....	105,600	5,280	....	....
Northumberland—				Stone
1910.....	1,892	....	....	120
Oil City—				
1910.....	11,500	....	....	....
Pottsville—				Flagstone
1910.....	20,000	26,000	....	....
1911.....	....	....	....	**13,591**
Reading—				
1910.....	....	600	....	....
Sharpsville—				
1911.....	**5,280**	....	....	....
Somerset—				
1910.....	2,000	....	....	....

Cities	Cement	Brick	Wood	Others
Swissvale—				
1910.....	1,780	....	....	....
1911.....	**910**	....	....	....
Tyrone—				
1910.....	5,280	2,640	....	....
Wilkes-Barre—				
1910.....	....	....	....	10,400*
* Flagstone and concrete.				
Wilkinsburg—				
1910.....	211,600	52,800	10,560	....
1911.....	....	....	5,280	....

RHODE ISLAND.

Cities	Cement	Brick	Wood	Others
Woonsocket—				Tar concrete
1910.....	50	....	....	560

SOUTH CAROLINA.

Cities	Cement	Brick	Wood	Others
Chester—				
1910.....	1,000	....	....	....
Progress.	1,000	....	....	....
1911.....	**1,000**	....	....	....
Florence—				
1911.....	**2,640**	....	....	....
Greenville—				
1910.....	120	....	....	....
1911.....	**2,000**	....	....	....
Union—				
1910.....	10,560	....	....	....
Progress.	21,120	....	....	....
1911.....	**21,120**	....	....	....

SOUTH DAKOTA.

Cities	Cement	Brick	Wood	Others
Aberdeen—				
1910.....	8,269	....	....	....
Deadwood—				
1910.....	2,000	....	....	....
Faulkton—				
1910.....	1,500	....	....	....
1911.....	**2,400**	....	....	....
Lead—				
1910.....	5,000	....	2,000	....
1911.....	**3,000**	....	**2,000**	....
Pierre—				
1910.....	10,560	....	....	....
1911.....	**10,560**	....	....	....
Rapid City—				
1910.....	7,000	....	....	....
1911.....	**10,000**	....	....	....
Sioux Falls—				
1910.....	44,900	....	....	....

TENNESSEE.

Cities	Cement	Brick	Wood	Others
Columbia—				
1910.....	19,800	7,920	....	....
1911.....	**19,800**	**7,920**	....	....
Harris—				
1910.....	15,800	....	....	....
1911.....	**5,280**	....	....	....
Knoxville—				
1910.....	14,700	....	....	....
1911.....	**79,400**	....	....	....
Memphis—				
1911.....	**52,800**	....	....	....
Rockwood—				
1910.....	10,560	....	....	....
Progress.	2,640	....	....	....
1910.....	278,098	....	....	....
Nashville—				
1910.....	42,100	....	....	....

TEXAS.

Cities	Cement	Brick	Wood	Others
Dallas—				
1910.....	....	....	....	26,400
Denison—				
1910.....	42,300	2,640	....	....
1911.....	**105,600**	....	....	....
Greenville—				
1910.....	26,400	....	....	....
Texas City—				
Progress.	10,560	....	....	....
1911.....	**21,100**	....	....	....

UTAH.

Cities	Cement	Brick	Wood	Others
Ogden—				
1910.....	25,700	....	....	....
Provo—				
1910.....	50,500	....	....	....
Progress.	1,500	....	....	....
1911.....	**10,560**	....	....	....
Salt Lake City—				
1910.....	16,600	....	....	....
1911.....	**316,500**	....	....	....

VERMONT.

Cities	Cement	Brick	Wood	Others
Barre—				Tar concrete
1910.....	203	....	....	636
Bellows Falls—				Tar
1910.....	....	....	....	2,620
1911.....	....	....	....	**2,460**
St. Albans—				Tar concrete
1910.....	6,400	....	....	1,800

VIRGINIA.

Cities	Cement	Brick	Wood	Others
Chatham—				
1910.....	5,280	....	....	....
1911.....	**2,640**	....	....	....
Danville—				
1910.....	32,650	57,500	....	....
Fredericksburg—				
1910.....	800	....	....	....
1911.....	**2,000**	....	....	....

WASHINGTON.

Cities	Cement	Brick	Wood	Others
Bellingham—				
1910.....	65,515	....	21,686	....
1911.....	**28,260**	....	4,000	....
Colfax—				
1910	1,025	....	....	....
Everett—				
1910.....	62,487	....	....	....
Progress.	22,820	....	....	....
1911.....	**87,300**	....	....	....
Hoquiam—				
1910.....	10,000	20,000	....	....
1911.....	**6,000**	**15,000**	....	....
Kent—				
1910.....	7,920	....	....	....
Port Angeles—				
1910.....	....	....	42,200	....
1911.....	....	....	**10,560**	....
Seattle—				
1910.....	363,686	107,131	....	....
S. Yakima—				
1910.....	26,400	....	....	....
Spokane—				
1910.....	493,680	....	....	....
1911.....	**5,550**	....		
Tacoma—				
1910 ..	254,951	....	12,355	....
1911.....	**53,592**	....	**1,320**	....
Walla-Walla—				
1910.....	20,000	....	....	....
1911.....	**40,000**	....	....	....

WISCONSIN.

Cities	Cement	Brick	Wood	Others
Beloit—				
1910.....	26,400	....	....	....
Berlin—				
1910.....	10,560	....	....	....
Burlington—				
1910.....	11,100	....	....	....
1911.....	**10,560**	....	....	....
DePere—				
1910.....	30,850	....	....	....
Eau Claire—				
1910.....	5,280	....	....	....
Fond du Lac—				
1910.....	42,250	....	....	....
1911.....	**42,250**	....	....	....
Hartford—				
1910.....	8,300	....	....	....
Lacrosse—				
1910.....	25,523	....	....	....
1911.....	**21,100**	....	....	....
Mazomanie—				
1910.....	3,920	....	....	....
Milwaukee—				
1910.....	129,300	....	....	....
1911.....	**136,000**	....	....	....
Oshkosh—				
1910.....	64,750	....	....	....
Port Washington—				
1910.....	9,250	....	....	....
1911.....	**9,100**	....	....	....
Stevens Point—				
1910.....	10,560	....	....	....
Watertown—				
1910.....	12,000	....	....	....
1911.....	**12,000**	....	....	....
Waupaca—				
1910.....	2,100	....	....	....
1911.....	**2,640**	....	....	....
Waupun—				
1910.....	8,146	....	....	....
1911.....	**8,146**	....	....	....

WYOMING.

Cities	Cement	Brick	Wood	Others
Laramie—				
1910.....	52,800	....	....	....
1911.....	**42,250**	....	....	....

CANADA.

Cities	Cement	Brick	Wood	Others
Kingston, Ont.—				
1910.....	23,700	....	....	....
1911.....	**21,150**	....	....	....
Toronto, Ont.—				
1910.....	281,000	....	12,700	....
1911.....	Approximately same as 1910.			
Winnipeg, Man.—				
1910.....	47,800	....	79,500	....

CURB AND GUTTER

A few cities have made separate reports of curb and gutter improvements not connected with sidewalks or street paving, as follows:

Birmingham, Ala., has 10,000 feet of curb and gutter under construction and proposes to lay 25,000 feet in 1911.

Dothan, Ala., constructed 35,180 feet of curb and gutter in 1910, has 63,000 feet under construction and proposes to lay 63,500 feet in 1911.

Topeka, Kan., laid 28,500 feet of curb and gutter in 1910 and proposes to lay 47,284 feet in 1911.

Yazoo City, Miss., laid 1,700 feet in 1910 and has 344 feet under construction.

Cape Girardeau, Mo., laid 6,000 feet in 1910.

Sedalia, Mo., laid 18,500 feet in 1910 and will lay 26,400 feet in 1911.

Kingston, N. Y., will lay 3,115 feet of curb in 1911.

Vinita, Okla., laid 13,000 feet of curb and gutter in 1910 and has 1,400 feet under construction.

Aberdeen, S. D., laid 11,536 feet in 1910.

LaCrosse, Wis., laid 17,133 feet in 1910 and will lay 5,280 feet in 1911.

SEWER IMPROVEMENTS

Official Reports of Sewer Improvements Made to Municipal Engineering by the Municipal Officials of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each class of sewer laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of sewer in process of construction.

In the line "1911" is given the number of linear feet of each class of sewer proposed for construction during 1911, printed in heavy type so that it can be distinguished readily.

In a few cities general statements only could be made. These will be found in their proper places in the table.

Following the table giving the length of sewers reported will be found items arranged in the same order of states and cities, giving information about recent and proposed construction of sewage pumping and sewage disposal plants, etc.

ALABAMA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Birmingham—				

Storm sewers, $300,000, under contract.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Dothan—				
1910	....	2,883	60	20,000
1911	....	....	....	**3,000**
Jasper—				
1910	....	....	....	3,960
1911	....	....	....	**5,280**
New Decatur—				
1910	....	....	1,850	278,100
Progress	....	....	....	2,180
1911	....	....	....	**5,280**
Talladega—				
1910	....	....	....	5,000

ARIZONA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Tucson—				
1910	....	....	....	6,600

ARKANSAS.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Batesville—				
1911	....	....	....	**5,280**
Ft. Smith—				
1910	....	....	....	42,702
1911	....	....	....	**20,000**

CALIFORNIA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Alhambra—				
1910	....	....	....	13,200
Antioch—				
1910	....	....	....	4,500
Coalinga—				
1911	....	....	....	**37,000**
E. San Jose—				
1910	3,920	....	....	74,000
Emoryville—				
1910	....	1,800	....	....
Lodi—				
1910	....	....	....	63,400
Los Angeles—				
1910	....	....	....	230,000
Progress	....	....	....	59,100
1911	....	....	....	**238,000**
Long Beach—				

In prospect for 1911, 792,000 feet of sewer, including 6,350 feet of main outfall.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Oakland—				
1910	2,640	14,300	....	124,000
Progress	....	15,800	....	26,400
1911	....	**21,100**	....	**105,600**
Palo Alto—				
1910	....	....	....	929
Pasadena—				
1910	....	....	....	1,097
Progress	....	....	14,450	....
1911	....	....	....	**39,200**
Portersville—				
1910	....	....	....	70,000
Progress	....	....	....	25,000
San Bernardino—				
1910	....	....	....	18,500
San Jose—				
1910	....	....	....	11,403
Progress	....	....	....	800
1911	....	**10,500**	....	....
San Mateo—				
1911	....	....	**5,000**	**10,000**
Santa Clara—				
1910	....	....	....	10,560
1911	....	....	....	**63,500**
Santa Cruz—				
1910	....	....	....	10,543
1911	....	....	....	**17,041**
S. Pasadena—				
1910	3,400	1,800	....	3,200
Visalia—				
1910	....	....	....	1,320
1911	....	....	....	**2,640**
Watsonville—				
1910	....	....	10,902	1,937

CONNECTICUT.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ansonia—				
1910	....	....	....	5,800
Progress	....	....	....	6,500
1911	....	....	....	**15,000**
Bristol—				
1910	....	....	....	2,000
Hartford—				
1910	28	62,500	300	7,900
Progress	400	....	....	....
1911	**4,800**	....	....	**1,000**
Meriden—				
1910	....	....	....	3,950
New Britain—				
1910	....	....	....	11,500
1911	....	....	....	**15,800**
New Haven.				
1910	321	....	638	12,868
Torrington*—				
1910	....	....	180	5,326
1911	....	....	**1,700**	....

*800 feet of castiron pipe proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Wallingford—				
1911	....	....	....	**5,000**

DISTRICT OF COLUMBIA.

Washington—Has $379,000 worth of sewer work in progress, and will do $446,500 in 1911.

GEORGIA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Americus—				
1910	....	....	....	21,120
Atlanta—				
1910	13,834	....	....	51,797
1911	**10,560**	**79,200**	....	**211,200**
Cordele—				
1910	....	....	....	2,800
Eastman—				
1910	....	....	....	45,000
Valdosta—				
1910	....	....	....	5,750

IDAHO.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Payette—				
1910	....	....	....	23,000
1911	....	....	....	**30,000**
Pocatello—				
1911	....	....	....	**10,560**

ILLINOIS.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Aurora—				
1911	....	**2,640**	....	**42,300**
Canton—				
1910	10,560	....	....	36,900
1911	....	....	....	**2,640**
Chicago—				
1910	79,613	2,000	1,000	216,448
Chicago Heights—				
1910	....	3,980	5,800	13,200
Progress	....	....	....	13,200
1911	....	....	**52,800**	**89,700**
Collinsville—				
1910	....	....	....	15,800
1911	....	....	....	**13,200**
Danville—				
1910	....	....	....	5,280
Progress	....	....	....	2,640
1911	....	....	....	**52,800**
Decatur—				
1910	....	....	....	11,567

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Dekalb—				
1911				**71,400**
E. St. Louis—				
1910		1,800	4,200	30,500
Edwardsville—				
1910				2,000
Elgin—				
1910				9,737
Progress		5,192	144	39,907
1911		**853**	**4,197**	**41,935**
Freeport—				
1911		**1,000**		**47,400**
Galena—				
1910				8,550
Galesburg—				
1910				17,690
1911	**7,232**			**15,598**
Granite City—				
1910				15,000
Harvey—				
1910				1,117
Joliet—				
1910				6,230
1911				**5,000**
Lagrange—				
1911		**15,800**		
Mattoon—				
1910				7,300
1911				**10,560**
Metropolis—				
1910	5,260			40,973
Moline—				
1910				27,000
Progress				15,800
Oak Park—				
1910				4,400
1911	**11,900**			**10,560**
Paris—				
1910				9,000
1911			**4,800**	
Peoria*—				
1910	52,800			158,400
1911				**3,960**
*462 ft. of pipe contracted for.				
Petersburg—				
1910				1,800
Rockford—				
1910			486	25,000
1911			**1,700**	**5,700**
Rock Island—				
1910				23,040
1911			**2,600**	**18,080**
Streator—				
1910				3,980
Taylorville—				
1910				9,560
1911				**21,200**
Waukegan—				
1910			7,900	66,000
1911				**36,300**
Wheaton*—				
1910				25,000
1911				**30,000**
*22,700 feet of open ditch in 1910.				

INDIANA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Anderson—				
1910				2,640
Angola—				
1910			4,789	19,140
Brazil—				
1910				400
Columbia City—				
Progress				1,320
Columbus—				
Progress				13,200
1911				**10,560**
Converse—				
1910				10,560
Crawfordsville—				
1910				2,170
1911				**5,120**
E. Chicago—				
1910	13,200			47,400
1911	**5,280**			**13,200**
Evansville—				
1910	2,167		10,064	2,067
Progress	1,409			5,439
1911				**20,000**
Ft. Wayne—				
1910				15,800
Progress				17,300
1911				**6,870**
Hammond—				
1910				10,269
Huntington—				
1910	865			
Indianapolis*—				
Progress	22,000			38,000
*127,037 feet of brick, concrete and vitrified pipe sewer constructed in 1910.				
Kokomo—				
1910				20,000
1911			**9,376**	**5,800**
Lebanon*—				
1910				2,640
*31,600 feet of sewer proposed for 1911, kind not decided.				
Logansport—				
1910				1,800
1911				**1,000**
Marion—				
1910			2,650	7,940
Martinsville—				
1910	2,640			
Michigan City—				
1910				7,000
Mishawaka—				
1910				15,200
Muncie—				
1910				2,500
1911				**650**
Newcastle—				
1910				10,560
Progress				5,280
1911		**10,560**		
Peru—				
1910				1,000
1911				**2,640**
Remington—				
1911				**3,000**
Richmond—				
1910		3,280		
1911		**1,320**		**6,600**
South Bend—				
1910			4,657	4,655
Terre Haute—				
1910	21,400			
Wabash—				
1910				1,900
1911				**4,500**

IOWA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ames—				
1910				79,400
Albia—				
1910				6,000
Belle Plaine—				
Will construct 26,400 feet of sewer in 1911.				
Burlington—				
1910			1,358	11,055
Carroll—				
1910				15,800
Cedar Falls—				
1910				18,450
Cedar Rapids—				
1910				24,500
Progress				3,000
Centerville—				
1910				3,800
Charles City—				
1910				22,500
1911				**15,800**
Clinton—				
1910				2,500
1911	**2,540**			**32,000**
Creston—				
1910				3,329

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Des Moines—				
1910			2,665	28,852
Eldora—				
1910				1,200
1911				**1,500**
Ft. Dodge—				
1910				21,400
1911				**10,560**
Glenwood—				
1910				9,650
Grinnell—				
1910				5,866
Independence—				
1910		1,650		
Indianola—				
1910				20,095
1911				**40,000**
Knoxville—				
1910				6,000
Mason City—				
1910				15,800
1911				**5,280**
Newton—				
1910				26,400
Osage— Sewer system to be installed.				
Pella—				
1910				15,800
Red Oak—				
1910				800
Washington—				
1910				1,500
Progress				500
Sigourney—				
1911			**47,500**	
Waterloo—				
1910				42,400

KANSAS.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Abilene—				
1910				42,300
Argentine—				
1910				7,920
Progress				5,280
1911	**5,280**			
Arkansas City—				
1910	24,700			
1911	**15,800**		**3,980**	
Burlington—				
1910				42,200
Chanute—				
1910				10,164
Clay Center—				
1910				5,000
Emporia—				
1910			2,640	
Holton—				
1910				42,200
Progress				18,500
Hutchinson—				
1910			3,800	14,000
Lawrence—				
1910	2,640		2,640	13,200
Progress				6,600
1911				**10,560**
Manhattan—				
1910			9,000	3,000
Progress				79,500
McPherson—				
1911	**10,560**			
Newton—				
1910				79,200
Olathe—				
1910				2,500
1911				**7,000**
Pittsburg—				
1910				12,021
1911				**1,900**
Pratt—				
1910				37,000
Selina—				
1910				8,500
1911				**8,000**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Topeka*—				
1910				2,608

*No sewer work in prospect for 1911.

KENTUCKY.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ashland—				
1911				**1,000**
Louisville—				
1910				38,706
1911		**751**		**40,000**
Maysville—				
1910				1,320
1911				**660**
Owensboro—				
1910	200			5,000
Winchester—				
1910				7,960
1911				**34,400**

LOUISIANA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Morgan City—				
1910				10,560

MAINE.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Lewistown—				
1910				1,200
1911				**4,000**

MASSACHUSETTS.

Boston—

Owing to the establishment of a Department of Public Works and the consequent disorder and wholesale moving of quarters, the desired data are not at hand.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Easthampton—				
1910				4,000
1911				**5,000**
Everett—				
1910				1,950
Greenfield—				
1910				3,530
Progress				7,500
1911				**10,000**
Hinsdale—				
1910				630
Lawrence*—				
1910				19,054

*1,368 feet of sewer, with brick arch and concrete invert constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Lowell—				
1910	200			9,900
Medford—				
1910				6,454
New Bedford*—				
1910			2,309	21,898
1911			**2,000**	**22,000**

*6,400 feet of outfall sewer and screen chamber proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Quincy—				
1910				24,634
1911				**24,000**
Webster—				
1910				1,770
Worcester—				
1910				5,000
Progress				1,000

MICHIGAN.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Alpena*—				
1910				9,646

*557 feet of plank sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Battle Creek—				
1910				14,240
Benton Harbor—				
1910				1,500
1911				**500**
Cadillac—				
1910				1,100
1911				**3,000**
Flint—				
1910		31,200		54,400
Gladwin—				
1910				1,000
1911				**1,000**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Grand Rapids*—				
1910		2,856	....	30,448
Progress	....	....	....	4,813

*2,657 feet of Parmley block sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Greenville—				
1910	....	....	....	29,646
Hancock—				
1910	....	....	....	7,590
Progress	....	....	....	2,900
1911	....	....	....	**22,000**
Highland Park—				
1910	....	....	....	42,200
Jackson—				
1910	....	....	2,900	10,560
1911	....	....	**7,920**	**10,560**
Kalamazoo—				
1910	....	....	....	11,287
Progress	....	....	51,000	....
1911	....	....	....	**15,000**
Lansing—				
1910	4,000	....	....	10,560
Progress	....	....	....	2,400
Manistique—				
1910	....	....	....	3,900
Marine City—				
1910	....	....	....	1,812
Marshall—				
1910	....	....	....	3,524
1911	....	....	....	**3,500**
Negaunee—				
1911	....	....	....	**4,000**

Niles—
$22,000 worth of sewers proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Norway—				
1910	....	....	....	2,000
1911	....	....	....	**2,000**
Port Huron—				
1910	....	125	....	2,640
Rochester—				
1910	....	....	....	300
Saginaw—				
1910	....	1,200	....	9,650
Progress	....	3,675	....	....
Sault Ste. Marie—				
1910	....	....	....	2,426
1911	....	....	....	**10,000**
Three Rivers—				
1910	....	....	....	3,960
1911	....	....	....	**2,640**

MINNESOTA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Bemidji—				
1910	....	....	....	3,200
1911	....	....	....	**2,640**
Cannon Falls—				
1910	....	....	....	1,250
Cloquet—				
1910	....	....	....	7,700
1911	....	....	....	**15,000**
Crookston—				
1910	....	....	....	3,830
1911	....	....	....	**860**
Faribault*—				
1910	....	....	....	8,253
1911	....	....	....	**3,000**

*3,230 feet of cement tile sewer constructed in 1910 and 1,500 feet proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Hastings—				
1910	....	....	....	2,227
Progress	....	....	....	3,000
1911	....	....	....	**1,500**
Mankato—				
1910	....	....	15,000	700
1911	....	....	....	**1,200**
Montevideo—				
1910	....	....	....	3,800
1910	....	....	....	**2,000**
New Ulm—				
1910	....	....	....	430
Red Wing—				
1910	....	....	....	2,640
1911	....	....	....	**5,280**
St. Cloud—				
1911	....	....	....	**42,100**
St. Peter—				
1910	700	....	....	....
St. Paul—				
Progress	....	....	....	3,960
1911	....	....	**5,280**	**42,240**
Winona—				
1910	....	....	....	1,100
1911	....	....	....	**2,000**

MISSISSIPPI.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Clarksdale—				
1910	....	....	....	2,640
1911	....	....	....	**10,560**
Hattiesburg—				
1911	....	....	....	**10,000**
Yazoo City—				
1910	....	....	....	100

MISSOURI.

Aurora—
1911—Complete system for city of 5,000.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Brookfield—				
1910	....	....	....	2,640
1911	....	....	....	**2,640**
Clinton—				
1910	....	....	....	48,000
Glasgow—				
1911	....	....	....	**10,560**
Independence*				
1910	....	....	....	7,451

*10,000 feet of sewer proposed for 1911, kind not decided.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Kansas City—				
1910	....	5,023	....	49,001
Libertyville—				
1910	....	....	....	5,280
Moberly—				
1910	5,000	....	21,100	....
1910	....	....	**42,250**	....
Nevada—				
1910	....	....	....	2,000
1911	....	**14,000**	....	**3,000**

Oregon—
1911—City sewerage plant.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
St. Joseph—				
1910	....	5,633	....	59,291
Progress	....	3,702	....	2,117
1911	....	....	....	**2,197**
Sedalia—				
1910	....	....	....	3,530
1911	....	....	....	**52,800**
Webb City—				
1910	....	....	....	14,428
Progress	....	....	....	3,528

MONTANA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Billings—				
1910	....	....	6,446	101,800
Bozeman—				
1910	....	....	....	1,950
1911	....	....	....	**1,200**

Butte—
550 feet of cement tile and 150 feet of wooden outlet sewer constructed in 1910; 500 feet of cement tile sewer proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Deer Lodge—				
1910	....	....	....	15,800
1911	....	....	....	**5,280**
Glasgow—				
1910	....	....	....	10,560
1911	....	....	....	**7,920**
Great Falls—				
1910	....	....	....	16,709
1911	....	....	....	**30,000**
Helena—				
1910	....	5,390	....	23,554
1911	....	....	....	**2,450**
Lewiston—				
1910	....	....	....	4,000
1911	....	....	....	**10,000**

NEBRASKA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Chadron—				
1910	....	....	....	42,250
1911	....	....	....	**4,000**
Hastings—				
1911	....	....	....	**7,940**
Lincoln—				
1910	....	4,561	....	32,542
1911	....	**5,000**	....	**30,000**
Neligh—				

One mile of sewer constructed in 1910 and complete system proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Norfolk*—				
1910	....	200	....	5,000
1911	....	....	....	**3,000**

*500 feet of cast iron sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
S. Omaha—				
1910	1,244	3,505	200	4,815
Progress	....	9,979	....	590
Tecumseh—				
1911	....	....	....	**34,000**
University Place—				
1911	....	....	....	**9,000**

NEVADA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Reno—				
1910	....	....	....	23,263
1911	....	**10,560**	....	....

NEW HAMPSHIRE.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Keene—				
1910	....	....	....	2,363
Littleton—				
1910	....	....	....	1,850

NEW JERSEY.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Bayonne—				
1910	....	....	....	3,620
Bloomfield—				
1910	....	2,000	4,400	15,790
1911	....	....	**10,560**	**15,800**
Dover—				

Considering complete sewerage system.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Elizabeth—				
1910	4,000	....	9,393	....
1911	**1,200**	....	....	....
Garfield—				
1910	....	....	....	2,640

1911—Complete sewer system proposed.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Irvington—				
1910	....	....	....	18,000
Jersey City*—				
1910	5,329	....	....	5,470
Progress	3,910	....	2,460	4,928

*1,857 feet of steel pipe sewer under contract.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ocean City—				
1910	....	....	....	10,560
Plainfield—				
1910	....	....	....	13,200
1911	....	....	....	**12,000**
Rutherford—				
1910	....	....	....	6,350
Progress	....	....	....	5,000
1911	....	....	....	**7,940**
S. Amboy—				
Progress	....	....	....	31,700
Westfield—				
1910	....	....	....	14,800

NEW MEXICO.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Silver City—				
1910	....	....	....	47,500

NEW YORK.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Amsterdam—				
1910	10,501	....	....	....
Batavia—				
1910	....	....	....	79,000
1911	....	....	....	**79,000**
Binghamton—				
1910	....	....	....	23,800
1911	....	....	....	**26,400**
Buffalo—				
1910	3,108	770	....	51,415
1911	**19,910**	....	....	**42,362**
Catskill—				
1910	....	....	....	1,500
Corning—				
1910	....	....	....	6,200
1911	....	....	....	**5,280**
Dunkirk—				
1910	400	....	....	6,850
Elmira—				
1910	....	....	....	4,698
1911	....	....	....	**4,000**
Frankfort—				

1911..$55,000 to $85,000 voted for complete sewerage system. If larger sum is used, disposal plant will be erected.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Geneseo—				
1911	....	....	....	**1,320**
Herkimer—				
1910	....	....	....	3,150
Jamestown—				
1910	....	....	....	47,500
Kingston—				
1910	....	....	....	3,700
1911	....	**1,000**	....	**4,000**
Little Falls—				
1910	....	....	....	2,500
Middletown—				
1910	....	....	....	3,000
New York City (Borough of The Bronx)—				
1910	....	2,006	1,637	40,128
Progress	....	3,168	6,336	33,264
1911	....	....	**10,560**	**27,984**
Niagara Falls*—				
1910	1,866	....	605	19,796
1911	....	....	**1,700**	**4,200**

*1,500 feet of tunnel constructed in 1910; 1,742 feet proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ogdensburg—				
1910	....	....	....	1,544
Olean—				
1910	....	....	....	18,500
1911	....	....	....	**15,800**
Oneida—				
1910	....	....	....	2,640
Progress	....	....	....	1,320
1911	....	....	....	**3,960**
Plattsburg—				
1910	....	....	....	2,640
1911	....	....	....	**800**
Potsdam—				
1910	....	....	....	1,600
Salamanca—				
1910	....	....	....	6,800
1911	....	....	....	**4,200**
Sidney—				
1911	....	....	....	**700**
Syracuse*—				
1910	4,150	330	....	26,020
Progress	....	....	....	4,540
1911	....	....	....	**45,400**

*8,800 feet of sewer of kinds not yet determined proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Troy—				
1910	80	....	14,234	....
Utica—				
1910	....	....	....	11,580
Watertown—				
1910	....	....	5,280	5,280
1911	....	....	....	**7,940**
White Plains—				
1910	....	....	....	1,000

NORTH CAROLINA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Asheville—				
1910	....	....	....	21,100
Greenville—				
1910	....	....	....	4,000
1911	....	....	....	**2,500**

*8,000 feet of storm water sewer constructed in 1910; 1,000 feet proposed for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Hendersonville—				
1910	....	....	....	15,800
Progress	....	....	....	10,560
1911	....	....	....	**5,280**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Raleigh—				
1910				10,560
Wilmington—				
1911—Plans being made for complete system.				
Wilson—				
1910				3,000
1911	**3,200**			

NORTH DAKOTA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Bismarck—				
1910				6,500
Grand Forks*—				
1910	2,000			10,270
*5,280 feet of sewer proposed for 1911, kind undecided.				
Jamestown—				
1910				2,640
1911				**2,640**
Mandan—				
1910				26,400
Minot—				
1910				13,200
Progress				2,640
1911				**21,100**
Williston—				
1910				14,640
1911				**5,620**

OHIO.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Akron—				
1910	5,280			85,400
Alliance—				
1910		7,500		3,500
Progress				2,000
Ashtabula—				
1910				8;054
Progress				2,160
Bellefontaine—				
1910				5,280
Progress				122,000
Bowling Green—				
1910				1,500
1911				**6,000**
Bucyrus—				
1910				6,482
1911	**6,700**			**18,827**
Canal Dover—				
1911				**10,560**
Carrollton—				
1910				6,000
Celina—				
1910				2,000
Cincinnati*—				
1910	7,700			58,600
Progress	15,500			13,700
*2,000 feet of concrete sewer, with brick invert, constructed in 1910.				
Cleveland Heights—				
1910				18,500
1911				**10,560**
Columbus—				
1910	427,673		31,551	1004723
Progress	625		1,100	8,000
Conneaut—				
1911				**4,000**
Coshocton—				
1910				2,640
Defiance—				
1910	2,640			
Delaware—				
1910				2,640
Progress				3,325
1911				**2,800**
E. Cleveland—				
1910				3,960
1911				**1,580**
E. Liverpool—				
1910				528
1911				**2,640**
Euclid—				
1910				1,320
1911				**2,640**
Findlay—				
1910				4,000
1911				**10,000**
Fostoria—				
Progress				5,333
Galion—				
1910				41,346
Progress				8,658
1911				**9,510**
Greenville—				
1910				3,440
Ironton—				
1910		3,100		4,400
1911		**6,200**		**600**
Lancaster—				
1911				**3,290**
Leetonia—				
1910				7,000
Progress				3,000
1911				**5,000**
Lorain—				
1910	4,423		1,850	28,300
1911	**5,000**		**2,000**	**20,000**
Louisville—				
1910				31,800
1911				**400**
Marietta—				
1910				5,010
Progress				5,048
Miamisburg—				
1910		1,320		2,640
1911		**2,640**		
Millersburg—				
1910				600
Progress				2,600
Napoleon—				
1910				3,000
Niles—				
1910				16,400
Progress				15,800
1911				**52,800**
Norwalk—				
1910			4,300	7,900
Norwood—				
1910		660		660
Oberlin—				
1910				2,000
Ravenna—				
1910				1,500
1911				**3,000**
Salem—				
1910				2,000
Progress				3,000
1911				**3,000**
Steubenville—				
1910	2,640			13,200
1911	**5,280**		**5,280**	**15,800**
Toledo—				
1910	6,400			29,900
Wadsworth—				
1910				3,616
Warren—				
1910				2,640
Progress				18,500
Youngstown—				
1911				**79,000**
Zanesville—				
1910	4,520			9,070
Progress				2,130
1911				**6,000**

OKLAHOMA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Chandler—				
1910				27,176
1911				**16,997**
Clinton—				
1910				31,600
Progress				10,560
1911				**42,300**
El Reno—				
1910		3,920		
1911			**31,700**	
Enid—				
1910	5,280	5,280	5,280	105,600

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Guthrie—				
1910	3,152	5,112		22,226
1911				**15,000**
Lawton—				
Progress		4,000		
1911		**3,500**		
Muskogee—				
1910			4,180	
1911			**45,000**	**45,000**
Norman—				
Progress		1,000		
1911				**15,800**
Shawnee—				
1910				52,800
1911				**52,800**
Tulsa*—				
1911				**35,000**

*24,000 feet of concrete pipe sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Vinita—				
1910				15,000
Progress				3,000
1911				**12,000**

OREGON.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Albany—				
1910				1,600
Progress				800
1911				**20,100**
Cloquille—				
1911				**10,560**
The Dalles—				
Progress				10,560
1911	**2,640**			**79,000**
Marshfield—				
1910				15,800
1911				**7,920**
Portland—				
1910	487	31,983		544,667
Salem—				
1910			3,200	8,000

PENNSYLVANIA.

Bellwood—
1911—Complete system in prospect.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Bloomsburg—				
1910				600
Carbondale—				
1911				**52,800**
Chambersburg—				
1910			179	4,098
Chester—				
Progress				13,600
Corry—				
1911				**850**
Erie*—				
1910		3,340		11,163

*Will lay 3,000 feet of sewer in 1911, kind not yet decided.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Gallitzin—				
1910				500
1911				**1,000**
Harrisburg—				
1910				7,415
Progress	915			8,852
1911			**25,600**	**38,000**
Homestead—				
1910				232

Ligonier—
1911—Complete system.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
McKees Rock—				
1910			350	1,000
1911				**2,000**
Minersville—				
1910				300
Newcastle—				
1910				5,290
1910				**5,280**
Norristown—				
1910				1,000
1911				**2,500**
Northeast—				
1910				7,940
Northumberland—				
1910				4,562
Oil City—				
1910			1,975	7,484
1911				**4,000**
Port Allegany—				
1911				**2,000**
Pottsville—				
1910				1,500
Reading*—				
1910				1,800

*$247,800 will be spent on sewers in 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Scottdale—				
1910				10,560
Progress				10,560
Sharpsville—				
1911				**10,560**
Somerset—				
1910				2,500
Swissvale—				
1910				2,450
1911				**1,000**
Tyrone—				
1910				2,700

Waynesboro—
Constructed 900 feet of stone sewer in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Wilkes Barre—				
1910	1,500			2,017
Wilkinsburg—				
1910	10,560			174,000
1911				**2,640**
Williamsport—				
1910				2,298
1911	**3,350**			**3,900**

RHODE ISLAND.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
E. Providence*—				
1910	7,920			84,500

*10,560 feet of sewer planned for 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Pawtucket*—				
1910	1,217	618		7,371

*1459 feet of vitrified pipe incased in concrete laid in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Providence—				
1910	19,200			14,200
Progress	3,400			4,700
1911	**13,200**			**15,800**
Woonsocket—				
1910				3,577

SOUTH CAROLINA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Chester—				
1910				2,000
Florence—				
1910				105,600
Greenville—				
1910				15,800
Progress				18,500

Rock Hill—
$100,000 system to be built in 1911.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Union—				
1910				23,800
Progress				800
1911				**800**

SOUTH DAKOTA.

Aberdeen—
Constructed complete system, costing $22,750, in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Faulkton—				
1910				3,000
1911				**1,500**
Lead—				
1910				1,000
1911				**3,000**
Lennox—				
1910				27,000
1911			**9,000**	
Mitchell—				
1910			3,385	2,035
Progress				10,560
1911				**10,560**
Pierre—				
1910				750

Sioux Falls—Proposes to build 52,800 feet of sewer in 1911, kinds not yet determined.

TENNESSEE.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Columbia—				
1910	......	......	......	6,800
1911	......	......	......	**7,000**
Knoxville*—				
1910	......	......	......	8,418

*Constructed 195 feet cast iron sewer in 1910; proposes 26,400 feet of sewer in 1911, kinds not yet determined.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Memphis—				
1910	......	......	......	179,142

TEXAS.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Belton—				
Progress	......	......	......	26,400
Denison—				
1910	......	......	......	4,000
1911	......	......	......	**10,000**
El Paso—				
1910	......	......	......	8,400
Progress	......	660	......	......
1911	......	**1,600**	......	......
Greenville—				
1910	......	......	......	3,960
Texas City—				
1910	......	......	......	10,560
1911	......	......	......	**84,500**

UTAH.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Ogden—				
1910	......	......	......	28,200
1911	......	**21,100**	......	......
Provo—				
1910	......	......	......	52,800
Progress	......	......	......	36,900
1911	......	......	......	**1,400**
Salt Lake City—				
1910	......	......	......	190,521
1911	......	......	......	**211,000**

VERMONT.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Barre—				
1910	......	......	......	6,532
Bellows Falls*—				
Progress	......	875	......	500

*200 feet of iron sewer incased in concrete under contract.

Chatham—
1911—Complete System proposed.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Fredericksburg—				
1910	......	......	......	2,000
St. Albans—				
1910	......	......	......	10,500

VIRGINIA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Danville—				
1910	......	......	......	93,000

Richmond—
$170,000 work in sewers being done. Budget for 1911 has not yet been adopted by City Council.

WASHINGTON.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Bellingham—				
1910	......	8,887	5,100	11,646
Progress	......	2,157	......	......
1911	......	**23,000**	......	......
Camp Washington—				
1910	......	13,200	......	6,400
1911	......	......	......	**8,000**
Colfax—				
1910	......	......	......	2,600
Everett—				
1910	......	2,123	......	18,798
Progress	7,798	......	2,971	25,454
Hoquiam*—				
1910	......	......	......	48,000
Progress	......	......	......	5,600
1911	......	......	......	**10,000**

* 3,000 feet of box sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Pullman—				
1910	......	......	......	9,900
1911	......	......	......	**5,000**
Puyallup—				
1910	......	......	......	21,100
Seattle*—				
1910	1,270	......	12,900	217,000

* 150 feet of creosoted wood stave sewer constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
S. Yakima—				
1910	......	......	......	2,500
Spokane—				
1910	......	......	......	114,600
Progress	......	23,750	......	......
1911	......	**26,400**	......	**143,000**
Tacoma—				
1910	......	39,758	3,485	160,248
Progress	......	6,072	8,712	19,008
1911	......	......	**8,712**	......
Walla Walla—				
1910	......	......	......	21,800
1911	......	......	......	**30,000**

WEST VIRGINIA.

Charleston—
$94,000 sewer system constructed in 1910.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Fairmont—				
1910	......	......	......	2,640
1911	......	......	......	**2,640**
Middlebourne—				
1911	......	......	......	**3,000**
Wheeling—				
1910	......	......	......	70,791

WISCONSIN.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Appleton—				
1910	......	600	......	11,903
Beloit—				
1910	......	......	......	13,200
1911	......	......	......	**5,280**
Burlington—				
1910	......	......	......	5,932
1911	......	......	......	**4,300**
De Pere—				
1910	......	......	......	2,750
Eau Claire—				
1910	......	......	......	9,378
1911	......	......	......	**900**
Fond du Lac—				
1910	......	......	......	7,137
1911	......	......	......	**10,560**
LaCrosse—				
1910	......	......	5,731	3,676
1911	......	......	......	**5,280**
Milwaukee—				
1910	11,647	......	......	39,249
1911	**26,400**	......	......	**36,960**
Oshkosh—				
1910	......	......	......	10,828
1911	......	......	**650**	**9,500**
Portage—				
1910	......	......	......	5,280
Progress	......	......	......	47,500
Racine—				
1910	100	......	2,000	10,560
Progress	......	......	......	1,600
Shawano—				
1911	......	......	......	**16,176**
Watertown—				
1910	......	......	......	1,655
1911	......	......	......	**3,500**
Waupaca—				
1910	......	......	......	4,178
1911	......	......	......	**5,280**
Wausau—				
1911	......	......	**2,400**	......

WYOMING.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Laramie—				
1910	......	......	......	2,640
1911	......	......	......	**10,560**

CANADA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Kingston, Ont.—				
1910	......	......	......	3,000
1911	......	......	......	**2,000**
New Westminster, B. C.—				
1910	......	45,000	......	......
Progress	......	......	......	75,000
1911	......	......	......	**75,000**

Cities	Brick	Con-crete	Rein-forced Con-crete	Vitri-fied Pipe
Swift Current, Sask.—				
1910	....	....	....	10,560
1911	....	....	....	**31,700**
Toronto, Ont.—				
1910	52,800	....	....	....
Progress	10,560	....	....	....
1911	**63,500**	....	....	....
Winnipeg, Man.—				
1910	....	6,240	....	78,400
Progress	....	12,600	....	....

SEWAGE DISPOSAL AND PUMPING PLANTS

CALIFORNIA.

Coalinga. A septic tank and filter bed will be built in 1911.
East San Jose. City completed septic tank and filter bed in 1911.
Fresno. A septic tank and 812 acre sewer farm were completed in 1910.
Portersville. The city completed 4 20x 30 septic tanks, and installed a 130-acre sewer farm.
San Mateo. Two septic tanks are to be built in 1911.
Santa Clara. One septic tank, a centrifugal pump, and a filter were installed in 1910.
Santa Cruz. The city will build a septic tank in 1911.

CONNECTICUT.

New Haven. City completed sand filtration plant and ½-acre filter bed in 1910.
Wallingford. City will build complete disposal plant in 1911.

GEORGIA.

Atlanta. A disposal plant will be built, and two small sewage pumps purchased in 1911.
Eastman. Two 100,000-gallon sewage pumps will be purchased in 1911.

ILLINOIS.

Canton. One septic tank was completed in 1910, and one will be built in 1911.
Chicago. Four clearwater flushing sewage pumps of 250 c. f. s. were purchased in 1910.
Chicago Heights. Extensive repairs to disposal plant were completed in 1910.
Collinsville. In 1910, a septic tank, 29x62x8 was completed.
In 1911, two small tanks will be built.
Dekalb. Complete disposal plant will be built in 1911.
Freeport. One sewage pump will be purchased in 1911.
Galena. Four flush tanks were installed in 1910.
Granite City. One septic tank was completed in 1910.
LaGrange. In 1911, a filter plant and pumping station will be built.
Taylorville. A settling basin was completed in 1910.

INDIANA.

Hammond. One sewage pump was purchased in 1910.
Indianapolis. Two centrifugal sewage pumps were purchased in 1910.

IOWA.

Des Moines. Two septic tanks were completed in 1910.
Indianola. The city completed a settling tank in 1910.
In 1911, one settling tank will be built.
Pella. A $2,500 disposal plant was built in 1910.
Sigourney. Will build 3 sewage disposal plants in 1911.

KANSAS.

Burlington. One septic tank, with an electric sewage pump was installed in 1910.
Concordia. The city has a stormwater disposal, controlled by a system of 12 dams.
Holton. Four 6x10 Adams feed time syphons are being installed.
Manhattan. Eight volute vertical motor-driven sewage pumps are being installed.
Olathe. A sewage disposal plant will be built in 1911.
Pratt. A septic tank was built in 1910.
Wellington. A disposal plant, or improvements to present system, will be put in operation in 1911.

MARYLAND.

Annapolis. Plans are being prepared for complete disposal system.

MASSACHUSETTS.

Easthampton. A ¼-acre sludge bed was completed in 1910.
Greenfield. A screen house is being built.

MICHIGAN.

Cadillac. A sewage pumping station is being built.

MINNESOTA.

Bemidji. A settling chamber was completed in 1910.
New Ulm. A septic tank and filter were completed in 1910.
St. Paul. In connection with sewer work in this city, 5914 ft. of sand rock tunnel was driven.

MISSOURI.

Nevada. A septic tank and filter bed will be built in 1911.
Sedalia. A $14,000 disposal plant will be built in 1911.

NEW JERSEY.

Elizabeth. Three 2,000 gal. per minute pumps were installed in 1910.
Millville. One small centrifugal pump was purchased in 1910.
Plainfield. The present pneumatic ejector plant is to be enlarged in 1911.

NEW YORK.

Batavia. A $375,000 sewerage system is under construction.
Oneida. One complete disposal plant will be built in 1911.

NORTH DAKOTA.

Mandan. One highwater sewage pump has been contracted for.

OHIO.

Akron. Plans have been prepared for a $300,000 disposal plant.
Bellefontaine. An automatic syphon system and filtration field are contemplated for 1911.
Bucyrus. Four settling tanks, 6 filter beds, ½-acre sprinkling filter, and 2 sewage pumps are included in the system to be built in 1911.
Delaware. Disposal plant will be built in the spring of 1911.
Fostoria. City is remodeling its present disposal plant.

Louisville. The contracts are let for a complete disposal plant and one sewage pump.
Niles. A disposal plant, with all accessories, will be built in 1911.
Oberlin. The city completed a disposal plant in 1910.
Salem. The State Board of Health has ordered the construction of a disposal plant.
Wadsworth. A $17,953 plant, including 4 sewage pumps, was completed in 1910.
Youngstown. Plans are prepared for 2 disposal plants, which will be constructed in 1911.

OKLAHOMA.

Chandler. The city completed a $3,500 disposal plant.
Muskogee. The city will build a $10,000 disposal plant in 1911.
Norman. The city completed a septic tank, and installed 7 Miller-Potts automatic syphon flush tanks in 1910.
In 1911, one 500,000-gallon pump will be purchased.

OREGON.

The Dalles. Plans are prepared for a complete disposal plant.

PENNSYLVANIA.

Carbondale. A disposal plant will be built in 1911.
Chambersburg. Plans for a disposal plant and trunk sewer have been prepared.
Corry. A disposal plant is contemplated for 1911.
Doyleston. Septic tanks and filter beds were completed in 1910.
Franklin. A complete disposal plant will be constructed in 1911.
Ligonier. A sedimentation tank, sprinkling filters, and one sewage pump will be installed in 1911.
Norristown. A complete disposal plant will be constructed in 1911.
Northeast. A sewage disposal plant will be built in 1911.

SOUTH CAROLINA.

Florence. A disposal plant is under construction.

SOUTH DAKOTA.

Mitchell. A complete disposal plant will be built in 1911.

TENNESSEE.

Memphis. The following additions to the sewage disposal system were completed in 1910:
One 7½ h. p., and one 15 h. p. electric motor, direct connected to 3-inch and 4-inch pumps, and two 20-inch, 150 h. p. pump, one 24-inch, 175 h. p. pump, and one 8-inch, 50 h. p. pump.

TEXAS.

Belton. A sewage disposal plant is being constructed.
Dallas. A $550,000 bond issue has been passed for the construction of a disposal plant. Two sewage pumps will be purchased in 1911.
El Paso. A disposal plant will be built in 1911.
Texas City. Two sewage pumps will be purchased in 1911.

UTAH.

Ogden. A complete disposal plant will be constructed in 1911.

VERMONT.

Fredericksburg. A water power plant is being constructed.

WASHINGTON.

Pullman. A septic tank was completed in 1910.

WISCONSIN.

Beloit. A disposal plant for a new district will be built in 1911.
Portage. The city completed a disposal plant in 1910.
Waupaca. One septic tank, 14x95, was constructed in 1910.

CANADA.

Toronto, Ontario. The city completed a septic tank and contact beds, and installed 2 sets of motor-driven pumps in 1910.
In 1911, a disposal system for the entire city, with duplicate motor-driven pumps, will be constructed.

WATER WORKS IMPROVEMENTS

Official Reports of Water Works Improvements Made to Municipal Engineering by the Managers of the Water Works Plants of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each kind of water pipe laid in the year 1910.

In the line "Progress" is given the number of linear feet of each kind of water pipe now under contract.

In the line "1911" is given the number of linear feet of each kind of water pipe proposed for construction in 1911, printed in heavy type so that it can be distinguished readily.

ALABAMA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Dothan—				
1910.....	15,800	....	....	....
Talladega—				
1910.....	10,000	....	....	....

ARKANSAS.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Arkansas City—				
1910.....	4,000	7,000	....	....
Batesville—				
Extensions of water mains proposed for 1911.				
Ft. Smith*—				
1910.....	60,000	....	....	....

* City has taken over plant from private company.

CALIFORNIA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Antioch—				
1911.....	**1,500**	....	....	....
Lodi—				
1910.....	31,700	....	....	....
Oceanside—				
Progress.	10,350	....	....	....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Palo Alto—				
1910	7,367			
1911	**5,000**			
Portersville—				
1910	5,000			
1911	**45,000**			
San Bernardino—				
1910	15,800			
San Diego—				
1910	50,530	91,450		
Progress.	15,312	11,616		
1911	**39,072**	**77,088**		
Santa Clara—				
1910	5,280	5,280		
Minor extensions in 1911.				
Santa Cruz—				
1910	8,372	4,310		
Visalia—				
1910		4,000		
COLORADO.				
Rocky Ford—				
1910		373		
Progress.	300			
1911	**10,560**			
CONNECTICUT.				
Meriden—				
1910	9,500			
S. Norwalk—				
1910	1,937			
Terryville—				Galvanized
1910	3,500			1,200
Wallingford—				
1911	**1,500**			
FLORIDA.				
Jacksonville—				Galvanized
1910	21,351			24,945
Miami—				
1910	84,500			
GEORGIA.				
Americus—				
1911	**10,560**			
Atlanta—				
1910	216,480			
1911	**158,400**			
Cordelay—				
1910	3,500			
Eastman—				
1911		**13,200**	**10,560**	
Valdosta—				
1910	5,300			
Wrightsville—				
1910	10,560			
Progress.		10,560		
IDAHO.				
Lewiston—				
1911				**10,560**
Payette—				
1911			**15,000**	
ILLINOIS.				
Aurora—				Lead
1910	36,639	145		50
Canton—				
1910	7,940			
1911	**7,940**			
Chicago Heights—				
1910	10,000			
1911	**15,000**			
Collinsville—				
1910	10,560			
Decatur—				
1910		25,000		
Dekalb—				
1910	5,000			
Elgin—				
1910	7,237			
Eureka—				
1910	7,960			
1911	**3,960**			
Galena—				
1910	28,950			
Galesburg—				
1910	11,750			
1911	**10,560**			

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Joliet—				
1910	1,840			
1911	**4,000**			
LaGrange—				
1910	500			
Mattoon—				
1911	**2,700**			
Moline—				
1910	15,300			
Progress.	7,940			
Morton—				
1910	3.000			
Moweaqua—				
1910			10,560	
Oak Park—				
1910	23,600			
1911	**10,560**			
Ottawa—				
1910	1,600			
Paris—				
1910	2,600			
Paxton—				
1910	3,960			
1911	**5,000**			
Petersburg—				
1910	2,500			
Quincy—				
1910	10,560			
Rockford—				
1910	30,000			
1911	**50,000**			
Rock Island—				
1910	12,100			
Progress.	3,600			
1911	**4,400**			
Taylorville—				
1910	10,560			
Waukegan—				
1910	11,200			
INDIANA.				
Anderson—				
1910	10,544	500		
Bloomington—				
1910	84,500			
1911	**10,560**			
Brazil—				
1910	3,000			
1911	**1,500**			
Butler—				
1911	**1,000**			
Columbia City—				
1910	2,640			
1911	**1,320**			
Columbus—				
1911	**2,640**			
E. Chicago—				
1910	7,558			
Elkhart—				
1911	**21,390**			
Evansville—				
1910	21,100			
Ft. Wayne—				
1910	18,400			
1911	**36,900**			
Hammond—				
1910	16,925			
1911	**3,600**			
Huntington—				
1910	5,200			
Indianapolis—				
1910	52,800			
1911	**52,800**			
Lafayette—		Service Attachments		
1910	5,600			154
1911				**150**
Logansport—				
1910	211,000			
1911	**10,560**			
Marion—				
1910	53,000			
1911	**1,580**			
Martinsville—				
1910	1,320			
Michigan City—				
1910		7,940		

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Mishawaka—				
1910	9,767			
Noblesville—				
1910	50,145	6,000		
Remington—				
1911		**600**		
Rushville—				
1910	10,560	5,280		
Progress.	5,280			
1911	**5,280**			
Sullivan—				
1910	500			
Tipton—				
1910		1,000		
1911		**1,000**		

IOWA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Albia—				
1910	2,000			
Ames—				
1910	2,200			
Belle Plaine—				
1910				26,400
Burlington—				
1910	17,100			
1911	**10,560**			
Cedar Falls—				
1910	6,600			
Cedar Rapids—				
1910	9,000			
Progress.	2,000			
Charles City—				
1910	21,100			
1911	**10,560**			
Des Moines—				
1910	137			
Eldora—				
1910	2,510			
1911	**1,000**			
Ft. Dodge—				
1910	10,560			
Glenwood—				
1910	400			
Grinnell—				
1910	2,000			
Indianola—				
1910	21,100			
Mason City—				
1910	13,200			
1911	**10,560**			
Mt. Pleasant—				
1910	4,350			
1911	**3,000**			
Muscatine—				
1910	15,800			
1911	**15,800**			
Newton—				
1910	300			
Pella—				

Constructed $60,000 plant in 1910.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Sioux City—				
1910	25,509	400		10,500
Waterloo—				
1910	74,000			
1911	**15,800**			
Webster City—				
1910	2,500			
1911	**3,000**			

KANSAS.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Abilene—				
Progress.	74,000	13,200		
Arkansas City—				
1910	3,960			
1911	**79,100**			
Burlington—				
1911	**33,000**			
Chanute—				
1910	11,000			
Cherryvale—				
1911	**36,900**			
Clay Center—				
1910		1,000		
Progress.		900		
Coffeyville—				
1910	15,000	5,000		
1911	**20,000**	**5,000**		
Emporia—				
1910	3,960			
1911	**3,850**			
Holton—				
1910	700	3,000		
Manhattan—				
1910	8,800	8,000		
Newton—				
Progress.	5,000			
Olathe—				
1910	1,000			
Ottawa—				
1910	4,400			
Pratt—				
1910	18,672			
Salina—				
1910		18,000		
Topeka—				
1910	13,200			
Progress.	1,900			
1911	**15,800**			
Wellington—				
1910	10,560			
1911	**10,560**			

KENTUCKY.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Ashland—				
1910	5,280			
Earlington—				
Progress.	3,200			
Louisville—				
1910	57,000			
1911	**95,100**			

LOUISIANA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Opelousas—				
Progress.		1,800		
1911		**2,630**		

MAINE.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Augusta—				
1910	3,441	1,774		
1911	**2,500**	**1,500**		
Calais—				
1910		1,800		

MARYLAND.

Baltimore—

1911—27 tons of cast iron pipe.

Cumberland—

James H. Fuertes is investigating for proposed $500,000 water supply system, which will be voted on shortly.

Pocomoke—

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Progress.	5,000			

Proposed new wells to reinforce present supply.

MASSACHUSETTS.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Attleboro—				Cement lined
1910	14,676			4,201
Progress.	3,500			
1911	**10,000**			**3,000**
Easthampton—				
1910	18,000			
1911	**15,000**			
Everett—				
1910	1,790			
Greenfield—				
Progress.	5,280			
Lowell—				
1910	10,700			
Medford—				
1910	8,167			
Quincy—				Cement
1910	18,480			18,480
Reading—				
1910	2,000	5,460		
Revere—				
1910	8,610			
1911	**7,920**			
Springfield—				
1910	52,148			
1911	**40,000**			
Webster—				
1910	3,500			
Worcester—				
1910	52,800			

MICHIGAN.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Alpena—				Galvanized
1910			5,125	3,300
Battle Creek—				
1910	15,800			
1911	**15,800**			
Belding—				
1910	2,694			
1911	**1,600**			
Escanaba—				
1910	5,280			
1911	**5,280**			
Flint—				
1911	**105,600**			
Gladwin—				
1910			800	
1911			**800**	
Grand Rapids—				
1910	32,267			
Greenville—				
1910	54,646			
Harbor Springs—				
Progress.	15,800			
Highland Park—				
1910	24,205			
1911	**6,047**			
Jackson—				
1910	29,000			
1911	**15,800**			
Kalamazoo—				
1911	**43,000**			
Lake City—				
1910			400	
1911			**300**	
Lansing—				
1910	10,560			
Manistique—				
1910	1,200			
Marine City—				
1910	400			
Marshall—				
1910	1,550			
Mt. Clemens—				
1910	2,640			
Norway—				
1910	111,000			
1911	**2,700**			
Port Huron—				
1910	5,290			
Rochester—				
1911	**2,500**			
Saginaw—				Cement
1910	13,200			
Progress.				1,200
Sault Ste. Marie—				
1910	300			
Three Rivers—				
1910	2,640			
1911	**2,640**			
Whitehall—				
1910	800	2,000		
1911	**400**			
Wyandotte—				
1910	400			

MINNESOTA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Amboy—				Galvanized
1910				1,320
Bemidji—				
1910	2,400			
1911		**1,200**		
Cloquet—				
1910	7,000			
1911	**10,000**			
Crookston—				
1910	11,420			
1911	**1,000**			
Duluth—				
1910	46,166			
1911	**102,312**			
Faribault—				
1910	3,906			
1911	**3,000**			
Hastings—				
1910	1,182			
Progress.	3,000	1,045		
1911		**1,500**		
Madelia—				
1911	**2,800**			
Mankato—				
1910	4,355			
Minneapolis—				
1910	210,200			
Montevideo—				
1910	6,700			
1911	**400**			
New Ulm—				
1910	1,280			
Progress.	1,250			
1911	**860**			
Red Wing—				
1910	2,000			
1911				**2,640**
St. Cloud—				
1911	**2,640**			
St. Paul—				Cement
1910	13,625	6,792		2,100
1911	**52,800**			
St. Peter—				
1911	**3,000**			
Virginia—				
1910	21,100			
1911	**10,560**			
Winona—				
1910	1,780			
Worthington—				
1911	**6,000**			

MISSISSIPPI.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Clarksdale—				
1910	1,000			
1911	**2,600**			
Hattiesburg—				
1911	**10,000**			
Yazoo City—				
1910	4,800			

MISSOURI.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Aurora—				
Progress.	10,560			
1911	**5,280**			
Brookfield—				
1910	19,800			
1911	**2,640**			
Fulton—				
1910	1,724			
1911	**2,640**			
Glasgow—				
1911	**1,200**			
Kansas City—				
1910	80,600			
Progress.	71,400			
1911	**158,000**			
Lebanon—				
1911		**15,800**		
Libertyville—				
1910	12,000			
Louisiana—				Galvanized
1910				400
1911	**600**			**1,000**

Moberly—
1911—$50,000 improvements to municipal plant, mains, pumps, engines, etc.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Tarkio—				
1910		2,640		

MONTANA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Bozeman—				
1910	640		2,700	
1911			**4,500**	
Deer Lodge—				
1910	21,100		31,700	
1911	**2,000**		**3,000**	
Glasgow—				
1910	58,000		2,640	
Great Falls—				
1910	6,794			
1911	**12,000**			
Helena—				Steel
1911	**228,036**		**112,415**	**430**
Lewistown—				
1910	3,000			
1911	**50,000**			

NEBRASKA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Chadron—				
1910	2,700			
1911	**8,000**			
Columbus—				
1911	**15,800**			
Hastings—				
1911	**10,560**			
Lincoln—				
1910	19,500			
1911	**21,100**			
Norfolk—				
1910	5,800			
1911	**3,000**			
Red Cloud—				Vitrified
1911	**1,500**			**9,500**
Tecumseh—				
1910	10,560			
University Place—				
1911	**3,000**			
Wymore—				
1911	**13,500**			

NEVADA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Reno—				
1910		1,352		
1911		**10,560**		

NEW HAMPSHIRE.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Keene—				
1910	6,012			
Littleton—				
1910	6,470			
Raymond—				
1910	350			

NEW JERSEY.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Atlantic City—				
1910	12,000		25,000	
1911	**20,000**			
Bayonne—				
1910	6,440			
Bloomfield—				
1910	26,400			
1911	**26,400**			
Garfield—				
1910	21,100			
Irvington—				
1911—Municipal plant being considered.				
Jersey City—				
1910	11,774			
Millville—				
1910	10,560			
Montclair—				
1910	12,331			
Newark—				
1910	49,100			
New Brunswick—				
1910	11,987			
Nutley—				
1910	13,200			
1911	**1,700**			
Ocean City—				
1910	15,800			
1911	**5,280**			
Perth Amboy—				
1910	13,400			
1911	**15,000**			
Rutherford—				
1911				**5,280**

NEW YORK.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Albany—				
1910	21,100			
1911	**26,400**			
Amsterdam—				
1910	7,770			
Auburn—				
1910	2,640			
Batavia—				
1911	**500**			
Binghamton—				
1911		**10,560**		
Buffalo—				
1910	43,556			
Progress.	26,400			
1911	**52,800**			
Corning—				
1910	2,400			
Dunkirk—				
1910	10,560			
Progress.	5,280			
Elmira—				
1910	10,000			
1911	**19,800**			
Herkimer—				
1910	1,357			
Huntington—				
1910	7,749			
1911	**11,100**			
Jamestown—				
1910	7,640	6,458		
Keeseville—				
1911	**5,300**			
Little Falls—				
1911	**2,500**			
Little Valley—				
1911	**42,200**			
Millerton—				Cement conduit
1911	**3,000**			**300**
Newark—				
1911	**4,200**			
Niagara Falls—				
1910	36,300			
Olean—				
1910	21,100			
1911	**10,560**			
Oneida—				
1910	1,320			
1911	**2,640**			
Plattsburg—				
1910	2,400			
1911	**10,000**			
Potsdam—				
1910	3,500			
Rome—				Cement
1910	31,700			31,700
Salamanca—				
1910	4,230			
1911	**6,340**			
Seneca Falls—				
1910	24,059			
Progress.	900			
Solvay—				
1190	1,000			
1911	**500**			
Syracuse—				
1911	**26,400**			
Troy—				
1910	10,000			
1911	**10,000**			
White Plains—				
1910	1,000			
Progress.		1,000		
1911	**300**			

NORTH CAROLINA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Asheville—				
1910	5,280			
Greensboro—				
1910	10,560			
1911	**10,560**			
Greenville—				Cement
1910	2,000		1,000	200
1911	**1,000**			
Hendersonville—				
1910	13,200	21,100		
Progress.		10,560		
Raleigh—				
1910	2,500			
Wilmington—				
1910	78,400			
Wilson—				
1911	**2,000**			

NORTH DAKOTA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Bismarck—				
1910	5,000			
Grand Forks—				Cement lined
1910	3,132			
1911				**10,560**
Jamestown—				
1910	2,640			
Progress.	5,280			

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Mandan—				
1910	6,000			
1911	**31,700**			
Minot—				
1910	61,136			
Wahpeton—				
1910	800			
1911	**2,500**			
Williston—				
1910	23,241			
1911	**2,660**			

OHIO.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Alliance—				
1910	8,000	2,000		
1911	**4,000**	**1,000**		
Bellefontaine—				
1910	6,600			
1911	**1,320**			
Bowling Green—				
1910	1,000			
Bucyrus—				
1910	4,000		10,560	
Cadiz—				
1910		8,600		
Canal Dover—				
1911	**2,800**			
Carrolton—				
1910	1,700			
Cincinnati—				
1910	95,500			
Cleveland—				
1910	105,600			
1911	**105,600**			
Cleveland Heights—				
1910	15,800			
1911	**10,560**			
Coshocton—				
1910	1,580			
Defiance—				
1910	2,500			
Delaware—				
1911	**2,640**			
E. Cleveland—				
1910	5,280			
1911	**3,960**			
E. Liverpool—				
1910	1,500			
1911	**2,000**			
Elyria—				
1910	26,000			
Euclid—				
1910	21,100			
1911	**26,400**			
Galion—				
1910	5,280			
1911	**2,640**			
Greenville—				
1910	1,350			
Leetonia—				
1911	**1,320**			
Lorain—				
1910	15,800			
1911	**21,100**			
Millersburg—				
1910	1,800			
Niles—				
1910	10,560			
Progress.	24,300			
Norwalk—				
1910	2,640			
1911	**7,920**			
Norwood—				
1910	2,500	2,640		
1911	**2,000**			
Ravenna—				
1910	2,000			
Reading—				
1910	3,000			
Steubenville—				
1910	5,280			
1911	**5,280**			
Toledo—				
1910	58,340			
1911	**900 tons**			
Warren—				
1910	15,840			
Progress.	5,280			
West Carrollton—				
1911	**3,000**			
Youngstown—				
1910	10,560			
Zanesville—				
1910	4,800			
1911	**4,100**			

OKLAHOMA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Clinton—				
1910	15,800			
1911	**52,800**			
El Reno—				
1911	**79,200**			
Enid—				
1910	52,800			
Guthrie—				
1910	18,000			
1911	**16,000**			
Lawton—				
1910	63,500			
Progress.	15,800			
1911	**26,400**			
Muskogee—				
1910	24,160			
Progress.	3,200			
1911	**35,000**			
Oklahoma City—				
1910	158,000			
Shawnee—				
Progress.	26,400			
Tulsa—				
1911	**25,000**			
Vinita—				Galvanized
1910				50,000
1911				**40,000**

OREGON.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Cloquille—				
1911			**21,100**	
The Dalles—				
1910	1,500		600	

PENNSYLVANIA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Altoona—				
1910	12,270			
1911	**12,270**			
Bellwood—Minor extensions.				
Bradford—				
1911	**4,000**			
Chambersburg—				
1910	2,000			
Progress.	55,400			
Dalton—System being put in.				
Doyleston—				
1911	**1,000**			
Erie—				
1910	28,502			
Galitzin—Preliminary surveys being made.				
Harrisburg—				
1910	28,384			
1911	**26,400**			
Huntington—				
1910	5,800			
Ligonier*—				
1911			**8,405**	**4,212**
McKees Rock—				
1910	500			
1911	**1,500**			
Northeast—				
1910	105,600			
Oil City—				
1910	2,900			
Scottdale—				
1910	15,800			
Progress.	15,800			
1911	**52,800**			
Somerset—				
Progress.	4,600			
Waynesboro—				
1910	1,600	3,960		

*Cement lined pipe, 202 ft.; cement pipe, 570 ft.; others, 3,440 ft.

RHODE ISLAND.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Pawtucket—				
1910	25,500	8,350		
Providence—				
1910	27,800			
Rumford—				
1910	2,640	3,000		

SOUTH CAROLINA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Chester—				
1910	4,000			
Florence—				
1910	34,300			
Union—				
1910	63,400			
Progress.	2,640			
1911	**2,640**			

SOUTH DAKOTA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Aberdeen—				
1910	13,941			
Faulkton—				
1910	1,000			
1911	**1,000**			
Flandreau—				
1910	1,500			
Lennox—				
1910	6,400			
Progress.	2,200			
1911	**3,000**			
Minot—				
1910		591,360		
Pierre—				
1910	5,280			
1911	**7,920**			
Rapid City—				
1910	6,000		21,100	
Sioux Falls—				
1910	31,700			
1911	**10,560**			

TENNESSEE.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Cleveland—				
1911	**4,500**			
Columbia—				
1910	3,000			
Knoxville—				
1910	15,073	1,850		
1911	**20,000**	**2,000**		
Nashville—				
1910	37,573			
Paris—				
1910	21,000			
1911	**1,000**			

TEXAS.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Belton—				
Progress.	3,700			
Dallas—				
Progress.	*11,000			
*Tons.				
Denison—				
1910	6,000	15,000		
Progress.	20,000			
1911	**8,000**			
El Paso—				
Progress.	26,400			
1911	**31,680**			
Greenville—				
1910	2,640	10,560		
San Antonio—				Cement
1910	79,200			
Progress.	500	2,000	1,000	
1911			**25,000**	**25,000**
San Marcos—				
1910	15,000			
1911	**6,000**			
Texas City—				
1911	**42,240**			

UTAH.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Ogden*—				Kalamein Pipe
1910				40,000
Progress.				8,000
1911				**40,000**

* 5,280 ft. cement pipe proposed for 1911.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Provo—				Cement
1910	47,500			
1911			**18,000**	**18,000**
Salt Lake City—				Vitrified pipe
1910	119,911			193
Progress.	2,000			
1911	**105,600**			

VERMONT.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Barre—				
1910	175	960		
Bellows Falls—				
1911	**1,000**			
St. Albans—				
1910	3,100			

VIRGINIA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Chatham—				
1910		1,000		
Danville—				
1910	174,500			
Fredericksburg—				
1910	2,000			
Richmond—				
1910	51,400			
1911	**47,600**			

WASHINGTON.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Bellingham—				Galvanized
1910	7,850		15,837	1,678
Progress.	440			
1911	**5,000**		**12,000**	
Colfax—				
1910		9,000		
Kent—				
1910			52,800	
Pt. Angeles—				
1910				*52,800
*Wood, steel, cast-iron and wrought iron pipe.				
Port Townsend—				
1910		18,000	10,000	
Seattle*—				Steel
1910	208,400		6,980	690
*Data regarding prospective work too late for this table.				
Spokane—				
19 10	103,800		31,700	*360,800
*Kalamein, 308,000 ft.; riveted steel force mains, 52,800 ft.				
Tacoma—				
1910	97,947		18,283	
Progress.	16,465		54,986	
Walla Walla—				Kalamein
1910				*15,840
1911				**26,400**
*Steel pipe, 6,000 ft.				
Wenatchee—				
1910	10,560		9,000	

WEST VIRGINIA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Fairmont—				
1910	10,560			

Middlebourne—Considering installation of water works.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Romney—				
1911	**15,800**		**1,200**	
Wheeling.				
Progress.	7,400			

WISCONSIN.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Berlin—				
Prospect.		2,600		
Burlington—				
1910	4,032			
1911	**4,000**			
Eau Claire—				
1911	**6,500**			
Hartford—				
1910	1,000			

LaCrosse—Extensions in prospect for 1911.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Milwaukee—				Water pipe tunnel
1910	87,389			467
1911	**82,280**			
Port Washington—				
1910	100			
1911	**2,000**			

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Shawano—				
1911	**17,245**	....	....	....
Sparta—				
1910	900	....	....	....
1911	**5,280**	....	....	....
Watertown—				
1910	1,800	....	....	....
1911	**500**	....	....	....
CANADA.				
Kingston, Ont.—				
1910	3,960	....	....	....
1911	**2,640**	....	....	....
Revelstoke, B. C.—				
1910	....	....	28,000	....
Swift Current, Sask.—				
1910	....	5,280	....	....
1911	....	**42,240**	....	....
Toronto, Ont.—				
1910	154,900	....	....	....
1911	**317,000**	....	....	....
Winnipeg, Man.—				
1910	73,600	....	....	....

WATER SUPPLIES

The following items, arranged alphabetically by States and cities, give the reports of work for 1911 in connection with the water supply department of water works plants.

The information includes that regarding construction of reservoirs, dams, pumping stations, filtration plants, etc. It also includes data regarding tanks, meters and other appurtenances not readily included in the preceding table:

ALABAMA.

Dothan—In 1911 this city will build a 1,000,000-gal. reinforced concrete reservoir and construct a combined electric power and pumping station.

ARKANSAS.

Arkansas City—A 4,000,000-gal. tank was built, 2 boilers and 2 pumps were purchased in 1910.

Batesville—A filtration plant will be built and a 9x12 Gould triplex pump will be purchased in 1911.

CALIFORNIA.

Lodi—A 100,000-gal. steel tank was built in 1910.

Palo Alto—A concrete water tank was constructed in 1910. In 1911 a new building, new well and pump were installed.

Portersville—In 1911 an auxiliary station, including a 500,000-gal. reservoir, will be constructed.

San Bernardino—In 1911 a reservoir will be constructed, which will be the third in the present system.

San Diego—A 17,620,000-gal. reinforced concrete reservoir was completed in 1910.

Santa Cruz—Two small dams were built in 1910.

Visalia—In 1911 an electrically-driven 500,000-gal.-per-minute 4-in. centrifugal pump will be purchased.

COLORADO.

Rocky Ford—In 1911 a pumping station and filtration plant will be constructed.

CONNECTICUT.

Meriden—The Broad Brook addition and extension will be built.

Perryville—The reservoir will be enlarged in 1811.

South Norwalk—A 50,000-gal. electric pumping station was completed in 1910.

Wallingford—A 100,000,000-gal. reservoir will be built in 1911.

FLORIDA.

Jacksonville—A 3,000,000-gal. covered reinforced concrete reservoir is being constructed and a 950-ft. 10-in. well being driven at present time.

Miami—A circular 50-ft. reservoir, 12 ft. deep, was built, and 1 Plattz 2,000,000-gal. and 1 Lawton-Gordon 3,000,000-gal. pump were purchased.

GEORGIA.

Americus—A 100,000-gal. reservoir will be constructed in 1911.

Atlanta—A coagulating basin of 3,000,000-gal. capacity was completed in 1910, and a 250,000,000-gal. reservoir and 10,000,000-gal. filtration plant are being constructed at present time.

Cordelay—One reservoir, with dam, was constructed in 1910.

Cuthbert—An artesian well and 150,000,000-gal. receiving well will be constructed in 1911.

Ft. Valley—A reservoir and air compressor pumping station will be built in 1911.

Wrightsville—In 1910 the following improvements were completed: A 100,000-gal. reinforced concrete reservoir, a 100,000-gal. steel tank and a 1,500,000-gal. pumping station.

IDAHO.

Lewiston—A 3,500,000-gal. centrifugal pump is being installed.

ILLINOIS.

Aurora—Two 250-ft. artesian wells were driven in 1910. In 1911 2 boilers will be purchased and a stack erected.

Canton—Extensive improvements are contemplated for 1911.

Chicago Heights—In 1911 deep-well pumps, electrical equipment, engines and 1,500 meters will be purchased.

Danville—In 1911 an additional pump unit and an extension to the dam will be added.

Downers Grove—A standpipe will be built in 1911.

Elgin—Eighteen hydrants will be purchased in 1911.

Eureka—In 1911 a 270-gal.-per-minute pump will be bought and a 65-ft. 10-in. well will be driven.

Galena—In 1910 a 20x50 circular steel reservoir was built and steam duplicate pumps were installed.

Galesburg—In 1910 2 boilers, 1 6,000,000-gal. pump, directly connected to Lentz engine, were installed.

Joliet—In 1910 a hypo-sterilization plant was installed, and in progress are 2 pumping plants and 2 artesian wells.

Morton—In 1911 a motor-operated 8-in. well will be driven.

Moweaqua—In 1910 a brick pumping station was erected.

Oak Park—In 1911 a booster plant will be installed.

Quincy—In 1910 1 pumping station and a 6,000,000-gal. $40,000 high duty pump were installed.

Waukegan—In 1910 the pumping station was enlarged and a 6,000,000-gal. pump was installed.

Wheaton—A 500,000-gal. producer gas engine was installed in 1910.

INDIANA.

Anderson—One unit of filtration plant was installed in 1910.

Brazil—A compressor room and air compressor are in progress at present.

Butler—In progress are 2 motor-driven 250,000-gal. pumps.

Columbia City—In 1910 3 350-h. p. vertical boilers were installed.

Columbus—In 1910 6 meters were installed. In 1911 100 more will be added. A filtration plant is also in prospect.

Evansville—In 1910 a Holly pumping station was installed, and in progress is a filtration plant, which will be completed in 1912.

Fort Wayne—In 1910 a reservoir and 3 pumping stations were installed.

Indianapolis—In 1911 a dam will be built at Broad Ripple and a large amount of work be done at the pumping station and filtration plant.

Logansport—In 1910 a timber dam and a 9,000,000-gal. pumping station were installed. In 1911 a 6,000,000-gal. pump 273 valves are in prospect for 1911. and a 500,000-gal. centrifugal pump, together with a brick addition to the pumping station, will be added.

Marion—In 1910 4 valves, 10 hydrants and 66 meters were installed. In 1911 3 valves and 3 hydrants will be added.

Martinsville—A supply well was drilled in 1910.

Mishawaka—In 1910 a reservoir and pumping station will be installed.

Newcastle—An auxiliary pumping station will be installed in 1911.

Noblesville—In 1910 3 reservoirs, 1 pumping station and 2 1,500,000-gal. pumps, with 1 air compressor, will be installed.

Remington—A filtration plant will be installed in 1911.

Richmond—Three 150-h. p. horizontal boilers were installed in 1910.

Rushville—In 1911 2 8 and 16-in. wells were driven.

Tipton—A $900 extension was added to the pumping station and 41 meters were installed in 1910. In 1911 extensions to the amount of $3,000 to the pumping station will be completed, and 100 meters will be added.

IOWA.

Clinton—A 2,200-ft. 10-in. well was drilled in 1910.

Council Bluffs—In 1910 1 filtration plant was completed. The city has commenced condemnation proceedings to acquire the plant, which is at present in private ownership.

Des Moines—In 1910 1 pumping station and a 3,300-lin.-ft. 4-ft. circular gallery were constructed.

Eldora—New machinery was installed in 1910.

Ft. Dodge—In 1911 a new deep-well and pump will be put in.

Grinnell—An air compressor was completed in 1910.

Independence—Two triplex pumps were added in 1910.

Indianola—Twenty-one Eddy hydrants were added in 1910.

Mason City—A $3,000 pumping station was completed in 1910. A $6,000 one is in prospect for 1911.

Muscatine—In 1910 30 hydrants were installed. In 1911 30 hydrants and a standpipe will be added.

Sigourney—One filtration plant will be constructed in 1911.

Sioux City—Three 16-in. wells were driven in 1910.

Waterloo—In 1910 a 1,750,000-gal. reservoir was constructed. In 1911 a centrifugal pump for artesian wells and dynamos to drive same will be installed.

Webster City—A pumping station, with a 50-h. p. gasoline engine for emergency use, was completed in 1910.

KANSAS.

Abilene—In progress is a 100-ft. 130,-000-gal. standpipe.

Arkansas City—In progress is a complete $90,000 system, and in prospect is 1 dam, 1 pumping station and 1 filtration plant.

Burlington—Wells are in prospect for 1911.

Cherryvale—An electric pumping station was completed in 1910.

Clay Center—A 1,000,000-gal. pump will be added in 1911.

Coffeyville—In prospect for 1911 are 1 dam, 1 boiler and a 6,000,000-gal. filtration plant.

Emporia—An engine in prospect for 1911.

Holton—Two air-lift pumping stations and 2 Roop oil burners for boilers were installed in 1910.

Manhattan—In prospect for 1911 is 1 2-stage, 5-in. vertical, motor-driven turbine pump.

Newton—An addition to the pumping station, a 200,000-cross compound flywheel pumping engine and 2 wells are in prospect for 1911.

Ottawa—At present the intake at the pumping station is being improved.

Pratt—A 100,000-gal. reservoir was completed in 1910.

Topeka—Additional wells will be drilled in 1911.

KENTUCKY.

Earlington—A 150,000-gal. reservoir is in progress.

Louisville—In 1910 a coagulating basin was completed. A 30,000,000-gal. centrifugal pump, an intake tower costing $69,800 and a 30,000,000-gal. turbine-driven centrifugal pump costing $40,000 are being installed.

Newport—A $60,000 reservoir and boilers costing $4,000 were completed in 1910.

Owensboro—A $30,000 softening plant is in prospect for 1911.

LOUISIANA.

Morgan City—A complete water works system is in prospect for 1911.

MAINE.

Augusta—Reservoir extensions, additions to the dam, a new floor and brick arches for the pumping station will be built, and 20,000 white pine trees will be set out on the watershed.

MARYLAND.

Baltimore—A 20,000,000,000-gal. reservoir, a 120,000,000-gal, filtration plant and a dam 100 ft. long by 70 ft. in height are in prospect.

Brunswick—A concrete reservoir is in progress.

Cumberland—James H. Fuertes is investigating for the proposed $500,000 water supply system, which will be voted on shortly.

Pocomoc City—New wells are proposed to reinforce present supply.

MASSACHUSETTS.

Attleboro—One reservoir and dam are being constructed.

Easthampton—A 2,000,000-gal. concrete covered reservoir was completed in 1910. In 1911 an engine and pump will be purchased.

Greenfield—A storage reservoir is being constructed.

Reading—A 1,500,000-gal. filtration plant was completed in 1910.

MICHIGAN.

Battle Creek—A small extension to the pumping station is in prospect.

Belding—In 1910 72 service lines were completed. For 1911 4 wells are in prospect.

Bessemer—One additional reservoir is in prospect.

Escanaba—A 6,000,000-gal. filtration plant was completed in 1910.

Flint—A $400,000 plant, with pipe extensions, is in prospect for 1911.

Grand Rapids—A pumping station is nearly completed. A contract has been let for a $400,000 filtration plant, with pipe extensions.

Hancock—A 1,000,000-gal. reservoir has been constructed and a 30-pipe 2-in. well point has been sunk. An electric pumping station will be built in 1911.

Harbor Springs—Two reservoirs and a $13,000 pumping station are in prospect.

Kalamazoo—A 350,000-gal. standpipe was constructed in 1910.

Marshall—Extensive improvements to the pumping station are in prospect for 1911.

Mt. Clemens—A 3,000,000-gal. pumping engine is in prospect for 1911.

Norway—A 3,000,000-gal. reservoir was completed and a 9x12 triplex pump of 500,000 gals. capacity was installed. Ten hydrants will be purchased in 1911.

St. Johns—A 1,000,000-gal. pumping engine is in prospect for 1911.

Wyandotte—A 3,000,000-gal. Pratt Iron Works pump was purchased and a $5,000 building constructed in 1910.

MINNESOTA.

Appleton—A 500-gal.-per-minute air lift steam or motor-driven pump will be installed in 1911.

Cloquet—Repairs and extensions to pumping station were completed in 1910, and further extensions are in prospect for 1911.

Duluth—A 5,000,000-gal. reservoir and a pumping station are in prospect for 1911.

Easton—A 50,500-gal. 80-ft. tower is in prospect for 1911.

Faribault—A $750 condenser was completed in 1910. In 1911 deep wells costing $75,000 and repairs to the reservoir amounting to $2,000 will be completed.

Madelia—A tank reservoir is in prospect for 1911.

Mankato—A 60,000-gal. tank and tower are in prospect for 1911.

Montevideo—An electric water pumping station was installed in 1910. A secondary station in prospect for 1911.

Red Wing—A $13,000 reservoir was completed in 1910.

St. Paul—A 200,000-gal. tank, 2 5,000,-000-gal. pumps at Centerville station, a deep well pumping plant for 6 12-in. wells at West St. Paul are in prospect for 1911.

St. Peter—A cement-lined reservoir is in prospect for 1911.

Virginia—A 250,000-gal. concrete surface tank was completed in 1910.

Worthington—A 150,000-gal. tank, with a 65-ft. tower, was completed in 1910.

MISSOURI.

Brookfield — A motor-driven duplex pump and a 100-h. p. tubular boiler were installed in 1910.

Glasgow—A pumping station and a filtration plant are in prospect for 1911.

Kansas City—A 45,000-gal. reservoir was completed at Quindaro in 1910. A hypochlorite system filtration plant is in progress at present. A 30,000,000-gal. engine at Quindaro and a high-pressure pump at Turkey Creek are in prospect. 8,800 ft. Missouri revetment work is in prospect for 1911.

Lexington—Additional pumps for the pumping station and reservoir extensions are in prospect for 1911.

Webb City—A 1,500,000-gal. reinforced concrete reservoir is in prospect for 1911.

MONTANA.

Bozeman—The reservoir will be enlarged to four and a half times its present capacity, in 1911.

Deer Lodge—Two reservoirs, and one dam were completed in 1910.

Glasgow—A 500,000-gal. reservoir and one pump were installed in 1910.

Great Falls—Two 2,500,000-gal. reservoirs, one 1,500,000-gal. electric centrifugal pump, two 2,000,000-gal. centrifugal pumps and one 8,000,000-gal. filtration plant are in prospect for 1911.

Helena—A 5,000,000-gal. concrete-lined reservoir, a complete new system (estimated cost, $590,000), 260 hydrants and

NEBRASKA.

Chadron—A $500,000 dam is in prospect for 1911.

Holdredge—Additional pumps for the pumping station and two new wells were installed in 1910.

Norfolk—The pumping station was remodeled in 1910, and a new pump and boiler will be added in 1911.

Red Cloud—A 100,000-gal. reservoir is in prospect for 1911.

Seward—A 300,000-gal. motor-driven water works pump, a triplex pump and a 24-ft by 45-ft. well were completed in 1910.

Tecumseh—A 125,000-gal. tank on tower is in prospect for 1911.

University Place—Electric pumps are in prospect for 1911.

Wymore—A pumping station is in prospect for 1911.

NEW HAMPSHIRE.

Keene—A 476-ft. earth dam, concrete core, was completed in 1910.

Raymond—A new boiler was completed in 1910.

NEW JERSEY.

Atlantic City—A $50,000 pumping station was installed in 1910. A 120-k. w. generator and engine are being installed at present.

Beach Haven—An aeration system filtration plant is in prospect for 1911.

New Brunswick—A boiler for the pumping station is in prospect for 1911.

Perth Amboy—A new stack, 2 200-h. p. boilers, 1 12,000,000-gal. pump and 21 ground storage pumps were installed in 1910.

Plainfield—New wells and an increased pumping capacity are in prospect for 1911.

NEW YORK.

Albany—Repairs to 3 triplex pumps were completed in 1910.

Auburn—A hypochlorite plant for use during the spring freshet is in course of construction.

Batavia—A 600-cu. yd. concrete dam is in prospect for 1911.

Binghamton—A 5,000,000-gal. reservoir is in prospect for 1911.

Buffalo—A 215,000-gal. pumping station is in progress of construction and a new intake pipe is being installed. A 66,000-ft. 9x12-ft. tunnel is in prospect for 1911.

Corning—Two reservoirs and 1 pumping station were completed in 1910.

Dunkirk—A new boiler house was completed in 1910.

Elmira—A 5,000,000-gal. reservoir is in prospect for 1911.

Frankfort—A 20,000,000-gal. reservoir is in prospect for 1911.

Geneseo—A cement-lined reservoir and a filtration plant are in prospect for 1911.

Huntington—A 25,000-gal. tank and 1 air tank are in prospect for 1911.

Jamestown—A 10,000,000-gal. reservoir is in prospect for 1911.

Keeseville—A concrete reservoir, 60x60x15, all-rock work, is in prospect for 1911.

Kingston—The project for raising Cooper Lake dam 10 ft. higher is in prospect for 1911.

Little Falls—A mechanical filtration plant is in prospect for 1911.

Millerton—A retaining wall and a filtration plant are in prospect for 1911.

Niagara Falls—A $75,000 intake crib and pipe line and a $15,835 conduit were constructed in 1910. A $124,880 pumping station and a $234,565 filtration plant are in progress of construction.

Norwich—A 2,000,000-gal. triple pump and a 75-h. p. gasoline engine for emergency use are in progress of installation.

Ogdensburg—One dam and 1 filtration plant are in prospect.

Plattsburg—A 170,000,000-gal. reservoir was constructed in 1910. Two 6,000,000-gal, reservoirs are in prospect for 1911.

Rome—A 15,000,000-gal, reservoir, a dam and 5,280 ft. of tunnel were completed in 1910.

Seneca Falls—In 1910 2 125-h. p. boilers were installed.

Troy—A 600,000,000-gal. reservoir is in prospect for 1911.

Watertown—Two concrete reservoirs were completed in 1910.

White Plains—A new standpipe was constructed in 1910.

NORTH CAROLINA.

Greensboro—In 1911 a 2,000,000-gal. pump, with steam turbine, 2 125-h. p. boilers and a stack, will be installed. An extension will be added to the filtration plant to filter 2,000,000 gallons per day.

Wilmington—A 1,000,000-gal. reservoir, a 4,000,000-gal. pump, 4,500,000-gal. filter units, a steel tower and new sedimentation basin were completed in 1910.

NORTH DAKOTA.

Grand Forks—A 4,000,000-gallon rapid sand filter was completed in 1910.

Mandan—Three reservoirs, a pumping station and a filtration plant are in prospect for 1911.

Minot—A 100,000-gal. tank, 2 Lawrence low-duty pumps, 2 Fairbanks-Morse horizontal duplex engines and a $44,400 lime and iron system filtration plant were completed in 1910.

Wahpeton—A 400,000-gal. concrete reservoir was completed in 1910.

Williston—A round concrete reservoir, 72 ft. diameter, 14 ft. depth, was completed in 1910. A 500,000-gal. filtration plant and 150-h. p. boilers will be installed in 1911.

OHIO.

Akron—F. A. Barbour is preparing plans for a $2,500,000 to a $3,000,000 system.

Alliance—A storage dam is in prospect for 1911.

Bellefontaine—A 100-h. p. boiler is in prospect for 1911.

Bucyrus—A 3,000,000-gal. pump and 2 125-h. p. boilers or gas engines will be installed in 1911.

Cadiz—Three wells and an air lift were completed in 1910.

Canal Dover—Four mains, 802 ft., and 4 wells were completed in 1910.

Cleveland—Two 25,000,000-gal. pumping engines are being installed. A lake tunnel, high-pressure fire-service pumping station is in prospect for 1911.

Coshocton—Eleven 10-in. filtration wells are in progress of construction. One 3,000,000-gal. pump, 1 4,000,000 pump, 2 1,500,000-gal. centrifugal motor-driven pumps and 1 vertical cross compound 125,000,000-gal. duty pump are in prospect for 1911.

East Liverpool—One pumping station and a well system are in prospect for 1911.

Leetonia—More wells are in prospect for 1911.

Millersburg—A 26-ft. well is in prospect for 1911.

Niles—A 3,000,000-gal. filtration plant is in prospect for 1911.

Norwood—A filtration plant has been proposed.

Port Clinton—A $24,000 mechanical filtration plant is in prospect for 1911.

Toledo—A 60,000,000-gal. clear-water basin, a 15,000,000-gal. centrifugal pump, direct connected; 14 1,000,000-gal, filters and high-pressure mains in business district are in prospect for 1911.

West Carrollton—One reservoir, 1 dam and 1 8-in. well are in prospect for 1911.

Zanesville—Two reservoirs, with a capacity of 4,500,000 gallons, 2 pumping stations and a 367,000-gal. standpipe were completed in 1910.

OKLAHOMA.

Clinton—A filtration plant was installed in 1910.

El Reno—Three reservoirs, 1 dam, 1 pumping station and 1 filtration plant are in prospect for 1911.

Guthrie—A $5,000 filtration plant was completed in 1910.

Lawton—Two reservoirs and a pumping station were completed in 1910. A 1,083-acre reservoir and 1 50-ft. dam are in progress of construction.

Muskogee—A $40,000 reservoir, a $75,000 pumping station and a $175,000 filtration plant are in prospect for 1911.

Oklahoma City—The pumping station was enlarged to double capacity in 1910, and 1 10,000,000-gal. cross compound Corliss engine, 250-k. w. direct-connected generator were purchased in 1910. A 200,000-gal. equalizing tower and 2,000 meters are in prospect for 1910.

Tulsa—A $15,000 reservoir and a $15,000 dam are in prospect for 1911.

OREGON.

The Dalles—The work of relining the reservoir with concrete is in prospect.

PENNSYLVANIA.

Bellwood—One reservoir is in prospect for 1911.

Bradford—The work of enlarging the reservoir from 37,000,000 to 200,000,000 gals. is in progress.

Chambersburg—A 2,500,000-gal. intermediate reservoir and a dam at the intake are in progress of construction.

Dalton—A 2,000-gals.-per-day pumping station was completed in 1910.

Doyleston—A 650-ft. well was installed in 1910.

Erie—A sterilization plant is in process of construction.

Franklin—A boiler and pump are in prospect for 1911.

Harrisburg—One reservoir and 1 dam are in progress.

Ligonier—A circular concrete reservoir, 85 ft. in diameter, is in prospect for 1911.

Northeast—A 4,000,000-gal. brick reservoir, 80,000,000-gal. reservoir and a filtration plant were completed in 1910.

Port Allegheny—An $8,000 pumping station was completed in 1910. The reservoir will be enlarged and used for storage in 1911.

Punxsutawny—A 65,000,000-gal. reservoir, a pumping station and a 3,000,000-gal. filtration plant were installed in 1910.

Somerset—A 500,000-gal. reservoir and 1 pumping station are in prospect for 1911.

RHODE ISLAND.

Rumford—Additions to the pumping station were completed in 1910.

SOUTH CAROLINA.

Chester—A $3,000 sedimentation plant, a $3,000 complete pumping station, a $4,000 filtration plant and 3 electric-driven,electric-valve turbine pumps were completed in 1910.

Florence—An air compressor and receiver and a 1,500-ft. deep well completed in 1910.

Rock Hill—The work of rebuilding the system at a cost of $50,000 is in prospect for 1911.

SOUTH DAKOTA.

Falkton—A $1,500 reservoir and a $10,000 pumping station were completed in 1910.

Minot—A 100,000 gallon reservoir was completed in 1910.

Pierre—A $5,000 concrete reservoir and a new $25,000 pump were completed in 1910. A $5,000 addition to the pumping station is in prospect for 1911.

TENNESSEE.

Columbia—A 1,000,000-gallon reservoir and a 2,000,000-gal. pumping station were completed in 1910.

Knoxville—A settling basin was completed in 1910. A 12,000,000 gallon filtration plant is in prospect for 1911.

TEXAS.

Belton—A reinforced concrete standpipe, 250,000 gals., 75 ft. high, is in progress.

Dallas—A 7,000,000,000-gal. reservoir is in process of construction.

Denison—A 1,500,000,000-gal. reservoir, with dam, was completed in 1910. A 2,000,000-gal. pumping station and 4 new wells are in progress.

El Paso—Twenty-two hydrants are in process of installation. Ten wells are in prospect for 1911.

Greenville—A 250,000-gal. artesian well was drilled in 1910. A 450,000-gal. reservoir is in prospect for 1911.

San Antonio—A new boiler was completed in 1910.

San Marcos—Seven fire hydrants were installed ni 1910. Ten more will be added in 1911.

Texas City—One reservoir and 1 dam are in prospect for 1911.

UTAH.

Ogden—A 15,000,000-gal., $50,000 concrete reservoir was installed in 1910. A filtration plant is in prospect for 1911.

VERMONT.

Barre—A 45,000,000-gal. reservoir and a dam were completed in 1910. Sewer work amounting to $50,000 is in progress.

St. Albans—A 10,000 rip-rap reservoir was completed in 1911.

WASHINGTON.

Kent—A 500,000-gal. reservoir was completed in 1910.

Port Angeles—A dam was completed in 1910.

Port Townsend—One 4,000,000-gal. and 1 2,000,000-gal. reservoir were completed in 1910.

Spokane—One 37,500,000-gal. pumping station and 1 standpipe were completed in 1910. One 12,500,000-gal, pumping station and 2 standpipes are in process of construction.

Wenatchee—A 7,054,900-gal. reservoir and 1 pumping station were completed in 1910.

WEST VIRGINIA.

Fairmont—A pumping station is in prospect for 1911.

Romney—A 150,000-gal. reservoir and a pumping station are in prospect for 1911.

Wheeling—An intake well and building and 2 20,000-gal. tanks were completed in 1910. Two motor-driven pumps are being installed.

WISCONSIN.

Antigo—New pumps are in prospect for 1911.

Burlington—A concrete retaining wall around a standpipe is in prospect for 1911.

La Crosse—A 6,000,000-gal. pumping station and a filtration plant are in prospect for 1911.

Milwaukee—Three boilers were completed in 1910. One 12,000,000-gal. pumping engine is being installed.

Sharon—A 110-h. p. internally-fired Scotch water-back boiler is in process of installation. The power house is being enlarged.

Sparta—A high-pressure boiler is being installed. The remodelling of the pumping station and the installation of a 1,500,000-gal. Corliss pumping engine are in prospect for 1911.

Watertown—One artesian well, 1,000 feet deep, was sunk in 1910.

Waupaca—A 187-ft. 12-in. intake main to Mirror Lake was completed in 1910.

Waupun—A pumping station was completed in 1910.

CANADA.

Winnipeg—One pumping station was installed in 1910.

Toronto, Ont.—A 33,000,000-gal. reservoir and 2 10,000,000-gal. engines were added in 1910. A filtration plant is in process of construction.

ELECTRIC LIGHT IMPROVEMENTS

The following table gives a summary of the reports of additions to electric lighting plants made in 1910 and to be made in 1911. The first column gives the number of feet of street wiring done or proposed, the second the number of poles, the third the number of feet of underground conduits and the fourth the number of street lamps.

As nearly as may be, the kind of street lamps is explained in a note under each town installing them. The number of kinds of lamps is now so great that this information is in general only as to class of lamp, and not always so definite as that.

The data for 1911 are printed in heavy-faced type, that they may be distinguished readily:

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
CALIFORNIA.				
Alhambra—				
1910	248,000			642
Antioch—				
Municipal electric plant proposed.				
Lodi—				
1910	105,600	300		
1911			**2,500**	***20**
*Ornamental boulevard lights.				
Palo Alto—				
1910	2,600	20		*542
*Tungsten lights.				
Pasadena—				
1910	95,000	400		470
Santa Clara—				
1911..... Minor extensions.				
Santa Cruz—				
1910			5,000	*660
*Incandescent lights.				
Progress		100		
1911				***100**
*Arc lights.				
S. Pasadena—				
1910	185,000	100	5,280	500
1911			**5,280**	
COLORADO.				
Holyoke—				
1910	26,400			
1911	**5,280**			
CONNECTICUT.				
New Britain—				
1910			23,324	
1911			Extensions.	
DISTRICT OF COLUMBIA.				
Washington—				
$125,000 for electric arc lighting now in progress. $395,000 for 1911.				
FLORIDA.				
Jacksonville—				
1910				*236
*Tungsten lights.				
1911	**450,000**			
Miami—				
1910	110,880	872		*285
*Mazda lights.				
GEORGIA.				
Cordele—				
1910		450		50
Cuthbert—				
1911—150 k. w. generator, 300-h. p. engine, 2 150-h. p. boilers.				
ILLINOIS.				
Chicago—				
1910	79,200			
1911—Prospective work not known until April 1st.				
Chicago Heights—				
1910				*2,640
*Ornamental boulevard lights.				
Collinsville—				
1910	158,000	1,200		*400
*50 Arc lights; 350 Tungsten lights.				
Decatur—				
Progress—New plant.				
Downers Grove—				
1910				122
Freeport—				
1911—City will let 5-year electric lighting contract before April 1.				
Galena—				
1910	249,235	2,900		92
Galesburg—				
1910	26,400	50		15
1911	**26,400**	**75**	**26,400**	**25**
Macomb—				
1910		200		
1911	**5,280**	**100**		
Metropolis—				
1910	47,520	10		3
Morton—				
1910	30,000	275		52
Oak Park—				
1910				41
1911				**25**
Paris—				
1910	2,000	8		10
1911	**158,000**			
Pekin—				
1910	36,100		108	178
Taylorville—				
1910	63,400			*200
1911	**10,560**			
*40Arc lights; 160 incandescent lights.				
INDIANA.				
Butler—				
Progress—Complete electric lighting system with 2 gas producer engines, 2 generators.				
Columbia City—				
1910	5,280	125		
1911				**75**
Converse—				
1910		3		60
Crawfordsville—				
1910	26,400			
Progress—$125,000 plant.				
Evansville—				
1910				*549
*509Arc lights; 40 incandescent lights.				
Ft. Wayne—				
1910	300,230	392		*84
1911	**400,000**	**500**		**50**
*62 Arc lights; 22 Tungsten lights.				
Indianapolis—				
1910				203
Logansport—				
1910	26,400	180		
1911	**10,560**	**80**		**50**
Martinsville—				
1910				*40
*Tungsten lights.				
1911—New unit.				
Remington—				
1910—One private plant.				
Rochester—				
1910				83
Rushville—				
1910	10,560			
1911	**15,840**			***66**
*Ornamental boulevard lights.				
IOWA.				
Ames—				
1910	10,560	100		20
Cedar Rapids—				
1910				*40
*Tungsten lights.				
Eldora—				
1911				**50**
Independence—				
1911				**16**
300 k. w. generator and engine to be installed in 1911.				
Indianola—				
1910—125-h. p. engine and generator installed. Old lights replaced by electroliers.				
Pella—				
1910—$30,000 municipal plant.				
Webster City—				
1911—Entire new station, $15,000 fireproof building.				
KANSAS.				
Argentine—				
1910				50
Private plant.				
Clay Center—				
1910				30
Coffeyville—				
1910	10,000	25		5
1911	**50,000**	**150**	**300**	**10**
Low pressure turbine installed in 1910.				
Garden City—				
1910	52,800	300		
Holton—				
1910	50,000			10
McPherson—				
1911—Electric street lighting to be installed in business section.				

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Ottawa—				
1910	5,280	50		*10
Progress	10,560			
*Tungsten lights.				
KENTUCKY.				
Ashland—				
1910				129
Earlington—				
Progress		2,500		
LOUISIANA.				
Morgan City—				
1910				40
MAINE.				
Westbrook—				
1910	10,000	100		
MASSACHUSETTS.				
Fall River—				
1910	1,135,416	3,724	77,421	844
Lowell—				
1910				*14
*2Arc lights; 12 incandescent lights.				
Quincy—				
1910				67
Wakefield—				
1910	16,739	90		*13
*Incandescent lights.				
Worcester—				
1910			500,000	
MICHIGAN.				
Alpena—				
1910		60		15
Bessemer—				
1910	5,000			20
Grand Rapids—				
1910	21,120	91		36
Lake City—				
1910	400	6		
Marshall—				
1910—187 k. w. alternator, and 264-h. p. water wheel.				
Norway—				
1911—System to be extended 2½ miles.				
St. Johns—				
1910—2 3-phase, 2,300 v. generators, 350 k. v. a. changed from single to 3-phase.				
Whitehall—				
1910	33,000			60
1911	**250**			**25**
MINNESOTA.				
Faribault—				
1910				110
New Ulm—				
1910	3,960		5,200	*44
*Ornamental boulevard lights.				
St. Cloud—				
1910	10,560	70		
St. Peter—				
1910	15,800			10
1911		**200**		
Will change from open arcs to tungstens in 1911.				
Virginia—				
1910	26,400			20
MISSISSIPPI.				
Yazoo City—				
1910	10,560	25		9
MISSOURI.				
Fulton—				
1910	6,056	53		
Independence—				
1910—$20,000 overhauling and betterment of electric light plant in 1910.				
Lebanon—				
1910	100,000	400		500
Oregon—				
1911—New equipment.				
Tarkio—				
1910				*115
*Tungsten lights. System changed to tungsten in 1910.				
MONTANA.				
Deer Lodge—				
1910	26,400			25
Glasgow—				
1910	10,500	100		10
Great Falls—				
1910				*40
1911				**56**
*Ornamental boulevard lights.				
NEBRASKA.				
Hastings—				
1910	15,800			
Holdredge—				
1910	52,800	350		*109
*Tungsten lights.				
Norfolk—				
1910—New boilers.				
1911			**5,000**	
Conduits to be built throughout city.				
Red Cloud—				
1910	5,280			
1911	**26,400**			
University Place—				
1911	**3,500**			**20**
Wymore—				
1911	**26,400**			
NEVADA.				
Reno—				
1910—One generator.				
1911—One generator; new plant of 3,000 h. p. water power.				
NEW JERSEY.				
Bayonne—				
1910				24
Garfield—				
1911—One elctric plant.				
Irvington—				
1911—One municipal plant.				
Jersey City—				
1910				22
17 gas street lamps.				
Nutley—				
1910				20
Rutherford—				
1911—New franchise contract to be entered into in 1911 for electric lights.				
NEW YORK.				
Plattsburg—				
1910	10,000			
1911				***14**
Salamanca—				
1910	12,300	40		18
1911	**15,800**	**50**		**25**
*5 Arc lights; 9 incandescent lights.				
Solvay—				
1910	5,000			85
1911	**5,000**			**40**
Troy—				
1910				714
Utica—				
1910				936
1911				**20**
NORTH CAROLINA.				
Greensboro—				
Electric lighting let by contract.				
Greenville—				
1910	400	100		10
1911	**1,000**	**300**		**10**
Raleigh—				
1910	3,000			50
NORTH DAKOTA.				
Grand Forks—				
1910—A $16,000 street lighting plant installed in 1910.				
Minot—				
Duplication of electric plant proposed for 1911.				
Williston—				
1910	7,640			10
1911	**7,000**			***28**
*Ornamental boulevard lights.				
OHIO.				
Cadiz—				
1910				60
Canal Dover—				
Progress—300-h. p. gas engine, 200 k. v. a. generators. Several miles copper, secondary.				

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Carrolton—				
1910		150		
Progress.	15,800			
Cleveland Heights—				
1910				12
1911				**80**
Euclid—				
1911				**10**
Ironton—				
1911				**15**
Leetonia—				
Progress.				*90
*Tungsten lights.				
Lorain—				
1910				231
1911				**350**
Madisonville—				
1911—100 k. w. direct connected unit.				
Napoleon—				
1910	37,000	37		
Reading—				
1910				5
Toledo—				
1910				297
1911				**200**
Warren—				
Progress—Installing 3 light Mazda tungsten series street lights.				
OKLAHOMA.				
Bartlesville—				
1910				101
Clinton—				
1911	**52,800**	**350**		**40**
Guthrie—				
1910		50		
Shawnee—				
1910	26,400			
1911	**26,400**			
OREGON.				
Cloquille—				
1910				90
PENNSYLVANIA.				
Bloomsburg—				
1911—Will add a few street lamps.				
Chambersburg—				
1910	132,000	50		30
Northeast—				
1910	105,600	1,000		*110
*39Arc lights; 71 incandescent lights.				
Pittsburg—				
1910				6,147
1911				**150**
Waynesboro—				
1910			800	
Williamsport—				
1910				68
SOUTH CAROLINA.				
Greenville—				
1910				180
1911				**125**
Union—				
1910	47,500			
Progress.	15,800			
1911	**15,800**			
SOUTH DAKOTA.				
Deadwood—				
1910				*200
*Tungstens replacing gas lights.				
Pierre—				
1910	11,800	80		20
A $16,000 engine installed in 1910.				
Rapid City—				
1910	26,400	2,000		300

TENNESSEE.

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Columbia—				
1910	7,940	50		*20
*Tungsten lights.				
Paris—				
1910	15,800	300		150
1911				**10**
Ripley—				
1910—One $14,000 plant installed.				
TEXAS.				
Denison—				
1910—250 k. w., 60 cycle a. c. generator installed in 1910.				
Laredo—				
1910	7,900	500		
San Marcos—				
1911	**26,400**	**300**		**30**
Texas City—				
Progress.	15,800			
1911	**37,000**			
UTAH.				
Ogden—				
1910			1,600	*60
1911			**2,500**	
*Tungsten lights.				
VIRGINIA.				
Danville—				
1910				206
WASHINGTON.				
Port Angeles—				
1910	79,400	1,000		
Seattle—				
1910				*59,500
1911				***49,900**
*Feet of street lighted with ornamental boulevard lights.				
Walla-Walla—				
1910	634,000	3,433	2,000	*186
Progress.	38,700	6,750		
1911	**450,000**	**280**		**20**
WISCONSIN.				
Antigo—				
1910	31,600			6
1911	**10,560**			
Burlington—				
1910	10,560	50		8
1911	**10,560**	**60**		**10**
Milwaukee—				
1910				2,198
Oconto—				
1911—Thorough overhauling of electric light system in 1911.				
Port Washington—				
1910	10,000	30		20
Ripon—				
1910	20,000			
Sharon—				
Municipal electric light system proposed for 1911.				
Wausau—				
1910	137,000	850	1,900	*410
*160 arc lights; 250 incandescent lights.				
CANADA.				
Kingston, Ont.—				
1910	4,000	50		
1911				**50**
Toronto, Ont.—				
1910	528,000	5,000	500,000	1,835
1911—Complete hydro-electric plant proposed for 1911.				
Winnipeg, Man.—				
1910	52,800		12,300	119
1911				**150**

GAS LIGHTING IMPROVEMENTS

The following table gives information as to the number of feet of gas pipe laid in 1910, now under contract and to be laid in 1911. It also shows the number of lamps installed last year and to be installed this year, and gives some idea of improvements recently made to gas manufacturing plants and to be made shortly.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

Cities	Gas Pipe	Gas Plant	Gas Street Lamps
ALABAMA.			
Talladega—			
1910.........	4,000	....	....
CALIFORNIA.			
Santa Clara—			
1910.........	5,280	....	....
1911—Minor extensions.			
ILLINOIS.			
Decatur—			
1910.........	42,300	....	....
Downers Grove—			
1910.........	52,800	....	....
Galena—			
1910.........	26,400	One	....
Macomb—			
1910.........	2,640	....	....
Pekin—			
1910.........	7,920	....	....
1911.........	**1,500**	....	....
Taylorville—			
1910—Complete system.			
INDIANA.			
Evansville—			
1910.........	....	....	697
Indianapolis—			
1910.........	....	....	33
IOWA.			
Ames—			
1910.........	63,400	One	....
KANSAS.			
Argentine—			
1910.........	63,360	Natural	....
Chanute—			
1910.........	27,000	....	....
KENTUCKY.			
Maysville—			
1910.........	5,280	....	....
1911.........	**2,640**	....	....
MASSACHUSETTS.			
Lowell—			
1910.........	15,800	....	74
Wakefield—			
1910.........	5,462	....	....
MICHIGAN.			
Wyandotte—			
1910—Minor improvements.			
MINNESOTA.			
Amboy—			
1910.........	21,100	One	18
Crookston—			
1910.........	10,000	....	....
1911.........	**15,000**	....	....
Duluth—			
1910.........	46,382	....	....
1911.........	**57,753**	....	....
New Ulm—			
1911.........	....	One	....
St. Cloud—			
1910.........	1,000	....	....
MONTANA.			
Bozeman—			
1910.........	26,400	One	....
NEBRASKA.			
Hastings—			
1910.........	5,280	....	....
1911.........	**4,240**	....	....
Norfolk—			
1910.........	1,200	Entirely renewed	....
1911.........	**2,000**	....	....
NEW JERSEY.			
Beach Haven—			
1910.........	....	Acetylene	....
Millville—			
1910.........	105,600	....	....
Ocean City—			
1910.........	10,560	....	....
1911.........	**5,280**	....	....
NEW YORK.			
Troy—			
1910.........	....	....	186
NORTH CAROLINA.			
Raleigh—			
1910.........	....	Double capacity	....
NORTH DAKOTA.			
Grand Forks—			
1910.........	26,400	....	....
OHIO.			
Bellefontaine—			
1910.........	6,600	....	....
1911.........	**3,300**	....	....
Carrolton—			
1910.........	31,700	....	....
Galion—			
1910.........	....	2 boilers	....
Zanesville—			
1910.........	....	Natural	....
OKLAHOMA.			
Bartlesville—			
1910.........	....	....	130
Shawnee—			
1910.........	52,800	....	....
1911.........	**52,800**	....	....
PENNSYLVANIA.			
Chambersburg—			
1910.........	4,000	....	....
McKeesport—			
1910.........	2,000	....	....
Northumberland—			
1910.........	23,700	High pressure	....
Pittsburg—		Gasoline	lamps
1910.........	....	....	3,791
1911.........	....	....	**200**
Waynesboro—			
1910.........	8,920	One	....
Williamsport—			
1910.........	....	Private	....
SOUTH DAKOTA.			
Flandreau—			
1910.........	500	....	....
Pierre—			
1910.........	2,640	....	....
TEXAS.			
Denison—			
1910.........	10,000	....	....
VIRGINIA.			
Chatham—			
1911.........	....	One	....
Danville—			
1910.........	95,000	....	....
Fredericksburg—			
1911.........	**400**	....	....
WASHINGTON.			
Walla-Walla—			
1910.........	191,600	....	....
Progress.....	23,575	....	....
WISCONSIN.			
Burlington—			
1910.........	18,500	....	....
1911.........	**5,280**	....	....
Milwaukee—			
1910.........	....	....	2,942
Ripon—			
1910.........	1,305	....	....
Stevens Point—			
1910.........	....	One	....
CANADA.			
Kingston, Ont.—			
1910.........	7,712	....	....
Toronto, Ont.—			
1910.........	....	....	1,089

GARBAGE COLLECTION AND DISPOSAL

In the following table are the reports from municipal garbage collection and disposal plants. A few cities report contracts, but many cities operating under the contract system have made no report.

The first column shows the number of wagons and carts purchased last year or to be purchased in 1911. The second column gives the same information as to horses and mules, the third column as to cans for deposit and collection, and the fourth as to completed or prospective garbage disposal plants.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

ALABAMA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Dothan—				
1910..	2	2	.....	
Jasper—				
1910..	3	5	30	

CALIFORNIA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Coalinga—				
1911..	...	...	.....	5-ton incinerator.
Fresno—				
1910..	15	...	.....	Open burning pit.
Maysville—				
1910..	3	6	Air-tight	Dump.
Oakland—				
1910..	...	...	.....	Garbage shipped to sea, 500 tons per day.
Palo Alto—				
1911..	...	...	.....	Garbage destructor.
Portersville—				
1910..	1	2	200	Dump.
1911..	**1**	**2**	**400**	
San Bernardino—				
1910..	...	...	.....	Under contract.
Santa Clara—				
1910..	...	...	.....	Designed by Cy. Engr. C. E. Moore.
Santa Cruz—				
1910..	...	...	.....	Contract let, 50c per dwelling.

CONNECTICUT.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Ansonia—				
1910..	1	2	.....	Contracted and fed to swine.
Meriden—				
1910..	...	...	.....	Collected under contract.
New Haven—				
1910..	...	...	.....	By contract.
Torrington—				
1910..	...	...	.....	Collected by farmers.

GEORGIA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Americus—				
1911..	**2**	...	**250**	
Atlanta—				
1910..	143	272	.....	Decarie incinerator.
1911..	...	...	.....	2 proposed.

ILLINOIS.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Chicago Heights—				
1911..	...	...	.....	Decarie incinerator.
Collinsville—				
1910..	1*	4	.....	
Danville—				
1911..	...	...	.....	Incinerator plant.
Dekalb—				
1910..	1	...	.....	
1911..	...	...	.....	One.
Downers Grove—				
1910..	1	2	.....	
E. St. Louis—				
1910..	...	...	.....	Handled by Supt. of streets.
Lake Forest—				
1911..	...	...	.....	One.
Oak Park—				
1910..	3	5	.....	Lewis & Kitchen incinerator, capacity, 15 tons per day, cost, $1.75 per ton.
1911..	**1**	**2**	.....	
Ottawa—				
1910..	2	4	.....	
Paxton—				
1910..	1	2	.....	Dump.
Taylorville—				
1910..	2	4	20	

* Tank flushing wagon.

INDIANA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Converse—				
1910..	...	...	.....	Dump.
Evansville—				
1910..	6	14	.....	Eagle crematory.
Hammond—				
1910..	12	8	.....	Dump.
Logansport—				
1910..	3	6	.....	
1911..	...	...	.....	One.
Mishawaka—				
1911..	...	...	.....	One.
Muncie—				
1910..	8	8	.....	Decarie incinerator.
Richmond—				
1910..	5	10	.....	Crematory.
Terre Haute—				
1910..	...	...	.....	Lewis & Kitchen incinerator.

IOWA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Burlington—				
1910..	3	6	.....	Burial and incineration.
Creston—				
1910..	...	...	.....	Fed to swine.

KANSAS.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Garden City—				
1910..	...	...	.....	Dump.
Hutchinson—				
1911..	...	...	.....	Incinerator.
Manhattan—				
1910..	2	4	.....	Contract.

KENTUCKY.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Louisville—				
1910..	54	108	.....	Incinerator not in use.
Pineville—				
1910..	1	2	12	

LOUISIANA.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Morgan City—				
1910..	2	4	24	

MAINE.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Lewiston—				
1910..	4	4	.....	

MASSACHUSETTS.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Everett—				
1910..	...	...	.....	Under contract.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Lowell—				
1910..	7	7	.....	Decarie incinerator.
New Bedford—				
1910..	...	...	.....	Extraction by steam; 7,132 tons collected; 582 animals in 1910.
Quincy—				
1910..	1	...	.....	
MICHIGAN.				
Grand Rapids—				
1910..	...	...	.....	Collected and delivered on on cars, hauled outside city, fed to swine.
Hancock—				
1910..	...	...	1,000	
Highland Park—				
1910..	1	2	.....	
MINNESOTA.				
Virginia—				
1910..	...	...	500	
MISSOURI.				
Sedalia—				
1911..	...	...	.....	One.
Webb City—				
1910..	1	2	.....	Dump.
MONTANA.				
Billings—				
1910..	3	6	.....	Incinerator.
Butte—				
1910..	...	...	.....	Small incinerator. Most of the refuse is put in trenches or on city dump. Incinerator in prospect to handle all refuse.
Great Falls—				
1910..	...	...	.....	Filling lowlands and river front. Collection by contract.
NEBRASKA.				
S. Omaha—				
1910..	...	...	.....	Collection by contract.
NEW JERSEY.				
Bayonne—				
1910..	4	...	24	
1911	**4**	...	**24**	
Beach Harbor—				
1911..	...	...	.....	Contemplated.
Elizabeth—				
1910..	...	...	.....	Contract.
Garfield—				
1910..	1	2	.....	
Irvington—				
1910..	4	7	.....	
NEW MEXICO.				
Silver City—				
1910..	1	2	.....	
NEW YORK.				
Batavia—				
1911..	...	...	.....	One.
Buffalo—				
1910..	...	...	.....	1 Morse-Boulger 1 Hecnan-Froude. Collection by contract.
Elmira—				
1910..	2	4	2,000	Bennett incinerator.
Herkimer—				
1910..	1	2	.....	
Kingston—				
1910..	...	...	.....	Contract.
Middletown—				
1910..	...	...	.....	Contract.
1911..	...	...	**500**	
Troy—				
1910..	26	...	450	
Utica—				
1910..	...	...	.....	Contract.
White Plains—				
1910..	4	8	.....	
NORTH CAROLINA.				
Asheville—				
1910..	...	...	.....	500 wagon loads in 1910.
Greenville—				
1910..	3	6	.....	
1911..	**3**	**2**	.....	
Wilson—				
1910..	...	...	36	
NORTH DAKOTA.				
Grand Forks—				
1910..	2	4	.....	
OHIO.				
Bucyrus—				
1910..	2	4	.....	
Coshocton—				
1910..	...	...	.....	Buried.
E. Liverpool—				
1911..	...	...	.....	Decarie incinerator.
Lorain—				
1910..	3	6	3,000	
Massilon—				
1911..	...	...	.....	One.
Toledo—				
1910..	23	46	.....	80 ton reduction plant, built by company having 15 year contract.
Zanesville—				
1910..	3	5	.....	Decarie incinerator.
OKLAHOMA.				
Bartlesville—				
1910..	...	...	.....	Private.
1911..	...	...	.....	Planned to contract.
Clinton—				
1910..	2	...	40	
El Reno—				
1910..	3	6	30	
Muskogee—				
1911..	...	...	.....	$35,000.
Vinita—				
1911..	...	...	**1,000**	
PENNSYLVANIA.				
Chambersburg—				
1910..	5	Use fire-steamer horses.	15	
Corry—				
1910..	2	4	.....	
Easton—				
1910..	...	...	.....	Morse-Boulger type, 2 units, 17½ ton.
Franklin—				
1911..	...	...	.....	One.
Harrisburg—				
1910..	...	...	.....	Contract.
McKees Rock—				
1911..	...	...	.....	20-ton incinerator.
Pottsville—				
1910..	...	...	.....	Contract.
Reading—				
1910..	...	...	.....	Contract.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Swissvale—				
1910..	...	...	.....	Contract.
Wilkes-Barre—				
1910..	...	...	.....	Bennett Garbage Co.
Wilkinsburg—				
1910..	...	...	.....	Wilkinsburg Sanitary Co.
RHODE ISLAND.				
Pawtucket—				
1910..	...	...	.....	Contract.
Providence—				
1910..	24	50	.....	
SOUTH CAROLINA.				
Greenville—				
1910..	5	6	175	
Union—				
1910..	2	...	.....	
1911..	**2**	...	.....	
SOUTH DAKOTA.				
Deadwood—				
1910..	1	...	.....	
Lead—				
1910..	1	2	.....	
Pierre—				
1910..	1	2	150	
TENNESSEE.				
Columbia—				
1910..	2	2	1,000	
Memphis—				
1910..	73	67	.....	2 crematories. 3 dead animal wagons.
TEXAS.				
El Paso—				
1911..	...	...	.....	One incinerator. Plans by Public Works Construction Co., ...Portland, Ore.
UTAH.				
Salt Lake City—				
1910..	28	56	24	
1911..	**35**	**60**	**25**	

VERMONT.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
St. Albans—				
1910..	...	...	18	
VIRGINIA.				
Danville—				
1910..	13	13	.....	
WASHINGTON.				
Everett—				
1910..	...	...	.....	Garbage scow.
Puyallup—				
1910..	1	...	21	
Seattle—				
1910..	...	...	.....	Meldrum 74.4 tons per day. Total for 1910, 22,920. Are building additional 4-cell plant; will probably build another.
Spokane—				
1910..	16	35	3,000	Crematory.
WEST VIRGINIA.				
Charleston—				
1910..	...	...	.....	1 crematory.
Wheeling—				
1910..	7	...	.....	Decarie incinerator.
WISCONSIN.				
Milwaukee—				
1910..	95	95	.....	Milwaukee incinerator, Hering & Fuller, engineers.
CANADA.				
Kingston, Ont.—				
1911..	...	...	.....	Plans for complete system.
Toronto, Ont.—				
1910..	219	327	.....	1 crematory and dumps.

STREET SIGNS

The following table shows the kind of street signs used in modern and prospective marking of streets, and gives the number installed in 1910 and the number that will probably be put up during 1911. The number of kinds of material of which signs are made is remarkable.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

ARKANSAS.

Cities	Number	Kind
Fort Smith—		
1910..	1,100	Plain.
CALIFORNIA.		
Long Beach—		
1910..	700	Enamel.
Maysville—		
1910..	2,000	Wood.
Santa Cruz—		
1910..	200	Enamel, 600 wood.
S. Pasadena—		
1910..	40	Wooden posts, 4x4 in.
COLORADO.		
Florence—		
1910..	....	Brass letters in cement sidewalk at corners.

CONNECTICUT.

Cities	Number	Kind
Ansonia—		
1910..	350	Blue enamel, white letters 3-in. high.
GEORGIA.		
Americus—		
1910..	150	Metal.
ILLINOIS.		
Canton—		
1910..	400	Blue enamel with white letters.
Collinsville—		
1910..	......	Enamel signs.
Downers Grove—		
1910..	......	Signs in concrete walks at street intersections.
Edwardsville—		
1910..	400	Enamel.
Galena—		
1910..	600	Wood.
Joliet—		
1910..	130	Tile letters set in sidewalk.
Progress	150	Tile.
Ottawa—		
1910..	......	Metal, at all street intersections.
Paxton—		
1910..	....	Iron board and post signs on all street corners.

Cities	Number	Kind
Taylorville—		
1910..	......	Wood at all street intersections.
Wheaton—		
1910..	300	Enamel steel.
INDIANA.		
Auburn—		
1910..	125	Enameled.
Columbus—		
Progress	1,130	Painted.
Evansville—		
1910..	1,200	Cast-iron.
Indianapolis—		
1910..	22	Wooden.
Mishawaka—		
1911..	......	Signs for outlying districts.
Rochester—		
1910..	300	Enamel.
IOWA.		
Cedar Falls—		
1910..	425	Metal.
Des Moines—		
1910..	2	Brass letters in cement walks.
	500	Tile in cement walks.
	3,500	Wood.
KANSAS.		
Arkansas City—		
1910..	......	4-inch letters stamped in concrete sidewalks at every street intersection.
KENTUCKY.		
Ashland—		
1910..	......	Wood signs, and signs in concrete curbing.
Louisville—		
Progress	1,900	Enameled plates on wrought iron posts.
LOUISIANA.		
Opelousas—		
1910..	386	Painted wooden.
MASSACHUSETTS.		
Everett—		
1910..	335	Wood at every street corner.
Lowell—		
1910..	94	Painted on wood.
Quincy—		
1910..	200	Metallic.
Webster—		
1910..	75	Enamel.
MICHIGAN.		
Grand Rapids—		
1910..	1,023	Steel.
Progress	639	Steel.
1911..	**639**	Steel.
Greenville—		
1910..	......	Sign boards on gas pipe.
Kalamazoo—		
1910..	17,000	Enamel.
Negaunee—		
1910..	125	Steel enamel.
MINNESOTA.		
Montevideo—		
1910..	100	Blue and white enamel.
St. Cloud—		
1911..	......	Contemplated.
MISSOURI.		
Kansas City—		
1911..	......	Contemplated.
Libertyville—		
1910..	......	4-inch white letters on blue ground, all street corners.
Moberly—		
1910..	......	Galvanized iron signs, all street intersections.
Webb City—		
1910..	220	Wood signs, with tin letters.

MONTANA.

Cities	Number	Kind
Great Falls—		
1910..	......	4-inch letters stamped in cement walks on all corners.
Lewiston—		
1910..	......	Enamel signs on all street corners, and in cement walks.
NEBRASKA.		
Elizabeth—		
1910..	......	Enamel steel.
Hastings.		
1910..	......	Common boards to each block.
NEW JERSEY.		
Plainfield—		
1910..	56	Enameled iron on white boards.
1911..	**50**	Same.
Red Cloud—		
1911..	**12**	..
Rutherford—		
1910..	600	White enamel metal.
NEW YORK.		
Buffalo—		
1910..	5,000	Cast-iron pipe or gas lamp posts.
Elmira—		
1910..	200	Wood, painted white on blue.
Syracuse—		
1910..	16	4-way Early electric signs.
	1,000	Blue enamel.
Watertown—		
1910..	300	Malleable cast iron, with raised letters, from Nichols Sign Co., Clyde, Ohio.
NORTH CAROLINA.		
Greenville—		
1911..	**1,000**	Wood.
Hendersonville—		
1910..	500	Wood signs and posts.
NORTH DAKOTA.		
Williston—		
1910..	208	Porcelain, blue background, white letters.
OHIO.		
Alliance—		
1910..	150	
Cincinnati—		
1910..	1,000	Blue and white enamel.
Delaware—		
1911..	......	Contemplated system.
E. Liverpool—		
1910..	400	Enameled signs.
Ironton—		
1910..	315	Porcelain iron.
Lancaster—		
1910..	300	Enameled iron.
Lorain—		
1910..	390	Enamel.
Wadsworth—		
1910..	72	Four-way signs.
1911..		Street signs and house numbering system.
OKLAHOMA.		
Bartlesville—		
1910..	140	Blue enamel, with white letters.
Enid—		
1910..	500	Porcelain.
Muskogee—		
1911..	**400**	
Norman—		
1910..	200	Sheet iron painted.
Shawnee—		
1910..	50	Street name in curb.
PENNSYLVANIA.		
Chambersburg—		
1910..	351	Furnished by E. C. Hayer, city.

Cities	Number	Kind
Doyleston—		
1910..	50	Iron.
Gallitzin—		
1911..	......	Contemplated system.
Luzerne—		
1910..	100	Enameled.
Minersville—		
1910..	500	Blue enamel, with white letters.
Northeast—		
1910..	......	Enamel, each street corner.
Oil City—		
1911..	**320**	Enameled.
Tyrone—		
1910..	......	Enameled steel.
Wilkes Barre—		
1910..	1,500	Enamel.
Wilkinsburg—		
1910..	......	Enamel signs tacked to buildings.
Williamsport—		
1910..	1,350	Galvanized iron.
RHODE ISLAND.		
Pawtucket—		
1911..	......	Several hundred may be put up.
SOUTH CAROLINA.		
Greenville—		
1911..	**1,200**	Steel enameled

Cities	Number	Kind
Union—		
1910..	400	
SOUTH DAKOTA.		
Sioux Falls—		
Progress	500	
TENNESSEE.		
Columbia—		
1910..	......	Wood at all street intersections.
Memphis.—		
1910..	500	
UTAH.		
Salt Lake City—		
1910..	50	4-way metallic American sign.
1911..	**50**	Same.
WASHINGTON.		
Port Angeles—		
1910..	500	Wood.
WISCONSIN.		
Appleton—		
1910..	......	Names in cement walks at street corners.
Beloit—		
1910..	......	Enameled signs.
Waupun—		
1910..	......	Complete new system.
CANADA.		
Toronto, Ont.—		
1911..	**1,000**	Enameled steel.

FIRE DEPARTMENT IMPROVEMENTS

The nature of the improvements reported for fire departments is such that they can not be classified in tables. The following items, arranged alphabetically by States and cities, give information as to such improvements made in 1910 and in contemplation for 1911. They include information as to new buildings, new steam and gasoline engines, chemicals, hose carts, ladder trucks, supply wagons, both horse-drawn and automobile; high pressure fire systems, horses, hose, fire alarm systems, wire, boxes, etc:

ALABAMA.

Jasper—1 building, 1 horse hose-cart, 1,800 ft. of hose comprise the present equipment.

ARKANSAS.

Ft. Smith—Purchased 4,000 ft. of hose in 1910. In 1911 will build $10,000 building, purchase two engines, horse or auto, one combination chief wagon, and chemical auto, and 7,000 ft. of hose.

CALIFORNIA.

Alhambra—In 1910, one auto fire-engine, one auto ladder-truck, 800 ft. of hose, 15 miles of wire, and a 30-box fire alarm system were purchased.

Antioch—In 1910, one thousand feet of hose were purchased. In 1911, one combination auto-apparatus will be added.

Coalinga—In 1911, a new city hall and fire-department building will be built.

E. San Jose—A new building was completed, and two hand-carts purchased in 1910.

Emoryville—A $9,733 fire engine house for automobile apparatus was completed.

Fresno—Present system comprises 7 buildings, 5 horse-drawn hose carts, 5 horse-drawn steam fire engines, 1 horse-drawn ladder-truck, 15,000 ft. of hose, and a 30-box Gamewell fire-alarm system.

In 1911, one new building will be built, and an auto-propelled steam fire engine will be purchased.

Lodi—In 1911, 2 horse-drawn hose carts, 1,200 ft. of hose, and 10-box alarm system will be purchased.

Long Beach—In 1910, 4 buildings were built, and the following equipment added: One horse-drawn hose wagon, 3 auto combination hose carts, one horse-drawn steam fire engine, one ladder-truck, one horse-drawn supply wagon, and a 28-box Gamewell alarm system. One auto gasoline fire engine has been ordered.

Maysville—The department comprises 1 building, 1 combination horse-drawn hose cart, 3 horse-drawn steam fire engines, 1 ladder-truck, 3,200 ft. of hose, and a 19-box Gamewell alarm system.

Palo Alto—In 1910, a 16-box Gamewell alarm system was installed.

An auto hose cart will be purchased in 1911.

Portersville—In 1911, one auto hose cart and one auto chemical engine will be purchased.

San Bernardino—In 1910, one new station was built, and one auto fire-truck added. A Gamewell alarm system is now being installed.

San Mateo—In 1911, 3 new buildings will be built, and an auto gasoline engine and 1,000 feet of hose will be added. A high-pressure system will be installed in business district.

Santa Clara—Fire service by direct pressure; no engines.

Santa Cruz—Two hose carts and two horses were added to the equipment in 1910.

Visalia—A four-piece department house was built in 1910, and the following equipment added: one horse-drawn hose cart, one horse-drawn steam fire engine, one ladder-truck, one horse-drawn chemical engine, 2,500 ft. of hose, and a 14-box Gamewell alarm system.

City will purchase auto fire engine in 1911.

CONNECTICUT.

Meriden—One Webb motor engine and $600 worth of hose were purchased in 1910. The fire alarm system comprises 43 boxes and 19 miles of wire.

FLORIDA.

Miami—Present system consists of 3 buildings, 2 hose carts, 1 ladder-truck, 1 supply wagon, 1 steam engine, all horse-drawn; 1 auto hose cart, 9,000 ft. of hose, and 24-box Gamewell alarm system.

GEORGIA.

Atlanta—The system includes 13 hose carts, 9 steam fire engines, 6 ladder-trucks, 1 water tower, 1 supply wagon, all horse-drawn; and 1 auto hose cart. One auto gasoline fire engine will be purchased in 1911. Twelve station houses and a 117-box Gamewell fire alarm system, with 100 miles of wire, complete the equipment for the city.

Cordele—The system comprises 1 building, 1 hose cart, 1 ladder-truck, 1 supply wagon, horse-drawn.

ILLINOIS.

Chicago Heights—In 1910, 1 central station was built and 2 horse-drawn steam engines added.

Collinsville—An $18,000 fire station was built in 1910.

A complete system, with equipment, to replace volunteer company, is being considered.

Danville—In 1910, 3,000 feet of hose was purchased.

In 1911, 1 building will be built, and 1 hose cart, and 1 gasoline fire engine, both auto-propelled, will be added.

Decatur—In 1910, 1 auto hose cart was purchased.

DeKalb—In 1910, 1,000 ft. of hose was purchased. A 4-box alarm system is being installed.

Downers Grove—The present system comprises 1 fire house, 2 hose carts, 1 ladder-truck, 3 fire wagons, all horse-drawn, and 2,000 feet of hose.

Freeport—A $5,000 building was built, and 1 horse-drawn hose cart, carrying 2,000 feet of hose, was purchased in 1910.

Galena—The present system includes 4 buildings, 3 hose carts, 1 ladder-truck, horse-drawn.

Galesburg—A horse-drawn American La France, Metropolitan, horse-drawn wagon, and 1,450 feet of hose were purchased in 1910.

A new building will be built in 1911.

Joliet—A new engine house will be built in 1911.

Moline—New fire station is being built.

Morton—New building, 1 ladder-truck, and 500 feet of hose were added in 1910.

Mt. Pulaski—Three Gamewell boxes and an extension ladder will be purchased in 1911.

Oak Park—The present system includes 2 buildings, 2 hose carts, 1 ladder-truck, horse-drawn, and 3,100 feet of hose, and 25-box Gamewell alarm system.

Ottawa—The present system includes 1 building, 2 hose carts, 1 supply wagon, 1 steam fire engine, all horse-drawn; 3,000 feet of hose, and a 23-box alarm system.

Paris—Purchased in 1910, 1,000 feet of hose.

Paxton—The system includes 2 hose carts, 1 ladder-truck and 1,700 feet of hose.

Peoria—The city bought in 1910, 3,000 feet of hose and a 78-box Gamewell fire alarm system, with 31 miles of wire. Three more boxes are being installed, and in 1911 1 $10,000 building, 5,000 feet of hose, and 1 truck, horse-drawn, will be added.

Rockford—One auto hose cart was purchased in 1910.

In 1911, 2 auto hose carts, 1 auto steam engine, 1 horse-drawn ladder-truck, and 1,500 feet of hose will be purchased.

Streator—One 2-wagon hose house, 1 hose wagon, and 1,500 feet of hose were added to the system in 1910.

Taylorville—The present system includes 1 building, 1 hose cart, 1 ladder-truck, 1 steam fire engine, all horse-drawn, and 1,600 feet of hose.

Waukegan—The department will build a new building and purchase auto hose cart in 1911.

Wheaton—One horse-drawn ladder-truck was purchased in 1910.

INDIANA.

Auburn—The present system includes 1 building, 1 combination ladder-truck, and hose cart, 6 chemical cans, 1,300 feet of hose, and 9 fire alarm boxes.

Columbia City—In 1910, 500 feet of hose and 1 horse-drawn ladder-truck were purchased.

Columbus—In 1911, 500 feet of hose and 1 fire alarm box will be purchased.

Converse—Present system comprises 1 building, 2 hose carts, and 1 steam fire engine, all horse-drawn.

Evansville—Present system comprises 12 buildings, 12 hose carts, 5 steam fire engines, 2 ladder-trucks, 2 supply wagons, all horse-drawn, and 14,000 feet of hose. The Gamewell fire alarm system includes 82 boxes and 35 miles of wire.

Ft. Wayne—The present system includes 8 buildings, and 8 hose carts, 3 ladder-trucks, 2 supply wagons, all horse-drawn. The Gamewell fire alarm system has been installed.

Hammond—The present system includes 5 hose carts, 2 steam fire engines, and 2 ladder-trucks, all horse-drawn, and 7,000 feet of hose. The Gamewell fire alarm system includes 35 boxes and 24 miles of wire.

Huntington—City purchased 500 feet of hose in 1910. In 1911, 1,000 feet of hose will be purchased.

Indianapolis—A $200,000 bond issue is under consideration for fire system additions and repairs.

Logansport—City purchased 1,000 feet of hose in 1910. In 1911, 1,000 feet of hose will be purchased.

Marion—The present system includes 3 hose carts, 2 ladder-trucks, 1 hose reel, all horse-drawn, and 11,000 feet of hose. The Gamewell system includes 41 boxes and 30 miles of wire.

Martinsville—The present system includes 3 hose carts, 1 ladder-truck, horse-drawn, and 1,500 feet of hose. In 1911, 1 auto steam fire engine will be purchased.

Mishawaka—A new hose-house is under construction, and a contract made with the American La France Fire Apparatus Co. for an auto truck.

Muncie—In 1910, 3 hose carts, one aerial truck, 1 50-h. p. and one 90-h. p. steam engine, all horse-drawn, were purchased. A 50-box Gamewell alarm system was installed.

New Castle—In 1910, 2 hose carts, 2,000 feet of hose, and 47 fire alarm boxes were purchased.

In 1911, 1 hose cart and 500 feet of hose will be added.

Peru—The present system includes 2 hose carts and 1 ladder-truck, horse-drawn, 3,500 feet of hose, and a 15-box Gamewell alarm system.

Rochester—The present system consists of 1 building and combination chemical ladder-truck, horse-drawn.

Rushville—One box and 1 mile of wire were added to the Gamewell system in 1910.

In 1911, 3 boxes and 2 miles of wire will be added.

Sullivan—One hose cart and 1,000 feet of hose were purchased in 1910.

Veedersburg—The present department includes 2 hose carts, 1 ladder-truck, hand-drawn, and 1,600 feet of hose.

Warsaw—One chemical hose wagon, or truck, will be purchased in 1911.

IOWA.

Ames—In 1910, 500 feet of hose was purchased.

Burlington—The present system includes 4 hose carts, 3 hose wagons, 1 chemical engine, and 1 ladder-truck, all horse-drawn, 12,650 feet of hose, and a 43-box Gamewell alarm system.

Charles City—The present system includes 1 ladder-truck, 1,500 feet of hose.

Des Moines—Present system includes 15 hose carts, 5 ladder-trucks, all horse-drawn; 24,000 feet of hose, and 126-box Gamewell alarm system.

Eldora—Purchased 500 feet of hose in 1910.

Glenwood—The volunteer fire department has 2 hose carts, 1,000 feet of hose.

Grinnell—The city purchased 500 feet of hose in 1910.

Indianola—One ladder-truck was purchased in 1910.

Waterloo—City purchased 1,000 feet of hose in 1910.

In 1911, equipment for 2 sub-stations will be purchased.

KANSAS.

Argentine—The present system includes 1 hose wagon, 2,000 feet of hose, and a 9-box Gamewell fire alarm system.

Clay Center—City will purchase 500 feet of hose in 1911.

Olathe—City hall and fire department house is being built.

Pittsburg—The present system includes 2 hose carts, 1 ladder-truck, and 4-box fire alarm system.

Pratt—In 1910, 1 horse-drawn chemical combination wagon, and 700 feet of hose were purchased.

Salina—In 1910, 1 combination hose wagon and ladder-truck was purchased.

KENTUCKY.

Ashland—The present system includes 3 hose carts, and 1,230 feet of hose.

In 1911, 1,000 feet of hose will be purchased.

Louisville—Present system includes 16 hose carts, 23 steam fire engines, 7 ladder-trucks, 1 water-tower, 7 supply wagons, all horse-drawn; 7,500 feet of hose and a 360-box Gamewell alarm system. The equipment is housed in 28 buildings.

Maysville—City purchased Knox combination auto apparatus in 1910.

Paducah—Present system includes 6 hose carts, 1 steam fire engine, 2 ladder-trucks, 2 supply wagons, all horse-drawn; 11,000 feet of hose, and an 88-box Gamewell alarm system.

LOUISIANA.

Morgan City—Present system includes 3 hose carts, 2 steam fire engines, 1 supply wagon, all horse-drawn; and 2,000 feet of hose.

In 1911, city will build 1 new station, and will purchase 1 horse-drawn hose cart, with 500 feet of hose.

MAINE.

Lewiston—The present system includes 4 carts, 2 reels, 2 steam fire engines, 1 chemical engine, and 2 ladder-trucks, all horse-drawn; and 12,900 feet of hose, a fire alarm system of 52 boxes is to be extended by the addition of 30.

MARYLAND.

Annapolis—The city will purchase 1 gasoline auto fire engine in 1911.

MASSACHUSETTS.

Easthampton—City completed 1 hose house.

Everett—The present system includes 3 hose carts, 2 fire engines, 2 combination motor trucks, 3 supply wagons, all horse-drawn; 6,400 feet of hose, and a 66-box Gamewell and Stevens alarm system.

Lowell—In 1910, 1 auto hose cart, 2,000 feet of hose, 2 Gamewell fire alarm boxes, and 44 miles of wire were purchased.

Quincy—The system comprises 5 hose carts, 3 combination hose carts, a steam fire engine, a ladder-truck, 4 supply wagons, all horse-drawn; 12,000 feet of hose, 6 buildings, and a 96-box Gamewell fire alarm system, with 2 miles of wire. An auto combination hose wagon will be purchased in 1911.

Revere—In 1911 a central station will be built.

Webster—One combination chemical and hose cart was purchased in 1910.

MICHIGAN.

Alpena—One building is being constructed.

Battle Creek—In 1911, 1 auto hose cart will be purchased.

Bessemer—1,000 feet of hose was purchased.

Flint—One combination auto-propelled chemical and hose cart, and 1 chief's chemical auto were purchased.

Gladwin—500 feet of hose will be purchased in 1911.

Hancock—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder-truck, and 22 fire alarm boxes. A new station is now being constructed.

Highland Park—One auto steam fire engine has been ordered.

Kalamazoo—One station has been constructed in 1910.

Negaunee—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder-truck, all horse-drawn; 4,000 feet of hose, and a 10-box Gamewell alarm system.

Norway—The city will purchase 1 hose wagon and 3 fire alarm boxes in 1911, and is contemplating the purchase of an auto truck.

Port Huron—One building was constructed and 500 feet of hose purchased in 1910.

Rochester—The city will purchase 250 feet of hose in 1911.

Saginaw—The city has purchased 1,500 feet of hose and extended the Gamewell alarm system one mile in 1910.

Three Rivers—The city purchased 500 feet of hose in 1910.

MINNESOTA.

Amboy—The present system includes 2 hose carts and 1,000 feet of hose.

Crookston—City purchased 1,500 feet of hose in 1910.

Faribault—City will purchase 500 feet of hose in 1911.

Mankato—City will purchase 1,000 feet of hose in 1911.

New Ulm—City has installed a 3-box Gamewell alarm system.

Red Wing—City has one gasoline auto fire engine and 1 horse-drawn water tower.

St. Cloud—City will build $15,000 station in 1911.

Virginia—City will purchase 1 auto hose cart.

Winona—The present system includes 4 hose carts, 2 ladder-trucks, 1 supply wagon, all horse-drawn.

MISSISSIPPI.

Yazoo City—The city has purchased 4,000 feet of hose, and will purchase 5,000 additional in 1911.

MISSOURI.

Aurora—The city will purchase an auto hose cart in 1911.

Fulton—The city purchased 500 feet of hose in 1910, and has under construction a 5-box fire alarm system.

Independence—The city purchased 1 ladder-truck and 500 feet of hose in 1910.

Kansas City—City purchased 10,000 feet of hose and 21 miles of wire for police and fire alarm system.

In 1911, 5 stations will be built, and 3 combination chemical wagons will be purchased.

Libertyville—The present system includes 2 hose carts, 1 ladder-truck, 1 supply wagon, all horse-drawn, and 1,700 feet of hose.

Webb City—The present system includes 1 hose wagon, 1 ladder-truck, horse-drawn; 1 auto hose cart, and 2,000 feet of hose.

MONTANA.

Billings—The present system includes 2 auto hose carts, 1 horse-drawn ladder-truck.

Bozeman—The city installed a 19-box Gamewell alarm system in 1910.

In 1911, 1 auto hose cart and 500 feet of hose will be purchased.

Butte—The present system comprises 4 hose wagons, 2 ladder-trucks, 1 supply wagon, all horse-drawn; 3 buildings, 13,000 feet of hose, and a 65-box Gamewell fire alarm system, with 31 miles of wire.

Deer Lodge—The present system includes 3 hose carts, 1 steam fire engine, 1 ladder-truck, all horse-drawn; and 2,500 feet of hose.

Glasgow—The city will purchase 500 feet of hose in 1911.

Great Falls—The city purchased 1 80-h. p. gasoline auto combination hose, ladder, and chemcial wagon from the Seagraves Co. in 1910.

The complete system includes 2 hose carts, 1 combination hose and ladder, horse-drawn; 1 cheif's auto, 7,400 feet of hose, and 21-box Gamewell fire alarm system.

Lewiston—The present system includes 2 hose carts, 1 ladder-truck, horse-drawn; 2,600 feet of hose, and 7-box Gamewell alarm system.

NEBRASKA.

Chadron—The city will purchase 600 feet of hose in 1911.

Hastings—The present system includes 2 horse-drawn hose carts, and 3,000 feet of hose.

S. Omaha—The city purchased 2 hose carts, 1 steam fire engine, 1 ladder-truck in 1910, and is building 2 new fire stations.

Wymore—The city will purchase 500 feet of hose in 1911.

NEVADA.

Reno—The Gamewell fire alarm system was extended by addition of 8 boxes, making 46 boxes in all.

Automobile apparatus is being considered for 1911.

NEW HAMPSHIRE.

Antrim—The present system includes 1 hose cart, 1 ladder-truck, and 1,550 feet of hose.

NEW JERSEY.

Bayonne—One auto combination chemical and hose wagon, 2,000 feet of hose, and 5 additional boxes for the Gamewell alarm system, were purchased in 1910.

Elizabeth—The present system includes 6 hose carts, 6 fire wagons, 2 ladder-trucks, and 3 supply wagons, all horse-drawn, and a 100-box Gamewell fire alarm system.

Garfield—The present system includes 5 hose carts and 1 ladder-truck, horse-drawn, and 2,500 feet of hose.

Irvington—The city purchased 2 hose carts and 1 auto hose cart in 1910.

Melville—A new station will be built and 1,000 feet of hose purchased in 1911.

Ocean City—One auto combination chemical and hose wagon, and 1,000 feet of hose were purchased in 1910.

In 1911, 500 feet of hose will be purchased.

Plainfield—The present system includes 1 steam fire engine, 1 ladder-truck, and 2 supply wagons, horse-drawn; 2 combination hose and chemical wagons, 8,000 feet of hose, and a 48-box Gamewell fire alarm system.

Rutherford—The present system includes 3 hose carts, and 1 ladder-truck, horse-drawn; 6,000 feet of hose, and a 25-box Gamewell alarm system.

NEW MEXICO.

Silver City—The present system includes 3 hose carts, and one ladder truck, horse-drawn, and one auto chemical engine.

NEW YORK.

Amsterdam—At present 1 building is in progress. In 1910, 1,500 feet of hose was purchased; the purchase of 1,000 additional feet is under consideration.

Binghamton—The present system includes 8 hose carts, 3 steam fire engines, 2 ladder-trucks, 4 supply wagons, all horse-drawn; and 1 auto supply wagon, 11,000 feet of hose and a 107-box Star electric alarm system.

Buffalo—The present system includes 33 steam fire engines, 3 steam fire boats, 31 two-horse hose wagons, 6 combination hose and chemical wagons, 7 chemical engines—two horse, 13 hook and ladder trucks, 2 water towers, 35 exercise wagons, 30 hose sleighs, 258 horses, 86,850 feet of 2½-inch hose, 14,300 feet of 3½-inch hose, 11 officer's wagons, 9 officer's sleighs, and a 720-box Gamewell fire alarm system, with 550 miles aerial wire, 6 ½ miles aerial cable, and 44 miles underground cable.

Elmira—The city purchased 1,000 feet of hose in 1910.

In 1911, 1 horse-drawn hose cart, 500 feet of hose, and 1 Gamewell fire alarm box will be purchased.

Frankfort—The present system includes 8 hose carts, 1 ladder truck, hand-drawn; 1 steam fire engine, horse-drawn, and 2,500 feet of hose.

Herkimer—In 1910 2 fire alarm boxes, with 8,920 feet of wire, were installed.

Middleton—In 1910 1 auto fire engine and 1,000 feet of hose were purchased, and 1 department house built.

Olean—The city has purchased 1 auto hose cart, 1 horse supply wagon and 6 fire alarm boxes.

Oneida—The city has purchased 1,000

feet of hose in 1910, may buy a like amount in 1911.

Salamanca—The city purchased 500 feet of hose, 20 Gamewell fire alarm boxes and 7 miles of wire in 1910.

In 1911 they will purchase one horse-drawn ladder truck, 800 feet of hose, 10 fire alarm boxes and 4 miles of wire.

Solvay—The present system includes 3 hand hose carts, 3,000 feet of hose and a 12-box Gamewell fire alarm system.

Syracuse—In 1910 city purchased 2,500 feet of hose and 2 fire alarm boxes.

In 1911 will purchase 2,500 feet of hose, 1 horse-drawn ladder truck and a complete new fire alarm system.

Troy—The present system includes 13 hose carts, 11 steam fire engines, 3 ladder trucks, 13 supply wagons, all horse-drawn; 21,000 feet of hose, 15 buildings, and a complete Gamewell system.

In 1911 the city will purchase one hose cart, one steam fire engine, one ladder truck, all horse-drawn; 4,000 feet of hose, and complete new fire alarm system.

Utica—The city purchased 2 Gamewell fire alarm boxes and 2 miles of wire in 1910.

In 1911, 1,500 feet of hose will be purchased, and a central fire station built.

NORTH CAROLINA.

Greenville—The city purchased 1,000 feet of hose in 1910. The complete system includes 2 hose carts, 1 steam fire engine, 1 ladder truck, 3 water towers, 2 supply wagons, all horse-drawn, and 4,000 feet of hose.

In 1911, two hose carts and 1,000 feet of hose will be purchased.

Wilson—The city purchased 500 feet of hose in 1910.

NORTH DAKOTA.

Bismarck—The city purchased 1,000 feet of hose in 1910.

Grand Forks—The city purchased 1,000 feet of hose in 1910.

Jamestown—The city will purchase a horse-drawn ladder truck in 1911.

Minot—The city will purchase 500 feet of hose in 1911.

Wahpeton—The city will purchase 500 feet of hose in 1911.

Willistown—The city purchased 1,000 feet of hose in 1910.

OHIO.

Ashtabula—The city has purchased 2 auto hose carts.

Bucyrus—The present system includes 3 hose carts, 1 steam fire engine and 1 ladder truck, all horse-drawn; 3,500 feet of hose and a 16-box Gamewell fire alarm system.

Canal Dover—The city has received bids for the purchase of 500 feet of hose. An automatic bell-striker will be installed in 1911.

Cincinnati—The present system is housed in 47 buildings, and includes 44 hose carts, 36 steam fire engines, 16 ladder trucks, 2 water towers, 4 supply wagons, all horse-drawn, and a complete Gamewell system. One service ladder truck was purchased in 1910. Three new sttaion houses will be erected in 1911.

Cleveland Heights—The city has purchased 2 hose carts and 800 feet of hose in 1910.

Conneaut—The city will purchase 1,000 feet of hose in 1911.

Coshocton—The present system includes one hose cart, one ladder truck, 2,700 feet of hose, and 21-box Gamewell alarm system.

Delaware—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder truck, 1 supply wagon, all horse-drawn, and 4,000 feet of hose.

East Cleveland—The city will purchase an auto-gasoline fire engine and fire alarm system in 1911.

East Liverpool—The present system includes 4 hose carts, 1 steam fire engine, 1 ladder truck, 1 supply wagon, all horse-drawn; 3,500 feet of hose and a 68-box Gamewell fire alarm system.

In 1911 1,000 feet of hose will be purchased and the alarm system extended one mile.

Ironton—The city will purchase 500 feet of hose in 1911.

Leotonia—The city will purchase one hose cart and 500 feet of hose in 1911.

Lorain—The present system includes 7 hose carts, 3 steam fire engines, 1 ladder truck and 3 supply wagons, all horse-drawn.

In 1911 the city will purchase 2 gasoline auto fire engines and 1 auto ladder truck.

Napoleon—The present system includes 1 combination hose wagon, 1 steam fire engine and 1 ladder truck, all horse-drawn, and 3,100 feet of hose.

Port Clinton—The city will build a $25,000 town hall and fire department building in 1911.

Steubenville—The city will build 1 station house in 1911.

Warren—The city proposes to purchase motor combination chemical and hose truck and sell 2 horse-drawn trucks.

Zanesville—The present system includes 4 hose reels, 4 combination hose wagons and 1 ladder truck, all horse-drawn; 8,200 feet of hose and an 80-box Gamewell fire alarm system.

In 1911 one station house will be built and one auto steam fire engine purchased.

OKLAHOMA.

Bartlesville—The present system consists of 1 hose cart, 1 7,600-pound, 600-gallon-per-minute steam engine, 1 ladder truck, all horse-drawn; 3,300 feet of hose and a 15-box Gamewell fire alarm system, and American La France auto chemical, hose and ladder is now being constructed.

Chandler—The city purchased 1,000 feet of hose in 1910.

Clinton—In 1911 the city will build 1 fire station, and will purchase 1 horse-drawn hose cart, 2,000 feet of hose and 20-box fire alarms system.

El Reno—The city purchased 1 ladder truck and 2,500 feet of hose in 1910.

Enid—The present equipment includes 1 hose cart, 1 steam fire engine, 1 ladder truck, 1 water tower, all horse-drawn; 1 auto hose cart, 3,000 feet of hose and a 20-box Gamewell fire alarm system.

Guthrie—In 1910 the city purchased 1 hose cart, 1 steam fire engine and 1 ladder truck, all horse-drawn, and 3,300 feet of hose.

Lawton—The present equipment includes 1 ladder truck, 1 supply wagon and 5,000 feet of hose.

In 1911 1 auto ladder truck will be purchased.

Muskogee—The present system includes 1 hose cart, 1 steam fire engine, 1 chief's wagon, all auto-propelled, and 2 steam fire engines, 1 ladder truck, horse-drawn; 5,800 feet of hose and a 45-box Gamewell alarm system.

In 1911 1 hose cart, 1 auto hose cart, 1 auto steam fire engine and an additional 5,000 feet of hose will be purchased.

Norman—The present equipment includes one hose-and-ladder truck and 2,000 feet of hose.

Shawnee—Will purchase 1 auto steam fire engine and 500 feet of hose in 1911.

PENNSYLVANIA.

Aspinwall—The city will purchase in 1911 2 hose carts, 2 ladder trucks and 300 feet of hose.

Bellwood—The city purchased 1 hose cart and 500 feet of hose in 1910.

Chambersburg—The present system includes 3 hose carts, 2 steam fire engines, horse-drawn; 1 gasoline fire engine, auto-propelled; 3,000 feet of hose and a 23-box Gamewell alarm system.

In 1911 the city will purchase 1 auto hose cart.

Chester—The present equipment includes 1 hose cart, 3 steam fire engines, 2 ladder trucks, 4 supply wagons, all horse-drawn.

Corry—The present equipment includes 1 hose cart, 1 combination hose and chemical wagon, both horse-drawn; 3,700 feet of hose and a 6-box Gamewell alarm system.

In 1911 1,000 feet of hose and 3 alarm boxes will be purchased.

Doyleston—The present equipment includes 2 hose carts, 1 ladder truck, 1 supply wagon, all horse-drawn, and 2,000 feet of hose.

Harrisburg—The present system includes 43 hose carts, 3 ladder trucks, 1 supply wagon, all horse-drawn; 15,000 feet of hose and a 65-box Gamewell alarm system.

Northeast—The present system includes 3 hose carts, 1 ladder truck, both horse-drawn, and 2,500 feet of hose.

Oil City—City has purchased 1 auto hose cart.

Pottsville—In 1910 3 boxes and 2 miles of wire were added to the Gamewell system.

In 1911 1 gasoline auto-propelled fire engine, 2,000 feet of hose, 1 alarm box and 1 mile of wire will be purchased.

Swissvale—The city will purchase 1,200 feet of hose in 1911.

Wilkinsburg—The present system includes 1 hose cart, 1 ladder truck, both horse-drawn; 2,000 feet of hose and a 30-box Gamewell alarm system.

RHODE ISLAND.

East Providence—The volunteer company now possesses 4,500 feet of hose. An auto-propelled hose cart is being constructed.

Pawtucket—The present system includes 7 hose carts, 2 steam fire engines, 4 ladder trucks, 6 supply wagons, all horse-drawn; 16,000 feet of hose and a 131-box Gamewell fire alarm system. An auxiliary automobile was purchased in 1910.

Providence—The present equipment includes 24 hose wagons, 17 steam fire engines, 11 ladder trucks, 1 water tower, 27 supply wagons, all horse-drawn; 40,000 feet of hose and a 456-box Gamewell fire alarm system.

SOUTH CAROLINA.

Florence—In 1910 1 gasoline, auto-propelled fire engine was purchased.

Greenville—The present equipment includes 3 hose carts, 1 steam fire engine, 2 ladder trucks, 1 supply wagon, all horse-drawn; 1 auto hose cart and 2,000 feet of hose.

In 1911 a complete fire alarm system will be installed.

Union—In 1910 the city purchased 1 hose cart, 1 supply wagon, 2,500 feet of hose and 4 fire alarm boxes.

SOUTH DAKOTA.

Aberdeen—The city purchased 1 horse-drawn steam fire engine in 1910.

Lead—The city purchased 1,500 feet of hose, 15 fire alarm boxes and 2 miles of wire in 1910.

In 1911 1,000 feet of hose will be purchased.

Rapid City—One hose house was completed in 1910.

Sioux Falls—The city will build fire stations costing $35,000.

TENNESSEE.

Columbia—The city completed 1 central station and installed 1 combination wagon, 3 horses and 3 carts in 1910.

Knoxville—The present equipment includes 5 combinationtion hose wagons, 1 hose wagon, 1 reel, 5 steam fire engines, 1 ladder truck, 1 water tower, 1 supply wagon, all horse-drawn; 11,500 feet of hose and a 73-box Gamewell fire alarm system.

Rockwood—The city purchased 500 feet of hose in 1910.

TEXAS.

Denison—In 1910 the city purchased 1 auto chemical wagon and 1,500 feet of hose.

In 1911 1 auto chemical engine, 1 horse-drawn steam fire engine and 1,000 feet of hose will be purchased.

El Paso—The present equipment includes 6 hose carts, 3 steam fire engines, 1 ladder truck and 1 supply wagon, all horse-drawn; 1 auto hose cart, 8,500 feet of hose and a 75-box Gamewell alarm system.

Greenville—The present equipment includes 2 hose carts, 1 steam fire engine and 1 ladder truck, all horse-drawn.

UTAH.

Ogden—In 1910 the city purchased 1 auto gasoline fire engine.

In 1911 city will purchase 1 auto-propelled steam fire engine, 1 horse-drawn ladder truck and a 10-box fire alarm system.

Salt Lake City—The present system includes 7 hose wagons, 3 steam fire engines, 4 ladder trucks and 1 supply wagon, all horse-drawn; 20,000 feet of hose and a 75-box privately-owned fire alarm system.

VERMONT.

Bellows Falls—The city will purchase 1 horse-drawn ladder truck and 1,000 feet of hose.

VIRGINIA.

Chatham—In 1911 the city will purchase 1 auto gasoline fire engine.

Danville—The present equipment includes 2 hose carts, 3 steam fire engines, 1 ladder truck and 1 supply wagon, all horse-drawn, and 4,000 feet of hose.

WASHINGTON.

Bellingham—The present equipment includes 1 hose wagon, 1 steam fire engine and 2 combination chemical wagone, all horse-drawn; 7,000 feet of hose and a 49-box Gamewell fire alarm system.

Hoquiam—The present system includes 3 hose carts, 2 fire engines, 3 ladder trucks, all horse-drawn; 8,000 feet of hose and a 26-box Gamewell fire alarm system.

Port Angeles—The present system includes 1 hose cart, 1 gasoline fire engine, 1 ladder truck, 1 chemical engine, all horse-drawn, and 1,000 feet of hose.

Pullman—The city purchased 3 hose carts and 800 feet of hose in 1910, and will probably install a complete fire alarm system in 1911.

Puyallup—The present system includes 2 hose carts and 1,000 feet of hose.

South Yakima—The city will purchase an auto-propelled gasoline fire engine in 1911.

Spokane—The present equipment includes 9 hose carts, 7 steam fire engines, 3 ladder trucks, 1 supply wagon, all horse-drawn; 1 auto hose cart and 1 auto chemical engine, 24,000 feet of hose and a 268-box Gamewell fire alarm system.

Walla Walla—The city purchased an 80-h. p. Seagrave combination wagon and 3,000 feet of hose in 1910.

In 1911 3,000 feet of hose will be purchased.

WEST VIRGINIA.

Fairmont—The city will purchase 1,000 feet of hose in 1911.

Wheeling—In 1910 the city purchased 5,500 feet of hose and 1 supply wagon.

WISCONSIN.

Appleton—The city purchased 1 steam fire engine in 1910.

Burlington—The city purchased 600 feet of hose in 1910.

DePere—The city purchased 600 feet of hose in 1910.

Eau Claire—The city purchased in 1910 one 30-gallon chemical wagon and 1½ miles of wire.

Hartford—The city purchased 500 feet of hose in 1910.

Milwaukee—The system includes 25 hose carts, 25 steam fire engines, 13 ladder trucks, 1 water tower and 4 supply wagons, all horse-drawn; 34 buildings, 93,000 feet of hose and a 675-box Gamewell fire alarm system, with 741 miles of wire. Two new buildings are in prospect.

Port Washington—The city will purchase 2,000 feet of hose in 1911.

Stevens Point—The present equipment includes 3 hose carts, 1 steam fire engine, 1 ladder truck, 1 water tower, all horse-drawn; 2,000 feet of hose and a 200-box fire alarm system.

Waupaca—The city purchased 500 feet of hose in 1910.

Waupun—The city purchased 1 ladder truck and 500 feet of hose.

Wausau—The present equipment includes 4 hose carts, 2 steam fire engines, 1 ladder truck, all horse-drawn; 8,000 feet of hose and a 43-box Gamewell alarm system.

CANADA.

Winnipeg, Man.—In 1910 the city purchased 1 auto hose cart, 5,500 feet of hose, 17 fire alarm boxes and 59 miles of wire. There are under construction 15 fire alarm boxes, including 25 miles of wire.

In 1911 the city will purchase 2 auto hose carts, 1 horse-drawn ladder truck and 1 supply wagon, 5,000 feet of hose, 15 fire alarm boxes and 20 miles of wire.

Kingston, Ont.—In 1910 the city purchased 1 hose wagon, 1 hose sleigh and 1 600-gallon steam fire engine.

In 1911 1 ladder truck and sleigh, 500 feet of hose and 5 fire alarm boxes will includes 74 pieces of apparatus, 9 steam fire engines, 22 fire stations, 105 horses be purchased.

Toronto, Ont.—The complete system and 261 officers and men.

ORGANIZATIONS AND INDIVIDUALS

Indiana Sanitary Association—South Dakota Engineers—Technical Associations—Calendar—Personal Notes

Indiana Sanitary and Water Supply Association.

The February convention of the Indiana Sanitary and Water Supply Association was one of the most interesting and valuable which it has been the fortune of the writer to attend. The proceedings will be published, and can be obtained of the president, Frank C. Jordan, Indianapolis. Two of the practical papers are published in this number of MUNICIPAL ENGINEERING, and others will appear later.

Free water and public service commissions were two interesting subjects of discussion. State and city health officers were on the program. Ex-vice president C. W. Fairbanks discussed conservation of forests, Geo. W. Fuller discussed the value of pure water, Prof. R. L. Sackett described French installations for purification of water by ozone. Joseph W. Ellms showed the construction of the Cincinnati filtration plants. The Southern Chicago drainage plan, the pollution of Lake Michigan, the care of hydrants, the flushing of streets were subjects in competent hands, which will be given in detail in later numbers.

Frank C. Jordan was elected president, and W. F. King, secretary, both of Indianapolis.

South Dakota Society of Engineers and Surveyors.

The second annual meeting of the South Dakota Society of Civil Engineers and Surveyors was held in the offices of the state engineer at Pierre, on January 25, 1911. Many prominent engineers were in attendance from all sections of the State.

President S. B. Howe, of Sioux Falls, presided. Among the addresses given were the following: "The Function of the County Surveyor," by U. S. Griggs, former state surveyor; "The Duties of the State Surveyor," by B. E. Lovejoy, former city engineer of Redfield; "The Filing of Plats of Records," by R. E. Easton, city engineer of Aberdeen, S. D.; "The Problems of the City Engineer," by S. B. Howe, city engineer of Sioux Falls.

The officers elected for the ensuing year are: President, S. B. Howe, Sioux Falls; vice president, B. E. Lovejoy, Redfield; secretary-treasurer, R. B. Easton, Aberdeen.

The International Municipal Congress and Exposition.

The management of the International Municipal Congress and Exposition, to be held in Chicago, September 18 to 20, 1911, has issued a handsomely executed prospectus which outlines the purposes and plans of the exposition and show.

The purpose of the congress and exposition is the betterment of municipalities throughout the civilized world, morally, artistically and physically; to illustrate the needed educational forces to accomplish this result, and to show examples of what has been done.

Among the subjects which have been decided upon for discussion and exhibit are the following: Charters and forms of government, municipal accounting, paving and the care of streets, road-making, parks and playgrounds, health and sanitation, taxation, charities and correction, home rule, public utilities, city planning, civic organizations, commercial organizations, schools, police and fire, libraries, municipal statistics, and varied exhibits.

Technical Associations.

The annual meeting of the Ontario Land Surveyors was held in the lecture room of the Engineers' Club of Toronto, on February 28 to March 2, inclusive.

The February meeting of the New England Water Works Association was held at the Hotel Brunswick, Boston, on February 8. The papers presented at this meeting were: "Construction Work on the Water Supply of New York City," by J. Waldo Smith, chief engineer, and "The Use of the Salinometer in Studies of Sewage Disposal by Dilution," by Kenneth Allen, chief engineer of the Metropolitan Sewerage Commission, New York.

The annual meeting of the Appalachian Engineering Association was held at Pottsville, Pa., on February 24-25. The program and entertainment were in charge of Capt. Baird Halberstadt, F. G. S., and Frank A. Hill. Prof. Henry Mace Payne, Morgantown, W. Va., is secretary.

At the meeting of the Montana Society of Engineers, held at Helena, on January 14, the following officers were elected: President, F. W. Whyte; first vice president, R. A. McArthur; secnd vice president, J. H. Klepinder; secretary, C. H. Moore; treasurer, Samuel Barker, Jr.

At the convention of the Iowa Cement Users, at Cedar Rapids, Ia., on January 13, the following officers were elected: President, J. W. Budd, Des Moines; first vice president, C. C. Merillat, Winfield; second vice president, H. H. Dean, Payne; treasurer, G. E. Tathwell, Waterloo; secretary, Ira A. Williams, Ames.

"The Geology of New York City in Its Relation to Engineering Problems" was the title of a paper by Charles P. Berkey, professor of geology, Columbia University, and John R. Healy, at the regular meeting of the Municipal Engineers of the City of New York, on February 21, 1911.

At the annual meeting of the Iowa Engineering Society, held at Des Moines, on February 15, 16 and 17, the following were among the papers presented: "Practical Points on Sewer Construction," by Lowell H. Stone; "Does the Boulevard Lighting System Pay," by Austin Burt; "Relative Merits of the Different Kinds of Pavements in Use Throughout the State," by Monroe L. Patzig, and "Cement Concrete Paving in Mason City," by Fred P. Wilson.

A paper on "The Pavement Problem in the Borough of Manhattan," by Daniel B. Goodsell, was presented before the Brooklyn Engineers' Club at a regular meeting on February 9.

The Oregon Society of Engineers was organized at a meeting held in the rooms of the Commercial Club of Portland, on February 6, 1911.

The Manufacturers of Corrugated Steel Culverts in the Northwestern States held their first annual convention in Minneapolis, Minn. The officers of the association are: President, T. M. Thompson; vice president, B. W. Harris; secretary-treasurer, N. V. Lux. The purpose of the organization is to standardize the gauge and weight of metal, in order to obtain equitable freight rates for their products.

The annual convention of the Wood Preservers' Association was held at the Auditorium Hotel, Chicago, January 17 to 19. A number of very interesting papers were presented, and the following officers were elected: President, J. T. Logan, of the National Lumber & Creosoting Co., Texarkana, Tex.; secretary-treasurer, F. J. Angier, timber-treating engineer of the Kettle River Co. (re-elected). The next annual meeting will be held in Chicago.

The Maine Society of Civil Engineers was organized in the rooms of the State Highway Commission, Augusta, on January 17. The following officers were elected: President, Cyrus C. Babb, Augusta; vice president, Walter H. Sawyer, Lewiston; secretary, Frank E. Pressey, Bangor; treasurer, H. S. Boardman, Orono.

The annual convention of the Carolina Municipal Association was held in the rooms of the Commercial Club, Raleigh, N. C., on January 18 and 19. The following officers were re-elected for the ensuing year: President, Fred N. Tate, High

Point; first vice president, James D. McNeill, Fayetteville; second vice president, T. W. Hawkins, Charlotte; third vice president, O. B. Eaton, Winston; fourth vice president, J. S. Wynne Raleigh; fifth vce president, W. D. LaRoque, Jr., Kinston; sixth vice president, W. G. McRae, Wilmington; secretary-treasurer, Thomas D. Meares, Wilmington.

The Manufacturers' Library, a free reading room and reference catalogue, a club house with all the accessories of telephones, stenographers and private rooms for business appointments, with many conveniences new and peculiar to itself, has recently been opened in the Hudson Terminal Building, No. 50 Church st., New York City.

The Association Francaise du Froid, 10 Rue Denis-Poisson, Paris, France, has issued a program of conditions on which it will grant a diploma of Refrigeration Engineer.

Officials and citizens of Fayette county, Pa., met February 11 to form an association to help secure state aid for the county roads and to stimulate interest in better roads.

The Building Trades Employers' Association of New York has announced the award of nine prizes for designs for small houses.

The special committee on "Bituminous Materials for Road Construction" of the American Society of Civil Engineers, Arthur H. Blanchard, Providence, R. I., secretary, has issued its blanks for reports for 1911, which will be sent on request to any engineer who will supply the information desired. The state of knowledge on this subject is as yet so indefinite that all engineers who have had experience, no matter how slight, should send for the blanks and use them.

Calendar of Technical Meetings.

Canadian Cement and Concrete Association. Annual convention, Toronto, Ont. Wm. Snaith, secretary, 57 Adelaide st., East Toronto, Ont. March 6-11.

New England Water Works Association. March meeting, Hotel Brunswick, Copley Square, Boston. Willard Kent, secretary, Narragansett Pier, R. I. March 8.

American Railway Engineering and Maintenance of Way Association. Annual convention, Chicago, Ill. E. H. Fritch, secretary, 962 Monadnock Block, Chicago, Ill. March 21-23.

National Electric Light Association. Annual convention, Engineering Societies Building, New York, N. Y. May 29 to June 3.

American Water Works Association. Annual convention, Rochester, N. Y. J. M. Diven, secretary, 14 George st., Charleston, S. C. June 6-10.

International Association of Chiefs of Police. Eighteenth annual convention, Rochester, N. Y. Major Richard Sylvester, superintendent of police, Washington, D. C., president. June 11-16.

New York State Association of Chiefs of Police. Annual convention, Rochester, N. Y. June 13-18.

Personal Notes.

C. L. Bernay, assistant city engineer of Houston, Tex., has accepted a position in the Texas Company's asphalt division.

F. E. Semon, formerly assistant to City Engineer Foster, of Medford, Ore., has been appointed city engineer of Ashland, Ore.

J. W. Paxton, a civil engineer of Norfolk, Va., has been appointed superintendent of street cleaning of Washington, D. C.

Alberto Schreiner has been appointed assistant engineer in charge of the bureau of design in the sewer department of the Borough of Queens, City of New York.

James H. Fuertes, consulting engineer, of New York City, has been retained by the city of Cumberland, Md., to report reupon a $500,000 water works system for that city.

N. B. Buchanan has established a general consulting engineering practice, with offices at Huntsville, Ala. He had lately served as assistant resident engineer for the U. S. Steel Corporation.

Dwight Horton, Assoc. M. Am. Soc. C. E., has left the J. W. Maxcy Co., of Houston, Tex., to enter a partnership with F. D. Horton under the firm name of F. D. Horton & Son, to engage in a general contracting business, with headquarters at Houston, Tex.

Gerardo Immediato, Assoc. M. Am. Soc. C. E., has been appointed by the town council of Montclair, N. J., to the newly-created position of town engineer. Mr. Immediato was formerly assistant engineer of the Monterrey water works at Monterrey, Mexico.

Frederick G. Clapp, consulting geological engineer, of Pittsburg, Pa., has decided to specialize in coal work. For this purpose C. V. Gould, who is a graduate mining engineer from Durham University, England, has become associated with Mr. Clapp in his practice.

James L. Tighe, M. Am. Soc. C. E., who has served the city of Holyoke, Mass., for the past 19 years as engineer of the city water works and as city engineer, has opened an office in the Caledonian Building, Holyoke, for practice as a consulting engineer, giving special attention to hydraulic and municipal engineering.

The estate of William H. Bryan, of St. Louis, Mo., has recently sold to the well-known consulting engineer, Henry Floy, of New York, the late Mr. Bryan's complete reference file on depreciation of engineering apparatus and structures. Mr. Bryan's standing as an engineer and his wide experience in making valuations and appraisals enabled him to make up one of the most complete collections of data relating to depreciation.

It has been announced that Oscar Claussen has been appointed to succeed L. W. Rundlett as city engineer of the city of St. Paul, Minn. Mr. Claussen, who is at present engaged in consulting work, was at one time city engineer, serving from 1899 to 1902. He has for some time been more actively engaged in railroad work. Mr. Rundlett, who will retire at the end of his term, on March 14, was first appointed city engineer in 1882. He has held the position continuously since that time, with the exception of two terms of three years each.

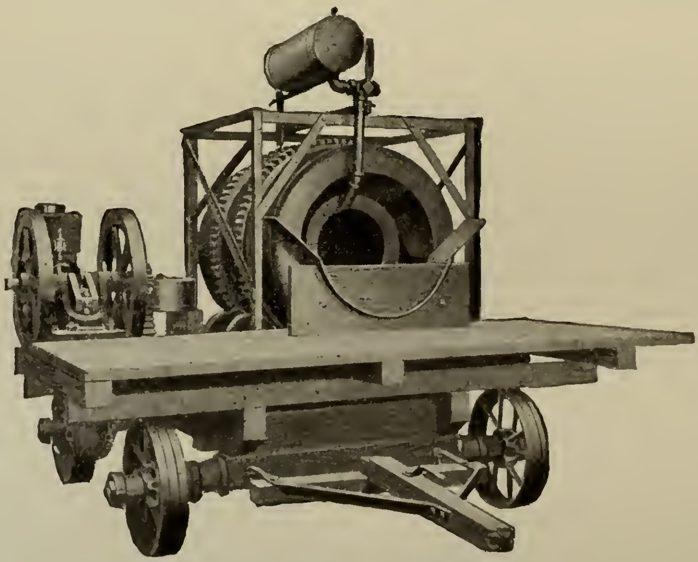
MACHINERY AND TRADE

The Cropp Mixer.

The "Cropp" Concrete Machinery Company, 84 La Salle street, Chicago, Ill., have recently placed on the market an improved double-chamber, low-charging concrete mixer. The new machine has eliminated entirely the use of high scaffolding and charging hopper. The material is charged at a low point and discharged at a much higher point, and will handle material as fast as it can be supplied to it.

These results are obtained by placing within the drum two separate and distinct chambers. The first of these is known as the receiving and mixing chamber. A wheelbarrow of sand is dumped into the receiving chamber, and two wheelbarrows of stone and one sack of cement, and the water is applied early when the first barrow is dumped; then when the last wheelbarrow is being dumped the door in the transfer passage way between the two chambers is thrown open and the entire contents of the receiving chamber are transferred into the storage chamber. The receiving chamber is then ready for another batch, and the contents of the storage chamber can be discharged at will. The operation is then repeated. Thus there is no loss of time, for as soon as a man can dump his wheelbarrow and get away, the next man behind him can dump his barrow, and the performance can be repeated as fast as the wheelbarrows can be dumped. There is no waiting involved as in the case where the charging hopper has to be dumped before the next barrow can be emptied.

In addition to these features of timesaving value, the material is being constantly mixed until discharged, and the fact that it travels through two chambers assures that the mixing will be thoroughly accomplished. The accompanying photograph shows one of the machines complete with a gasoline engine, and the charging platform rigidly attached to the trucks at the charging end.



THE CROPP CONCRETE MIXER.

The Kuhlman Patent Sewer Cleaning Machine.

There has been in use for a number of years, though only recently was it patented, a sewer-cleaning device which has been used with marked success in the cities of Chicago, Ill., Indiana Harbor, Hammond and Gary, Ind., Watertown, Oconomowoc and Wausau, Wis. This machine, known as the Kulhman patent sewer-cleaning machine, is manufactured by the Northern Manufacturing Co., of Hammond, Ind.

The machine complete consists of 5 clam-shell buckets, 2 cables, one small and one large windlass, and one trolley system. The operation of the device is very simple and efficient, and is essentially as follows: The windlasses are set at manholes, some distance apart, a line being passed from one to the other. The bucket is then placed at the end where the smaller windlass is located, and is drawn through the sewer, its peculiar construction allowing all liquid matter to filter through and collecting only the solids, dirt, roots, sand, brick, cinders and all other foreign matter. Upon arriving at the second manhole the trolley arrangement engages, swinging the bucket with its collection of material free and allowing it to be raised to the surface without disengaging it from the cable by means of which it was drawn through the pipe. In this manner absolutely no handling by hand is required. The operation is repeated on the return trip of the bucket.

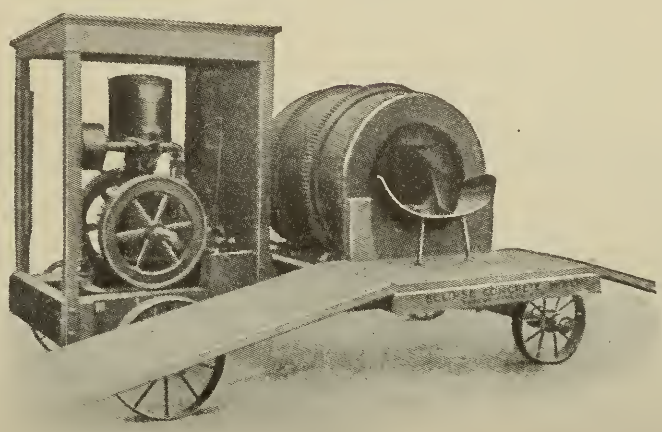
The advantages of the machine lie in the fact that it does not interrupt the flow of the sewer while in operation; it will remove all gravel, brick, stone, sand and other refuse; it may be used with economy in any size of sewer, from 10 inches to 10 feet; and in the direct application of the power which draws the cable in raising the material to the surface. Cases are on record in which the machine has successfully removed obstructions such as toughened roots, large stones, and even in one case in Wausau, Wis., an almost solid obstruction of sand with which was mixed sufficient tar to make the mass compact. In the latter case about 1,700 feet of sewer were cleaned at a saving of about $1,800.

The Eclipse Concrete Mixer.

The Eclipse Concrete Mixer, as illustrated herewith, is a machine adapted for various classes of work. A special feature of this machine is the low-charging drum, which makes it necessary for the charging platform to be only about 24 inches high when the mixer is mounted on truck and high enough to discharge into wheelbarrows at the discharging side. This charging platform is mounted on the truck with the mixer and is always complete, ready for operation as soon as it arrives on the job.

The large opening in the charging end of the drum is another advantage, because the entire batch can be seen while mixing, and it can be determined before discharging that the concrete is in the condition desired, and it is not necessary to discharge part of the batch to see whether it is too dry or too wet, as often happens with mixers with small openings. The fact that the entire batch can be seen while mixing enables the contractor to produce uniform high-grade concrete and avoids any loss or damage which is liable to happen if the concrete is not uniformly mixed.

The discharging arrangement on the mixer is semi-automatic in that the discharge door is held in either mixing or discharging position by a strong spring under tension, and all that is necessary for the operator to do is to throw this door past the center of tension in either direction and the spring will complete the movement and hold the door until it is again thrown open by the operator. This door can be thrown open for discharge and left open until the entire batch is discharged, or, as the mixer is made to discharge about 3 cubic feet or one wheelbarrow of concrete per revolution, the door can be closed after a barrow of concrete is discharged and left closed until the next man has placed a wheelbarrow in position.



THE ECLIPSE CONCRETE MIXER.

The blades within the drum are set diagonally and made to overlap, so that when the material is fed to the blades over the charging chute it passes into the interior mixing portions of the drum as the blades advance, and, of course, can not return again as long as the drum is kept revolving. For discharging there is a low blade extending across the drum leading to the discharge pockets. This blade carries over the balance of the material to the pockets when the drum is nearly empty, but is low enough so that the greater part of the material falls over when the drum is full. The pocket at the discharging end is closed by throwing the discharge door so that the concrete entering this pocket is lifted and discharged from the discharge chute.

It is not necessary to have a man operate the discharge door, as the one wheeling can throw the lever without any difficulty.

From this description the contractor will readily see that the mixer is very simple to operate. The men are only required to wheel the material on the low platform, about 24 inches high, and on account of this platform being so low they can run a barrow up a 12-foot plank almost as easily as on the ground. The material from the barrow can be thrown into the drum very quickly on account of the large opening. In discharging the drum it is preferable to put in a barrow of stone or gravel first, to be followed with a barrow of sand; the cement can be placed on top of the sand in the barrow and both be dumped in together, then another barrow of stone following the sand and cement, the water having been placed in the mixer first. This method, of course, is based on the one-bag charge, and by charging the mixer in this manner it is only necessary to allow two or three revolutions of the drum after the last barrow is thrown in before the batch is ready for discharging, due to the fact that the materials are being mixed during the process of charging, and it is only necessary to thoroughly mingle the last barrow with the balance of the material.

When the work is rushed and the concrete wheelers have become accustomed they can discharge the drum without closing the discharge door after first opening it. To do this it will be necessary for them to have enough of barrows ready so that when the door is opened and the first barrow loaded from the first discharge revolution of the drum, the first wheeler will pull his barrow back from under the discharge chute and the second wheeler push in a barrow from the other side, catching the discharge from a second revolution, when he will pull his barrow back and the third man come in from the same side as the first man and take the discharge from the third revolution.

It will be seen from this description that if three revolutions are figured for mixing and four for discharging and the drum operated at 14 r. p. m. there will still be seven revolutions allowed for discharging, which should be done in three or four revolutions, or as quickly as the discharging, and by making one batch per minute there would be allowed about three revolutions for lost time.

While the machine as described would be the ordinary outfit mounted on truck, the Eclipse is built in various styles, capacities and is mounted to suit special conditions, also furnished with hoist for handling the mixed concrete when desired. The mixers are also furnished with either gasoline, steam or electric power, the one shown in the first illustration being gasoline driven.

One other feature about the Eclipse Mixer is that it will operate on either wet or dry mixed and with any kind of material. It can also be used for mixing cement mortar or top dressing for sidewalks, the smaller sizes being especially adopted for sidewalk work.

A recent addition to the machine is a flexible means of discharging the concrete after mixing, which allows the material to be placed exactly where desired and distributed over an area equal to the half circle of which the discharge arm is the radius.

The Eclipse Mixer is manufactured by the Standard Scale and Supply Company, 1345 Wabash avenue, Chicago, Ill, and is described in their catalogue No. 35.

The Burr Municipal Castings.

The E. M. Burr Co. Foundry at Champaign, Ill., has for a number of years made a specialty of municipal castings of all sorts, and have established a reputation for prompt service and excellence of workmanship in such supplies.

Catalogue No. 12 of this company shows a complete line of castings manufactured by them and contains a great deal of information which is of value to city engineers and contractors engaged in municipal work. Among some of the supplies listed are catch-basin rings, lamphole covers, manhole rings and covers, curb inlets of every conceivable type, catch-basin inlets, gutter plates and tampers.

In addition to these municipal supplies, the Burr Company has a patented gasoline and distillate vertical hoist. This hoist is of the standard vertical type, connected by gears to a hoist drum, the whole mounted on a bedplate. The construction is such that it can be taken apart, no one part weighing over 250 pounds.

The pinion on the engine shaft is provided with a dental clutch, so designed as to disconnect the engine from the hoist drum when desired. This makes the engine available for general purposes, such as pumping, running dynamoes and for running concrete mixers.

In addition to the above-mentioned machines and supplies, the Burr Company manufactures a number of special castings and is equipped to handle special work with an assurance of satisfaction and promptness.

The Cannelton Sewer Pipe Company.

In connection with coal mining operations at Cannelton, Ind., previous to 1850, deposits of a superior quality of clay for stoneware manufacture were discovered. In the early fifties the Clark Brothers of Ohio, attracted by this deposit, built a small plant, which was the nucleus of the present Cannelton Sewer Pipe Company. This small plant continued in the manufacture of sewer pipe and other stoneware for about 45 years, when for various reasons the plant was taken over for the exclusive manufacture of stoneware.

By reason of the splendid quality of the product, several local parties with a thorough faith in the properties of the clay for sewer pipe organized and capitalized the present company. This company, the officers of which are John Meyer, of New Albany, Ind., president; Henry Bosquet, of Louisville, Ky., vice president; A. P. Clemens, of Cannelton, Ind., treasurer, and H. P. Clemens, Cannelton, secretary and general manager, completed and put in operation in 1909 the present very complete sewer pipe plant.

This plant consists of a main dry room, built of brick, three stories in height; a four-story machine room and a boiler and engine room. Twelve kilns, 30 feet in diameter, of the down-draft type provide for the fireing. In the dry room there is a floor space of 46,000 square feet; the steam dryer system being used exclusively, the ample space allowing of the continuous operation of 12 kilns.

The power plant is equipped with two 150-horsepower boilers, one Brownell 225-horsepower engine, one press, one dry pan, two wet pans (all of the Stevenson make), one Grote power elevator, and one Taplin-Rice gravity elevator.

The plant has operated continuously since its completion with the exception of three weeks, begining January 1, 1911, when it was necessary to shut down to put in additional machinery. The product includes salt-glazed sewer pipe, wall coping, stove pipe and flue liners. Sewer pipe is made in sizes varying from 3 to 24, both in the standard and double strength, and fire clay is used exclusively in their manufacture. The normal capacity of the plant is 100 car loads per month.

The shipping facilities are very complete, the yards being equipped with two switches, accommodating 19 cars, and conveniently located for the rapid handling of the product. The accompanying illustration shows the method of river transportation in low-water season, the barge shown being loaded with eight cars of 15-inch pipe, consigned to Hartford, Ky. The product is marketed in Cincinnati, Indianapolis, Louisville, Evansville, Nashville, Memphis and New Orleans, and in the States of Oklahoma, Arkansas, Montana, South Dakota, Texas, and Old Mexico. The entire shipments for the first year was over 800 cars.

The quality of the pipe furnished by the company has been tested by one of the most exacting sewer commissions, namely that of Louisville, Ky. In connection with the construction of the $4,000,000 sewer system in that city certain specifications were insisted upon, and tests made under the personal direction of the inspector of materials. The results of these tests are given herewith.

SHIPMENT OF CANNELTON SEWER PIPE ON THE OHIO RIVER.

The first pipe tested was made by Cannelton Sewer Pipe Company, Cannelton, Ind. Fire clay pipe, brownish yellow in shade, ¼ of the socket being broken off and was selected by the inspector on Frankfort avenue sewer. This pipe broke under a pressure of 7,355 pounds.

Four other tests were then made, using the product of two other companies. The test piece in each case being the 15-inch double strength, 24 inches long. These broke at pressure of 5,270, 4,870, 4,500 and 3,655 pounds respectively. A second test of the Cannelton Sewer Pipe Company's product was then made, breaking this time under a pressure of 5,470 pounds.

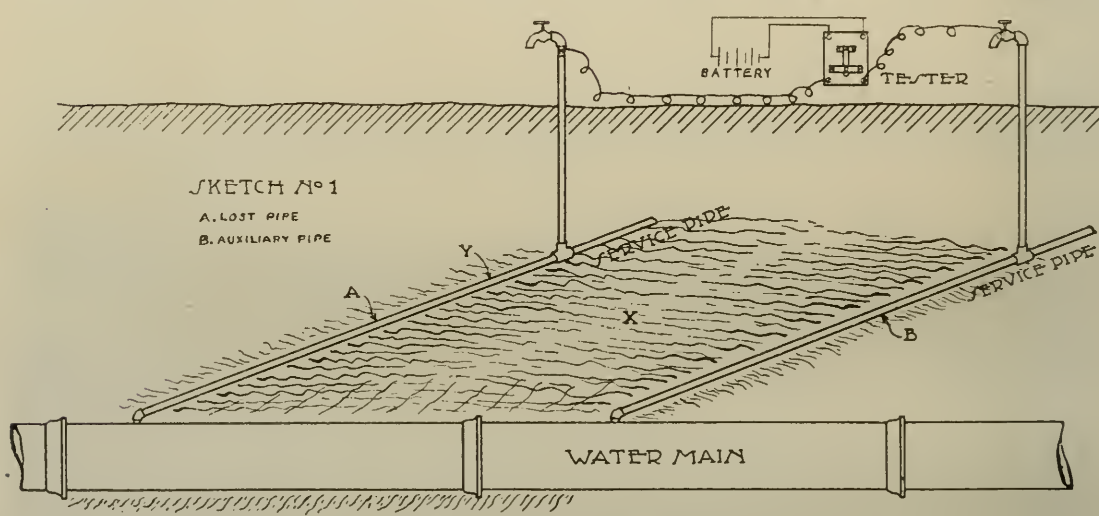
The reason for the exceptional strength of the Cannelton product is the fact that the clay of which it is composed possesses qualities practically ideal in proper constituents. Combined with this is the fact that the long experience, over fifty years, in manufacturing stoneware products, has reduced the proper combination of material and the proper firing to a scientific basis, practical, efficient and having nothing of the nature of experimentation at the expense of the user.

The main offices of the company are located at Cannelton, Ind., and the territory west of the Missipi river is taken care of by the St. Louis Clay Products Company.

The D. B. M. Wireless Pipe Locater.

The Modern Iron Works, of Quincy, Ill., is manufacturing an apparatus for use in locating pipes under ground. To anywho has had to dig numerous test holes or to make "soundings" by means of a long iron rod, the value of the instrument will be at once apparent.

The diagram given herewith serves to illustrate the working principles of the apparatus. An instrument for producing an electric current is attached as is shown, being marked "tester" in the diagram. This instrument is self-contained and compact within itself. The "locator" is then carried by the operator, no wires nor superfluous parts being attached to the small box within which the "locator" is contained. A special head telephone receiver is provided, attached to the locator, which is merely to all appearances a coil of wire about 6 inches in diameter. Through the telephone receiver, the operator can hear a distinct tone, which changes to a marked degree upon coming directly over the buried pipes. In this way the location of the hidden pipe can be followed as far as may be necessary.



WIRELESS PIPE LOCATOR.

The entire apparatus is mounted in a nicely finished case, equipped with a lock and handle for carrying. The principle of the locator is not magnetic, being based entirely upon the theory of wireless wave transmission. Fuller description of the instrument will be furnished upon application to the manufacturers, the Modern Iron Works, 500 Ohio street, Quincy, Ill.

Economy of Marriott Curb Conduit.

Mr. J. C. Marriott, Park Row Building, New York City, presented the following very interesting argument at the office of the president of the Borough of Manhattan, New York City, regarding the economy of the use of his curb conduit for the removal of snow by water carriage:

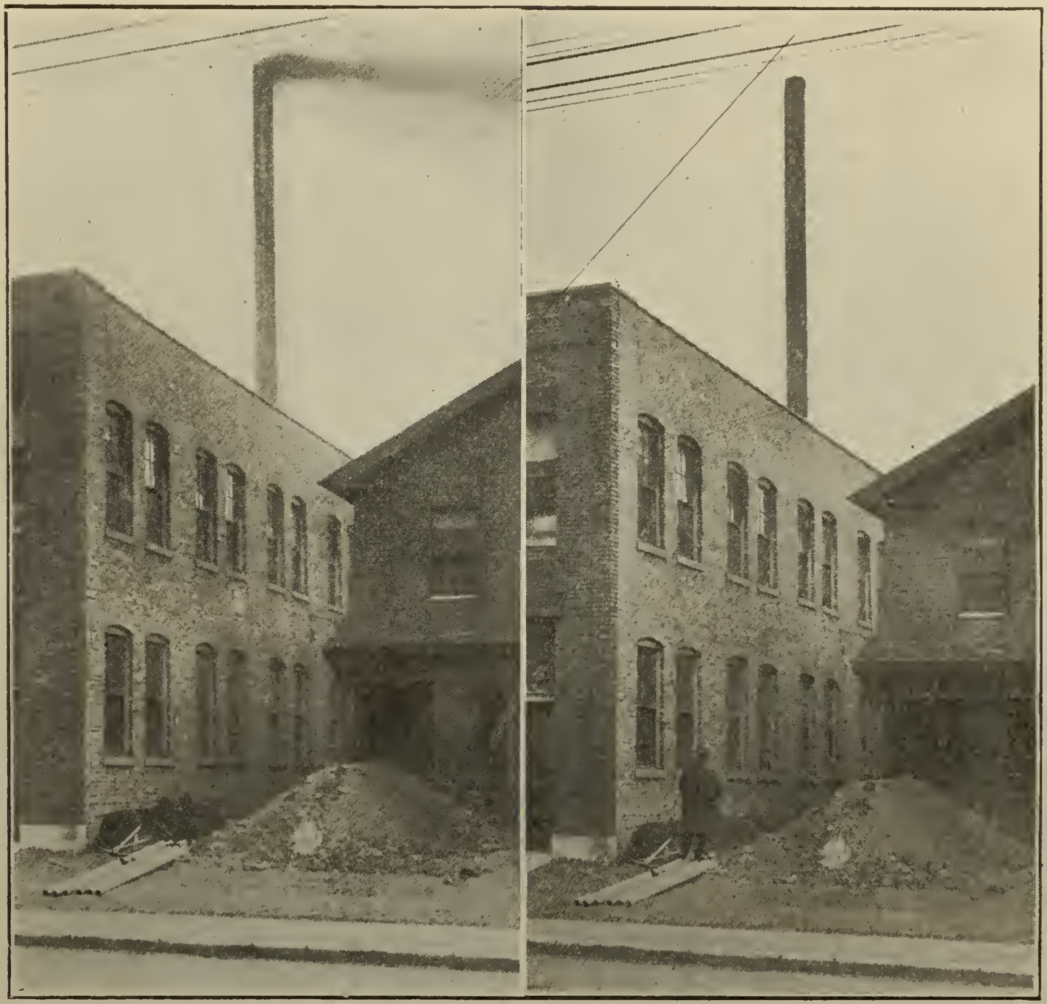
On a 90-foot street (building line to building line) with average annual snowfall of 26 inches (or 2 1-3 feet), we have 2 1-3 times ninety or 210 cubic feet of newly-fallen snow. After trampling, shoveling and packing, this is reduced to four-tenths in its original volume, or 84 cubic feet, which equals 3 1-8 cubic yards. At 43 cents per cubic yard for haulage, this is slightly in excess of $1.33 as the annual snow-haulage cost per linear foot of street. Multiplying $1.33 by 5,280 gives $7,022.40 per annum.

The cost of blue-stone curbing at $1 per linear foot (omitting width of cross streets) is $4,000 for each side of the street, or $8,000 per mile, and such installation cost provides a dividing line between the sidewalk and roadway surfaces, and thereafter necessitates the above-mentioned annual outlay for snow haulage of $7,000. The cost per mile of curb conduit at $1.75 per linear foot is $7,000 for each side, or $14,000 for installation cost, and ever thereafter effects a saving of $7,000 annual snow-haulage charge. Two years' snow-baulage saving installs the curb-conduit—omitting consideration of the $8,000 initial cost of bluestone curbing, and also omitting consideration of the value of the curb-conduit during at least 300 additional days each year, as an efficient means for surface-drainage of rainfalls and of the street scourings incident to the use of sprinkling and flushing carts for cleaning streets.

The Royal Laundry Smoke Prevention.

The city of Indianapolis has recently been agitating the question of smoke prevention, with the result that a number of manufacturers were brought to the consideration of smoke preventive devices. The Royal Laundry Company, by reason of its situation directly opposite the Masonic Temple, a white stone structure, was one of the offenders first to be noticed. It may be said to the credit of the company that the smoke inspector was not obliged to take any action to compel them to accede to the provisions, but the company of its own volition installed a furnace which has been highly satisfactory to all concerned.

This furnace was installed under the 100-horsepower return tubular boiler which was already in use in the laundry. The principle of the device involves the complete combustion of the fuel in the firebox. Two air ducts are provided which carry the air from the interior of the ash pit, at the side, across the front of the firebox above the arch of the door. Directly above the door are placed two "dissociators," one being connected to each of the air ducts. Connected to each of these "dissociators" are pipes carrying steam under pressure. This steam is blown through the "dissociators" into the firebox, dissociating the steam into its constituents and directing them into the products of combustion arising from the burning fuel on the grate. This results in a complete combustion of the latter, entirely eliminating all smoke.



With Smokeless Furnace Inoperative. With Smokeless Furnace in Use.

THE ROYAL LAUNDRY, INDIANAPOLIS.

In the case of the Royal Laundry installation, the two photographs will indicate the thorough results of the use of the apparatus. In the first picture the steam was shut off, eliminating the smokeless appliance entirely from use. The fire was about ten inches thick on the grate, and was freshly replenished with a mixture of Indiana straight run and slack (sometimes called "Indiana real estate"). The volume of smoke may be noted. The steam was then turned on, and within 16 seconds, the time it took the gases to travel through the firebox and up the stack, the result was as is shown in the second photograph.

The device used may be adapted to any boiler; in fact, this installation was made in 36 hours' time, during Saturday night and Sunday, without interfering with the operation of the plant. The Harris Smokeless Furnace, as it is designated, is manufactured by the Harris Smokeless Furnace Company, of Nashville, Tenn.

Sewage Ejectors.

The application of centrfugal pumps to the more exacting pumping operations has widened the field of this type of pump in the last few years. Among other important applications that of sewage pumping, even in small plants such as required by city buildings where the sewer is too high to drain by gravity, has been made a matter of special study by Yeomans Brothers, Chicago, who have developed a centrifugal sewage ejector which has been thoroughly worked out by ten years' experience. These ejectors are large enough to take care of municipal work and many are now in service.

As compared with the old, pneumatic method of sewage ejection, these centrifugal ejectors take one-fifth the space, and less than one-fifth the power to operate, and cost much less in addition. They can be operated by electricity, steam, gas or gasoline, and are not subject to clogging or any kind of sewage, and are entirely automatic and noiselelss in operation. For use in connection with sewage purification palnts, they are indispensable where pumping is required.

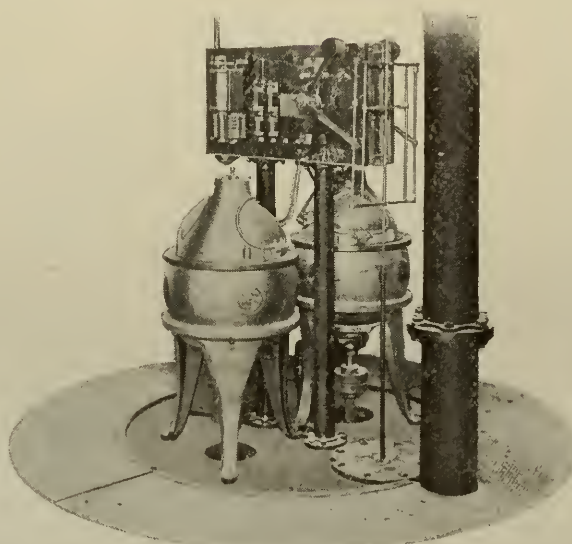
Among the distinctive features of the Yeomans ejector, the following are of especial interest to engineers and architects:

1. The ejector is ordinarily constructed with two complete units, and the automatic control is so arranged that if one unit should fail or prove inadequate in case of flood conditions the other machine acts automatically.

2. The ejector is further equipped with an automatic high-motor alarm bell, which instantly informs the attendant of failure of the machine to operate.

3. The Yeomans ejector is so arranged that it will pump out its own pit in case the latter should become flooded.

These invaluable characteristice, combined with low first cost and power consumption and saving in floor space, make this ejector a desirable machine from both engineering and commercial points of view.



YEOMAN'S DUPLEX EJECTOR.

The Yeomans ejector is in use in the Cook County Court House, City Hall, central and sub-stations of the Commonwealth Engine Company, and in many of the modern public buildings in Chicago, as well as in New York, Boston, San Francisco, St. Louis, Pittsburg, New Orleans, Spokane and other cities.

Full information regarding the ejector and its operation may be obtained by addressing Yeomans Brothers, Monadnock Building, Chicago, Ill., and inquiring for catalogue "D."

The King Junior Road Grader.

The essential elements of road construction demand thot there shall be liberal side ditches provided for drainage, for regardless of the kind of road, its maintenance and its durability are most directly dependent upon the one factor—drainage.

This fact has made it necessary in most instances for the road builder to have in his equiment, in addition to the graders and other machinery, a plow or other more or less efficient means of providing for the side ditch. With the development of the road grader, manufactured by J. D. Adams & Co., Indianapolis, this plow has been displaced and its work better accomplished.

This grader, known as the King Junior, has details of construction which make it a most practical road-building machine. The wheels are so set as to be adjusted to lean in the direction towards which it is desired to move the dirt. This is not, as some have imagined, made necessary by reason of the inclined face upon which the machine works; but it is so provided that the weight of the machine is made to counteract the side thrust of the dirt and allow the latter to be moved up hill. This renders it entirely free from side draft, lightening the back pull of the machine upon the teams. By reason of this fact it is possible to average from one-half to two times as much work with the same teams in a given time as would be possible without the leaning wheels.

The photograph shows the machine in actual work with four horses. The material is being moved up toward the center of the road to make the grade. The sharp angle of the mould, which assures a light draft, will be noted, and the feature of the leaning wheels is here shown, the machine being held firmly against its load without slipping.

The machine is of extra strength, weighs about 2,300 pounds, and has a mould 7 feet in length. It is equipped complete with double and single trees, evener, pull chain and extra cutting edge.

KING JUNIOR ROAD GRADER.

An Improved Material for Pipe Jointing.

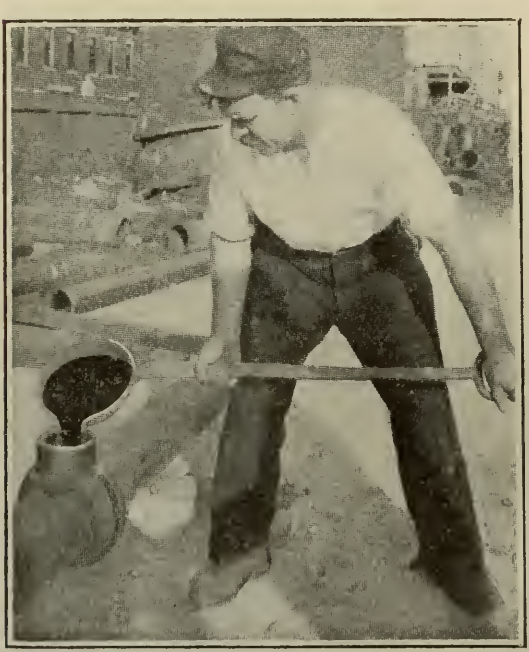
Advances had been made in every feature of cast-iron construction, including the perfecting of the form of bell and spigot pipe; the increased accuracy of molding; improved caulking tools and a a number of other changes which had developed under years of use; but until recently there has been discovered no means of providing a tight joint without using the antiquated lead caulking, which is and has been one of the greatest stumbling block in water main work.

A new material was used for the first time some years ago, which material under the most rigorous usage and tests has proven superior to the lead joint. This material, known as "Leadite," is a substitute for lead, composed of mineral ingredients, but differing from the former in a number of very important features.

The "Leadite," which in its commercial form is a powder packed in sacks or barrels, weighs only 118 pounds per cubic foot; and from its nature will make four times as many joints as an amount of lead of equal weight. It makes a joint which is permanent and water-tight, and will not leak under any pressure used in water works service, its strength and adhesion to the joint increasing with age.

A number of severe tests have been made of the properties of the "Leadite" joints, among which were the following:

A line of pipe 85 feet long was supported on blocks at both ends and allowed to sink to the ground at the center, a pressure of 100 pounds being maintained without the slightest evidence of leakage. Test pieces of extra heavy 6-inch pipes, 5 feet long, were allowed to drop 8 feet upon a log, and afterwards sustained a pressure of 130 pounds without leakage. Two lines of pipe 98 feet in length, one jointed with lead, and the other with "Leadite," were allowed to freeze over night, with the result that the first sample was parted in the middle, while the second remained intact. Other tests have proven "Leadite" to be proof against oxidation and electrolysis; and pipes which have been removed after 15 years' service have been found free from leaks, proving its durability. Th Leadite Company, 1236 Land Title Building, Philadelphia, who



POURING A PIPE JOINT WITH LEADITE.

are the manufacturers of "Leadite," have received a large number of letters which further assert the practical lasting qualities of the joints.

The method of making the joints with this material eliminates one of the greatest expense items of cast-iron main construstuction. For, in addition to the fact that the tedious hand-caulking is done away with, there is a considerable saving in the cost of bell holes, which are unnecsary in making "Leadite" joints. The accompanying photograph illustrates the making of such a joint. The compound is melted in the ordinary gasoline furnace, and is poured into the joint after the latter has been yarned in the ordinary manner. The compound, upon cooling, grips the cast iron, forming a watertight joint, which the afore-mentioned tests show to possess every feature of perfection.

The Favorite Wood for Street Paving.

As a result of a number of inquiry circulars sent out to the leading cities of the United States, the American Society of Municipal Improvements has collected an interesting set of data regarding the use of wood in street paving. One of the questions upon these blanks was: "What is your favorite wood for wood paving blocks?" There were thirty replies received in answer to this question, each reply being specific in its meaning and unqualified as to any consideration which would admit of any doubt as to the assurance of the choice indicated.

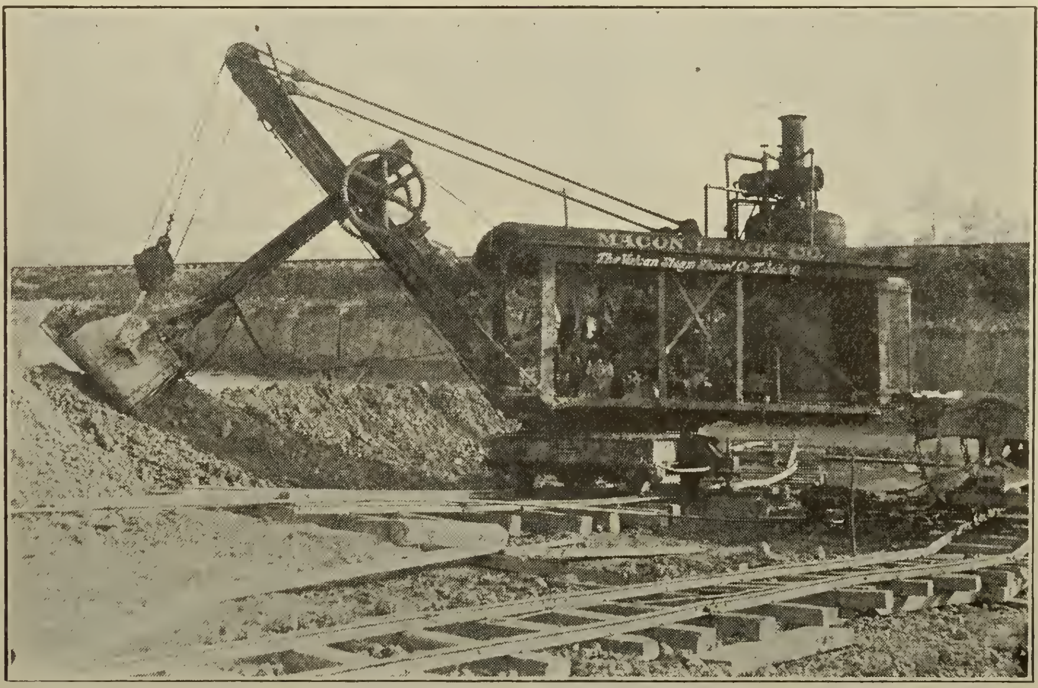
Of this total of thirty replies there were twenty-three cities which endorsed yellow pine. Some cities had stated their preference for long leaf, and a smaller number preferred the short leaf. With the enormous amount of wood block pavement in use at the present time in these larger cities the answer to this question may be taken as accurately indicating the pavement which has given the best satisfaction.

The good qualities of the wood block pavement are now acknowledged, though for a number of years there was considerable doubt relative to its durability. As regards this property, there are pavements in Boston which after five years of the heaviest of traffic have shown a wear of only about ⅜ of an inch. Another pavement, in Chicago, has shown only ⅛ inch of wear under heavy traffic and has been in constant service for nine years. In both of these cases the wear was even over the entire surface, so that the pavement was in no way roughened.

Another feature upon which some doubt has been stated is with regard to the slipperiness of the surface of wood block pavement. This matter was another of the points upon which the American Society of Municipal Improvements asked for information. Twelve of those replying to the above question stated that they did not find the slipperiness objectionable, one stated that wood was no more slippery than asphalt, and another that wood was by no means as slippery as asphalt. In reply to this question there was more discussion submitted than in the previous case. The majority of those who did state that wood blocks were slippery qualified their statement by the fact that this quality could be largely prevented by keeping the pavement clean and dry and in such condition as all pavements should be maintained. In those cities which stated that the wood pavements were slippery, sand was recommended as a remedy, while one city uses ashes and another cinders.

The statement is sometimes made that wood is impracticable for use on streets with a grade greater than 2 per cent. In reply to a question along this line it was found that eighteen of the larger cities have wood block pavements upon grades greater than 2 per cent. Of these there were eleven who had laid the wood upon grades of 3 per cent or more, and one city, Hoboken, N. J., reported no trouble with a 4½ per cent. grade. These figures prove conclusively that the old statement is one of those old ideas which have been so obstinately held and which have forced the most rigorous of tests before dying out. The increasing use of the wood pavement under these conditions is in itself sufficient evidence of its superior qualities.

The Yellow Pine Manufacturers' Association, seventh floor Wright Building, St. Louis, Mo., have for distribution a number of valuable booklets which recount the reports and the results of tests upon yellow pine paving blocks, and in addition contain information regarding the best practice in laying and maintaining the pavement.



VULCAN STEAM SHOVEL IN BRICK CLAY PIT.

A Revolving Steam Shovel in a Brick Plant.

In properly equipping a small or modern brick plant to insure economy in operation there are many things to be considered, and while the broad economics of the steam-shovel plant are well known to a large number of brick manufacturers, yet there are many who are prone to take into consideration the first cost only, and the question that often arises is whether the capacity of the plant will warrant the installation of a steam shovel.

It has been demonstrated many times that a plant having a capacity of from 30,000 to 60,000 brick per day can be operated much more advantageously and economically by utilizing a small-sized steam shovel for handling the material than by the old method of hand labor. The difficulty in procuring efficient labor, especially during the busy season, and the many delays incidental thereto has always been a more or less serious problem for the brick manufacturers to solve and one that has usually been successfully solved by the installotion of a steam shovel.

A very good example of the low cost at which a steam shovel plant may be operated may be seen in the plant of the Macon Brick Company, which is operating a 25-ton revolving shovel in its plant at Macon, Ga. This company manufactures from 50,000 to 60,000 building and press brick per day, which requires only about 100 cubic yards of material, therefore the shovel is used much less than half the time.

The material is a very fine quality of brick clay which is loaded by the shovel into two 2-yard clay cars. A cable is then attached to the loaded cars and they are hauled to a large Chambers granulator, the length of haul being about 800 feet. The material is then dumped into the granulator from which it is taken direct to the brick machine.

The company manufactures a very fine grade of brick, and their limited output has kept them behind with orders about eleven months in the year.

The shovel is a Vulcan 25-ton revolving type and carries a ¾ cubic yard dipper. The dipper handle is 12 feet long and the dipper will dump 10 feet 6 inches above rail. It will clear a floor 32 feet wide and make a cut 40 feet wide in a 6-foot bank. It swings through a complete circle, which enables it to dig and dump on all sides and at rear.

While it usually requires about one man to operate this type of shovel for moderate outputs, the Macon Brick Co., however, have two men on their shovel, which is operated at full capacity for a short part of the day only, or until a sufficient amount of clay has been excavated to supply their plant for the day, after which the shovel is shut down. They also employ two pitmen; and the maximum cost of operating their shovel plant per half day is about as follows:

	One-half Day.
One engineer at $5.00 per day......	$2.50
One fireman at $2.50 per day.......	1.25
Two pitmen at $1.75 each, $3.50 per day	1.75
Oil, waste and repairs, $1.00 per day	.50
Depreciation of plant, $1.35 per day	.68
600 lbs. of coal..................	1.05
Interest on investment............	.85
Total	$8.58

or about 8½ cents per cubic yard.

These figures are only approximate and are taken at a maximum cost and based on a half day's operation, while the shovel is really operated but a part of this time. Yet a decided saving is shown over hand labor, for to dig and load the same amount of material by hand labor would require about ten men a full day at a cost of about $17.50, or 17½ cents per cubic yard. Besides reducing the cost of excavating the material, the shovel will cut through the entire bank, thoroughly mixing the clay and resulting in a better grade of brick.

This type of shovel is also used for all classes of general contract work, road building, sewer trench digging, etc..

The Reliance Steel Stone Crusher.

The Universal Road Machine Co., 1 Emrick st., Kingston, N. Y., is manufacturing a steel stone crusher, which is one of the most simple as well as one of the most powerful machines on the market. The frame and all the working parts of this crusher are of solid castings of open hearth steel, thoroughly annealed, while forgings and shafts are of the best quality open hearth hammered steel of special carbon content, ensuring great strength and durability. The jaw plates are of manganese steel, the toughest and most durable of known metals, the jaw plates and check plates being reversible.

The crusher can be quickly and easily adjusted to vary the size of the product. Each machine has four adjusting plates, which in connection with two adjusting liners give twelve different sizes of product, varying each about 3/16 of an inch. This does away with the annoyance of ordering intermediate or special sized adjusting plates in order to obtain the full output of the machine. The Reliance crusher does not require the disconnection of the tension rods in order to change the adjusting plates. By backing off the nuts and bearing down on one side rod the adjusting plate may be readily removed by means of a large eyebolt furnished for that purpose. This is a great saving in time and trouble over old methods. All the bearings in the machine are protected, and there are no gears to wear out, and every part that is exposed to wear is easily accessible and can be readily removed and replaced.

Another feature of the crusher is the fact that it is built low to the ground, which greatly reduces the labor of feeding. The swinging jaw plate is designed to obviate the danger of stone becoming clogged upon entering the jaws of the crusher.

The Universal Road Machine Co. also manufacturers a number of machines which will recommend themselves to the users of crushers who require plants capable of easy and quick transfer from place to place. These machines, the Reliance steel truck, the Reliance folding elevator and the Reliance portable bin, combined with the crusher above described constitute a complete plant which may be easily and quickly moved and set, which handles the product easily and is convenient and efficient in operation.

The Merriman One Car Asphalt Plant.

The One Car Asphalt Plant, manufactured by the East Iron Machine Company of Lima, O., has given great satisfaction for a number of years. This plant is, as its name implies, entirely contained on one car, and yet has a capacity of 1,800 square yards of 2-inch sheet asphalt, or 400 yards of 1-inch binder in ten hours.

It is made strong, to withstand the hard usage incident to the asphalt business. All the machinery parts are direct connected, eliminating all belts for transmission. The asphalt pipes and valves are all steam-jacketed, which precludes the possibility of freezing in cold weather, and the tanks are piped for either air or steam agitation.

The asphalt is heated with steam furnished from a 125-horsepower flue Marine-type boiler, the use of steam eliminating all possibility of burning the asphalt. The two independent tanks have a melting capacity of 712 cubic feet each, each tank being equipped with four coils of 1¼-inch double-strength pipe, electrically welded, leaving no connections within the tank, where leaks may occur. The condensed steam from the tanks returns to the boiler by means of a hot-water pump working automatically.

The sand drum is 28 feet long, 5 feet 6 inches in diameter, has four heavy spiders on inside and 8-inch shaft. This is a return heat drum, the heat passing under and returning through same. Flights are inserted on the inside for conveying sand and stone through. It is a strong, substantial drum and has a capacity in excess of requirements and is very economical from a fuel standpoint, owing to its large heating surface.

The hot-sand tank, screen, mixer and a mixer engine, hoisting engine and elevator engine are all on a sliding carriage on one end of the plant, which is slid out in position to drive under by means of two large screws. The hot-sand tank is raised and lowered by four right and left-hand screws, one on each corner—raised when in operation and lowered when being transported. This saves removing tank from car when being transported.

One of the plants in actual use laid 114,000 square yords of finished material, traveling 1,185 miles, being taken down and set up seven times and lost about four weeks waiting on material. The same plant laid 162,000 square yards and traveled 1,260 miles in one season. The plant being self-contained involves very little outlay in taking it down and setting it.

G. F. W. Road-Oiling Machinery Business Changes Hands.

Many of the roads of the present are constructed with a binder of asphalt oil or similar material. The pressing need at this time is for machinery capable of handling this material in the quickest, easiest and most economical manner. Realizing this fact the Good Roads Machinery Company, Kennett Square, Pa., who are specialists in road-building machinery, tools and supplies, have taken over the road-oiling machinery and devices hertofore manufactured by the G. F. W. Co., Saratoga Springs, N. Y. This machinery will hereafter be manufactured at Groton, N. Y., and will be marketed by the Good Roads Machinery Company through its various branch offices and selling agencies.

The Perfection Oil and Asphalt Distributor has been manufactured and sold by the G. F. W. Co., Saratoga Springs, N. Y., for the past two years, and has received the endorsement of road-building contractors as well as of highway engineeers in New York and other States. With this machine it is possible to heat heavy oil and spread it upon the road in a smooth, unbroken sheet in any volume required. The appliance also handles lighter oil that does not require heating. That the machine is a labor and money saver is evidenced by the fact that it can be operated by one team of horses and one man. The fuel cost per day does not exceed $1.00.

For further information in regard to the Perfection Oil Distributor and other oiling devices address The Good Roads Michinery Company, Kennett Square, Pa.

A New Reisert Water Filtration Plant.

The Anheuser-Busch Brewing Association of St. Louis is at present engaged in remodeling their filtration system at their lower ice plant. They have awarded a contract to the Reisert Automatic Water Purifying Company for the installation of three gravity filtrers of the New Improved Reisert type, which will have a total capacity of 4,000,000 gallons per days. These Reisert filters will replace filters of another make, the operation of which will be discontinued and will be installed in the existing filter house.

The water to be filtered is pumped from the Mississippi river into two settling tanks of 500,000 gallons capacity each, in which the water is treated with caustic lime and sulphate of alumina. From these settling tanks the water flows into a large reservoir holding approximately 1,500,000 gallons, and from this reservoir it overflows to the Reisert filters.

Each of the three filter units is 35 feet long by 15 feet 2 inches wide, and is 11 feet high. The capacity of each unit is 60,000 gallons per hour. As they were necessarily designed to fit the present filter house, they are constructed wholly of tank steel, to save space. The filtering material is selected filtering gravel and fine crushed flint.

The filter beds are washed, according to the Reisert method, with filtered water and compressed air. The ratio of the wash water required to the total amount of clean water delivered by the filters is 1 to 60.

For cleaning purposes one unit at a time is shut off, and the cleaning does not occupy more than from one to two minutes each time. In this manner the capacity of the plant is maintained practically uniform. Each filter unit will be cleaned on an average of twice in 24 hours.

The first unit will be in operation on or before March 15th, and the entire plant before April 15th. The water will be used for beer and ice-making and boiler purposes.

The Busch-Sulzer Brothers-Diesel Engine Company.

On January 26th was incorporated at St. Louis, Mo., one of the largest engine manufacturing companies in the United States. The company was incorporated with a capital stock of $2,100,000, and has for its purpose the manufacture of the Diesel oil engine, which has been manufactured and used in this country for some years. The officers and directors of the new company are:

Adolphus Busch, president; August A. Busch, first vice president; James R. Harris, second vice president and general manager; Edward A. Faust; E. D. Meier, president American Society Mechanical Engineers, New York; Robert Sulzer, of Gebrueder Sulzer, Winterthur, Switzerland; Eugene Angert, attorney, St. Louis; Rudolph Diesel, engineer, Munich, Germany; Daniel N. Kirby, of Nagel & Kirby, attorneys, St. Louis.

One of the first acts of the new corporation will be the erection of one of the most modern and complete plants in the world, the estimated cost of which is about one million dollars. The location of the plant has not as yet been definitely decided upon, but unless the location of the plant in St. Louis would interfere with its success, that city will no doubt be selected. The connection of Adolphus and August A. Busch with the company will no doubt operate to influence the selection of St. Louis.

Adolphus Busch has been interested in the Diesel engine business since the Diesel engine was invented by Rudolph Diesel, an engineer of Munich, Germany, who is to be one of the directors of the new company, and even as far back as 1897, when Mr. Busch bought the basic patents for the United States of America and anada, he saw the great future of the engine, although it was then in the embryo stage, having just been invented and not a commercial article.

On May 10, 1909, Adolphus Busch bought the assets of the American Diesel Engine Company and transferred the business of the company from New York to St. Louis. It has since been managed by James R. Harris, under the close direction of August A. Busch.

The old American Diesel Engine Company brought their type of Diesel Engine to a very high state of perfection, so that the engines now being manufacturers by Adolphus Busch, purchaser of the American Diesel Engine Company, are giving the greatest satisfaction to its users throughout the United States. This is well demonstrated by the fact that the present company conducted by Mr. Busch has sold over 1,000 horsepower of the type of Diesel engine during the last sixteen months and could have sold more if the company had had the proper facilities for turning out the engines.

The Diesel engine is an internal oil combustion engine and is built both as a two-cycle and a four-cycle engine. Ordinary crude oil is used for fuel, and the method by which this fuel is used in connection with the engine is simple and different from that of other types of power. There are no boilers, neither is the fuel used as is gasoline in the automobile engine, although the operation in the latter case is somewhat similar. In the Diesel method of combustion there is no "mixture," nor is there any "spark" or other mechanical or electrical device to cause trouble. The cylinders of the engine (in which the power is developed and supplied through the pistons and rods to the driving shaft) contain nothing but air until the "compression" stroke has been completed, and until the temperature which results from this compression is more than sufficient to ignite the fuel. The fuel is atomized by air into an extremely fine spray and is introduced into the cylinder at a rate which does not permit of an explosion, but generates a steady pressure on the piston as does the steam in a steam engine, the quantity being regulated directly by the governor in proportion to the load on the engine.

The average experience of users of Diesel engines in this country shows that the fuel cost of operating an ordinary steam plant is cut down fully two-thirds where Diesel engines are used. Records kept by users of Diesel engines show that the average Diesel engine in service develops 100-horsepower for an hour's time on 6½ gallons of oil.

A further saving of great importance is the elimination of labor necessary in a steam plant for firing, cleaning and repairing steam boilers, labor necessary in a steam plant for firing, cleaning and repairing boilers and handling coal and ashes. It is to be noted, then, that the cost of this extra labor in the steam plant has been shown in several cases to be actually sufficient to pay for all the fuel consumed by an equivalent Diesel installation. Several Diesel installation in municipal lighting and power plants have proven them to be especially adapted to this use by reason of their economy of fuel in addition to the points just noted.

A kilowatt hour for one-third cent is the average daily record of every electrical plant driven by an American Diesel engine. This is based on a cost of three cents per gallon for crude or fuel oil.

An interesting economical feature of the Diesel engine is that no fuel is consumed until the engine is started and also that as soon as the engine is shut down the fuel consumption immediately ceases.

The new company has been particularly fortunate in procuring for their chief engineer, Mr. Max Rotter, the present chief engineer of the Allis-Chalmers Company, who has been given full authority to procure the most capable engineering staff to be found.

The offices of the company are at present in the South Side Bank building, St. Louis, Mo.

Commendation for Composite Pipe.

Though it has only been upon the market for a short time, the improved cement and metal pipe is meeting with a great deal of commendatory notice. Along this line J. Waldo Smith, chief engineer of the New York Water Supply, stated in a lecture delivered February 8th, before the New England Water Works Association, "that it would be of interest to the people of New England, which was the home of cement-lined pipe, to know that nothing had been discovered dduring all the years of experimenting which equalled cement for protection for steel, and, therefore, they were coating the 9-foot-in-diameter steel pipes with Portland cement and afterwards lining the same with Portland cement mortar."

The Composite Pipe Company, of Mansfield, Mass., has recently been incorporated to manufacture the cement-lined pipe, such as was described in the February issue of Municipal Engineering.

Street Signs and Sign Posts.

The types of street signs and methods of designating streets are many and varied, as a reference to the reports on street signs in different cities (tabulated on another page of this issue) will testify. The greatest number of these cities, however, use some one of the many types which are mounted on poles at the street corners.

An Early Criss Cross enameled sign is located in front of the Borough Hall, Staten Island. This is one of the many types of street signs manufactured by Joseph N. Early, Reade and Hudson streets, New York City. Of these a few of the types are the "Early Welsbach," which is adopted for use with the gas lamp which is common in street illumination in the outlying districts of many of the larger cities. The "Early Electric," which may be attached to the arc light poles, being made in either enameled or zinc stencils, with opal glasses, and the "Early Dead Welsbach," which can be used on electric or trolley poles on changing the lamps. A special one-piece lamp post is also manufactured by this company. This post was adopted by the city of New York in 1909.

IMPROVEMENT AND CONTRACTING NEWS

Note—Only the dates for letting of contracts are published in this department this month. Reference should be made to the large tables in the department of "Municipal Improvements, 1910-1911," on pages 232 to 291, for the fullest reports of contemplated work and work in progress in the municipal field which have ever been published. Information received after March 1 will be found in this department in the April number of Municipal Engineering.

PAVING.

CONTRACTS TO BE LET.

Savannah, Ga.—Bids will be received Mar. 9 at 12 m. for furnishing 5,000 cu. yds. of cement, gravel, or similar material for public roads. Co. com.

Brazil, Ind.—Bids will be received Mar. 11, 1:30 p. m., for constructing two gravel roads. F. A. Staggs, audt.

Brownstown, Ind.—Bids will be received Mar, 6, 1:30 p. m., for constructing a gravel road in Vernon tp. H. W. Wacker, audt.

Lebanon, Ind.—Bids will be received Mar. 13, 7:30 p. m., for graveling and constructing sewer in Baronne st. Edmund Connor, cy. clk.

Muncie, Ind.—Bids will be received until Mar. 11 for paving various streets. J. Kelley, cy. clk.

Paoli, Ind.—Bids will be received Mar. 17 for constructing a gravel road in Paoli tp. Alvin B. Ham, audt.

Rockville, Ind.—Bids will be received Mar. 7, 1:30 p. m., for constructing a gravel road in Liberty tp. James. E. Elder, audt.

Wabash, Ind.—Bids will be received Mar. 7, 1 p. m., for constructing two gravel roads. J. F. Naftzger, audt.

Winamac, Ind.—Bids will be received Mar. 7, 12 m., for improving public highways. W. E. Munchenburg, audt.

Worthington, Minn.—Bids will be received Mar. 13, 2 p. m., for grading two mi. of road. Certified check, 5 per cent. E. C. Parnell, audt.

Jackson, Miss.—Bids will be received Mar. 9 for county road construction. Bond required. Mayes Cooper, highway engr.

Lorain, O.—Bids will be received Mar. 7 for furnishing material and constructing sidewalks and crosswalks, etc. L. B. Johnson, clk.

Youngwood, Pa.—Bids will be received until Mar. 13 for paving 2 mi. of street with brick blocks. Warren T. Mitchell, Greensburg, boro engr.

Ft. Monroe, Va.—Bids will be received until Mar. 21, 10 a. m., for constructing concrete walks, macadam roads, etc. Capt. R. B. McBride, Ft. Monroe, Va.

Olympia, Wash.—Bids will be received Mar. 8 for completing state aid road No. 71. State Highway Com., Olympia, Wash.

Monroe, Wis.—Bids will be received until Mar. 7 for paving 5,057 sq. yds. W. G. Kirchoffer, cons. engr.

SEWERS.

CONTRACTS TO BE LET.

Ft. Morgan, Colo.—Bids will be received Mar. 15 for the construction of pipe sewers and concrete for manholes and flush tanks. C. C. Rickel, cy. clk.

Atlanta, Ga.—Bids will be received Mar. 14 for constructing intercepting sewer and disposal plant on Intrenchment creek. City council.

Rockmart, Ga.—Bids will be received Mar. 7, 2 p. m., for furnishing material and constructing water works and sewerage system. City mayor.

Pocatello, Ida.—Bids will be received Mar. 9, 8 p. m., for constructing trunk sewers. City council.

Lebanon, Ind.—Bids will be received Mar. 13, 7:30 a. m., for graveling and constructing sewer in Baronne st. Edmund Connor, cy. clk.

Ft. Andrews (Boston P. O.), Mass.—Bids will be received Mar. 10 for extending water mains and changing the sewer at Ft. Andrews. Capt. A. M. Miller, 263 Sumner st., Boston, Mass.

Ft. Washington, Md.—Bids will be received Mar. 20 for constructing an 8-in. sewer outlet and iron outfall. Capt. R. H. C. Kelton, Ft. Washington, Md.

St. Cloud, Minn.—Bids will be received Mar. 8 for sewer construction, including the following: 19,746 lin. ft. of pipe sewer from 8 to 24-in.; 67 manholes; 67 catch basins, and 8 flush tanks. City council.

Tracy, Minn.—Bids will be received Mar. 9, 8 p. m., for sewer construction. Certified check, 15 per cent. Lester J. Fitch, cy. rec.

Bridgeton, N. J.—Bids will be received Mar. 7 for furnishing material and constructing sewage disposal plant and pumping station, etc. City council.

Grand View (Columbus P. O.), O.—Bids will be received until Mar. 21 for furnishing material for the construction of a sewer with an outlet. Vil. clk.

Moundsville, W. Va.—Bids will be received until Mar. 21 for furnishing material and constructing about 26 miles of sewers, varying in size from 6 to 36 in. Oscar B. Bonar.

WATER WORKS.

CONTRACTS TO BE LET.

Rockmart, Ga.—Bids will be received Mar. 7, 2 p. m., for furnishing material and constructing water works and sewerage system. Cy. mayor.

Owensboro, Ky.—Bids will be received Mar. 10 for constructing a water softening plant. S. Lambert, mayor.

Ft. Andrews (Boston P. O.), Mass.—Bids will be received Mar. 10 for extending water mains and changing the sewer at Ft. Andrews. Capt. A. M. Miller, 263 Sumner st., Boston, Mass.

Macomb, Miss.—Bids will be received Mar. 7 for sinking an artesian well. J. D. Harrell, cy. clk.

Hornell, N. Y.—Bids will be received Mar. 10 for constructing an earthen reservoir with concrete curve wall, etc., including 3 miles of water mains. Cy. clk.

Ogdensburg, N. Y.—Bids will be received Mar. 7 for constructing covered sand filters, pipe lines, steam and electrical pumping machinery, water turbine, etc. Board of water comrs.

Troy, N. Y.—Bids will be received Mar. 11 for furnishing material and installing water mains from the intersection of Adams st. to Miami county infirmary. A. E. Sinks, audt.

Jonesboro, N. C.—Bids will be received until Mar 13, 5 p. m., for constructing and furnishing material for water works; 385 tons of 6 to 8-in. cast-iron pipe; hydrants and specials; laying 6 miles of 6 and 8-in. pipe and erecting 75,000-gallon tower and tank. Certified check, $500. W. S. Murchison, clk.

Grand View (Columbus P. O.), O.—Bids will be received until Mar. 21 for laying water mains and water pipes within the city limits. Vil. clk.

Bristol, Pa.—Bids will be received Mar. 20 for furnishing material and constructing water works and filtration plant. Borough council.

West Telford, Pa.—Bids will be received Apr. 1 for water works construction. H. Z. Walpole.

Gettysburg, S. D.—Bids will be received Mar. 20, 7 p. m., for constructing a complete water works system. Certified check $500. Cy. audt.

Miller, S. D.—Bids will be received Mar. 3 for constructing an artesian well in the court house square. Chas. I. Odie, audt.

Seattle, Wash.—Bids will be received Mar. 7 for constructing a steel water tower on Magnolia Bluff. C. B. Bagley, sec.

BRIDGES.

CONTRACTS TO BE LET.

Los Angeles, Cal.—Bids will be received Mar. 6 for constructing concrete arches, graveled approaches, curbs, etc. H. T. Lelande, county clk.

Martinsville, Ind.—Bids will be received Mar. 7, 2 p. m., for constructing a number of arches. J. S. Whittaker, audt.

Petersburg, Ind.—Bids will be received Mar. 7, 2 p. m., for constructing a steel bridge. John D. Gray, audt.

Ida Grove, Ia.—Bids will be received Apr. 3 for plans and construction of steel bridges in Ida county. Board of supervisors.

Grasston, Minn.—Bids will be received Mar. 10, 1 p. m., for constructing a steel bridge across Rice creek. Certified check 10 per cent. Peter Backlund, town clk.

Rockport, Mo.—Bids will be received until Mar. 7 for constructing two steel high-truss bridges, 90 ft. long. Certified check, $500. Board county comrs.

Utica, N. Y.—Bids will be received until Apr. 1 for constructing a bridge over the Mohawk river. William F. Cogley, cy. engr.

Hamilton, O.—Bids will be received until Mar. 11, 10 a. m., for constructing sub and superstructure of a bridge and road fill. Certified check, 10 per cent. J. E. Brate, audt.

STREET LIGHTING.

CONTRACTS TO BE LET.

Boston, Mass.—Bids will be received Mar. 4 for furnishing and installing about 11,000 lamps in various streets, parks and alleys. Louis K. Rourke, board of public works.

Cleveland, O.—Bids will be received until Mar. 8, 12 m., for furnishing and delivering transformers for municipal electric light plant. A. B. Leo, dir. pub. serv.

FIRE APPARATUS.

CONTRACTS TO BE LET.

Princeton, N. J.—Bids will be received until July 5 for furnishing auto pumping engine. E. M. Updike, chrm. fire and water com.

Ottawa, Ont., Can.—Bids will be received until Mar. 14, 12 m., for furnishing combination auto fire engine, capacity, 700 gallons per minute. John Henderson, cy. clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTRACTS TO BE LET.

Woodruff Place, Ind.—Bids will be received Mar. 13, 2 p. m., for collecting and removing ashes and garbage. Carrol E. Swain, cy. clk.

McKees Rocks, Pa.—Bids will be received Mar. 13 for constructing a garbage disposal plant. City council.

Municipal Engineering

VOLUME XL APRIL, NINETEEN HUNDRED ELEVEN NUMBER FOUR

Turbine Pumping Units in the Indianapolis Water Works

Editorial Correspondence

THE city of Indianapolis is supplied by direct pumpage through a common distribution system from two stations which derive their supply from White river through a canal. This canal starts at a point above a dam located at Broad Ripple, some nine miles above the city. The water is carried from this point along the canal, which is 40 feet wide, 5 to 9 feet deep and 9 miles long to the filtration plant where part of the water is diverted into a sedimentation basin of 48,000,000 gallons capacity; the balance being carried to the Washington station and used for power purposes. The sedimentation is by natural means during the greater part of the year; but when the turbidity becomes greater than 30 or 40, lime and iron or other coagulants are used. From this basin the water passes through a slow sand filter consisting of 6 units of eight-tenths of an acre each. It may then pass either into clear water basins of 4,000,000 gallons storage capacity, or into a 52-inch conduit which conducts it to a covered reservoir of 6,000,000 gallons capacity located at the Riverside Pumping Station. In this plant is located a steam turbine which is hereinafter mentioned.

The conduit is then continued to the Washington Station 6,000 feet further south of the Riverside Station. The Washington Station takes suction from a large well supplied by this conduit.

The combined pumpage from the two stations above noted averages about 20,000,000 gallons per day, a maximum of 30,000,000 gallons has been reached, and in case of a large fire a 48,000,000 gallon rate has been noted.

HYDRAULIC TURBINE UNITS.

The pumping equipment at the Washington Station is driven by hydraulic turbines; the steam engines having been entirely displaced. The accompanying photograph and floor plan show the pumping installation at this station. As will be noted, each four-stage centrifugal pump is connected to two pair of turbines. The pumps are of the inclosed impeller type, with 36-inch wheels; delivering direct into the supply mains through the control valves shown.

The turbine wheels consist of two pairs of 16-inch improved New American turbines, manufactured by the Dayton Globe Iron Works Co., of Dayton, Ohio. They are of the improved inward flow type, set horizontally. Each unit is designed to deliver 350 h.p. at 550 r. p. m.; or 220 h.p. at 450 r. p. m. under a 29 foot working head. They operate on normal domestic pressure at 400 r. p. m. increasing to 500 r. p. m. on fire pressure. The bearings are of the generator type, with large oil chambers and oil rings.

At the power and speed above noted, i. e., with the pumps operating under domestic pressure, the turbines have a rated efficiency of 80 per cent. By reason of some minor changes and capable handling, the present efficiency under domestic pressure is about 82 per cent.

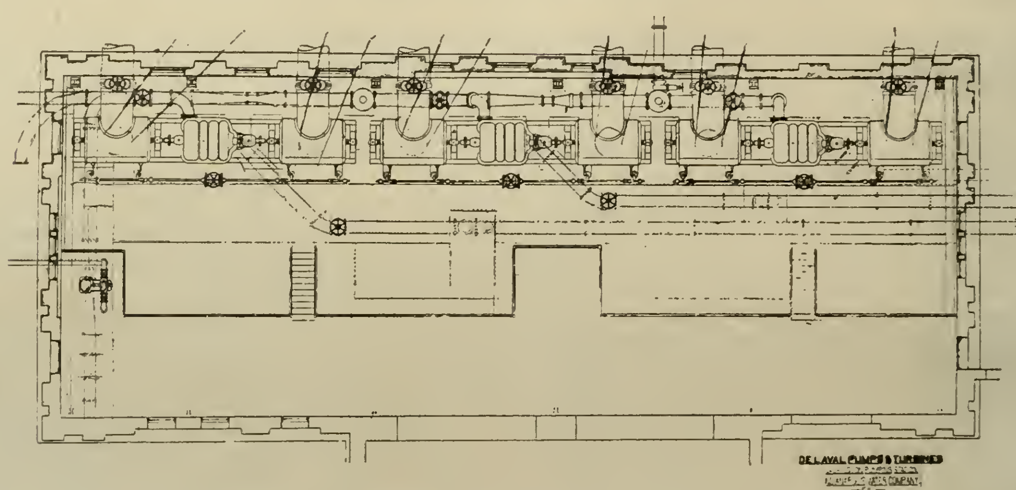
The wheel flumes are 5 feet in diameter by about 6 feet long and consist of heavily ribbed cast iron heads mounted on a cast iron base. The delivery pipe is so designed that a reduction in section supplies an equal volume of water to each of the four turbines. This delivery pipe is shown in the accompanying photograph of the canal dam and tail race. The wheel valves provided are operated by draw shafts in such a manner as to do away with all gearing within the water. The draft tubes are of special design, extending out from beneath the wheels as shown in the accompanying drawing. They increase in diameter from 36 inches at the wheel to 8 feet at a point of delivery beneath the water surface outside of the building.

The accompanying photograph shows the tail race, the draft tubes discharging beneath the water in the foreground.

The turbines are direct connected by a 2 15-16-inch steel shaft to two 36-inch, 4-stage centrifugal pumps. The impellers are of special design by reason of the pressure conditions; a maximum efficiency being obtained under normal domestic pressure. An increase of speed to about 500 r. p. m. gives a fire pressure of 300 feet.

DeLaval Steam Turbine Co., of Trenton, New Jersey, and installed by Dravo, Doyle Company, of Pittsburg, has recently been installed at the Riverside pumping station. This unit, which is rated at 8,500,000 gallons per day, is operating almost continuously at 10,000,000 gallons, and has at times delievered over 11,500,000 gallons, the exact amount being unknown by reason of the fact that the Venturi meter on the discharge is only calibrated up to 11,500,000 gallons.

The steam turbine is of the De Laval single stage "velocity" type with a 32-inch wheel. A complete expansion of steam takes place in each single nozzle; steam entering the nozzle at



FLOOR PLAN, WASHINGTON STATION, INDIANAPOLIS.

The old pumping plant at the Washington Street Station had a capacity of about 9,000,000 gallons per day. With the turbine centrifugal units, the pumpage is increased to about 15,000,000 gallons per day. The turbines are operated in conjunction with the steam turbine unit installed at the Riverside Station.

A peculiar condition is fulfilled in the hydraulic turbine installation. It was necessary to take water at a head of 30 feet and generate power sufficient to pump water at fire pressure which is approximately 300 feet. This made necessary the combination of two pairs of turbines to each pump. The turbines operate in parallel, developing sufficiently high rotative speed to obtain the required pressure in the pumps which operate in series. In this manner, when delivering at fire pressure, a delivery head of 75 feet to the stage is obtained in the pumps.

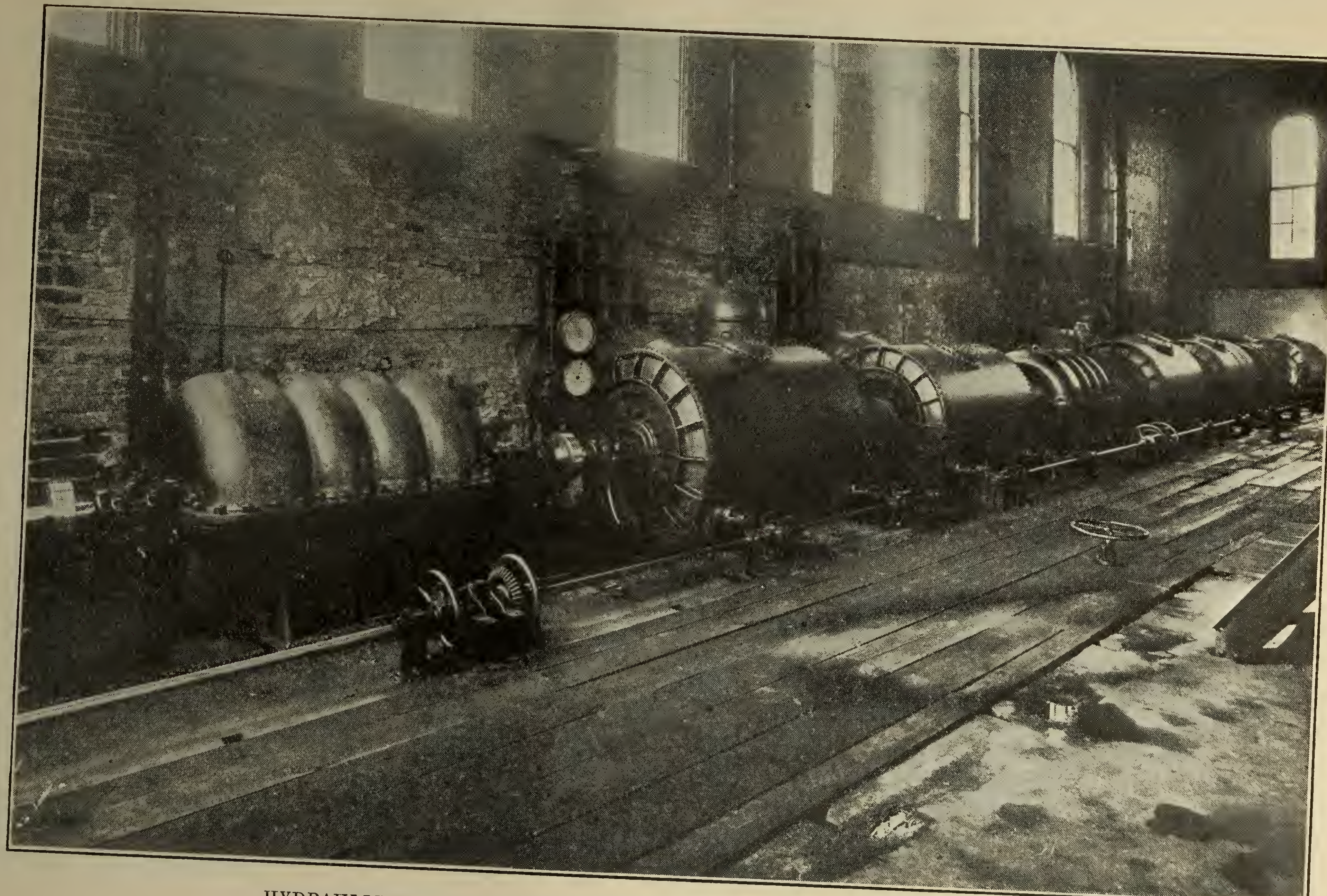
STEAM TURBINE UNIT.

A steam turbine driven centrifugal pumping unit, manufactured by the

full pressure expands to exhaust or condenser pressure, converting all the heat energy available into velocity energy before the steam impinges on the buckets of the wheel.

A series of low pressure nozzles, 26 in number, are distributed around the periphery of the wheel so that a sufficient number of nozzles are provided to suit a wide range of speeds. In addition to these there are 8 high pressure nozzles provided in event that it becomes necessary to use the turbine without the condenser.

The turbine proper consists of a high carbon steel disk fitted at the periphery with a single row of steel blades and enclosed in a steel casing. The disk is secured to a light flexible shaft of small diameter. This flexible shaft allows the wheel to assume its proper center of rotation. It is supported on three self-aligning bearings, the one at the side of the wheel nearest the pump side of the turbine, being entirely free to oscillate; operating only to seal the wheel casing against leakage. The power is transmitted through the



HYDRAULIC TURBINE INSTALLATION, WASHINGTON STATION, INDIANAPOLIS.

shaft to two special gears of improved type, enclosed and running in oil. These gears reduce the speed at a ratio of 10 to 1.

The power of the turbine depends upon the number of nozzles in action, and these can be opened and closed by a hand wheel at each. Each nozzle performs its work as efficiently when operated alone as when operating in conjunction with others. It will deliver 525 h. p. at 9,000 r. p. m. About 14 to 15 pounds of steam per brake horse power is used.

The pump, which is direct connected to the steam turbine, is a De Laval duplex series double suction type. The impellers are of bronze, so designed as to be hydraulically balanced against side thrust on the bearings, which are of the generator type, ring oiled. The suction and discharge are both 16 inches in diameter.

This unit is used for continuous service, delivering from 8,500,000 to 11,500,000 gallons. In case of fire, a few more steam nozzles are opened on the turbine, providing a higher speed with a corresponding increase of quantity from the pump.

The accompanying tables were compiled from data taken under direction of C. H. Hurd, chief engineer, C. R. Waller, of the De Laval Steam Turbine Co., and J. D. Berry, vice president Dravo, Doyle Co., Pittsburg.

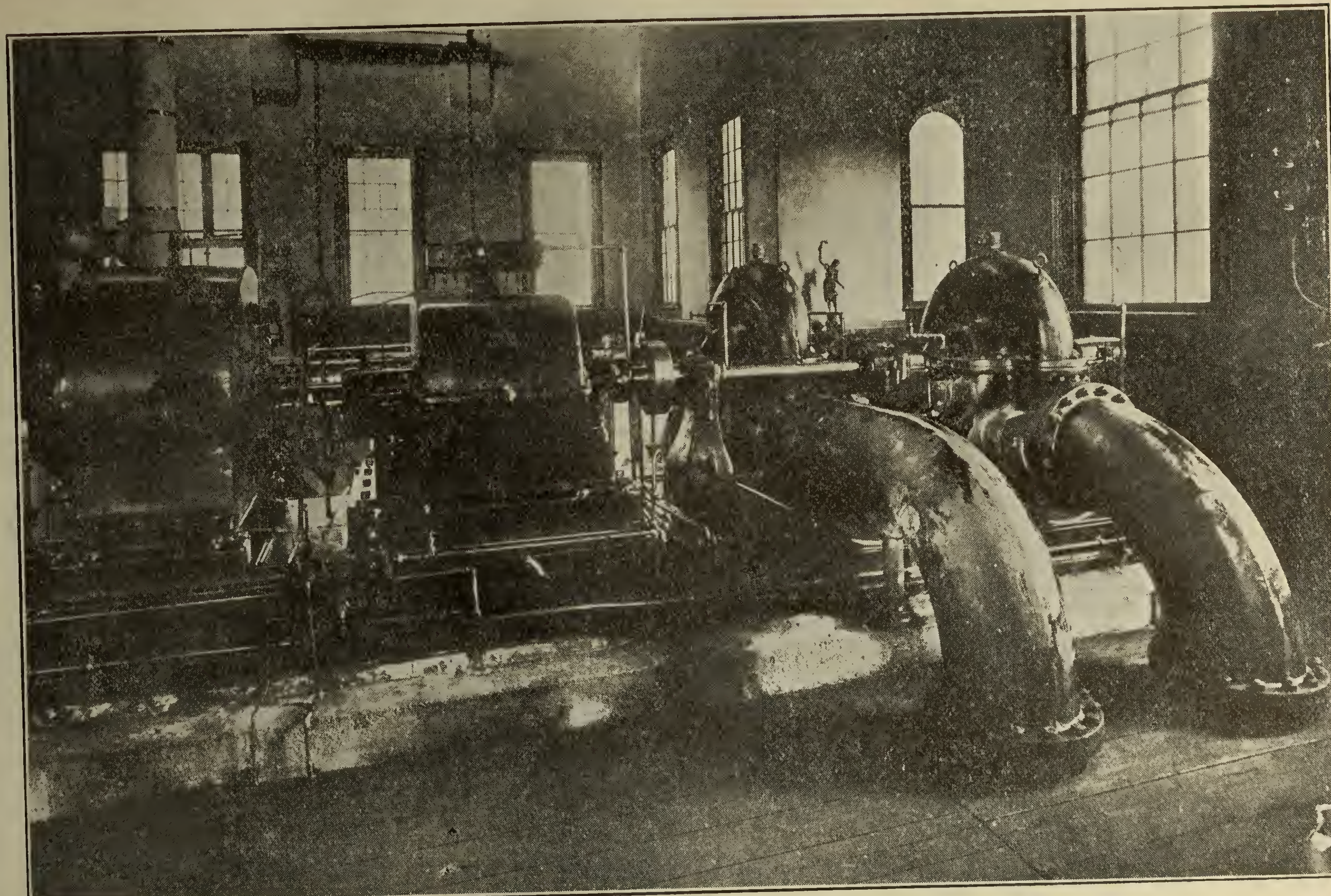
CANAL DAM, TAIL RACE AND DELIVERY PIPE AT WASHINGTON STATION.

TABLE I.

FIRE PRESSURE CONDITIONS.

Suction lift in feet	10.21
Discharge head in feet	227.23
Correction (difference in elev. of gauges) in feet	4.16
Total head in feet	241.70
Nozzles open	20
Vacuum in turbine case, inches of mercury	28.40
Discharge per day, gallons, by Venturi meter	9,477.500
Discharge per hour, gallons	394,895.83
Discharge per min., gallons	6,581.6
Steam pressure at throttle, lbs.	176.83
R. P. M.	884.30
Steam consumed per hour, lbs.	7,853

Duty=101.32 million foot lbs. per 1,000 lbs. of steam.



STEAM TURBINE UNIT, RIVERSIDE STATION, INDIANAPOLIS.

TABLE II.

DOMESTIC SERVICE CONDITIONS.

Suction head in feet......	13.607
Discharge head in feet....	142.000
Correction (difference in elev. of gauges) in feet.	4.160
Total head in feet......	159.767
Nozzles open............	14
Steam pressure at throttle, lbs................	175.17
Vacuum pressure at throttle, lbs................	175.17
Vacuum in turbine case, inches of mercury.....	28.00
Speed R. M. P...........	754
Discharge per day, gallons, by Venturi meter......	9,023,700
Discharge per hour, gal..	375,987.5
Discharge per min., gal..	6,266.5
Steam per hour, lbs.....	5,518.33

Duty=90.7 million ft. lbs.
per 1,000 lbs. of steam.

The turbine unit has proved exceptionally efficient, having exceeded the guarantee conditions of the contract under which it was purchased to such an extent that a bonus was allowed to the contractors upon its performance. As will be noted from the above tables, the vacuum was held at 28 inches, which was the condition upon which the duty clause of the contract was based and the bonus provided. From later tests at which a higher vacuum was maintained an even greater duty per thousand lbs. of steam was obtained.

The following table gives a summary of all the tests made to date showing the various number of nozzles used, from 8 to 20, the various heads and the duties obtained:

The conditions in Indianapolis are unique for a city of such size, as a fire pressure is furnished direct; the steam fire engines being called in use in only a very few instances. This makes necessary the maintenance of an exceedingly large capacity of reserve pumping units. The present pumping equipment entire comprises in all about 85,000,000 gallons capacity, while, as was noted above, the maximum that has ever been required has been but 48,000,000 gallons. This fact makes the steam turbine practically an ideal unit for use under the conditions. The company has announced its intention of installing more of the steam turbine driven centrifugal pumps as the need for additional units arises or when it becomes necessary to replace the present reciprocating engines.

Mr. Hurd has expressed his entire satisfaction with the unit as fulfilling the purposes for which it is intended. As a reserve unit it costs little to operate, is efficient and requires little attention to maintain or operate, and affords a combination of speeds and capacity at comparatively high efficiency. In addition to this, the centrifugal pump is low in first cost, and where coal is cheap, the steam turbine unit, when everything is considered, is the most economical type. The slight balance in favor of the reciprocating engine as regards higher duty is more than off-set by the conditions above noted where a unit is required for intermittent use.

In addition, there are a number of features in which the steam turbine unit is far superior to the reciprocating engine. There is no expenditure of steam when the engine is inoperative; while in the case of the reciprocating engine, steam must be kept on jackets and coils, and in addition there will be some waste due to unavoidable leakage.

TABLE III.

SUMMARY OF TESTS—DELAVAL TURBINE—RIVERSIDE MARCH, 1911.

Nozzles open Number.	Total head in feet	Steam pressure in pounds.	Vacuum inches of mercury.	Steam consumed per hour Pounds.	R. P. M.	Discharge per day Gallons	Duty million ft. lbs. per 1000 lbs. steam
* 8	164.35	173.75	27.97	4,028.00	679.85	5,709,000	80.955
10	152.04	175.42	28.73	4,159.00	674.00	6,933,000	88,031
*12	157.74	176.92	28.02	4,789.00	709.10	7,880,000	90.150
*14	159.77	175.17	28.00	5,518.33	754.00	9,023,700	90.700
16	157.10	177.50	28.60	6,318.00	804.00	9,876,700	85.301
18	157.91	179.50	28.50	7,039.00	886.50	10,459,800	81.520
*20	250.11	176.98	27.98	7,742.50	886.00	8,989,000	100.858
20	241.70	176.83	28.40	7,853.00	884.30	9,477,500	101.320

In the reciprocating engine the cost of packing and lubrication is very high. The packing for plungers alone, costs several hundred dollars per year, while the valves and other parts form a considerable item. In the steam turbine there is no packing except in the small glands on the shafts, and no valves. The lubrication cost is very low as only the bearings require oil. Then, too, there is no oil in the steam which passes into the condenser and the latter may be used again, without treatment, as feed water.

With the centrifugal pump there are no pulsations which are usual with pumps of the reciprocating type. The quantity of water delivered varies inversely with the pressure, with a constant horse power. It is particularly adapted to fire pressure service as the mere setting of a few nozzles causes the pressure to climb without any surden shock and with no delay in starting if the engine is at rest.

The cost of labor both in maintenance and operation is much less in the case of the turbine driven centrifugal unit. But the most attractive feature is the low first cost, its economy over a wide range of conditions, its reliability, and the small amount of space occupied by this character of installation. The centrifugal unit shown in the photograph pumps 11,500,000 gallons and occupies a space about 17 feet by 6 feet.

It must not be understood that Mr. Hurd recommends the steam turbine centrifugal unit for all purposes, but rather he recognizes its superiority as a reserve unit under most conditions.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Operation and Maintenance of Dam and Reservoir

IN my former articles I have discussed methods by which the commercial value of a water power project may be safely found, and which should be adopted in the designing and constructing of the plant in order to secure the most resourceful development, and in these, the closing articles of this series, I present the maintenance and operation of such a plant.

In compiling the estimate of the operating and maintenance cost of a plant, they are generally taken at 20 per cent of the cost of the works and 5 per cent of that of the equipment, and while this holds true of the general average, being based upon statistics of a large number of plants in commission, the rate may be considerably lowered, especially as pertaining to the works, and on the other side it may be greater. Broadly speaking, any maintenance cost of such works is a penalty paid for faulty design or construction as, barring some accidents which cannot be economically guarded against and which may or may not occur in a life time, the works may readily be so conditioned as to be absolutely permanent and requiring no repairs. In this respect hydro-electric plants differ from those of other industrial enterprises; they can and should serve the purpose of permanently re-arranging the original natural conditions and fixing them in the desired new order without violation of the laws of nature, but by adapting them to these in every essential detail. When planned and executed in this manner, the spillway, dam, canal and power-house become permanent features and fixed for ages.

The works consist of the spillway, abutments and reservoir embankments or bulkheads which complete the dam system; canal, flume or pipe line; headgates, intake, forebay, powerhouse and tailrace with the possible addition of storage reservoirs.

The spillway serves the purpose of partially ponding the flow, maintaining the desired upper level, and passing all water in excess of that to be utilized for power development. It may be constructed of timber, concrete, masonry or concrete-steel. The defects of the spillway may be underwashing, settlement, temperature cracks and injuries to the crown, toe and apron.

Underwashing is the passing of water beneath the sub-structure, and may occur with any of the different spillway types. When in rock location, the formation being stratified, water may find a passage between layers of rocks; the origin or upper end of it may be near or at a considerable distance up-stream of the spillway. The consequences may never imperil the safety of the structure, but the volume thus passing beneath is likely to increase and prove a considerable loss from the available low flow. The upper pool should be lowered by opening the underflow sluices, and the location of the underwash determined; when the upper pool is down to a depth of two or three feet, the entrance to the passage way will be readily detected by the disturbed surface in its vicinity, and investigations as to the extent of the fissure can then be made. If the surface rock near the opening is solid it may be closed by concrete placed in bags. The mixture should be rich, the gravel aggregate not larger than will pass a half inch ring. The bags are of jute, filled about half and securely tied. When the surface rock is shaly, the loose pieces must be removed. If the origin of this passage cannot be readily found, the water at a distance above the spillway may be discolored by some aniline, dye-stuff or blueing, while the appearance of this color is watched for below the spillway; if it is not discovered within fifty feet down-stream of the spillway, it is likely that the passage is at considerable depth below the sub-structure, and in that event it will be a hopeless and exceedingly expensive task to remedy the defect. If, however, the discolored water appears close below the spillway, it indicates that the water passes below the top layer of the stratified rock and the passage may then be closed by cutting a channel some two feet wide out of the rock about ten feet up-stream of the spillway abreast of the point where the discolored water appears below the structure, and through the first and into the second rock stratum. This channel cutting should be preceded, however, by making test drills at various points up-stream of the spillway until the water passage-way is struck. The channel, when properly located, is filled with concrete placed in bags, creating a concrete curtain or cut-off.

Underwashing of spillways in rock location is a rare occurrence. The author calls to mind such a case at a Government dam on a Southern river. The formation is of stratified lime rock and ever since the construction of the lock and dam such an underwash has there existed, and has at this time (the author examined it recently) assumed considerable proportions, passing approximately fifteen cubic second-feet when the upper pool stands at the level of the spillway crest. This passage crosses under the spillway foundation and one of the lock walls, but the only serious consequence to the plant is evidenced by the difficulty of opening the upper lock gates, which can be accomplished only by means of block and tackle.

The failure of the Austin, Texas, dam was in part caused by underwash. Its location was in stratified limerock, which, at the eastern end where the first break occurred, was shaly and faulty, the dam being destroyed during a high flood by sliding off its base in sections.

Much more frequent and more serious of consequences is the underwashing of spillways in alluvial locations. In fact, it may be stated that they are in a large number of cases the original causes of the failure of the spillway. Most alluvial stream beds contain strata of sand, gravel and boulder formations which are porous in their very nature. If overlaid by clay or hardpan of a depth equal to about one-fourth of the maximum height of water retained by the spillway, there is little likelihood of water breaking through the impermeable upper material into the porous strata. But frequently the latter pass through the clay or hardpan with an upward continuation, even at a considerable distance up-stream of the spillway, and under such conditions they readily form a passage for the water. If a proper curtain has been placed upstream of the spillway, cutting off such a porous stratum, there is little likelihood of an underwash occurring, and if it does appear it is evidence that the curtain has opened or was not driven deep enough and the fault must be corrected by just such a device.

The determination of the locus of the underwash will be made without much difficulty, as it requires but a brief space of time for such an underwash to excavate a considerable space. The under pool must be lowered promptly and the washout coffered by a sheet pile curtain of timber or steel piles driven on the upstream side of the original curtain; it should be extended from 20 to 30 feet on both ends and the space between the two curtains filled with concrete in bags. When considerable of the material underlying the spillway base has been washed out, the condition may or may not endanger the stability of the structure. As a rule the void should be refilled by excluding the water from the down-stream side by coffering and, if the washed area cannot be pumped out, by placing concrete in bags as above detailed. All the conditions growing out of underwashing point forcibly to the great advantage of the hollow concrete-steel spillway. Such a structure will not be seriously injured by a washout, while the latter can readily be refilled by penetrating the spillway base and passing suitable material through it into the space beneath by a variety of methods, all of them possessing the pronounced advantage of showing with considerable certainty what is being accomplished in the way of remedies. A timber spillway is not so likely to underwash as the masonry or concrete type, as the interior filling of rock will fill any opening caused by leaks.

Settlement of the spillway would be due to faulty foundation design or construction and be followed by cracks and leaks. If the defect is at all serious, the foundation, at the faulty point, should be extended up or down stream, or in both directions, and these extensions rigidly connected to the original foundation or sub-structure. The cracks can readily be refilled.

Temperature cracks may be looked for in any masonry spillway during the first winter. No remedy can be effected until the following spring, when cement milk (fluid cement) may be forced into the cracks, or into holes drilled into the masonry at the top of the crack locations, by aid of a hand pump.

The crown of the spillway may be injured by shocks from logs or ice. If floatage is plentiful, a timber whaling guard should be secured to the upstream edge of the crown. Ice pressure may be exerted against the spillway crown in northern latitudes from a thick ice covering on the upper pool to a dangerous extent. In such locations ice fenders should be provided and an open channel two feet wide should be maintained a few feet above the spillway.

The apron down stream of the spillway may be injured and even destroyed by excessive overfall or the shocks from passing logs. The author recalls a spillway on a Government dam of a Southern river where the down-stream curve of the spillway was so unfortunately designed that, with an overflow depth of from 2 to 4 feet, the passing logs would be raised up out of the water into a nearly vertical position and strike the apron end on, like a pile acting under the force of a dropping hammer. The apron was entirely destroyed during the first high overflow. When the apron is too short, (it should always be of a width equal to the height of a spillway) it may readily be undermined and, if of masonry, will then settle and break up.

At the Holyoke, Mass., timber dam, which has been displaced by a masonry structure during the last ten years, the approach was entirely washed out, and in addition a trench exceeding 30 feet in depth was created by the overfall. This apron should be designed with the same care as the spillway foundation itself, in fact it is a part of it. Spillways in alluvial locations have been known to be deflected down stream bodily, though they may be safe against sliding. The cause is the moving of the entire underlying mass in which the bearing piles stand. It is therefore recommendable, in soft locations, to drive every other longitudinal pile row with the greatest practicable down-stream batter, by which any such tendency to deflect the foundation would meet the additional resistance of the inclined piles and thus be generally prevented.

Spillway operations pertain entirely to the control of the flow. No matter how small the fluctuations may be, the spillway should be provided with some sluice capacity, if for no other reason than the required facility to lower the upper pool level for the purpose of removing silt accumulations and making necessary repairs. Sluice gates should be operated at regular intervals, at least once each week, in order to be assured that they are in serviceable working conditions and free from choking sediment and floatage. The operating gear should be kept free of rust and lubricated. The gate posts, and in fact all of the timber framing above water, should be painted annually. Pike poles and trash rakes should always be kept on hand to remove any logs or roots which may lodge against the gate or its frame.

Flashboards form an important device. The particular local conditions and the frequency of utilizing them will soon point to the most expeditious and convenient operating routine.. The most important feature is that they can be readily removed at the approach of a rise in the stream to avoid their loss and prevent undue pressure against the spillway. On account of the ice they cannot be successfully operated during the winter season in Northern latitudes. Some automatic types have been developed, but the author knows of none which are economically practical for the purpose.

Log chutes deserve the same operating care as sluices and their gates. A boom must be maintained up stream to their entrance, and when logs are passed they should not be permitted to crowd the chute's capacity, but must be steered to take the chute square and straight.

Fish ladders require no special operating care, but must be examined in the spring of the year, as they may have been injured during the winter by the ice.

Abutments, if properly designed and constructed, are not likely to be injured, excepting by underwashing, settlement or temperature cracks; the remedies described for the spillway apply as well to the abutments. A very frequent defect, however, occurs on the land side of the abutment when the connection between it and reservoir embankments is insufficient. A washout is very likely to take place there. Nearly every high flood rise on the Ohio and its tributaries witnesses its repetitions. The author visited two Government dams and locks which were isolated midstream, the river having broken its way past the abutments. The location was in clay and gravel. The structures had just been completed and the first flood rise found the weak points. In both cases the natural river channel had been greatly contracted by a short spillway in order to find location for the lock structure, and the corresponding rise of the flood waters had broken through. The works were not otherwise seriously injured. Both were re-designed and given greater flood discharge capacities and concrete core walls were carried further into the banks. The necessity of providing the longest practical spillway, not less than the natural channel width, has been fully dwelt upon in the treatment of designs, also connecting the abutments by a substantial core wall leading into the natural or artificial banks which complete the dam structure.

Reservoir embankment or bulkheads complete, with the spillway, the impounding of the upper pool. When of earth fill the probable defects occurring in them are underwash, subsidence and erosion.

Underwash of reservoir banks is similar to that described in connection with spillways; their causes, in addition to those already cited, are frequently traceable to roots of trees formerly standing on the embankment site. The water passes along these and thus may break through under the structure. If the site is properly prepared, there is no likelihood of any underwash. The remedies of such defects are like those given for spillways.

Subsidences of the banks are the sliding of considerable portions. In the up-stream bank these may be caused when the upper pool is lowered too quickly, so that the water in the bank cannot leave the material as rapidly as the surface falls, and then follows under the pressure of its head above the pool level and carries with it the bank material. The lowering of the upper pool should be restricted to two feet per hour, when no considerable accumulations of water will be retained by the bank. Subsidences of the up-stream bank occurring with filled upper pool are due to defective material in the bank or its insufficient compactness; or they may be caused by portions of the pavement becoming detached and, while sliding down, gradually, taking bank material along with them. If the pavement is laid on edge and the vertical interstices are staggered and well filled with spalls, this is not likely to happen. When the level in the upper pool fluctuates frequently and the water thus rises and falls constantly along the paved slope, the latter had best be of concrete anchored to the material. This class of paving is also recommendable when much wave action is likely to prevail in the upper pool on account of the prevalence of down-stream winds. Subsidences in the down-stream bank are also caused by the rain run-off finding an entrance into the material in considerable quantities. This may be due to an excess of clay in the mass which, when dry, cracks and thus opens the way for rain to enter, which will loosen portions of the bank and they will become detached from the mass and slide down. With proper material and a thick stand of slope grass this is not likely to be the case.

Erosion of a reservoir bank is the cutting of its surfaces by concentrated rain run-off. Its origin is at the top, where the crest and slope lines meet, and it is enhanced by slopes of too great a length. This fault occurs especially on the down-stream slope, and is more frequent when the top is used as a highway, in which event the wagon ruts and other road defects become the source of the trouble. In some localities burrowing animals cause considerable damage to earth embankments, generally just above the water line. None of these will seriously endanger a reservoir embankment which has been provided with a proper core wall. Frequent inspection of the embankment is the main operating function, and repair of the slope pavement and of the crest dressing, and maintaining a good turf on the down-stream slope, are the principal matters requiring attention.

When the reservoir structures are concrete-steel bulkheads, the defects and their remedies given for spillways apply. However, as no water is to pass over them, they may be under constant inspection whereby repairs can be properly made, though if properly planned and constructed they will need none.

Rate Making*

By Frank C. Jordan, Secretary of Water Company, Indianapolis, Ind.

THE most important consideration for the city is the provision of a dependable supply of water, which will be furnished to the citizens without discrimination, after which a rate must be agreed upon which will provide a sufficient fund to take care of the following items:

1. Necessary operating expenses;
2. Proper maintenance of the property;
3. Depreciation charges;
4. Interest charges on the investment in the plant;
5. In the case of the privately-owned plant, a reasonable profit sufficient to encourage capital to incur the risks of this class of enterprise.

The first item, viz.: Necessary operating expenses, will include those items necessary to the proper operation of the company, bearing in mind at all times the desirability of furnishing a supply of pure water which has undergone a purification process if such treatment is necessary, and which shall be furnished at a uniform pressure sufficient to provide a satisfactory service throughout the entire city. The courts and Public Utility Commissions are giving due credit to good management and in the future more credit will doubtless be given in a financial way to that management which, with careful attention to details and the exercise of that which we call "far-sightedness," is able to provide a good supply at a low cost of operation.

The importance of the second item, viz.: Proper maintenance of the property, is so well understood that there is no need of any discussion of this item.

The third item, viz.: Depreciation charges, is an item with which, unfortunately, a great many of the plants are not familiar. Recent court decisions have called our attention in very plain terms to the necessity on the part of the Water Company or Department of setting aside in a separate fund an amount which will, at the termination of the life of a company, leave intact the value of the physical property of the company, and the court has held, in no uncertain terms, that the company or department is in error which fails to lay aside from its annual receipts proper depreciation charges.

The fourth item, viz.: Interest charges on the investment in the plant, is one which must be taken into account in an accounting system, and yet we will frequently hear certain water works managers give statements covering the cost of furnishing water and, on careful inquiry, will find that no account whatever is taken of the interest on the investment. This obviously is misleading and the interest on this investment is as surely a charge against the consumer as the ordinary operating expenses such as coal, oil, etc.

The last item, viz.: A reasonable profit to the investor, is one about which there should be no question, although there unfortunately has been an apparent desire on the part of some authorities to make such rates as would prohibit the showing of a fair return to the investor. It has been held by the Supreme Court that the investor is entitled to a fair return on the value of his investment, but it has also been held that the investor is not entitled to an income on expenses incurred on account of gross error or lack of reasonable care. It has been held that a plant should be appraised as a "going concern" with a proper credit for the

*From a paper before the Illinois Sanitary and Water Supply Association.

reproductive value plus the added value of the business on the lines, which has been procured at a considerable loss to the investor.

Courts and Public Utility Commissions have disagreed on the percentage of this return on the investment, the rates varying from 7 to 10 per cent. per year on the total value, and it would seem that the latter figure is not far from a fair rate, when we take into consideration the risks connected with this class of enterprise. With a proper appraisement and with reliable data covering the cost of operation and other expenses, the annual revenue necessary to take care of the plant can be ascertained, after which comes the question of the proper distribution or assessment of rates to provide this amount.

In connection with this subject it has been shown that a thorough accounting basis is indispensable in the proper solution of the question of rate making, and it is unfortunately true that scarcely 50 per cent. of our companies, whether public or private, can tell within a reasonable degree of accuracy what it is costing them to furnish a million gallons of water to the private consumers, and in many cases it is even impossible for them under their present accounting system to arrive at a figure giving the actual cost of the production of a million gallons of water. It is agreed by all that the company, whether private or municipal, must furnish water to the citzens without discrimination, but there is room for argument as to what constitutes discrimination. Every department manager will admit that there are certain sections of his city which have not and will not for years pay a sufficient revenue to the water department to take care of the proper charges on the investment, and yet it is so desirable to have these sections taken care of as regards fire protection and sanitary measures that it becomes advisable to install the lines, even though their installation imposes a burden on the better districts of the city, and the rates must be so arranged that the consumer with a large property will pay a sufficient amount to insure profit large enough to offset the loss on the properties in the poorer districts.

It is admitted that the water mains add to the abutting property a certain value and it has repeatedly been shown that the principal asset of a company is in its readiness to serve. In making a rate a certain charge must be made for this readiness to serve, whether the charge covers the readiness to serve in the case of fire protection or in the case of standing ready to serve at a faucet or connection in a private residence. As is often the case, the water department may not be called upon for service in the case of fire protection lines and yet the service rendered is just as valuable for the reason that the consumer has received his full benefit in the way of protection, thus reducing his insurance premium and reducing the liability of the suspension of his business on account of fire damage. In the case of the private consumer, the desirability of having a good supply always at hand is apparent, and is worth a certain fixed amount.

In preparing estimates on which the water rates are based, consideration must be given not only to the amount of water to be furnished to each consumer, but careful consideration must be given to the amount of water which will undoubtedly be lost on account of leaky services, broken lines, etc., the cost of which is just as much to the department per million gallons as that water which is actually sold. It has been shown that this loss varies from 15 to 25 gallons per capita per day in the New England towns, and it is a well-known fact that these towns are managing their plants in a most careful and conservative manner.

The rate as fixed for water should not contemplate the furnishing of any free water. It is recognized that the term free water is a misnomer, and is an impossibility with the exception of that water which comes from above. The city will always be the largest consumer of the water plant, and a proper rental for fire hydrants as well as a proper charge for all water used for purposes other than for the extinguishment of fires, should be paid by the city and each department should be made to stand for its proper portion of this charge.

It has been estimated that the cost of fire protection is approximately 45 per cent. of the interest and fixed charges due to construction and from 18 to 22 per cent. of the cost of operation. It is doubtful whether the average city would pay to the water company or department its proper share, figured on the above basis, for the reason that in most cases the hydrant rental would apparently be a prohibitive amount, and it, therefore, devolves on the consumer to pay a certain percentage of this cost in his rate.

The amount received from the city

should be deducted from the amount ascertained to be necessary to carry on the operation of a company, and the balance will of necessity be provided from receipts from private consumers. In making the rates it must be borne in mind that the consumer is buying more than water, in that he is also purchasing a certain valuable asset, i. e., a ready to serve condition, and it must also be borne in mind that a charge covering the bare cost of the water will not bring to the Department sufficient funds to carry on its business.

The New England Water Works Association has suggested that in arranging meter rates it should be borne in mind that these rates should insure a sufficient revenue to meet the financial and operative demands of the company; that they should be flexible so that they may easily be changed in case of a deficiency or a surplus of income; that the method should allow the use of meters to the small consumer as well as to the large, and that the rates should secure from the large properties a sufficient amount to meet the proportional fixed charges of the plant even if little water should be used.

It is hardly advisable to figure on a rate which may require an increase in a certain number of years, for the reason that the communities, as a general proposition, are calling for a reduction in rates rather than an increase, and yet it must be borne in mind that the cost of furnishing a safe supply of water is increasing year by year and the rates must inevitably follow the increase in the cost of production.

Various methods of rate assessment have been adopted by Water Companies throughout the country, among them being the frontage assessment plan, the valuation assessment equal to a certain percentage of the flat rate. In some of the municipal plants it has been found that the assessing of a certain percentage on the valuation of the property has worked very satisfactorily; this assessment amounting to from $10 to $15 on a property assessed at $3,000, is called a ready to serve charge and covers a small amount of water sufficient for domestic purposes. Under this plan every citizen of the town became a consumer and the larger property owner pays his proper proportion of the cost of running the company. It is manifestly unfair for certain properties of the city to share in the benefits naturally accruing to the property by reason of the water mains and yet have the property fail to pay its proper share of the cost of the operation of the company.

It has been shown that in the development of a city it becomes necessary to install water mains in certain districts in which the growth of revenue will be exceedingly slow and it will be a matter of interest to the average department to prepare data showing the growth of income in the various districts. It will be a surprise to the average Superintendent to find that, as a general proposition, the average line does not get on a paying basis until approximately 20 years after its installation. As stated before, it becomes important that the rates in the better sections should be sufficient to take care of these outlying districts for the reason that these districts, without water, would become a menace to the health of the community.

For a number of years the flat rate or schedule rate was thought to be satisfactory in its operation, but of recent years there has been a decided tendency toward the metering of water, and some plants have found to their sorrow that the one-rate plan for meters with no ready to serve charge, does not provide sufficient revenue to cover the expenses of the company. The proposal on the part of the company to furnish water to all persons at one rate appears beautiful in theory, but in its workings it is disastrous to the finances of the company. From time to time the advocates of the meter system fall into errors which, in their operation, become serious questions to the company. In an article read before one of our large associations on the subject of the meter system will be found the following:

"One of the most important features of a meter system that appeals to the consumer is the fact that with a meter on his service he is very independent; he can do as he pleases with the water after it has passed through his meter; he can add many spigots without asking permission of any one; he can use a hose to his heart's content, the city's authority ending at the meter."

That company which maintains no control whatever over the water after it passes the meter will, in the course of time, find itself face to face with some unpleasant problems. Many water departments at the present time find it necessary to limit the sprinkling of lawns to certain hours, and it has been found necessary in some departments to make other regulations regarding the use of water, and the loss of all control over the consumer after he purchases his water at the meter would place the company in an unfortunate position. The very basis of the ready to serve charge depends on a knowledge of the value to the consumer of its readiness to serve, and this of course depends on a knowledge of the number and kind of fixtures which may be served.

In a recent tabulation prepared by the writer, it was shown that the maximum meter rate, covering the smaller consumption, varied from 60 cents per thousand gallons to as low as 5 cents per thousand gallons. It would seem that there should not be this degree of difference and yet when all conditions are considered, it may be that the rate of 60 cents was in fact no higher in the city charging this rate than the 5 cent rate in the other city.

It has been found in a number of cities that the flat rate levied on a reasonable basis and commensurate with the service furnished was satisfactory to a large extent and generally speaking the people have apparently come to the conclusion that a rate of from $15 to $20 covering the cost of a full supply of water for a house of six rooms with all modern conveniences, including sprinkling service, is not far from a fair figure, the difference in the rates of course depending entirely on the conditions existing in the city.

In the establishment of rates the unfortunate mistake is often made of making a rate which is about the average charged in other cities, without taking into consideration the conditions existing in the city under consideration. This is obviously unfair and that committee, upon whom rests the responsibility of deciding on what constitutes a fair rate for the water of a city, should give careful consideration to the conditions existing in their city, and if comparisons are necessary these comparisons should only be made with other cities furnishing a like supply of water under like conditions. As has well been stated on a number of occasions, the public has a right to know the details of the operation of a plant and full publicity of all matters pertaining to the supply of water is absolutely essential, and the writer shares the opinion of the best engineers that the average citizen, if given a clear understanding of the cost of the supply of water, will agree to a rate which is fair and is commensurate with the service furnished by the department.

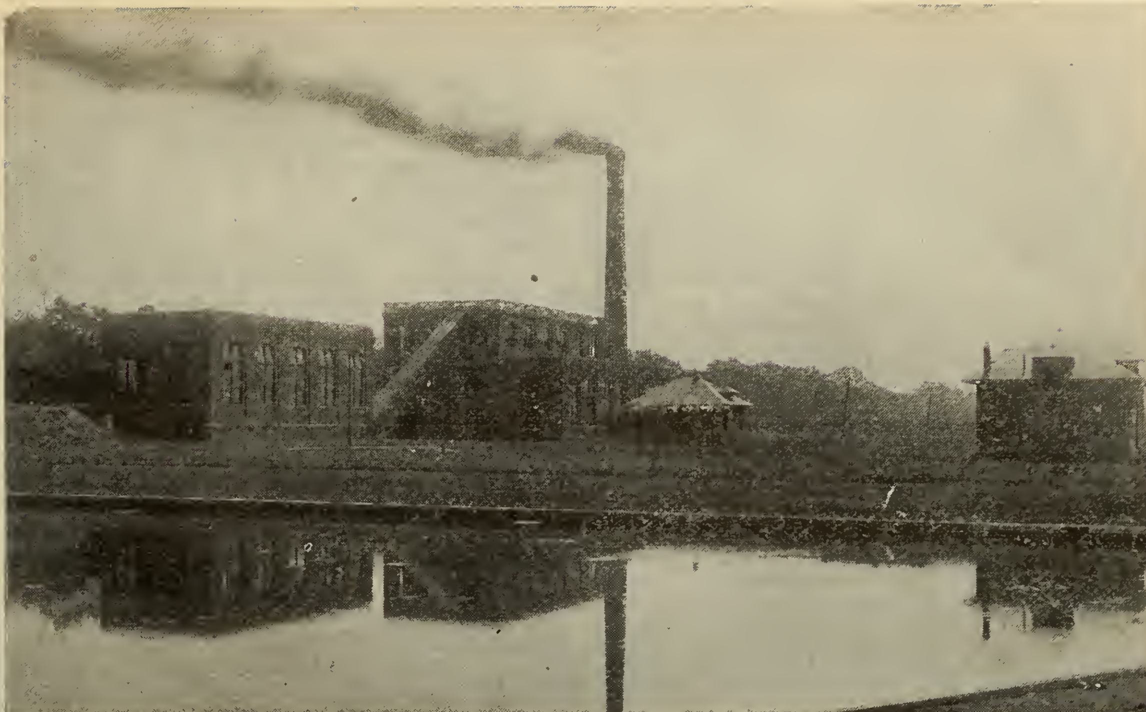
The Municipal Garbage Reduction Plant at Columbus, Ohio

OVER seven months have elapsed since the city of Columbus, O., started in operation the first municipal garbage reduction plant, designed and constructed by a municipality for the disposal of the garbage and the utilization of the by-products for maintenance. The majority of larger cities in the United States have their garbage disposed of by the reduction process under contract by private companies.

From a commercial standpoint, the reduction of garbage has in most cases proved successful, although failures have occurred in this as well as in other methods of disposal, due to faulty design and lack of proper attention and management. From a sanitary standpoint the reduction of garbage has been looked upon as being very undesirable, due largely to the manner in which the plants have been constructed and operated. This will continue to be the case as long as cities contract for the disposal for a short term of years. The contractor usually cannot afford to install an expensive plant or pay much attention to the design from a sanitary standpoint. Under contract the disposal of garbage is considered chiefly from a commercial standpoint, which consists in obtaining the largest remuneration possible at the least cost.

In designing the Columbus plant, the first object was to make it as sanitary and free from undesirable features as possible, and at the same time make the appearance of the buildings and general design agree favorably with other municipal improvements. The plant was designed with a capacity for disposing of 80 tons of garbage in 12 hours, or a total of 160 tons per day with the plant operating continuously. The total capacity of the plant is sufficient to take care of the future growth of the city of Columbus for the next twenty years.

The garbage is collected in wagons



I. COLUMBUS GARBAGE REDUCTION PLANT.
Settling Basin of Sewage Works in Foreground.

II. DUMPING THE GARBAGE AT THE LOADING STATION

III. INTERIOR OF GREEN GARBAGE PLANT, WHERE THE GARBAGE IS SORTED AND SHOVELED INTO CONVEYOR.

which have water-tight steel bodies and sectional canvas covers. The garbage is hauled to a central loading station located on the Hocking Valley Railroad, near Mound street. The loading station consists of a building 40 feet wide by 90 feet long, with a railway track extending through the building.

Fig. 2 shows the method of dumping the wagons into the car; they are drawn up an incline driveway to the second floor of the loading station, and by means of a power hoist the front end of the wagon is elevated, discharging the garbage out of the rear end into the garbage cars below. The cars are constructed with semi-circular bodies especially for handling garbage. These cars have a capacity of 1,400 cubic feet, or 40 tons each.

The reduction plant is located about four miles south of the city of Columbus, on the Scioto river. The railroad tracks at the plant are on top of the levee which surrounds the building site and about 10 feet above the ground floor of the buildings.

Fig. 1 shows an outside view of the plant. The garbage, when delivered, is weighed on railway track scales, and then run into the green garbage building on a siding which extends through it.

Fig. 3 shows an interior view of this building with the garbage dumped and the method of sorting. The free water is drained off through a gutter extending the full length of the building; the swill water from the gutter is drained into a catchbasin, from which it is discharged into the grease-separating tanks, after which it is evaporated.

The garbage is sorted and shoveled into a scraper conveyor shown alongside and extending the full length of the building. This is a Jeffrey type scraper conveyor and extends to the main building, carrying the garbage along the incline truss to the top of the main building, and then along the bottom chord of the roof trusses and over the tops of the digesters. Connecting the conveyor with the digesters are swivel spouts which discharge the garbage directly into the digesters.

Fig. 5 shows a photograph of the digester floor and the method of delivering the garbage from the conveyor to any one of the eight digesters through the feeding spout.

Note the longitudinal section, Fig. 4, showing the arrangement of the digesters, they being eight in number, each 7 feet in diameter by 14 feet long, each having a capacity of 10 to 12 tons of garbage; the inside is lined with cement and tile, 1½ inches thick, so as to protect the digester from wear, due to the agitating of the gritty material when boiling, and at the same time to resist the action of the acids which would attack the metal. The digesters are arranged in nests of four, and are connected to a common receiving hopper, which is directly connected to the roller press. The four digesters, one receiving hopper and a roller press are called one unit.

The time required for cooking varies with the kind of the garbage, but averages about six hours, with steam at 60 to 70 pounds pressure as it enters the digester.

The presses, which are connected to the receiving hopper, are of the continuous roller type, and were designed by Chas. Edgerton especially for handling garbage. They are directly connected to the bottom of the receiving hopper, so that the material from the digesters passes through the press before being exposed. The press is provided with an upper and lower conveying apron. The upper apron is made up of ½-inch steel slats riveted to a heavy forged steel chain. The upper apron acts as the bottom of the receiving hopper, and when the press is running carries the material through the feeding rolls and discharges it onto the lower apron.

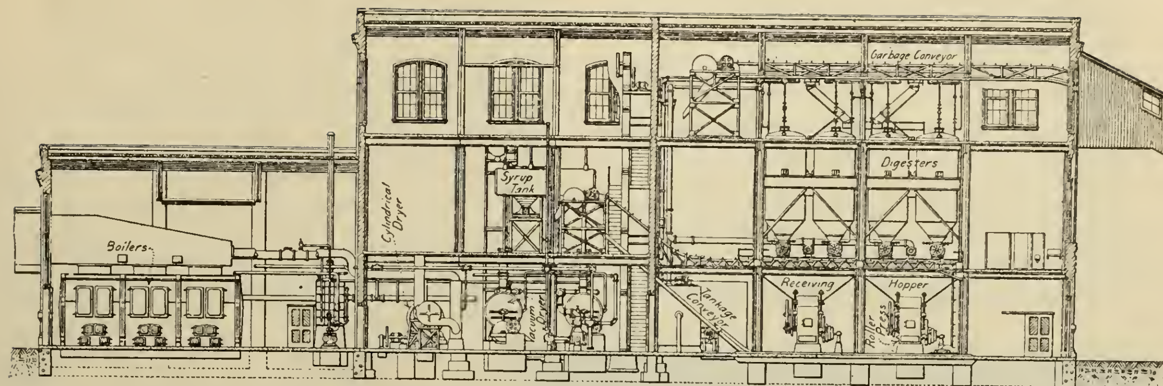
The lower apron is composed of perforated slats ⅜ inch in thickness, and passes through between six cast iron rolls, arranged in pairs.

Fig. 6 shows the presses on first floor. The pressed material is discharged at the front of the press into a Jeffrey scraper conveyor, which carries the material to the second floor of the drying department—see Figs. 6 and 7.

The water and grease flow from the presses to catchbasins in the grease separating room. The grease is drawn off and pumped into storage tanks, ready for shipment.

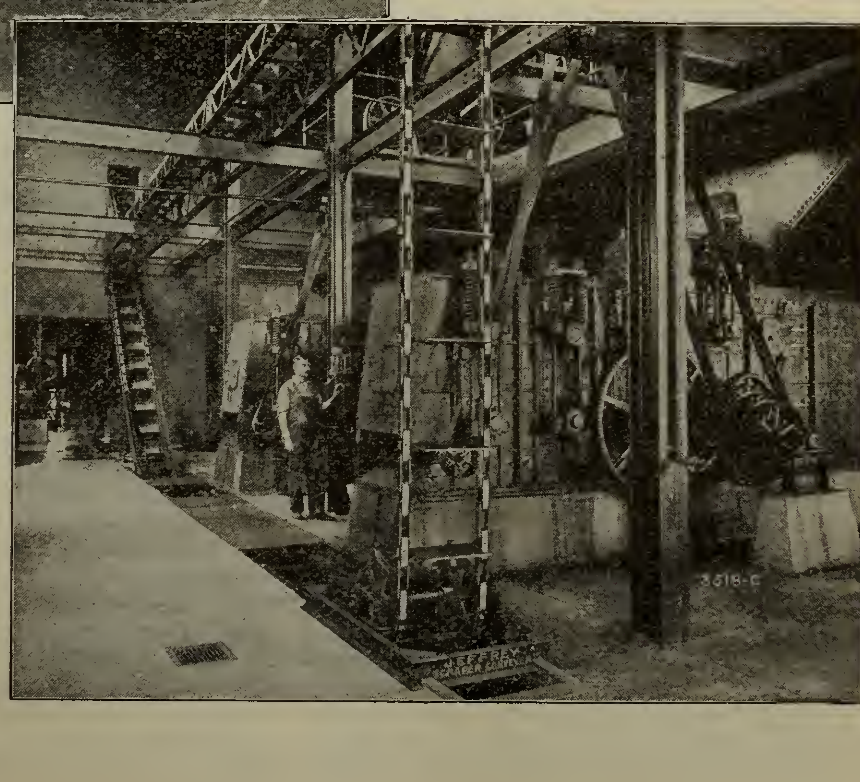
The liquor coming from the presses carries more or less solids in suspension. These solids are known as muck and silt. The muck settles to the bottom of the grease separating tanks and the silt rises to the top of the water.

The tank water, after the grease has been separated, is drawn off to a large storage tank outside of the building. The tank water contains 5 to 7 per cent. of solids in solution; it is evaporated in a triple-effect evaporator. The evaporator is made up of thin rounded-body cast iron pans built especially for the conditions to be met in handling garbage tank water. This triple effect



Longitudinal Section through the Columbus Garbage Reduction Works.

V. UPPER FLOOR, SHOWING JEFFREY SCRAPER CONVEYOR DISCHARGING GARBAGE TO DIGESTERS.



VI. FIRST FLOOR. SHOWING PRESSES DELIVERING DRY GARBAGE TO THE SCRAPER CONVEYOR.

evaporating process is entirely new in the disposal of garbage, although used extensively on the tank water at the large packing houses. The concentrated syrup in the evaporator is drawn off by a Magma pump and discharged into a storage tank on the second floor.

The muck and silt from the grease-separating tanks are placed in a screw press, from which the liquor flows to the catchbasins and the solids pass and enables the moisture in the syrup to be driven off. The addition of the syrup to the fibrous tankage produces a higher grade of tankage from a mechanical and fertilizing standpoint.

The dryers are 15 feet long and 60 inches in diameter. Through the center of each dryer is a shaft, to which paddles are attached for agitating and mixing the material. When dry, the material is discharged from the dryer into another Jeffrey spiral conveyor

VII. SCRAPER CONVEYOR DISCHARGING DRY GARBAGE.

VIII. STORAGE FLOOR. BUCKET ELEVATOR DELIVERING TANKAGE USED FOR FERTILIZER.

along in the Jeffrey scraper conveyor to the dryer room—see Figs. 6 and 7.

The solids are then fed to a revolving cylindrical dryer. This dryer is constructed with a steam jacket and radiator coils, which provide heat for the drying process. The material is fed into the dryer continuously and discharged by means of two short spiral conveyors placed at the opposite end.

The dry material issuing from the revolving dryer is then passed through the revolving screen; the screened tankage is then placed in the vacuum or mixing dryers and the concentrated syrup from the evaporator is added. The dry fibrous material acts as a filler connected to a Jeffrey bucket elevator, which discharges the tankage onto the third floor, where it is stored until shipment.

Fig. 8 shows the shipping floor.

This tankage contains a higher percentage of ammonia, due to the addition of the concentrated water issuing from the evaporators. Its appearance is granular and black. Each load of tankage is analyzed, the valuation varying from \$10 to \$10.50 per ton, according to the amount of ammonia.

The buildings are constructed fireproof throughout, having concrete foundations, steel frame and roof trusses, reinforced concrete floors, brick walls and a hollow terra cotta roof tile, covered with a built-up four-ply composition felt and asphalt roofing. The exterior and interior walls of the building are laid up with a high-grade, impervious, wire-cut face brick. The construction of all parts, so far as possible, was made to agree with the best modern practice employed in building construction.

The approximate cost of the plant was $180,000, divided up as follows: Grading and levee, $11,000; buildings, $76,000; garbage machinery, $60,000; power and conveying machinery, $30,000; railway tracks, $3,000.

After seven months of operation, the plant has more than met the expectations, as the returns from the sale of by-products have more than paid for the cost of disposal.

The Kutztown Foundry Machine Company supplied the grease-separating machine, digesters and presses. The Zaremba Company installed the evaporator. The entire elevating and conveying machinery, beginning with the handling of the green garbage until the by-products are stored for shipment, was designed and erected by the Jeffrey Manufacturing Company, of Columbus, O.

This plant was designed and constructed by I. S. Osborn, who has made a specialty of the disposal of garbage and municipal wastes and has supplied the information for this article.

Legislation on Stream Pollution*

By H. M. Ely, Superintendent of Water Company, Danville, Ill.

IN Illinois the number of cities having surface supplies is 67, only 16 of which are filtered. It would seem to be fair that the community casting its sewage into a stream should clarify it to a reasonable extent that the cost of handling its sewage should not be borne entirely by the next community below which depends on the river for its water supply.

The legal principles are thus classified:

1. Rights of riparian owners to pure water as against one another.
2. Right of public as distinguished from individual owners to have inland waters kept free from pollution.
3. Conditions and extent of use of inland waters for disposing of sewage permissible to municipalities.

Rights of riparian owners are guarded by the common law. Rights of public to prevention of pollution and to dispose of sewage properly are sought to be defined by the anti-stream pollution laws.

Every riparian owner has the right to use the water running over his land but has no right to pollute it to the injury of those below him. This has been confirmed by such decisions as The Indian Refining Co. v. The Commonwealth, Franklin County, Ky.

The municipality has no more right than a riparian owner to pollute a water supply injuriously, but it is advisable to have specific laws that the matter may be more minutely defined than it can be by the results of injunction suits and the like.

The Federal government has no authority to prevent the pollution even of streams which may be termed interstate streams, but recognizes the jurisdiction of the states. Bills have been introduced in Congress providing for the study of the problem but none have yet been passed.

Minnesota's State Board of Health has general charge of all springs, wells, ponds and streams used for water supply for domestic use and her authority to preserve them from pollution endangering the public health. No sewage which will impair the healthfulness of water can be deposited where it will drain into a source of water supply. Appeal to district court is permitted.

Wisconsin provides that water supply and sewage plans of cities must be submitted to the State Board of Health for approval and certificate as to whether the works will be unsanitary or dangerous to public health. There is no relief from present sewage discharge. A more specific law is desired.

Rhode Island's State Board of Health can enjoin the placing of polluted matter on the watersheds of streams used as public water supplies, but has no control over the use of such streams or over sewage disposal.

Maryland's Board of Health has pro-

* Abstract of a paper before the Illinois Sanitary and Water Supply Association.

cured a number of injunctions under a law making the pollution of a water supply sufficient to make it unfit for domestic use a misdemeanor with a $200 fine.

Vermont gives its State Board of Health oversight over public water supplies and authority to prohibit use of polluted sources of water supply, with the approval of the Court of Chancery.

New York's State Health Commissioner can make rules for government of pollution of watershed of streams used as water supplies but cannot as yet order existing sewage pollution removed.

Massachusetts has the strongest stream pollution laws. Its State Board of Health may examine into purity and fitness of water supply for domestic use and make regulations for sanitary protection thereof. Plans for water supply, sewerage and disposal must be approved by the Board. Pollution of water supply may be prohibited. Supreme or Superior Courts have jurisdiction to enforce orders of Board, and to enjoin violations of their rules on application by city or private person or corporation. The Board must examine annually all main outlets of sewerage and disposal. Cities can take lands about sources of water supply for purposes of protection. The Board may require enlargement, improvement and proper maintenance of existing sewage disposal works. Manufacturing waste detrimental to sewage purification process may be kept out of sewers.

Pennsylvania laws are similar to those of New York. They prohibit discharges of sewage into streams, except such as were already in existence and concerning which satisfactory reports of effects on sanitary conditions are made. Whenever such sewage discharge becomes injurious to public health it can be stopped by the State Board of Health. Permits to discharge sewage may be issued when deemed permissible by governor, attorney general and State commissioner of health. Decisions can be appealed from to a court of common pleas in the county in which the sewage outlet is located. Fines may be assessed for violation of laws.

Kansas has a similar law to that in Pennsylvania, except that the power of the Board in requiring improvements in water supplies is limited.

New Jersey laws are specific regarding sewage disposal. Cities have right to condemn lands for sewage disposal plants. There are several drainage and sewage disposal commissions to which have been assigned various districts for installing sewage disposal plants.

Ohio laws give the State Board of Health control over effluents of water and sewage purification works and power to enforce competent supervision and efficient operation. Methods of raising funds for sewage and water purification plants are fully provided.

Indiana has a law similar to that in Ohio, not yet enforced for lack of necessary appropriations.

As to enforcement of these laws reports are as follows:

Pennsylvania enforces its laws very strenuously.

The first New Jersey case is now in court, but many improvements have been made on notice without suits.

The Ohio Board has issued five orders to install sewage purification plants and two for water purification. It is now under a temporary restraining order, the constitutionality of the act having been attacked.

Kansas reports the laws well enforced. Twenty-six sewage purification plants are now in operation or under construction. Two water supplies have been ordered purified.

Illinois has no law of general application and is attempting the passage of acts similar to those of Ohio and Indiana.

Settling basins or septic tanks for the purification of sewage are in operation in the following Illinois cities: Aledo, Belleville, Champaign, Collinsville, DuQuoin, Harvard, Highland Park, Naperville, Paris, Polo, Upper Alton, Urbana, Wheaton and Woodstock.

Bituminous Materials in Road Construction and Maintenance*

By Prof. Arthur H. Blanchard, Consulting Highway Engineer, Brown University, Providence, R. I.

THE development of the use of bituminous materials in the construction and maintenance of roads in the United States since 1908 is worthy of careful consideration and critical analysis.

The bituminous materials which have been used in the United States during the past three years may be classified as follows: Fluxed native asphalts, oil-asphalts, residual asphaltic and semi-asphaltic oils, light oils; coke-oven tars, coal-gas tars, water-gas tars, and combinations of coal-gas and water-gas tars; combinations of asphaltic materials and tars.

The nomenclature used to designate the various kinds of tars is self explanatory. In order to avoid misunderstanding the terms used in connection with asphaltic materials will be defined, the definitions given being abstracts of those proposed by Prevost Hubbard, chemist, United States Office of Public Roads.

"Fluxed native asphalts are native asphalts fluxed with a heavy petroleum residuum. Native asphalts are solid or semi-solid native bitumens, consisting of a mixture of hydrocarbons of complex structure, free from any appreciable amount of solid paraffins, melting upon the application of heat and evidently produced by nature from petroleums containing little or no solid paraffins. Unrefined native asphalts with few exceptions contain water, vegetable matter, clay, sand, etc.

"Oil asphalts are solid or semi-solid products produced by the distillation of semi-asphaltic and asphaltic petroleums.

"Residual asphaltic and semi-asphaltic oils are heavy viscous residues produced by the evaporation or distillation of crude asphaltic and semi-asphaltic petroleums until at least all of the burning oils have been removed and often some of the heavier distillates as well.

"The term light oils includes crude and partially refined paraffin petroleums, semi-asphaltic petroleums and asphaltic petroleums.

"Paraffin petroleum is an oil the base of which is composed principally of the paraffin hydrocarbons.

"Semi-asphaltic petroleums are oils containing a semi-asphaltic base, i. e., oils whose residues produced by evaporation or distillation, while composed mainly of asphaltic hydrocarbons, contain also a certain percentage of paraffin wax.

"Asphaltic petroleums are oils containing an asphaltic base, i. e., they are capable of producing residues very similar to native asphalts if evaporated or distilled down to the consistency of such asphalts. They contain little or no solid paraffins. Native asphalts are probably produced from such oils by natural processes."

As typical of the practice in the United States will be cited the work of seven State Highway Departments which have used bituminous materials extensively. The writer wishes at this time publicly to thank the Highway Departments of the States mentioned below for their co-operation in collating the following information. The figures given refer to the total amount of work of the various types indicated which has been accomplished in 1908, 1909 and 1910 by the State Highway Departments of the States of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania and Rhode Island. The work has been classified on the basis of the method employed and the kind of material used. Three general methods are referred to; namely, superficial treatment of roads constructed of ordinary macadam or gravel, the construction of bituminous pavements by penetration methods, and the construction of bituminous pavements by mixing methods. The bituminous materials employed have been classified in three groups: first, tars and tar-asphalt compounds; second, fluxed native asphalts, oil-asphalts and residual asphaltic and semi-asphaltic oils; third, light oils.

The following tables give the amount in square yards of surfaces treated and bituminous pavements constructed by the State Highway Departments men-

* A paper before Section D of the American Association for the Advancement of Science.

tioned above during the years 1908, 1909 and 1910.

third, an increase in the use of light oils for the purpose of allaying dust

Superficial Treatment of Roads.

	Tar and Tar-Asphalt Compounds.	Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils.	Light Oils.
1908	57,700 sq. yds.	239,500 sq. yds.	....
1909	95,500 sq. yds.	910,600 sq. yds.	4,125,900 sq. yds.
1910	123,400 sq. yds.	2,434,200 sq. yds.	9,890,400 sq. yds.

Bituminous Pavements Constructed by Penetration Methods.

	Tar and Tar-Asphalt Compounds.	Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils.	Light Oils.
1908	37,800 sq. yds.	25,200 sq. yds.	....
1909	170,200 sq. yds.	2,077,400 sq. yds.	....
1910	339,300 sq. yds.	4,840,200 sq. yds.	26,500 sq. yds.

Bituminous Pavements Constructed by Mixing Methods.

	Tars and Tar-Asphalt Compounds.	Fluxed Native Asphalts, Oil Asphalts and Residual Asphaltic and Semi-asphaltic Oils.	Light Oils.
1908	52,100 sq. yds.	4,400 sq. yds.	....
1909	136,000 sq. yds.	219,500 sq. yds.	....
1910	158,000 sq. yds.	432,600 sq. yds.	....

It is interesting to note from the standpoint of the general increase in the use of bituminous materials in the States cited that in 1908 bituminous materials were employed in the construction and maintenance of 416,000 square yards of road surfaces, in 1909 of 7,734,000 square yards and in 1910 of 18,244,000 square yards. Although the construction of bituminous pavements is in its infancy in the United States, remarkable progress is being accomplished in certain sections. For instance, by the close of the construction season of 1911, if the plans of the State Highway Commission are carried out, the State of New York will have a trunk highway with a bituminous surface extending north from New York City to Albany and thence west to Buffalo aggregating over 400 miles in length.

In the surface treatment of macadam and gravel roads, several lines of development have been especially noticed: first, a more general use of refined coal-gas and water-gas tars in place of crude tars; second, an extraordinary increase in the various kinds of heavy asphaltic oils, combined with sand, gravel or stone chips to form a carpet wearing surface; on state roads and thus, to a certain extent, preserving the surface of the road by the retention of the top dressing; fourth, a substitution of mechanical distributers of both the pressure spray and gravity flow type in place of hand application methods.

The practice of the past three years has amply demonstrated that the success of superficial tarring is dependent upon the recognition and adoption of those fundamental principles which were laid down by the French engineers in 1903. As those principles have not been adopted in many instances in the United States, they will be given here in brief. First, superficial tarring should be done only during dry and warm weather in order to obtain efficient and economical results; second, the road must have a dry, smooth and durable surface; third, all dust must be thoroughly brushed off in order to facilitate the adherence of the tar; fourth, after the distribution of the coat of tar it is necessary, in order to avoid a slippery surface, to apply a dressing of sand, gravel or stone chips. The practice of some prominent English engineers does not include the adoption of the fourth recommendation cited, as it is maintained that a top dressing is not an essential element of a non-slippery tarred surface.

A well developed plan of annually treating certain roads of a system with a thin coat of bituminous material is being adopted in certain states. This practice embodies the recognition of the fundamental principles of economy and efficiency in modern highway construction; namely, the adaptation of method and material to local conditions.

In connection with the use of bituminous materials by penetration methods certain noteworthy tendencies are apparent. Most important are the employment of distributing apparatus and the formation of broken stone courses in such a manner as to endeavor to secure the maximum uniformity of distribution of material and the definite limitation of penetration.

The average size of stone employed varies from ½ inch or ¾ inch in longest dimensions to 1¼ inch to 1¾ inch. In exceptional cases, however, engineers have adopted the English and French practice of using larger and more uniform sizes of stone for the top course. The unfortunate delays in the application of the penetration method due to damp stone have been overcome in some instances by the employment of mechanical surface heaters.

A modification of the penetration method is known as the "puddling method." The top course in this case is filled with screenings, puddled by watering, and thoroughly rolled. After the surface dries out it is picked up. The bituminous material is then applied, a coat of chips is spread and the surface rolled. After the surplus chips are brushed off, a flush coat of bituminous material is applied. The application of another coat of chips and a final rolling complete the process.

Another modification of the regular penetration method has been employed during 1910. In this method the foundation is thoroughly filled and rolled. A layer of sand is spread upon the foundation course to a depth of about one inch. Refined tar heated to about 250 degrees F. is then applied to the coat of sand. The top course composed of broken stone varying from ¾ inch to 2¾ inches in diameter is spread and rolled, the lower voids being filled with the bituminous mastic. After consolidation a second coat of refined tar is applied. As soon as possible after spreading the second coat of tar a layer of stone chips is spread and rolled. A third coat of refined tar is then applied and the surface finished by rolling a covering of screenings cr sand.

In the reconstruction of old roads there has been a general employment of the method of picking up the old surface to a depth of 2 inches to 4 inches by the use of mechanical scarifiers, placing a thin coat of new road metal on the loosened surface, and then constructing a bituminous pavement by the penetration method.

In both the construction and reconstruction of roads by penetration methods the surface is finished in various ways. One method is to spread a coat of chips or sand after the first coat of bituminous material is applied, roll thoroughly and after the road has set up sufficiently open it to traffic. Another method is to apply a second coat of bituminous material for the flush coat, which may or may not be the same as used for the first coat. A layer of chips or sand is then spread over the flush coat and thoroughly rolled. A third method is essentially the same as the second method cited except that a layer of chips is applied to the first coat of bituminous material, thoroughly rolled and the surplus chips brushed off before the application of the flush coat of bituminous material.

From the standpoint of the character of bituminous material used it is of special interest to note the increased use, particularly in 1909 and 1910, of fluxed natural asphalts and oil-asphalts especially manufactured for application to unheated crusher run stone.

In the construction of bituminous pavements by the mixing method a number of improvements and developments should be noted. Some attention has been paid to having the stone dry and reasonably clean. Although the advantages accruing by using clean and dry stone are recognized, the practice has been far from satisfactory, only very crude methods having thus far been employed. The practice of heating stone on plates has been used to a certain extent with deleterious results. In a few cases mixing machines and tar coating machines have been employed in connection with the construction of bituminous pavements which are to cost not over $0.90 to $1.00 per square yard. The types of the mixers which have been used to date are more or less unsatisfactory, especially when bituminous materials are used which are solid at ordinary temperatures or which flow with considerable difficulty when cold. During the season of 1911 considerable development should take place in the heating of stone by mechanical dryers and also in the use of new types of mixers especially manufactured for the purpose of mixing bituminous materials with a mineral aggregate.

The mixing of broken stone or other aggregate with bituminous materials at a central plant and shipping the finished product by rail has not been developed to any extent in this country. The product of one company, however, has been used quite extensively in three or four states. In another case refined asphaltic petroleums have been mixed with sand and gravel and molded into blocks at a central plant. The blocks have been laid as the wearing surface and rolled.

Bituminous pavements constructed by mixing methods have been finished in different ways. In certain instances satisfactory results have been attained by applying a coat of chips or sand to the surface of the course of mixed aggregate and thoroughly rolling the same. In other cases a flush coat of bituminous material has been applied before the layer of mineral matter is spread over the surface. The bituminous material used for the flush coat in many bituminous pavements is not the same as was used in the mix.

In the above discussion of the mixing method it should be noted that the remarks do not in general apply to bituminous pavements constructed by mixing a carefully graded aggregate and bituminous materials, and hence do not refer to many types of bituminous pavements which have been used to a considerable extent in the construction of streets in municipalities.

In various parts of the United States sand, gravel and earth have been mixed in place by various processes with bituminous materials in the endeavor to form an impervious, dustless and durable road surface. This work is being watched with considerable interest, as the utilization of local materials for the aggregate in many instances reduces the coast of construction materially. The limitation in the weight of traffic to be carried throughout the year under all climatic conditions is one of the most important points under discussion at the present time in connection with the above methods.

A new type of construction recently introduced by Logan Waller Page, Director of the United States Office of Public Roads, is known as oil-cement concrete. In this process fluid residual petroleum is added to the usual ingredients composing concrete.

From the standpoint of the nature of the material used, again it is noted that there is an increase in the use of refined tar, considerable employment of heavy asphaltic compounds and also the employment of combinations of tar and asphalt, the most noticeable increase, however, being in the use of heavy asphaltic oils which can be mixed readily with broken stone as it comes from the crusher.

There has been a marked tendency on the part of highway engineers during the past three years to appreciate more fully the importance of the various chemical and physical properties of bituminous materials. Many engineers and manufacturers now wisely advocate using different grades of the same type of bituminous material for varying local conditions and for different methods of bituminous construction. During 1909 and 1910 bituminous materials for use in the construction and maintenance of roads have been purchased in two ways; namely, by buying direct from the manufacturer a product known under a trade name and purchasing the material under specifications. The old custom of simply purchasing bituminous material under a trade name without investigation of its properties is being replaced by the second method. The object of the second method has been to cover one or more of the following points: first, to secure uniformity in the material furnished for a given contract; second, to obtain a compound which conforms to certain requirements with reference to the chemical and physical properties of the material which are considered essential; third, to provide a standard by which it is hoped that a satisfactory material may be duplicated on other contracts. The effect of the various physical and chemical properties of bituminous materials on their value as road binders is being investigated by a special committee of the American Society of Civil Engineers. Standard methods of testing bituminous materials is the subject of investigation by a sub-committee of the American Society for Testing Materials.

In this country, as well as in Europe, considerable confusion results due to the lack of uniformity among engineers, chemists and manufacturers relative to the nomenclature of bituminous materials. Until a recognized nomenclature is adopted it will be advisable to define methods and materials in order to avoid misinterpretation of information furnished relative to the construction and maintenance of bituminous surfaces and bituminous pavements.

Modern Municipal Sanitation in Cuba*

By R. Winthrop Pratt, Chief Engineer of the State Board of Health, Columbus, O.

AFTER the Spanish war and during the first American intervention, under General Leonard Wood, sweeping reforms were instituted in all of the cities of the Island of Cuba in regard to water supplies, sewerage, street cleaning, and the collecting and disposing of garbage. Owing to the importance of controlling yellow fever, which was particularly fatal to foreigners, as well as for general sanitary reasons, the work inaugurated at this time was very thorough; and has served as the basis for the continuance of sanitary work since Cuba commenced to govern herself.

The construction of municipal works has been facilitated by the fact that appropriations therefor come from the national treasury and not from the cities and towns. The latter depend upon local taxes for their income and these amount to barely enough to cover running expenses. The funds of the National Government, received through the custom house, must therefore be used. This condition has the advantage of permitting the central government to direct the work under the best obtainable engineering advice, and to adopt uniform policies with reference to the various localities.

Similarly the execution of all health laws is under the supervision of the National Department of Health and Charities, the secretary of which is a member of the President's cabinet. In immediate charge is the director of sanitation, who supervises the local health officers and health departments; all being paid from the national treasury. Each local health officer has, among other responsibilities, full charge of street cleaning and sprinkling; removal of garbage; disinfection, (both public and private); and the petrolization of mosquito breeding places.

In Havana, (as well as in the other cities and villages) the streets are now very clean and the principal ones are kept well sprinkled.

A box of garbage from each household is placed every evening on the sidewalk in front of the house and is collected during the night and hauled to a loading wharf, where it is dumped on to a garbage scow. Later it is taken out into the gulf stream three miles or more from shore, depending on the wind, and there unloaded. During the first American intervention, a large number of substantial galvanized iron garbage cans were purchased; but owing to the very narrow streets and sidewalks, it was found that these cans were usually knocked over by wagons or kicked over by pedestrians, so that their life was not long. Moreover, many of them were stolen. Since then the custom has been to use small uncovered wooden boxes. Of course, these are not as neat as the covered can and a great deal of the garbage is strewn about the streets by dogs and cats. Nevertheless by having the street cleaner promptly follow the garbage collector, the streets are kept in a clean condition.

The principal work of the disinfection department consists primarily in the regular application of a disinfectant, or deodorizer, hauled about in a tank wagon, to the storm water inlets in the old drains which are in effect combined sewers. In addition this department stands ready to disinfect private dwellings where there have been cases of infectious disease.

Allied to the disinfection work there is a division which is devoted to the elimination of mosquitoes, its work being primarily of great importance as an aid in controlling yellow fever; but also a great comfort to many residents who would otherwise be annoyed by mosquitoes. The employees of this division, armed with cans of crude petroleum and note books, not only apply oil to swamps and low lands, but also make continuously a house to house inspection in search of any stagnant water which might afford opportunity for mosquito breeding. Suspicious places in houses or yards are sprinkled with oil; and any gross neglect or disobedience of previous orders on the part of the householder is noted with reference to imposing a fine, which may be collected by the local health officer. Some over-zealous inspectors have been known to condemn water standing in a vase of flowers or in the drip pan under an ice chest. On the whole,

*A paper before the American Society of Municipal Improvements.

however, the work is intelligently carried out and is of great benefit.

In connection with mosquito elimination the health department is given authority to fill and drain low swampy places within municipalities and assess the cost upon those benefited. Also, projects have been made for reclaiming and draining large swamps at the borders of some of the cities.

Another important branch of the municipal health service in Havana and surrounding villages, is the division of plumbing inspection. Plumbing in all public and private buildings must be executed according to definite regulations; plans for each installation must first be approved by the local health officer on recommendation of the chief inspector. No master plumber can work without first passing an examination and obtaining a license from the health department. This service has resulted in a wonderful improvement in house sanitation.

The most important construction work planned, by the Americans, as part of the general policy of improved municipal sanitation is the new sewerage system and street paving for the city of Havana, which works are to cost at least $16,000,000.

The plans for the new sewerage system were prepared under the general direction of the United States Military Engineers, assisted by the expert advice of Mr. David H. McComb of Washington, D. C. and Mr. Samuel M. Gray of Providence, R. I. Mr. McComb is now chief engineer in charge of the execution of the work.

The sewer system is designed entirely upon the separate plan. Storm water drains are to discharge into the harbor or into the gulf at a number of convenient points; while the domestic sewers will terminate in a screen chamber at the edge of the harbor from which the screened sewage will pass underneath the harbor through an inverted siphon, about one-quarter mile long, to a pumping station, located a short distance south of Cabanas Fortress. At this point the sewage will be raised by centrifugal pumps into a 7-foot masonry tunnel about a mile long passing under the abrupt and rocky peninsular which forms the northeasterly side of Havana harbor and upon which is located the well known Morro Castle. The tunnel terminates at an outfall chamber, from which a cast-iron flanged pipe, five feet in diameter and some 500 feet long will extend into the swift current of the gulf stream, and there discharge the sewage at a depth of some 30 feet below the surface. The total length of sewers will be about 180 moles.

The smaller sewers will be of standard vitrified pipe and above that the larger ones will be either of concrete lined with a single row of brick or of reinforced concrete. Two of the outlying districts are so located that the domestic sewage will have to be collected at subsidiary pumping stations and from there raised into the main system and conveyed to the outfall.

Owing to the very narrow streets in the older portion of the city, and also to the fact that most of the sewers in this district are below the harbor, there have been a number of constructional difficulties to contend with. Nevertheless fair progress is being made and it is probable that within five or six years Havana can be classed as a well sewered city.

Special stress is laid in the contract to keep the open trenches at all times in a sanitary, and as far as possible odorless condition. The contractor is directed to use chloride of lime in a specified proportion. While these precautions have not been successful in entirely eliminating the odors, it is believed that conditions are better than in many American cities where new sewers are constructed in old and crowded districts. The principal source of odor in the Havana work seems to originate from the connecting of old sewers and cesspools into the new sewers rather than from any foul odor inherent in the sub-soil. Such odor in the sub-soil was expected by some in view of the fact that it has been continuously polluted for some 300 years.

Outside of Havana there has been very little sewerage construction under either American or Cuban administrations since 1898, except at Cienfuegos and Santiago. At the former place a complete system of sewers, built under a special decree of the former provincial governor, is nearly completed. The original plans for this system included a septic tank as a means of treating the sewage; but it was later decided, after a more thorough study of the currents and available dilution in the harbor, to omit the tank and substitute a mechanical screening plant.

At Santiago there were built during the first American intervention several miles of sewers and also a pumping station and equipment; but owing to many changes of administration and and lack of funds, the outlet sewer has never been built; consequently the finished work is useless and the pumping machinery is rapidly deteriorating through non-use and lack of care.

Referring to the places where water supply construction has been performed since 1898, there may be mentioned Cienfuegos, Santiago and Camaguey. Plans have been prepared for supplies for many other places; and the necessary funds have been promised by political leaders but have never been forthcoming.

At Santiago, (since American intervention) the old supply has been abandoned and there has been constructed a large impounding reservoir holding 444,400,000 gallons, formed by an earthen dam 60 feet high and 700 feet long with concrete core walls.

This reservoir was completed in 1908. During the past year, under the general direction of the writer, there have been prepared complete plans for a mechanical filtration plant to purify the water from this new supply, and it is hoped that this plant will be built during the coming year. The total cost of water works improvements at Santiago since the American intervention has been at least $1,500,000.

At Camaguey, which is located in the central part of Cuba, a very complete water works is about completed. This was designed and carried out principally by American engineers. The supply is from a creek, 14 miles north of the town, which is stored in an impounding reservoir holding only four months supply and formed by a reinforced concrete dam, 33 feet high and 840 feet long. The total cost of this work will be about $1,000,000.

In closing it may be said that sanitation in Cuban cities compares very favorably with, and in some cases is superior to, that in American cities of equal size. On the other hand, the warm climate and other local conditions in Cuba compel more activity on the part of the municipal officers, than is the case with cities in this country. Proper sanitation in Cuba is of concern not only to herself, but to the United States and to other nations having large commercial interests in the Island. It is, therefore, probable that the standards established under American administration will be maintained.

Relation of Bridge Specifications to Highway Improvement*

By Professor Albert Smith, Purdue University, Lafayette, Ind.

THE Indiana Engineering Society, in co-operation with several other organizations in this state, and supported by a great volume of public opinion, is urging upon the state legislature the establishment of a state highway commission.

No one of us doubt that some time in the near future, if not actually at this season, such a commission will be teen ton road-rollers as an alternative loading. Reports from manufacturing firms give the weights of the heaviest road-rollers as from 30,000 to 42,000 pounds. These weights and the distribution of the load will be shown on Table I.

Road rollers are not the only heavy loads that may come on highway bridges. In Table I are given also the weights on drivers of the heaviest road locomotives now in use in the west. We have not in this part of the country used such heavy engines, and we still haul with horses. The conditions of agriculture in this country are changing. The decrease of rural population and the accompanying increase in the value of farm property are the signs of the age of machinery on the farm. We are pretty certain to see the day when the traction engines on our highways will be much heavier than those now running. The use of the roads by such engines is likely also to established. The lack of some general organization of highway repair and improvement causes a waste which increases year by year. When such a commission is organized, the first obstacle which its plans for improvement will encounter is the fact that very many of the bridges on highways which should be among the first improved are unable to safely bear the the machinery of improvement: That new bridges unsafe for road-making machinery should be put in, while such

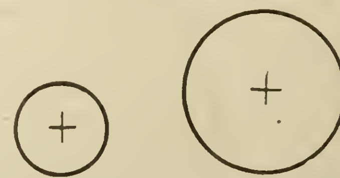
*A paper before the Indiana Engineering Society, January 13, 1911.

a movement is in progress, is a folly which no present shortage of funds can condone. The certainty that the bridges on all our main highways will be called on to endure road-roller loads within a period well inside the life of any steel bridge now building makes it improper to neglect such loads in their design.

which for the 21-ton roller above gives 7,100.

Below are given the lengths of I-beams in which the fibre stress from a concentrated load of 7,100 lbs. and the floor weight is 16,000 lbs. per square inch.

For the stringer spacing above, 8-inch I's in 16-inch panels with wooden



Road Rollers	(Name witheld)	21 T.	14000	28000
	Buff Steam Roller Co	20 T.	16000	24000
	Austin Western Co	15 T.	8000	22000
	Iroquois	13 T.	8000	18000
Traction Engines	J. I. Case	110 HP		31500
	Rumely Co.	120 HP		31000
	Avery Co	90 HP		24000
	Case	75 HP		20400

TABLE I. WEIGHTS ON ROAD ROLLER AND TRACTION ENGINE AXLES.
Giving weight of roller and weight of each axle for the road rollers and traction engines named.

The highway bridge specifications of those states whose highway work is most thoroughly organized specify fif-demand the use of the heavier road rollers in construction.

The most common spacing for stringers of country highway bridges is 2 feet 8 inches. The tread of the 21-ton roller above is 94 inches. On plank floor it will not be safe to assume the load carried to more than half of one stringer space on either side. Calling the tread "t," the stringer spacing "s" and the weight of the wheel "w," the load on one stringer will be expressed by:

$$P = \frac{w\,s}{(t + s)}$$

floors have, under this road roller, a a fibre stress of about 25,000, which is very large. With a concrete floor of 110 lbs. per square foot it would have 31,900.

It is very probable that, in view of the fact that so many of our bridges are too light in the floor for 20-ton rollers, few of them will be used on our road improvement. Even the 15-ton road roller given above has 22,000 on its rear wheels, would produce deflections in an 8-inch I, 16 feet long, sufficient to crack the concrete arches badly, aside from the doubtful security of steel members with a fibre stress of 25,000 lbs. produced mainly by moving load.

Granted the most favorable circumstances—that we use only 10-ton road rollers—for the present, we cannot be sure that developments in the practice of road making may not make it extremely desirable in the future to use the heavier rollers, on the more important roads. I am strongly of the opinion that, in the absence of any state specifications in regard to this matter, we ought to design stringers spaced 32 inches apart for a load of 6,000 lbs. on one stringer concentrated at the center of the panel, and for a fibre stress of 16,000 lbs. per sq. in.

Road roller loadings do not ordinarily produce stresses in the truss members of a bridge equal to those from uniform live loads. There is one action of heavy road machines which is not, I believe, ordinarily considered, at least has not been by the writer. A short time ago a young man brought me a sketch of a highway bridge whose stringers has. been tipped over sidewise by the turning of a traction engine on the bridge floor. The driver of the engine drew it up beside one truss to take water from the stream, and when his tank was full turned toward the center of the bridge and started his engine. The force necessary to overturn these stringers must have been very large and it would seem that this is a thing likely to occur at any time. It is tolerably easy to secure the stringers against such forces, but it made me wonder if almost any pony highway truss were not in some danger from such a test. A pony highway truss is not any too secure at any time, and when you conceive a heavy concentrated load which causes nearly the maximum stress in the top chord, suddenly deflected by hitting the wheel guard on the side, you are moved either to wish you had not been the designer or to be glad you were not, as the case may be.

I believe the supposed economy of the pony truss over beam-spans or plate girders to be a mistake. In in-

Size	Length Wood Fl.	Length Concrete Fl.
7" I	7'-9"	6'-8"
8" I	10'-6"	9'-0"
9" I	13'-9"	11'-6"
10" I	17'-7"	14'-3"
12" I	26'-0"	19'-5"
15" I	40'-0"	27'-4"

TABLE II. RELATION OF SIZE AND LENGTH OF I-BEAMS HAVING 16000 LBS. MAXIMUM FIBRE STRESS.

Span	Beam	Deck Girder	Through Girder	Truss
20	3000	4100	4400	
30	7100	6700	7800	
40	12100	9900	11700	10600
50		15800	18000	13400
60		21100	23700	16300
70		27400	30600	20400
80		34000	40000	25000

TABLE III. WEIGHTS OF STEEL IN GIRDERS AND TRUSSES.

vestigating the subject, I have made some combinations of the weights of bridges given in Ketcham's Bridges. These weights are taken from tables furnished by the Boston Bridge Works and the American Bridge Company. In order to compare the total steel weights I have added a floor of 7-inch I's to the spans below 40 feet and 8-inch I's for spans above 40 feet.

Above is the table of total steel weights, the beam spans directly from the tables, the girders and trusses by combination and the addition of the joists.

The cost of fabrication and erection varies so with different shops that one can hardly propose a figure that would be accepted by everybody, but it seems pretty clear that 1,700 lbs. of steel would not pay for the difference between the cost of shop work and erection of a 40-ft. truss beam bridge. At ¾ cent a pound the saving in 10,000 lbs. is $80.00, which buys the steel three times.

For 50-ft. trusses the saving from trusses appears to be 4,600 lbs. The saving in shop work of plate girders is less than in beam spans, yet it is considerable. J. A. L. Waddell several years ago proposed before the American Society of Civil Engineers the difference of ½ cent per pound as the difference between the cost per pound of girders and trusses. At this rate the saving from shop work in 50-foot spans appears to be $67, which will very nearly buy the extra steel. For deck girders the cost appears to be less, both for 50 and 60-foot girders.

Half through trusses can be built so that there is no question about their security, but where the only stiffening of the top chord consists of the bearing of the ends of the vertical posts on the floor beams, held tightly (at least at first) by "U" bolts, the security of a compression member 50 to 70 feet long is problematical, when it gets anything approaching a working stress. The writer has heard many men driving traction engines speak of "going around" to avoid light bridges, but none of those were plate girders. One has only to shake the top chord of a pony truss to see how loosely it is secured laterally, and to demonstrate its lack of fixity at intermediate points. A 30 or 40-foot truss bridge seems a little absurd to the writer, who has been unable to see any motive for building them at present beyond a desire to make a show for your money.

As for longer trusses, is not the money well spent that gives additional security and permanence?

The Concrete Outlet Sewer at Fort Smith, Ark.

By Matt and Bemis, General Contractors, Seward, Neb.

WE constructed last season the storm sewer terminal outlet for the Board of Public Improvement of Fort Smith, Ark., commencing the work the latter part of September, 1909, and completing it in February, 1910. This was a large concrete sewer, 11 feet feet and 9 inches inside diameter, built with wooden forms in the trench, and of concrete composed of 1-3-5 mixture, and was 1,320 feet in length, including the spillway.

To construct this sewer required a trench 14 feet wide and 27 feet deep to be excavated. The first ten feet of the excavation we took out with teams and slips, and the balance was removed with a cable-way, with tubs having a yard capacity, into which the dirt was shoveled by men. The tubs were carried back by the cable and dumped on the finished work. In this way we had only about 150 feet of trench to backfill at the completion of the sewer construction.

The weather was favorable during the entire period, with the exception of two weeks in January, when the mercury went down to zero, and stopped the concrete work.

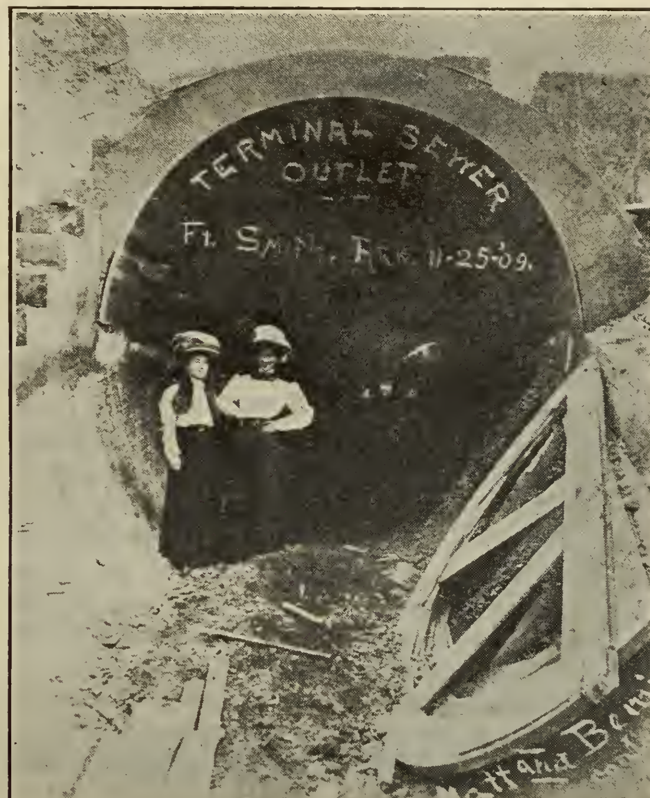
The difficult part of the work was the putting in of the spillway. This was planned so that the bulkhead at the end would be below low water mark in the Arkansas river, into which the sewer emptied. Here we encountered water and quick-sand, but by cribbing the excavation with 2¼-inch tongue and groove flooring, we were enabled to keep the water and sand out until we could get the concrete placed.

Accompanying is a reproduction of

a snapshot showing the end of the sewer and the upper end of the spillway, taken when we had constructed 400 feet of the sewer. The forms can easily be seen at the upper end of the work. No reinforcement was used in the construction.

posit, with some sand at the bottom.

This work was planned and supervised by Mr. George H. Myers, engineer for the Improvement Board. The construction was under the inspection of Mr. Bercher, a man of large experience in construction work



OUTLET SEWER, FORT SMITH, ARK.

The concrete at the arch was 11¾ inches thick; at spring-line, 19 inches; at invert, 11¾ inches. The rock was quarried and crushed at a plant in the bluff about 100 rods from the work and the sand was taken from the river on the opposite shore and barged to the work. We placed two lines of bracing in the trench at 8-foot intervals, the lower string being 6x6-inch timbers and the upper 6x8-inch timbers. The first 14 feet of the cut was heavy clay and the balance an alluvial de-

himself, as contractor and superintendent, and as a consequence there was no friction as to ways and means of doing the work, all knowing just how the work should be handled and managed. The Board of Improvement consisted of three members, who were thorough business men, two of them being bankers and the other a manufacturer. Mr. Harry E. Kelley, being the active member of the Board, had the management of the affair, as to the Board.

EDITORIAL COMMENT

Licensing Civil Engineers—Contractors' Costs

LICENSING CIVIL ENGINEERS.

Numerous bills have been proposed and others have been introduced in various State legislatures, which have the object of controlling the practice of engineering in its various branches. The following abstracts of bills proposed by an Indiana engineer give the general features of most of these bills:

The provisions in the bill for a state board of examining engineers may be stated as follows: 1. Three civil engineers practicing in three branches, if practicable, thirty years old, in practice ten years and in actual charge of work in the state for three years, are to be appointed by the governor for six-year terms. 2. Officers of board and provision for quarterly examinations of applicants. 3. Expenses paid from fees paid into an examining engineers' fund or by appropriations. Compensation, $10 a day and expenses. 4. Examinations to be advertised in two engineering journals at least three issues each, but interim examinations may be provided for. Fee, $25, of which $20 is returned if candidate fails. Candidates must be twenty-five years old, residents of Indiana, of good moral character, employed as assistant in civil engineering work at least five years and in responsible charge of work at least one year, graduation from engineering school counting for two years. Examination to consist of investigation of record, training and general success of applicant, with written answers to all technical or other questions to be kept on permanent record. Board to establish grade of qualifications to which applicants and their papers must conform. Questions may be varied from time to time, and related to particular branches when occasion demands. Those now in practice may file affidavits of training, experience and class of work and length of practice, with license fee of $25, and receive license. Engineers immigrating from other states having similar examination standards may receive license on payment of fee. 5. Provides for issue of license. 6. No person shall be county surveyor, city or town engineer or hold any responsible position in charge of construction of public work, and no one shall practice as consulting engineer, civil engineer or surveyor, or design, lay out or be responsible for, except as assistant, any civil engineering work without license. 7. Fines of $50 to $500 for each violation of law.

The bill regarding appointment of city civil engineer provides that the mayor shall appoint him and put him under the board of public works, or the council in cities of fifth class. Salary, $2,500 to $3,500 in cities of first class; $2,000 to $2,500 in second class; $1,200 to $1,800 in third class; $1,000 to $1,500 in fourth class. The city engineer is also to receive additional compensation of one per cent. of the excess in cost of public improvements under his charge of $300,000 in cities of first class; $200,000 in second class; $150,000 in third class, and $100,000 in fourth class, payable on approval of final assessment rolls for improvements made after rolls to above amounts have been made. No engineer to receive more than $5,000 a year. The extra one per cent. is to be added to the assessment. Board to determine compensation due on unfinished work at date of termination of employment or end of year.

The latter bill seems to be a move in the right direction, for the compensation of city engineers in Indiana has never been commensurate with the responsibilities assumed and the work done. As a consequence good engineers will not accept the positions unless they can carry on a private business in connection therewith or take it for the experience or to fill in an interim between more profitable employments. There are, of course, public-spirited exceptions to this rule, but they should not be required to suffer for their philanthropic acts.

A bill similar to the one first mentioned was introduced in the Colorado legislature. It goes somewhat more into detail, and differs slightly in some unimportant features and contains provisions for revocation of licenses.

The legislature of New York has under consideration three bills. One of these has a tendency to reduce the profession of civil engineering to the level of a trade, and would make it possible for one passing the examinations in one branch of civil engineering to practice in any other branch, whether competent or not, being in this respect no better than, if as good as, the Indiana bill above quoted. The other two are built on the lines of the form of statute prepared by a committee of the board of directors of the American Society of Civil Engineers. This bill details all branches of engineering as being affected by it, and provides, in much more detail than the proposed Indiana bill, for the examining board and the qualifications of its members, expenses, procedure, examinations, issue and revocation of license, penalties and exceptions. The scope of examinations is placed in the hands of the board, but there seems to be no restriction of the license to the practice of any particular branch or branches of the profession. Reciprocity with other states is provided for.

It will be seen that these bills are all based on the same principles, and vary only in details and in fullness.

The writer does not accept the principles on which the bills are based as correct, and, assuming them as valid, he cannot see that they are properly drawn and safeguarded to secure the results desired, namely, the protection of the engineering profession from dishonesty and incompetency, which have their chance now on account of the ignorance of employers, both public and private, of the differences between good and poor engineers and the necessity of discrimination between them if the resulting work is to be entirely satisfactory.

It seems to the writer that the State has the right to determine the qualifications of engineers engaged in public work, state, county or municipal, and that it is stretching its police powers well beyond their limits in extending its supervision of the competence of engineers into private affairs.

The exercise of trades which may affect the public injuriously if incompetent men attempt to do the work, whether for private or public employers, may be considered as subject to regulation under the police powers of the state, and barbers, plumbers, and even surveyors, may well be subject to examination. But draftsmen, for example, are not such direct public servants that the State can justly assume the necessity and therefore the right to specify their qualifications and the methods of determining them. Perhaps the fact that draftsmen, often poor workmen, masquerade as architects, gives a slight warrant for the regulation of the architects' profession which has been undertaken by several states, this warrant being based on the protection of the ignorant public from the consequences of its acceptance of the pretensions of such incompetents.

The states that have passed laws for the regulation of engineering practice have really covered the practice of surveying with only partial reference to the practice of engineering, and the bills proposed and those introduced in western state legislatures, except those above described, have been of similar nature.

When we come to the professions of architecture and engineering, as distinguished from the trades or handicrafts of surveyor, draftsman, builder, and the like, we pass beyond the field of legitimate state regulation, and the only excuse for restrictive measures of any sort is the expressed desire of members of those professions for protection from the pretensions of the incompetent masqueraders referred to.

The medical profession is the only one which, by the vote of practically all its members, has demanded this protection, and as a consequence certain schools in that profession have been able to secure a protection which has worked injustice upon equally competent schools and has interfered with the general progress.

The regulation of the legal profession by the State is legitimate, for attorneys practice in the courts of the State, and thus come directly within its control. The State of Indiana, however, specifically excepts the legal profession from the control of the State legislature and makes such control by the courts themselves almost of no effect.

Most engineers recognize the propriety of the freedom of their profession from State control, perhaps without formulating the principle behind it, but none the less fully. But few organizations of engineers have put themselves behind a movement to secure such control. The American Society of Civil Engineers puts itself in the peculiar position of deprecating State control at the same time that it presents a form of bill which it prefers in case a State should desire to pass a controlling law. Unfortunately, this bill could not attain the desired end.

The writer has frequently presented a measure which seems to him to meet the legitimate demands of those on both sides of this question. It is based on the one hand on the undoubted right of the State to define the qualifications which its own employes or those of its subordinate corporations must possess. It recognizes, on the other hand, the right to freedom of the engineering profession in general.

In brief, it is proposed that the State, through a proper examining or civil service board, shall establish eligible lists, under classifications and regulations of its own, from which shall be appointed city engineers, their principal assistants, superintendents of streets, of water works, of lighting plants, engineers of highways, bridges, State structures, of the various State and county boards, etc. These lists should be varied enough to cover all the public engineering and architectural work in the State, construction, repair, maintenance and operation. The State board may provide for local aid in preparing eligible lists for minor appointments if it finds this desirable. The kind of examination should be left entirely to the board. Certificates giving date of examination, kind of examination, classes of position for which it is given, should be given to each candidate successful in getting his name on an eligible list. He then has a certificate equal in all respects, so far as it goes, to a license from the State, except that it does not exclude from practice those not holding such certificates, although it does exclude those not holding them from appointment to the public offices coming under its class.

A competent examining board will soon establish a reputation for choosing competent men for its lists, and judicious advertising of the qualities to be expected of engineers on the various lists, and of the differences in these qualities for the various lists, will soon cause employers of engineers to demand, as a first requisite of employment for responsible positions, the possession of a certificate for a list which will cover approximately the qualifications required for the position to be filled. Thus the State's certificate will answer all the good purposes of a license and will not have any of its objectionable features.

An engineer can, of course, secure places on as many of the lists as he desires and can qualify for. Thus the certificates will definitely state the work for which the engineer has shown his competence, and will not be open to the very serious objection made to the bill of the American Society of Civil Engineers, namely, that it allows the issue to an engineer qualified in one branch of engineering of a license which would permit him to practice any branch of engineering. It is often true, for example, that an engineer fully competent to design and construct sewers would be too ignorant of electrical engineering to choose intelligently a motor for a given duty. Such a law is scarcely a protection of the profession against dishonest incompetency.

Unfortunately, membership in the national engineering societies has not always been a certificate of competence, and it is quite as indefinite in its statement of specific qualifications as the license proposed in the above quoted bills. Then, too, many competent engineers are not members of such societies and there are regions in which the number of members is very limited. Neither are the qualifications for membership under the control of the State.

It seems to the writer, therefore, that engineers will do their profession the most service if they will favor the passage of laws providing for well-selected eligible lists of men for appointment to public service positions, putting no limit on the number of examinations or to the number of names on the lists, and issuing certificates defining the nature of the qualifications covered by them. The public will then have a minimum standard of qualifications for its various classes of technical employes and private employers will have a means of determining the qualifications of the men presenting themselves for employment as engineers in any grade of work. They can then restrict themselves in making appointments as closely to these lists as they desire and will know the nature of the chances they take in making appointments outside of them. No engineer can object to the closing of the profession nor can he complain that it is reduced to the level of a trade. At the same time, the employer has all the advantages in making his choice that the license system would give him, and the public offices have the advantage of a close classification and the definite determination of qualifications thereunder.

CONTRACTORS' COSTS.

The great importance of accurate knowledge of the cost of doing work to the contractor who has taken a contract or who is proposing to bid on a contract is more thoroughly recognized as the business of contracting develops and the field is entered by men whose education and training fit them to attack in a scientific manner their work and the principles underlying the methods of doing it.

As a consequence there has been much discussion of methods of keeping costs, of the value of the data obtained and of methods of using these data in preparing estimates of the probable cost of new work. Like all new sciences, this one has developed slowly and in the midst of much blind groping for principles and simple methods of procedure.

Evidently the keeping of the costs of a job is in itself of little value, no matter how detailed may be the classification of items. Quite as evidently a judicious grouping of items is necessary to procure results which can be used to any advantage and an intimate knowledge of conditions and methods is equally necessary for the most efficient application of the information obtained by any system of cost keeping.

The term cost-analysis has been used to denote the process of discovering what information is needed and what it means when it is obtained, and the term has been extended by some to cover the synthetic operation of applying the information as collected and analyzed to the estimation of the cost of a proposed piece of work. This use of the term is hardly scientific, however, as this process is really independent of the analysis of obtained results.

In the past the successful contractor by natural adaptation and largely unconscious cost analysis and synthesis has been able to bid with considerable intelligence and to come out on the right side of the balance sheet. Too many good men have gone down because they did not have the judgment to bid on some one contract and so could not make both ends meet.

The present, and more truly the future contractor, is applying the modern business aids to his judgment, and all contractors must come to the modern ways or vastly decrease their chances of success in their line of work.

Definition and simplification of the processes which are being tried must be the next line of advance, and MUNICIPAL ENGINEERING proposes to do what it can in this line, having in mind the benefit of the small contractor as well as of the one undertaking heavier work.

A SERIES OF ARTICLES.

We shall, therefore, beginning probably with the May number, present a series of articles covering the subjects of cost keeping, cost analysis and cost management, beginning wtih elementary principles and proceeding month by month to illustrate methods whereby the contractor may profit by a systematic organization. This work will be given a regular department in the magazine, conducted by a man who has had practical experience and who today occupies a leading position in this line of work. In addition, side lights on the questions will be submitted by others who have special qualifications.

This series of articles will be entirely practical, at the same time that they treat the subjects thoroughly. Our subscribers are invited to send us their special problems, that they may be given practical solutions directly applicable to their particular conditions.

THE QUESTION DEPARTMENT

Water Rates of American Cities.

Will you kindly inform me where I can obtain a list of water rates charged in other cities. E. R., Port Huron, Mich.

The fullest list of water rates is that given in the "Manual of American Water Works" ($3) for 1897. It gives the rates charged in some 1,250 cities, large and small. Discussions of the subject, which will make it possible to study this table with understanding and further information about the rates will be found in the following recent articles in MUNICIPAL ENGINEERING:

In vol. xl: "Water Rates in Municipal Plants," p. 103; "Charges for Sprinklers and Standpipes for Fire Protection," p. 120.

In vol. xxxix: "Meter Rates for Water by Gravity System," p. 208; "Charges for Water for Laying Macadam," p. 209; "Water Rates," p. 120, in Connecticut municipalities; "Water Rates and Records at Valparaiso, Ind.," p. 18; "Information about Water Rates," p. 209. Several of these articles give references to earlier articles on the subject.

Joining New Concrete to Old.

Can you inform me where a preparation can be had for softening or making old work adhere to new in concrete? I have been informed that there was such a preparation called "Ransomite," but could not find anything further about it. Any information you can give will be appreciated. Thanking you in advance.
W. H. L., Sunbury, Pa.

Ransomite is one such preparation and there is also the Livingston process. Perhaps our readers can refer us to still other preparations. The Ransome Concrete Machinery Co., is at Dunellen, N. J., and J. B. Livingston is in Baltimore, Md.

Forms for Proposals and Estimates.

Are there in back numbers of MUNICIPAL ENGINEERING illustrations of office blanks for engineers use, such as proposal blanks and notices to contractors and monthly estimate blanks, or can you cite me to where I can procure the same?
J. W. M., Elgin, Ill.

Johnson's "Engineering Contracts and Specifications" ($3) contains forms of proposal blanks, notices to contractors, specifications, etc.

The National Paving Brick Manufacturers' Association, Board of Trade Building, Indianapolis, prepared a book of the forms required for special assessments in Illinois, which contains all the forms asked for except the monthly estimate blanks. As these forms differ in accordance with the differences in laws and customs in the various states, our correspondent should use those prepared for Illinois.

The article on "Handling Day Labor in Holyoke, Mass., in MUNICIPAL ENGINEERING, vol. xxxviii, p. 202, gives some forms for city engineer's use. In one on "Forms for Daily Force and Material Reports" on page 270 of the same volume are given some abstracts of daily reports. The article also refers to a number of earlier articles giving forms for cost keeping, field notes and office records.

Will our readers send us copies of the forms they use? They will be published either in full or by comparison with others differing but slightly from them. Please call attention to particular provisions which have been found convenient or necessary.

Concrete Fence Posts—Weight of Concrete.

Will you gindly state what you think of cement fence posts? Also what does a cubic foot of concrete weigh?
J. F. E., Guide Rock, Neb.

Concrete fence posts if properly designed and made of good materials well mixed, placed and cured have some points of advantage overy any other form of post. There are now many patented and unpatented designs for posts and reinforcement and others for methods of fastening to the post, some of which are good and some are not, some practical and some not. The general opinion above expressed in favor of the concrete post should therefore not be applied indiscriminately to any particular design of post.

The weight of concrete depends upon the weight of the ingredients composing it. Taylor and Thompson's "Concrete, Plain and Reinforced" ($5) gives the following average weights for concrete of the aggregates named, respectively, when made with Portland cement: Cinder, 112 pounds; conglomerate, 150; gravel, 150; limestone, 148; sandstone, 143; trap, 155 pounds.

Who Makes the Gisburne Ruling Pen?

Could you let me know where I would be able to get the "Gisburne Ruling Pen? I bought some pens about fifteen years ago. About two weeks ago I tried to buy some and corresponded with different concerns but they did not know anything about the pen. W., Wausau, Wis.

Can any of our readers enlighten our correspondent?

Books on Municipal Engineering.

Please give me names of at least two books on municipal engineering recommending the best. F., Chicago, Ill.

McCullough's "Engineering Work in Towns and Small Cities" ($3) is an excellent practical book on the subject named in its title.

Maxwell and Brown's "Encyclopedia of Municipal and Sanitary Engineering" ($10) is a new English book which covers much of the field in encyclopedic fashion with rather brief articles upon the various subjects.

Whinery's "Municipal Public Works" ($1.65) may also be considered to be a book on municipal engineering.

The field of municipal engineering is so large that few books attempt to cover it all in any form whatsoever. Surveying, paving, sewers, sewage disposal, water supply, water purification, lighting, garbage and refuse disposal, even such detailed subjects as shade trees, have their books and only through these books can the field be covered by the student not in practice.

Booklet on Public Service.

Can you inform me where I can secure the leaflet "Yourself as a Public Servant" by Arthur S. Huey?
A. B. A., Decatur, Ill.

Can any of our readers answer this question?

Cities Carrying Their Own Insurance.

It is vitally important to me to get some information on the question as to municipalities carrying their own insurance; the idea being that their risks are scattered because of the fact that the buildings are separated from each other. If you know of any cities where it is being done or have any information, you will very much favor me by sending it to me. M. J. G., ———, Wis.

Can our readers give any information on this subject? The writer knows of no cities that carry their own insurance. Most of those of which he knows anything carry quite a full line on all public buildings.

Public Lavatory for Cold Climate.

Could you furnish me with some information as to the best form of public lavatory for cold winter climates such as ours, or give me the addresses to which I could apply for plans or blue prints showing the best and most modern methods of dealing with this difficulty?

Any information you can furnish will be gratefully apreciated.
T. H. W., Edmonton, Alberta.

It is necessary to heat a public lavatory used in the winter time anywhere in the United States and Canada, except perhaps in the territory bordering on the Gulf of Mexico and the Mexican line. Several articles describing public comfort stations, which include lavatories, have been published in MUNICIPAL ENGINEERING. Probably the whole of the comfort station is desired. The following are recent articles:

In vol. xl: "Appliances for Public Comfort Stations," p. 130; Public Comfort Station at Seattle, Wash.," p. 184.

In vol. xxxix: "Two Public Comfort Stations," p. 452, describing in considerable detail the stations in Indianapolis, Ind., and Brookline, Mass., including methods of heating.

Methods and Tools for Sewer Cleaning.

I wish to obtain some information on sewer-cleaning-methods, tools, cost, etc. Will you kindly give me a list of articles in MUNICIPAL ENGINEERING on this subject, or any other reliable source of information?
E. R. W., Port Huron, Mich.

In vol. xl, p. 218, will be found a list of articles on "Flushing Street Sewers." A list of articles on "Methods of Cleaning Sewers" others than by flushing will be found in vol. xxvii, p. 440. Since the last list mentioned was published the following articles not included in the first list have appeared:

In vol. xl: "An Interesting Test of a

Sewer Cleaner," p. 69; "The Shannon Sewer Cleaner," p. 153; "A New Sewer Cleaning Device," p. 373; "The G-K Sewer Pipe Inspector," p. 486.

In vol. xxxviii: "Cost of Sewer Cleaning in New York City," p. 287; "Cost of Sewer Construction and Cleaning in Boston, p. 347; "The Shannon Sewer Cleaner," p. 440.

In vol. xxxvii: "Results of Cleaning Water Mains," p. 111; "Makers of Sewer Rods," p. 180.

In vol. xxxvi: "Ordinance Controlling Tree Location and Roots in Sewers," p. 236.

In vol. xxxiv: "A Unique Sewer Cleaner," p. 171; "Roots in Sewer Pipe," p. 239; "Security Sewer Rods," p. 317.

In vol. xxxiii: "Cleaning Water Mains," p. 39; "Sewer Cleaning Machinery," p. 249.

In vol. xxxi: "Makers of Sewer Cleaning Tools," p. 180.

In vol. xxx: "Cost of Cleaning a Large Brick Sewer," p. 287; "Sea Water for Flushing Sewers," p. 292.

In vol. xxviii: "Tools for Cleaning Sewers," p. 96.

Specifications for Street Cleaning.

I would be pleased if you can refer me to where I may obtain specifications governing contracts for cleaning paved streets.
W. H. R., Columbus, Ind.

It has usually been considered difficult, if not impossible, to write specifications which would properly govern contracts for cleaning paved streets and at the same time keep the cost down to a reasonable figure. Therefore, aside from prescribing the machinery to be used, the times the pavements are to be cleaned, and such general matters, the specifications have simply prescribed that the result shall be satisfactory to the proper city official in charge of the work. Most cities have taken up the work by their own forces that they may have full control of the results, both as to quality of work and cost of doing it.

Some years ago the city of San Francisco adopted elaborate specifications for hand and machine cleaning, which resulted in prices much higher than other cities were paying, presumably for the same work. A brief abstract of the requirements of these specifications will be found in Municipal Engineering, vol. xx, p. 74, and fuller abstract will be printed if desired.

How to Find House Connections in Sewers.

Do you now of any apparatus on the market for locating T or Y branches in old sewers? I find in Summit, and I imagine it is so in nearly every town where sewers have been laid, that the location of T's put in for proposed future connections are in a great many cases incorrect, and it entails considerable expense, particularly in very deep ones, to attempt to find them by digging down.

I have in a number of instances where T's were not found after digging for them, made hub connections, but this is of course not as satisfactory as connecting to T or Y branches.
J. S. S., Summit, N. J.

Can our readers make any suggestions on this line?

It ought to be possible to locate most connections by means of the sewer pipe inspector described and illustrated in Municipal Engineering, vol. xxxix, p. 486, which piece of apparatus was invented by a former employe of the city of Summit. Not all connections could be caught by this instrument, but if there are any records of connections whatever it may be possible to find one by locating a connection in its vicinity and then measuring the recorded distance between them.

A method of making a new connection with a pipe sewer by removing a length of pipe from the sewer, usually by breaking it in pieces, and then inserting a new length of pipe with a Y-branch on it, is described in Municipal Engineering, vol. xxii, p. 302. Parts of the bells must be cut away, to let the new length in, and these parts must be supplied by means of a carefully made cement joint.

Effect of Sweeping on Macadam Streets.

I notice an article in the January number of Municipal Engineering describing the injury caused to macadam roads by the use of high-speed automobiles, as they dispose of the binding material from the surface and cause the road to crumble. Would the constant use of a street sweeper injure a stone road in the same way?

Our town authorities are considering the advisability of purchasing a street sweeper. Would this treatment shorten the life of a macadam road, and to what extent?

Is it customary to sweep such roads, and to what extent is the practice followed?
W. L. Bishop,
Supt. of Streets and Water Works,
Dartmouth, N. S.

Customs vary in this regard. Such cities as New York and St. Louis clean only paved streets, while Denver sweeps its macadam streets as well as those having harder pavements. Many small cities clean their macadam and gravel streets with hoe or scraper.

The harder surfaced macadam streets will stand sweeping very well indeed, provided it is not too strenuous, and the roadway has been well designed and constructed. With automobile traffic the conditions are very different, and it is found to be necessary to bind the particles of stone more closely together by the use of bituminous material, ranging from oil to asphalt according to the amount and kind of traffic. These bituminized roads may be swept carefully.

Will our readers report their practice and experience?

Gas Processes and Rates.

(Continued from page 220.)

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Net.	Fuel. Gross.	Net.
OHIO—Continued.						
Oberlin, coal	2.50	....	1.10	1.00	1.10	1.00
Painesville, coal	2.25	....	....	1.00	....	1.00
Ravenna, coal	2.25	....	....	1.00	....	1.00
Troy, coal	....	....	....	1.50	....	....
Urbana, coal	....	....	1.50	....	....	....
Van Wert, Lowe	6.50	2.63	1.50	1.30	1.20	1.00
Washington, coal	2.50	....	1.10	1.00	1.10	1.00
Wilmington, coal	....	....	1.50	1.40	1.10	1.00
Wooster, coal	....	....	....	0.40	....	0.40
OKLAHOMA.						
El Reno, coal	4.40	....	1.50	1.45	1.50	1.00
OREGON.						
Baker City, coal	....	....	....	2.50	....	2.00
Marshfield, crude oil	....	....	....	1.75	....	1.75
PENNSYLVANIA.						
Ashland, Lowe	....	4	2.00	1.80	1.60	1.60
Bangor, Lowe	....	....	1.60	1.50	1.60	1.50
Bloomsburg, coal	3.40	....	....	1.75	....	1.25
Bristol, coal	....	....	....	1.50	....	1.50
Carlisle, Lowe	....	3.875	1.50	....	0.90	....
Clearfield, coal	1.45	....	1.40	1.33	....	....
Conshohocken, Lowe	....	....	....	1.80	....	1.25
Danville, coal	3.20	....	1.75	1.31	1.25	0.94
Gettysburg, carburetted water	....	3.25	1.65	1.57	1.25	1.25
Hanover, Lowe	....	....	1.50	1.40	1.50	1.40
Honesdale, Lowe	4.25	4.1	2.00	2.00	1.50	1.50
Huntingdon, Phœnix	....	....	1.50	1.40	1.50	1.40
Jersey Shore, Lowe	4.50	3	1.60	1.50	1.35	1.25
Lewistown, Lowe	4.65	3.125	1.60	1.50	1.25	1.25
Lititz, Lowe	....	3.125	....	1.50	....	1.50
Lock Haven, coal	2.75	....	1.90	1.50	....	1.50
Mauch Chunk, Lowe	4.00	3.5	1.70	1.50	....	....
Meadville, McKay-Critchlow	....	....	1.00	0.90	....	....
Mechanicsburg, Lowe	4.95	3	1.50	....	1.20	....
Milton, coal	3.15	....	1.50	1.25	1.50	1.25
Schuylki'l Haven, Lowe	....	....	1.50	1.50	1.25	1.25
Slatington, Lowe	....	....	1.60	1.50	1.60	1.50
Stroudsburg, Lowe	....	3.15	1.60	1.50	1.30	1.20
Tamaqua, Lowe	....	....	....	1.50	....	1.50
Towanda, coal	....	....	2.00	1.50	....	1.50
Tyrone, coal	....	....	1.60	1.50	1.60	1.40
Waynesboro, Lowe	....	....	1.50	1.25	1.50	1.25
RHODE ISLAND.						
Bristol, Lowe	....	....	1 60	1.50	1.60	1.50
SOUTH DAKOTA.						
Aberdeen, Lowe	7.20‡	4.25	1.85	1.70	1.85	1.70
Huron, Lowe	7.20‡	4.5	1.85	1.75	1.85	1.75
Mitchell, Lowe	7.50‡	4.8	1.75	1.65	1.75	1.65
Rapid City, coal	6.00	....	2.00	1.70	....	....
Watertown, Tenney	....	....	....	1.65	....	1.50
TEXAS.						
Gainesville, Lowe	7.00‡	4	1.60	1.50	1.60	1.50
VERMONT.						
Bennington, Lowe-Sutherland	5.55	3.25	1.90	1.75	1.90	1.75
Brattleboro, Lowe	4.35	3.5	1.60	1.54	1.60	1.54
Montpelier, coal	5.20	....	2.00	1.60	2.00	1.10
St. Albans, Lowe	7.10	4.1	2.10	2.00	1.60	1.50
St. Johnsbury, Lowe	6.75	3.3	1.75	to		1.40
VIRGINIA.						
*Charlottesville, coal	3.50	....	1.25	1.13	1.25	1.13
*Fredericksburg, coal	2.82	....	1.25	1.00	1.25	1.00
Suffolk, Lowe	4.20	3.86	1.50	1.30	1.50	1.30
Winchester, coal	....	....	....	1.50	....	1.50
WASHINGTON.						
Port Townsend, coal	5.00	....	3.00	2.70	....	2.50
North Yakima, coal	....	....	1.75	1.50	1.75	1.50

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
WISCONSIN.						
Antigo, Lowe	6.75‡	4	1.60	1.50	1.60	1.50
Baraboo, coal	4.80	....	1.75	1.50	1.50	1.25
Beaver Dam, Pettegrew	5.25	3.24	1.50	1.30	....	....
Berlin, coal	4.15	....	2.00	1.75	1.50	1.25
Chippewa Falls, Springer	....	....	....	1.50	....	1.35
Menomonee, Pettegrew, water	6.40	3.451	1.65	1.50	1.65	1.10
Merrill, Lowe	....	....	1.50	1.40	1.50	1.40
Monroe, Lowe	....	2.96	1.50	1.40	1.50	1.40
Platteville, coal	....	....	1.75	1.65	....	....
Portage, coal	....	....	....	1.30	....	1.30
Rhinelander, Lowe	....	....	1.50	1.35	....	....
Stevens Point, coal and Sutherland	....	....	2.00	1.75	1.50	1.25
Stoughton, Lowe	5.65	3	1.35	1.25	1.35	1.25
Watertown, coal	4.10	....	1.60	1.60	1.60	1.25
Waukesha, coal	....	....	1.30	1.20	1.20	1.20

Coal gas is popular in Alabama, Arkansas, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Maine, Michigan, Mississippi, New Jersey, New York, Ohio, Oklahoma, Virginia, Washington; less so in Colorado, Massachusetts, Missouri and Pennsylvania, with a few plants in Iowa, Maryland, Minnesota, Nebraska, New Hampshire, North Carolina, Oregon, South Dakota, Vermont and Wisconsin.

Water or oil gas is most popular in Arizona, California, Connecticut, Florida, Iowa, Louisiana, Maryland, Minnesota, Nebraska, New Hampshire, North Dakota, Pennsylvania, Rhode Island, South Dakota, Texas, Vermont, Wisconsin, with a few plants in Colorado, Illinois, Indiana, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oregon, Virginia.

There are but few combination coal and water gas plants in cities of this size, one in Florida, two in Indiana, five in Michigan, one in New Jersey, two in New York and one in Wisconsin.

There are 133 coal gas plants, 147 water or oil gas plants and 12 combination plants among the 292 plants in the list.

The standard net price for gas for lighting seems to be $1.50 per 1,000 cubic feet. There are 85 plants having this rate, 87 having higher rates and 120 having lower rates, so that the average rate is probably less than $1.50. The extremes are Amherst, Mass., with $4, and Stoughton, Wis., with $4.95, the former having some 60-candle power; and Wooster, O., with 40 cents, possibly mixing coal gas with natural gas.

The states of Illinois, Indiana, Kentucky, Michigan, Ohio and Virginia have exceptionally low rates, nearly all below $1.50. Of the 76 plants in these states, 25 have a rate of $1.25, 25 have rates above $1.25, all but two or three being less than $1.50, and 26 have rates less than $1.25, quite a number being as low as $1.

Colorado rates are all about $1.50, whether water or coal gas. Connecticut, Florida, Kansas, Maine, Massachusetts, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Vermont, Washington, Wisconsin, have consistently high rates, not far from $1.50, with very few in three or four of the larger states running below $1.25.

Regulations for Collecting Garbage at Householders' Expense.

Do you know of an ordinance covering collection of garbage, wherein the city imposes a tax upon the resident? It seems to me that that would be the means to a satisfactory adjustment of a difficulty which confronts us, for under the present system we have nothing but trials and tribulations, due very much to the inclination on the part of the garbage collector to take advantage of the people, as well as a natural inclination of the individuals who hide the garbage rather than have it hauled away.

DANIEL REAMER, Burgess,
Monessen, Pa.

The most satisfactory method of collection of garbage and refuse is by the city, either by city wagons or by contractors, in either case under complete control of the sanitary authorities of the city. The article in MUNICIPAL ENGINEERING on "Garbage Collection and Disposal in Minneapolis, Minn.," vol. xxxix, p. 275, and that on "City Refuse Collection," on p. 286, will give many valuable pointers. The cost of the work may be met by drafts on the general fund, by assessments upon the property or by assessments upon the people directly served, the method to be chosen according to the legal limitations, the difficulties of collection, tax limitations, etc.

Where the collection of garbage is let by contract, the contractor to collect his pay from the citizens served, there is always much trouble, and the sanitary officer of the city must be given full authority to fine those who fail to have their garbage removed under the regulations, or, in other words, fail to pay the contractor for doing his work. The contractor's wagons must also be placed under the close supervision of the sanitary officer, and this supervision must be even closer than it would be under a contract paid out of the city treasury. Some of the suggestions in the article on "Night Soil Removal," in vol. xxxviii, p. 37, will be available in preparing the ordinance.

The Chicago ordinance governing the condition and operation of wagons for collection of garbage and refuse is given in vol. xxx, p. 34. A report on systems of garbage collection and disposal, made with reference to St. Louis conditions, will be found in vol. xxviii, p. 393. There are many other articles in these and other volumes, but these apply most directly to the formation of an ordinance governing collection.

Bay City, Mich., has the most complete ordinance governing the collection of garbage by scavengers licensed by the city and paid by the citizens served. It was passed June 25, 1906, and reads as follows:

An Ordinance Relative to the Removal of Garbage.

It is hereby ordained by the common council of Bay City:

Sec. 1. That it is hereby made the duty of the occupant or occupants of every dwelling house or other building of any kind in the city of Bay City to provide a suitable tight box or other receptacle, with a closely fitting cover therefor, in which such occupant or occupants shall cause to be placed or deposited all the offal, garbage and kitchen refuse accumulating in or upon such premises; such occupant or occupants shall also cause the contents of such boxes or receptacles to be taken therefrom at least twice in each week from May 1 to November 1, and at least once in each week from November 1 to May 1 in each year, and deposited in some place without the limits of Bay City or otherwise disposed of, as shall be directed by the common council: Provided, however, That such garbage and offal may be burned or incinerated upon the premises by permission of and under the direction of the health officer of Bay City.

Sec. 2. It is hereby made the duty of the city recorder, as soon as convenient after the adoption of this ordinance, and on the second Monday in April of each year hereafter, to advertise for and receive propositions from responsible persons to collect, carry away and dispose of, as herein provided, the garbage and kitchen refuse referred to in Sec. 1, for a period of one year from and after May 1; said bids to be based upon the price per can per week, separate propositions to be made for hotels and dwelling houses.

Sec. 3. If the proposition of the lowest responsible bidder, in the opinion of the common council, is reasonable, said common council may then instruct and authorize the city recorder to issue a license to such person making such proposition, granting him the privilege to collect and receive such garbage and kitchen refuse and at the price named in his offer or proposal, the same to be collected from the individual, owner or occupant so served by such person, same to be full compensation for the services so rendered and contemplated by the provisions of this ordinance. In doing such work said licensees shall remove all the garbage offered for removal in any and all parts of the city twice each week from May 1 to November 1, and once each week from November 1 to May 1 of each year, as hereinbefore set forth, and shall also comply with the provisions and requirements of all the ordinances of the city, and particularly the ordinances relative to nuisances, public health and the use and protection of streets, alleys and public places; and shall be required to give a bond to the city in the sum of $1,000 to guarantee the faithful performance of said work and in the manner provided by law; said bond to be approved by the city comptroller: Provided, further, That in case any person fails or neglects to pay on demand for such services so rendered as aforesaid, said licensee shall promptly report same to the health officer of Bay City, and shall not be required to remove any more garbage or kitchen refuse for such person or delinquent until full payment is made for services rendered and unpaid for.

Sec. 4. Any person failing or neglecting to comply with any of the provisions of this ordinance shall be punished by a fine of not exceeding $50 and the costs of prosecution, and by imprisonment in the county jail for a period not exceeding thirty days, or by either, in the discretion of the court, and where only a fine and costs are imposed, the court may make a further sentence that the offender be imprisoned in the Bay county jail until the payment of such fine and costs, provided such imprisonment shall not exceed three months.

Sec. 5. All ordinances or parts of ordinances applicable to the whole or any portion of Bay City in any wise contravening the provisions of this ordinance are hereby repealed.

Following are some suggestions from the ordinances in other cities covering points not completely covered above:

Duluth, Minn., has a section in its ordinance providing that "the owner or agent of all buildings occupied by more than one tenant, and all flats and rows of connected houses, shall be held responsible for the permitting or suffering of any accumulation of garbage, etc., mentioned in the first section of this ordinance, and for the removal thereof. Provided, however, that nothing herein shall in any manner relieve any person who has actually caused the accumulation of such garbage, etc., upon said premises from liability for violation of this ordinance and punishment thereunder, as well as from the payment of the expenses of the removal of the same, as provided herein;" also one stating that "the common council of the city of Duluth may direct the manner in which the expense of removal of said accumulation of garbage, etc., incurred by the board of health, shall be collected; either by action, or the said common council may assess and levy a special assessment on the real estate from which the same shall have been removed by said board of health, and the said common council may so assess and levy said special assessment on said real estate in like manner provided for special assessments for building sidewalks." Probably it would be necessary in most states for the sums to be collected to accrue before assessments could be made to collect them from the property. The service is rendered to the residents rather than to the property owners, so that if collection for the service is to be made from any one it should be made, as provided in the Bay City ordinance, from the householder, rather than the owner.

Grand Rapids, Mich., has a brief ordinance placing the garbage collection under the board of health, which shall prescribe rules and regulations; defining garbage; prescribing conditions of wagons and cans, location thereof, etc.; authorizing board to contract for garbage removal and to license such scavengers; and providing that "the scavenger thus licensed shall receive no compensation from the city of Grand Rapids, but shall be permitted to make such arrangements with the citizens in the various districts that may be established by the said board of health, at a compensation not to exceed 25 cents a month for each householder, and not more than $1 a week for each hotel, restaurant or boarding house."

Omaha, Neb., has a schedule of fees for removal of garbage and dead animals, as follows: Animal over 500 pounds, $2, under 500 pounds, $1; dog, 75 cents; cat, 25 cents; load of manure, ashes or refuse, 50 cents, standard load being 64 cubic feet of manure and 27 cubic feet of ashes and other solid refuse; barrel of garbage or refuse matter of 30 gallons or more capacity, 20 cents; barrels, boxes or other receptacles of less than 30 gallons, 10 cents; night soil accessible by teams, 10 cents a cubic foot.

Salt Lake City, Utah, has the following schedule of fees: Manure, 2 cubic yards, 75 cents; barrel of refuse, not more than 30 gallons, 25 cents; smaller vessels, 15 cents for each 10 gallons; ashes, 75 cents per load; refuse, 75 cents per load; less quantities than one load, 10 cents per bushel.

Information About Garbage Plants.

Please send me information for garbage plant for small town, and where I can get Morse's "Collection and Disposal of Municipal Waste."

J. R. S. Monongahela, Pa.

Municipal Engineering is preparing some information about garbage plants for small cities and towns for early publication. Meantime, information about such plants, some in operation and some in prospect, can be obtained from the firms listed in Municipal Engineering in the "Business Directory," published each month, under the heading "Garbage Disposal Plants."

Morse's "Collection and Disposal of Municipal Waste" will be sent by Municipal Engineering Company on receipt of the price, $5.

Portable Plants for Asphalt Repairs.

This city has a number of old streets paved with sheet asphalt that are constantly having holes worn through the wearing surface, particularly along the street car tracks, and it is our desire to purchase some suitable portable asphalt mixing plant to make the necessary repairs.

Next to the street car tracks worn places six or eight inches in width and from one to six feet long frequently occur, while the worn places on the roadway between the tracks and gutters are usually circular in shape, one foot in diameter and larger, depending upon the length of time allowed to elapse before repair is made.

It has been the custom heretofore to have this work done by a local paving company, who, as a rule, would first clean out all rubbish from the worn places and trim up the edges of the wearing surface surrounding the wornout places in the pavement and later on deposit the wearing surface material in these holes and compress it more or less by light rolling. It is hardly ever practicable to protect these patches from traffic after they have been put in, consequently they often become more or less marked by the wheels of vehicles before the material has become hard set.

This is not the chief source of trouble, however; but because of the fact that the wearing surface material is hauled on to the streets in wagon load lots of perhaps two cubic yards, and although some attempt is made to prevent cooling by keeping a canvas spread over the load, the amount of material in one load being sufficient to fill a number of patches on the street, considerable time elapses before the whole amount is used, and often times when the last of the load is being deposited on the street it has thoroughly cooled off and the material is hard and tough and not of the proper consistency to be made to unite with the edges of the old wearing surface or with the concrete foundation of the pavement on which it rests. Nor is it possible with the material cooled off to this extent to give it the proper amount of compression, even by heavy rolling, to resist ordinary wear of vehicles. Our experience has been that these patches soon wear out and require repatching in a very short time thereafter, especially in rainy weather.

We feel that our troubles could be greatly overcome by the use of a small portable plant, one that could be operated upon the street in such a way that the material could be gotten out in small quantities and delivered for use upon the street at the desired temperature. If such a plant is not available on the market, perhaps some suitable portable heating device that would prevent the material from cooling off as it is being used could be made use of to obtain the desired results, the idea being, in the latter case, that the material should first be mixed in the ordinary asphalt plant and hauled to the heater adjacent to the work.

If your information bureau can advise us as to where such a plant can be procured or what other plant may be adopted to meet our difficulties, we will be greatly obliged.

R., City Engineer, ———, Cal.

Names of manufacturers of such plants will be found in the "Business Directory" published in each number of Municipal Engineering, under the heading "Asphalt Machinery," "Asphalt Plants," "Portable Paving Plants. Descriptions of the work done by such plants and some figures of the cost will be found in the following articles in Municipal Engineering:

In vol. xl: "The Municipal Asphalt Paving Plant at Detroit, Mich," which is a municipal plant, but is not a portable plant.

In vol. xxxix: "The Goodwin Portable Asphalt Plant," p. 60; "Denver's Municipal Asphalt Plant," p. 138, a municipal plant, not portable; "Cost of Maintaining Asphalt Streets in Brooklyn," p. 314, with a municipal plant, not portable; "A Portable Asphalt Plant," p. 410, describing the Link-Belt Company's plant used on the street; "Capacity of Link-Belt Company's Portable Asphalt Plant," p. 489.

In vol. xxxviii: "Atlas Dryers and Portable Asphalt Plant," p. 60, a one-car plant; "Report of the Indianapolis Municipal Asphalt Repair Plant for 1909," p. 116, a municipal plant, but not portable; "Asphalt Repairs in Marion, Ind., in 1909," p. 197, made with a Hooke portable heater; "Cost of Operating San Francisco's Asphalt Plant," p. 201, a municipal plant, not portable; "The Cummer Portable Asphalt Paving Plant," p. 215, a one-car plant; "A Portable Atlas Dryer," p. 280, for use on streets; "Bitu-Mass for Roadways," p. 360, using a portable plant on the street; "Cost of Asphalt Repairs in Brooklyn," p. 428, a municipal plant, not portable; "Dryer and Heater for Broken Stone, Grit, Sand and Gravel," p. 438, a portable machine for use on the street.

In vol. xxxvii: "Asphalt Repairs for a Small City," p. 36, giving also some references to earlier articles on the subject; "Cost of Asphalt Repairs in Syracuse, N. Y.," p. 38.

Concrete Foundation Under Steam Railway Tracks in City Street.

This city contemplates repaving one of its principal business streets. In this street there is located a steam railway. I have insisted that the railway company place its tracks on a concrete foundation. The railway company does not object to this, but they doubt the success of this method of construction and have asked that I point out to them some place where a concrete foundation is placed underneath the ties and rails of a steam railway. I would greatly appreciate it if you can advise me where there is a steam railway track placed on a concrete foundation.

S., City Engineer, ———, Va.

Such foundations are very common under street and interurban railway tracks but are very uncommon under steam railroad tracks. The only one known to the writer is one under an industrial railway track with comparatively light loads, not much greater than those of the heavy interurban cars. This railway is described in MUNICIPAL ENGINEERING, vol. xxxii, p. 38, and vol. xxxiv, p. 40. The inventor recommends this construction for steam passenger railroads, but it has not been used as yet under their rails. The shocks to the foundations are so much more severe in a steam railroad that much heavier concrete construction would be required for permanence than under a street railway.

Can our readers give information about concrete foundations under steam railroad tracks?

Water Required for Laying Concrete Walks.

Can you inform me approximately the amount of water necessary per cubic yard for making concrete sidewalks where one part cement, three parts sand and four parts gravel are used. This information is desired as the water department is trying to find out how to charge them for water.

J. H. T., Arkansas City, Kan.

In MUNICIPAL ENGINEERING, vol. xx, p. 214, it is stated that a square yard of cement walk 4 inches thick, including amount necessary for wetting stone, may easily require 30 gallons, allowing a little for excess of moisture. Water used in moistening foundation for tamping or rolling must be added, also waste and water used for washing and cleaning boards, tools, etc. At the same rate, a cubic yard of sidewalk material would require some 270 gallons of water, or say 300 gallons with the allowance for waste. There may be considerable variation from this estimate in any particular case, owing to conditions of moisture of atmosphere and materials, rate of evaporation, specifications, rate at which work is done, etc. Can any of our readers give results of measurements taken in the regular course of construction?

Who Should Pay for Changes in Water Connections Due to Street Paving.

The water company had to lengthen a number of service pipes on West Second street, because the council wanted the street widened when bricks were adopted for paving, and the pavements were made narrower to the same extent as the street was widened. When the water company did put in all these services, the law was obeyed, and each stopbox was put one foot inside of curb, company receiving only $5.00 for each service, no matter if it was 40 feet long or only a few feet. This price has been a hardship on water company and now the council widening the street, makes another expense to solder on a few feet of pipe, etc., for which I believe the city ought to pay.

The water company set a number of fire hydrants, according to stakes driven by council committee. Changes in width and elevation of street made it necessary to move a number of hydrants, and I say the city should pay for all such changes.

A. S., Superintendent.

This is a question which can be answered only after a study of the provisions of the contract between the water company and the city and of the other local conditions. It is quite common to require in franchises that all such changes as those mentioned shall be made by the water company upon due notice without expense to the city. Service pipes under some franchises are paid for by the property owners and in such cases the practice may be different regarding them.

The privilege of doing business in the city streets is worth something, and the burden which the water company's use of them places upon them must be made as light as possible. Therefore, the decision, in case the matter is not mentioned in the franchise or contract, is likely to be the same as that given above. However, if the water company has made concessions in the form of free water to the city or low hydrant rentals or low rates to consumers, equity may require that the city or property holders should pay the expense of the changes described. In the absence of full knowledge regarding all these conditions a just decision could not be rendered.

Bitu-Mass for Roads and Pavements.

The Bitu-mass pavement is a new kind of a pavement in this section of the country, but we were informed that it was or is, to be used quite extensively in Indianapolis.

Can you give us any data on this kind of pavement as to the cost as compared to asphalt, durability, sanitation, etc., and is it giving entire satisfaction?

How long has the pavement been laid in your city and in what kind of a condition is it at the present time?

R., Walla Walla, Wash.

I would like some information about Bitu-mass, which has been laid in Indianapolis, as to

1. Present condition of these streets in Indianapolis with reference to age and amount of wear, travel, etc.
2. Resistance to heat.
3. Dustlessness.
4. Foothold for horses and its favor with motorists.
5. Actual cost of maintenance, repair, etc.
6. Does the general public favor it?

B., Spokane, Wash.

A similar request has been received from Olympia, Wash.

The first three Bitu-mass streets were laid in Indianapolis in 1909. The first was laid with too much bitumen, and not enough gritty material and has been too soft for any considerable travel. The second street was an improvement over the first and the third street, laid late in the fall of the same year, was better laid in both respects and is in excellent condition. Two streets laid in 1910 are also in good condition. One street begun in 1910 has not yet been completed. Travel over the first two streets is rather heavy, especially over the first one laid, as the cross-town travel of a considerable residence district strikes it. The other streets have the ordinary travel of residence streets, which are not thoroughfares of through traffic. The streets, except the first two mentioned, show no appreciable wear.

2. The pavement is in effect a bituminous concrete, and has the general characteristics of such material. The writer has not observed it in very hot weather, but his observation of both the streets in which too much bitumen was used and those in which the materials were properly proportioned, indicates that it will withstand successfully the temperature conditions of this country.

3. The aggregate is held in place by the bitumen so that the formation of dust from the aggregate is reduced to a minimum.

4. The surface shows the mineral particles and is, therefore, not slippery. It should be entirely satisfactory both to horsemen and motorists.

5. Pavements with proper proportions are not yet old enough to show need for repairs. The cost of maintenance should not be greater than that of other bituminous pavements of equally high grade. The latest street built was petitioned for by nearly all the property owners on the street, and they are reported to be well pleased with the result.

7. The cost is materially less than that of asphalt pavement. It compares favorably with that of other bituminous macadams of like grade.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Water-Tight Sewer Joints at Harrisburg, Va.

To the Editor of MUNICIPAL ENGINEERING.

Sir—We have just finished laying two miles of 8-in. sewer pipe at a cost of $5,000.00. Six hundred feet of this was laid through a swamp through the race track grounds, in which I used G-K sewer joint compound. I found it an excellent material and feel that there can be nothing better to make a good sanitary and water tight joint. After draining the grounds the sewer was put through three feet deep. This will be submerged and made a lake again. The infiltration of water was practically nothing through 600 feet. I am sending you picture of laying the pipe.

J. F. NOEL, Superintendent Public Works,
Harrisburg, Va.

What Happened to Smith.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Bill Smith, the engineer of a small town in California, was recently called upon, by the Town Board of Trustees, to prepare plans and specifications for a new water works and distributing system. Up to this time, his work had been land surveying and outside of giving a few street grades and staking out a couple of town lots, he had done little else. Bill is conscientious and well read, but, while always having been interested in municipal improvements, he was forced to realize that he was not entirely fitted to handle this job.

Smith had about made up his mind to suggest to the board that a brother engineer, who was thoroughly familiar with such work, be employed in consultation to supervise the preparation of these plans and specifications, when a contractor named Browne dropped into town. Browne makes a specialty of this kind of work and it is a part of his business to keep posted in the doings of town officials. He is generally on the job before the bids are called for and gets very well acquainted with useful members of the community. Aided by an agreeable personality, showing a generous disposition to buy more than his share of drinks and cigars, and purposely being a good loser in a game of poker, he soon gained Bill's friendship and confidence.

During a discussion of the proposed improvements, Bill Smith told Browne of his intention to ask the members of the Board for help, saying that in justice to the people of the town and to the members of the Board he should not undertake something which he could not properly finish. Browne proffered his help. He said that he knew more about this kind of work than anybody in the State; that he had put in a dozen or more works of this kind; and that he already had plans and specifications of a water works system almost identical to the one proposed. He said that Bill could have a copy of the specifications and that if there was anything which he did not understand, he (Browne) would consider it a pleasure to explain it to him. If Bill would say so, he would prepare a set of plans, estimates, etc., which Bill could turn into the Board as his own. This, Browne said, was a trifling expense to him, part of his regular overhead, and would keep some of the younger members of his office force busy and out of trouble while he was away from the office.

Browne argued that the fee of the consulting engineer was an unnecessary expense to the town and that to call for help was a bad thing for Smith to do because he was supposed to be posted on such matters. He argued further that if Smith could get along without help, it would help him politically. He would be raised in the estimation of the people of the town for having carried on such a large and creditable piece of work.

Smith was non-commital, but when a week later a neat drawing of the proposed water works and well-arranged specifications were sent to him by Browne, he decided to go at it alone. He retraced the plans and had several copies of the specifications made by the printer, who was editor and general manager of the town paper. He was congratulated by the president of the Board when he turned in his report and plans and for some time afterward was beseiged with the ingratiating attentions of numerous contractors who were to bid on the work.

When the bids were opened Browne's bid was low and considerably lower than those of the majority of bidders, who were very close together. Browne got the job. One high bidder was heard to remark that he was just as well satisfied that he did not get it because there was a good deal of uncertainty about some parts of the specifications and he had thought it necessary to protect his company by adding five per cent for emergencies.

The contract was signed up and the work started. As things progressed it was discovered that the specifications were not clear about a gas-engine foundation. A five-hundred-gallon fuel tank, though necessary, was not mentioned, nor was a roof over a settling reservoir. Later, when an old fire pump, which was to be part of the new system, was moved over into a concrete pit built to receive it, Old Zeik Edgecome, the oldest inhabitant and an authority on things generally, discovered that the pump was a foot longer than the pit. The dimensions of the pit had been shown on the plan, which Browne had followed carefully.

Browne's contract provided for extra work on a very liberal basis and he started in at once to make all the necessary alterations and additions.

When the cost of the work had run up from $16,500 to $21,400, it suddenly struck Smith that the town would have very little money left out of the sale of the bonds with which to buy water meters. Smith tried to call a halt on Browne. Browne smiled and quietly suggested that the whole matter be put up to the Board. This Smith could not afford to do because he had allowed the impression to exist that he was familiar with the work and all this was clearly his oversight, caused by inexperience. Smith waited and worried.

The job was finished and the machinery tested. The guarantee was exceeded and the Board complimented Browne upon the efficiency of the plant. This efficiency was about one hundred and ten per cent. Something that the town should be justly proud of. Browne had made a nice little stake out of the extra work and departed to put through a job in another town.

When it was found that there was not enough money left to buy even a few meters and that a nephew of old Zeik could not be paid as driver of the new water wagon, there was on awful fuss. The people of the town accused Smith of grafting and the Town Board of Trustees criticised him severely.

Smith is honest and conscientious and had worked as hard as he knew how to make the work a success. Instead of the town's saving money, money was lost because there was no competition on this extra work, part of which was unnecessary.

Browne says that Smith is a pseudo engineer and that if it had not been for the members of the Board and himself the town would have had no water works at all. Smith was always bothering him he says.

Smith has lost his reputation in town and is hustling to keep a young college man from beating him out for the nomination for county surveyor. This young man is another relative of Old Zeik and claims that, from what he learned at college and from what the professor of physics has written him about efficiency, more than one hundred per cent is too much for a country town, and that Bill Smith ought to have known it. DIOGENES.

Smoke Abatement Campaign Material.

The Smoke Abatement Compaign Association of Indianapolis has prepared the accompanying form of report for distribution among its members and others. Tho plan is to make such reports at reasonably regular intervals, to collect information concerning each individual offender and then take up the question of abatement in the manner best suited to the particular case. The Association has appointed three engineers to aid in this stage of the work by recommending methods of reducing smoke in particular cases. The Association is engaged at present in a special inspection campaign in one portion of the city and is collecting a large amount of data on the blanks regarding all the offenders against the smoke ordinances at this particular time.

Smoke Abatement Association

OF INDIANAPOLIS

Period of observation from .... *to* ....

Name of property owner ....

Address ....

Point of observation ....

Observation began .... *M.*

" *ended* .... *M.*

" *interval* .... *Min.*

Weather .... *Wind* ....

Remarks ....

Observer ....

Address ....

Date of report ....

DENSE BLACK OR GRAY SMOKE				
BEGAN		STOPPED		INTERVAL—MIN.

Dense smoke for .... MIN.

Per cent. of time dense ....

When plant has more than one stack, indicate one observed

To Prevent Dusting or Easy Abrasion of Improperly Laid Concrete Floors.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Cement floors, particularly in office buildings or warehouses, which do not have the advantage of obtaining the necessary moisture from the atmosphere such as outside floors and sidewalks on which the dew falls at night, if not properly protected and kept damp, become prematurely dry and are therefore more or less porous and weak, causing easy abrasion under foot traffic, or what is commonly known as dusting.

Care should be exercised in keeping such floors damp by covering with wet sand, wet hay or straw, for a week or more until the floor has properly hardened. If this has not been done and the floors are found to dust under foot traffic, the following remedy will be found very easy to accomplish, economical and effective:

Wash the floor thoroughly with clean water, scrubbing with a stiff broom or scrubbing brush, removing all dirt and looso particles. Allow the surface to dry, as soon as dry apply a solution of one part water-glass (sodium silicate) of 40 degrees Baume, and three or four parts of water, the proportion of water depending upon the porosity of the concrete. The denser the concrete the weaker the solution required. Stir well, and apply this mixture with a brush (a large whitewash brush with long handle will be found the most economical). Do not mix a greater quantity than you can use in an hour.

If this solution is sufficiently thin, it will penetrate the pores of the concrete. Allow the concrete surface thus treated to dry. As soon as dry, wash off with clean water, using a mop. Again allow surface to dry and apply the solution as before. Allow to dry and again wash off with clean water, using a mop. As soon as the surface is again dry, apply the solution as before. If the third coat does not flush to the surface apply another coat as above.

The sodium silicate, which remains on the surface, not having come in contact with the alkalies in the concrete, is readily soluble in water and can therefore be easily washed off, thus evening up the color and texture of the floor. That which has penetrated into the pores, having come in contact with the other alkalies in the concrete, has formed into an insoluble and very hard material, hardening the surface, preventing dusting and adding materially to the wearing value of the floor.

ALBERT MOYER,
New York City.

LAYING WATER TIGHT SEWER IN SWAMP AT HARRISBURG, PA. (See page 352).

MUNICIPAL MATTERS IN COURT

Higher Courts—Protection of Contractors—Street Ownership—Character of Water—Purchaser Must Pay—Creosote Poisoning

Decisions of the Higher Courts of Interest to Municipalities.

Power of County Commissioners to Relocate an Existing Bridge—Where a river spanned by an expensive bridge cuts a new channel, through which thereafter most of the water of the stream flows, it is competent for the county commissioners to remove the bridge from its position over the old channel and to rebuild it over the new one, and an owner of land some distance from the bridge, but through whose land the highway connecting with the bridge passes, and who has full and free access to and from the land by other highways, is not entitled to an order enjoining the commissioners from removing the bridge. Anderson vs. Board of Commissioners of Cloud County et al. (Kan.). 111 P. 464.

Right to Issue Water Works Bonds—Assuming that under the statutes above described water works bonds should be included in estimating the amount of outstanding indebtedness for the purpose of ascertaining whether the statutory 5 per cent. limit has been reached, if the city's financial condition is such that two sets of bonds, one for water works and one for a city hall, may lawfully be issued by giving the latter priority in time, both may be issued at the same time without violating the statute; and where under such circumstances city hall bonds are first voted and first authorized by ordinance, their issuance must be deemed substantially contemporaneous with that of water works bonds which bear the same date and mature at the same time, but which are actually executed a few weeks earlier. State ex rel. Taggart, County Attorney vs. Kansas City et al. (Kan.). 111 P. 494.

Injury to Pipes of Water Company by Electrolysis—In a suit by a water company against an electric street railway company to enjoin defendant from injuring the mains and service pipes of complainant by electrolysis caused by electricity generated by defendant, the evidence showed that both parties used in part the same streets under franchises granted by the city; that defendant operated its line by the single trolley system, using the rails as return conductors; that complainant's pipes were being injured by electricity which passed to them from the rails through the earth, but not to the serious extent claimed, and that the injury was being lessened by means adopted by defendant by the use of brazed rail bonds and by feeder wires from the rails to the negative side of the dynamos. The weight of the expert testimony also tended to show that, while the escape of electricity from the rails to the water pipes and consequent injury to the latter by electrolysis could not be entirely prevented in the system used by defendant, it could be so lessened by the means defendant was adopting or other means suggested and used elsewhere as to practically prevent serious injury to the pipes of complainant. *Held*, that it was the legal duty of defendant to prevent such injury by all reasonable and practical means; that it would be enjoined from continuing such injury, but would be left free to adopt within a reasonable time such means to that end as it should be advised. Peoria Water Works Co. vs. Peoria Railway Co. (Ill.). 181 F. 990.

Expenses of City Official Inspection Trips—A resolution was passed by the city council of Atlantic City to pay the expenses of that body, together with the mayor, city engineer and city solicitor, in visiting Pensacola and New Orleans to inspect drainage systems in operation in those cities, as a preliminary to the installation of one in Atlantic City; "the expenses * * * to be paid out of the funds now in the treasury belonging to the drainage system." There was no appropriation for the purpose; the only balance in the treasury belonging to the drainage system was from the proceeds of bonds issued under ordinance "for the purpose of providing moneys for the payment of contracts now made or hereafter to be made for the construction and installation * * * of a drainage canal," etc. *Held*, that the resolution was beyond the purpose specified in the ordinance and was invalid. Louderslager vs. Atlantic City (N. J.). 77 A. 1060.

The Right to Reject the Lowest Bid—The Spokane city charter, providing that the board of public works shall reserve the right to reject any and all bids for work to be done by contract, allows the board to let the contract to the one it considers the best bidder, quality of material as well as price being considered; so that in the absence of a showing of absolute fraud or such a pecuniary loss to the city, determinable by some measurable standard, as to indicate a manifest abuse of discretion, its rejection of the lowest bid and acceptance of the higher for pumps and equipment to raise a certain quantity of water, the bidders offering machinery of different manufacture cannot be interfered with by the courts. Stern vs. City of Spokane et al. (Wash.). 111 P. 231.

Street Improvements not Public Utilities—Street improvements do not constitute "public utilities," within the meaning of the term as used in section 27, art. 10, of the Constitution, which provides that: "Any incorporated city or town in this state may, by a majority of the qualified tax paying voters of such city or town, voting at an election to be held for that purpose, be allowed to become indebted in a larger amount than that specified in section 26, for the purpose of purchasing or constructing public utilities, or for repairing the same, to be owned exclusively by such city." Dingman vs. City of Sapulpa (Okla.). 111 P. 319.

Free Service as a Consideration in a Franchise—A heating company acting under a municipal franchise granted on condition that it furnish heat for a public library building, free of charge, bringing the service to the curb, cannot escape performance because the building was not in existence, being merely contemplated, when the franchise was granted, nor because as originally erected the building was not equipped to receive the heat, nor because it is two blocks away from the mains. State ex rel. City of Marion vs. Marion Light & Heating Co. (Ind.). 92 N. E. 731.

Control of Sanitary District Annexed to Municipal Corporation—There cannot be at the same time within the same territory two distinct municipal corporations, exercising the same powers, jurisdiction and privileges. A sanitary district is extinguished and dissolved on annexation of its territory to an adjacent municipal corporation. In re Sanitary

Board of East Fruitvale, Sanitary District (Cal.). 111 P. 368.

Front Foot Assessment Invalid—A special assessment for a street improvement, which is made on the basis of frontage merely, without regard to special benefits, is invalid. City of Nokomis vs. Zepp et al. (Ill.). 92 N. E. 809.

Powers of a Municipal Corporation—A municipal corporation possesses only such powers as are expressly granted, those necessary or fairly implied as incidental to the powers expressly granted, and those essential to the declared objects and purposes of the corporation, not including those merely convenient. Any fair, reasonable doubt concerning power in a municipal corporation is resolved against it. City of Chicago vs. Weber et al. (Ill.). 92 N. E. 860.

Right of Condemnation by a Public Utility Corporation—A corporation organized to furnish municipalities with electricity to light the streets and public buildings, and for other municipal purposes, may be authorized by the Legislature to condemn land necessary for the generation and transmission of electricity for such purposes, though the powers of the corporation embrace matters of private use. Deerfield River Co. vs. Wilmington Power & Paper Co. (Vt.). 77 A. 862.

Validity of Paving Assessments—A City can create a valid municipal lien for improving a street only when the improvement is made pursuant to law, and the mode established by statute is strictly followed. Where the mayor and city council fail to meet "to hear and adjust any complaint and review such assessment" at the meeting called pursuant to the notice required, such assessment is void. Morrow vs. Barber Asphalt Paving Co. et al. (Okla.). 111 P. 198.

Technicalities Invalidating a City Election—Where the last publication of the notice of a city election to adopt the commission form of government in a city of the second class was only five days before the date fixed for the election, and less than a majority of the registered voters voted upon the proposition, the commission form of government was not adopted, although a majority of the votes cast were in favor of the proposition, and although the vote was canvassed and the result declared accordingly. Rice et al. vs. Robson et al. (Kan.). 111 P. 186.

Police Powers in Preventing Smoke Nuisance—Rochester city ordinances prohibiting the emission of dark smoke from chimneys during certain hours of the day, and providing a penalty for the violation thereof, was within the city's police power. City of Rochester vs. Macauley-Fien Milling Co. (N. Y.). 92 N. E. 641.

Liability of a Subcontractor—Defendants, an owner and a principal contractor, contracted with a subcontractor to build a water tower. The subcontractor furnished the material and constructed it. *Held,* that the subcontractor, being an independent contractor, defendants could not be liable for the death of an employe resulting from the collapse of a platform on the tower, due to weakness of the supports. Kilts vs. Board of Supervisors of Kent County et al. (Mich.). 127 N. W. 821.

Condemnation of Railway Right-of-Way—Where a city had only general charter power to open, lay out, establish, widen, alter, extend, vacate or close streets, and to appropriate and condemn private property therefor, it had no power to condemn a part of a railroad's right-of-way to construct a street longitudinally along the same, especially where there was no provision for joint use of the property by the railroad company and the public. Portland Railway, Light & Power Co. vs. City of Portland et al. 181 F. 632.

Street Improvements as Trespassing—Where a city proceeds with the work of grading a street and damages property without first taking steps to ascertain and pay the damages, it is a trespasser, and those actively participating in the work by directing it are co-trespassers. Abercrombie vs. Kansas City (Mo.). 131 S. W. 129.

Unlawful Occupation of a Street by a Public Service Corporation—A railroad company cannot condemn the interest of abutters in a street where its franchise to occupy the street has been revoked for breach of a condition of the grant. Unlawful occupation of a street by a railroad constitutes a public nuisance, which may be abated by an abutting owner suffering a special injury therefrom. Sylvester et al. vs. Superior Court for Benton County (Wash.). 111 P. 19.

Liability for Character of Municipal Water Supply.

In a case decided recently by the Supreme Court of Minnesota, it was held that a municipality is liable for damages suffered by citizens owing to the character of the city-supplied water.

The decision was given in the cases of Della Keever and Kate Flanagan, two Mankato women whose husbands died during the typhoid fever epidemic in that city in 1907 and who sued the city for $5,000 damages each. The lower court ruled against them and the Supreme Court reversed the case. The attorneys for the defendants said in their argument before the court last spring if it was decided that the city was liable it would mean damage suits aggregating $10,000,000 would be filed against the city. This, they said, would bankrupt the city and threaten its very existence, as the assessed valuation of property in Mankato is only $4,000,000.

The court discusses this point in the

opinion written by Justice Jaggard, but says that while the attorneys showed the far-reaching danger of such a decision, this point could not be considered, as there was nothing in the record to show that any more suits would be filed and the danger facing Mankato was not known to the court.

The decision says cities are at present held liable for neglect in connection with streets, sidewalks and sewers, and there is no more reason why they should not be held liable for neglect in furnishing water. There is no reason why a private corporation furnishing water should be liable and a public corporation doing the same business should not be liable to innocent people who may have been damaged by its neglect.

The case was remanded to the lower courts to establish whether the water supply was responsible for the deaths, and if the city was negligent in the matter of maintaining the purity of the water supply. It was stated that the typhoid epidemic had been caused by a leak from the sewer system into the water mains.

The city of Lexington, Va., has recently encountered a similar case of contamination of the water supply. A typhoid epidemic in the public schools led to the investigation of the local water supply by Richard Messer, state sanitary engineer, and Dr. A. W. Freeman, assistant health commissioner of Virginia. It was held probable from the investigation that the epidemic was due to the contamination of the water supply by the entrance of sewage into the water mains. The source of the water supply is a mountain stream entirely free from contamination. It is piped to an elevated reservoir, from which it runs to a supply basin.

During a recent water shortage, the valve at the reservoir was closed every night in order to guard against waste through leakage from the supply main, as the latter had been found to be old and in a leaky condition. It is supposed that as the water in the supply main ran down into the distributing basin, a partial vacuum was established, allowing sewage to be drawn into the mains from a sewer built directly alongside of the water main. Excavations have shown the ground adjacent to the water main to be saturated with sewage.

The typhoid epidemic has been checked and care is being taken to guard against what is considered to have been the cause.

For the Protection of Material Contractors.

The state of Georgia has recently passed an act for the protection of material men who furnish supplies to contractors engaged in city or other public work. This act provides that any firm or corporation entering into a contract with the state, county or municipal authorities for any public work shall be required to execute a bond with sufficient surety, conditioned that such contractor will promptly make payment to all persons supplying labor or material for the contract. The right of action under this bond, on the part of the material men, is made one year from its date of execution.

Ownership of Streets.

The Supreme Court of Illinois has made a decision regarding the power of a city council to grant space on sidewalks or streets for the display of merchandise, signs, etc. In this connection the ownership of public streets is definitely specified as follows:

> The public streets of the city are dedicated to the public for public use and are subject to the control and management of the city council, but that body had no power to alienate or otherwise encumber such streets so long as they are public streets, but must hold them in trust for public use only. The municipal corporation can grant no easement or right therein not of a public nature and the entire street must be maintained for public use, hence no individual or corporation can acquire any portion of the street for exclusive or private use to the exclusion of the public.
>
> The city council has no right to grant such use. It may grant a temporary use in such a way as not to interfere with public use, yet there is no power in the municipality to sell or grant for private use a public street and exclude the public therefrom.
>
> A permanent encroachment upon a public street for a private use is purpresture and is in law a nuisance.

Liability for Creosote Poisoning.

In the case of Pinkley v. Chicago & Eastern Illinois R. R. Co. before the Supreme Court of Illinois, the question of assessing damages for injuries received in handling creosoted ties was decided. It was held that the employer was not an insurer of the safety of his employe and the law does not impose upon him the duty of warning the employe of the danger of handling timbers treated with a coal-tar preparation containing creosote.

The court further held that if an employe knows that the handling of timbers treated with a coal-tar preparation containing creosote will produce a burning of the skin sufficient to cause it to peel off, the employer owes him no duty to warn him of such danger, and that the fact that the employe becomes permanently poisoned as a result of handling the timbers does not render the employer liable unless he knew, or in the exercise of ordinary care could have known, that such a consequence might result and failed to warn the employe.

WATER WORKS

Rockford, Ill.—Derwent, England—Norfolk, Va.

The Derwent Valley, England, Water Works.

The report of Vice Consul William Force Stead, Nottingham, England, contains an account of the Derwent Valley Water Scheme which is just being completed in the Derbyshire hills. A short abstract of this report follows:

This is the undertaking designed to supply water to the cities of Nottingham, Derby, Leicester and Sheffield and to the counties of Nottinghamshire and Derbyshire. The full scheme comprises the construction of five reservoirs for impounding the waters of the Derwent and Ashop Rivers, with about 100 miles of aqueduct for distributing the water to the various authorities, about 20 acres of filter beds at Bamford, and a general service reservoir at Ambergate. For the present, of the five reservoirs ultimately to be constructed, only two, the Howden and Derwent, are being proceeded with, and it is estimated that these two alone will provide the following daily yield, in gallons, to the following places: To Leicester, 4,018,000; Derby, 2,813,000; Sheffield, 2,813,000; Nottingham, 2,000,000; Nottingham and Derby Counties, 1,750,000.

The following table will give an idea of the scope of the plan:

From the river bed to the top of the dam over which the water will flow is 118 feet; the foundation, of stone and concrete, is 68 feet deep, and below the foundation, to prevent any percolation, a cut-off wall or heel trench of solid concrete, 6 feet thick, runs down a farther depth of 60 feet. Thus the masonry from the bottom of this cut-off wall to the top of the dam represents the great height of 246 feet. The thickness at the base is 176 feet and the length 1,070 feet. The waters held by this huge structure will extend back a mile and a quarter, forming a reservoir of 1,940,000,000 gallons. Some idea of the magnitude of the whole scheme may be gained by reflecting that ultimately there are to be four other reservoirs, giving a total capacity of 10,067,000,000 gallons. At present the scene of the future lake at Howden is a pleasant valley containing pasture lands where the cattle are feeding and an old stone farmhouse. In another year or two pastures and farmhouse will be at the bottom of the lake.

It was thought at first that the hills on either side were of solid rock, and that the dam could be keyed in. Excavations, however, revealed that, owing to earth movements, the rock has become shattered, and what are known as wing walls, or wing trenches, had to be constructed to prevent a leakage through the rock. These wing walls, built of concrete, 5 feet thick, are carried up the valley from the dam a distance of 3,000 feet on both sides, varying in depth from 200 to 40 feet, and have involved an expenditure of $973,000.

Reservoir	Water shed area	Area of reservoir when full	Capacity	Level of top water above ordnance datum	Length of reservoir	Height of dam	Length of dam
	Acres.	Acres.	Gallons.	Feet.	Miles.	Feet.	
Howden	9,321	157	1,940,000,000	870	1¼	118	1,070
Derwent	3,899	183	2,000,000,000	776	1¾	114	1,110
Hagglee	10,987	178	2,160,000,000	806	2	136	980
Ashopton	1,257	141	1,472,000,000	675	2	103	840
Bamford	6,482	242	2,495,000,000	585	2¼	95	1,950
Total	31,946	901	10,067,000,000	....	9¼	....	....

No pumping stations are required, as the whole supply will be by gravitation. At the Howden Reservoir the top water level is 870 feet above sea level; at the Ambergate Service Reservoir the level is 640 feet, and the highest point near Nottingham is the Ramsdale Reservoir near Arnold, which is 500 feet above sea level, while Mapperly, the highest point to be supplied in Nottingham, is 100 feet lower.

The Howden Dam, is the farthest up and the starting point of the scheme.

From one of the two valve towers surmounting the dam the flow of the filters is regulated, and in the other are the scour-out pipes for relieving the dam of refuse. A subway runs through the dam, connecting these two towers, and saving the long distance that would otherwise have to be covered in crossing from one side to the other.

The Derwent Dam is two miles downstream from the Howden. Its length is 1,110 feet, its height is 114 feet, the length of the reservoir it will form is one and three-quarter miles, and its capacity will be 2,000,000,000 gallons. The hills here also proved to be formed of shattered rock; but instead of wing walls running back upstream, as resorted to at Howden, a trench 6 feet broad and 200 feet deep, filled with concrete, has been continued from the ends of the dam and carried into the hills a distance of 500 feet on either side.

The filters are built on a hill above Bamford. These are for the water sent to Nottingham, Leicester, Derby, and the counties of Notinghamshire and Derbyshire, the Sheffield water being taken off in separate pipes and filtered elsewhere. The filters are divided into two sections, the fine or sand filters, and the rough or gravel filters. The Derwent, flowing through regions where peat is found, carries considerable matter in times of flood, and consequently roughing filters have to be provided. There are four of the latter, all identical, and all subdivided into four sets each, with gravel of increasing fineness. The first contains gravel of ⅝ inch size; the second, gravel of ⅜ inch; the third, ¼ inch; and the fourth, ⅛ inch. The gravel rests on perforated concrete plates. These rough filters are equipped with a compressed-air cleaning process, by means of which the accumulated debris is blown off and washed out through a channel provided for the purpose. This is a French patent, operated by a Paris company.

After the coarser particles are removed, the water is sent on to the fine filters, but when the stream is comparatively clear, the rough filters are not employed. For the present there are seven of the fine, or sand filters, covering an area of five acres. All seven are not required at a time; four or five may be serving the reservoirs while the others are being cleaned. Two feet of fine sand rest on 12 inches of gravel, and this in turn on moon-shaped tiles. The water, from a channel at the rear, is let in by valves to a trough, over the top of which it ebbs gently on to the sand. When the sand requires cleaning, 1 inch of the surface is removed, and the edge of the trough being lowered the same amount, the ebb is maintained without a fall. From the filters the water passes out through a valve house, where an automatic recorder takes account of the amount filtered, the estimated capacity being 10,000,000 gallons per day.

Thence the supply is sent to the general service reservoir at Ambergate, 24 miles below. On its way to this the water is carried through a 45-inch pipe, with an average fall of 3½ feet per mile; a culvert is employed on a level, and tunnels at hills where it is found cheaper to go through than around. The culverts and tunnels fall 1 foot in 4,000 feet. Culverts and tunnels alike are 6 feet 3 inches in diameter on the inside, constructed of a 9-inch ring of concrete lined with blue bricks. Only one pipe has been laid for the present supply, but when the scheme is complete, there will be three of these 45-inch pipes, while the culverts and tunnels will remain as at present. There are valves every half mile, and if the pipe bursts, the valve shuts off the water automatically above the break.

Up to July 14, 1910, $14,000,327 had been expended on the works, and the final outlay for the entire scheme is expected to reach $34,065,500. The city of Nottingham will make an annual contribution of $121,662 toward the sinking fund, interest, and maintenance charges, and will receive in return 2,000,000 gallons of water daily, equal to about one-quarter of the amount at present distributed by the Nottingham water department.

Water Works Extension in Norfolk, Va.

The inadequacy of the distribution system of the Norfolk water works has been made the subject of a report by the National Board of Underwriters. This report is substantiated by the investigation conducted by Mr. Nicholas S. Hill, engineer, who was retained by the city. In his report Mr. Hill makes the following statements:

There are at present about 72 miles of pipe in the distribution system of the municipal plant, covering the first six wards of Norfolk. Of this pipe 72 per cent. is 6 inches in diameter or smaller. During the period from 1904 to 1909 but 10 miles of new pipe was added to the distribution system, of which 67 per cent. was of 6 inches in diameter or smaller. The policy of laying small mains, which are practically useless for fire purposes, has been continued up to the present time. No material reinforcement of the larger supply mains has been made during the past ten years and the capacity of pipes and mains added has not been commensurate with the growth of the city. The first mains were laid in 1873, and some of them are still in use, the result being that the older pipe is highly tuberculated and its carrying capacity is materially reduced.

The number of public hydrants is inadequate. The average linear spacing of hydrants in the congested value district is 320 feet and in the residential districts about 530 feet. Many of the hydrants are of obsolete design. Tests made by the Board of Underwriters upon the free flow from hydrants, which give the probable amount of water available for fire engine supply, show that this amount is inadequate for reasonable fire protection. Tests of the drop in pressure in the mains, between the point of the test and the point where the force mains from the pumping station enter the distribution system, plainly evidenced the inadequacy of the mains in the congested value district, the lack of large feeders and the effect of small minor distributers.

Of the two force mains, one a 30-inch pipe, is in good condition; but the 24-inch main is badly tuberculated.

The pumping station was built in 1873 and somewhat enlarged in 1892. It is of non-fireproof construction. The equipment is in good condition and efficiently handled. In the pumping station are four units with a total capacity of 22,000,000 gallons. These units are divided as follows:

10,000,000 gallon unit constructed in 1891.

5,000,000 gallon unit constructed in 1891.

5,000,000 gallon unit constructed in 1885.

2,000,000 gallon unit constructed in 1880.

The pumping capacity does not allow the necessary reserve for fire at the time of the maximum domestic consumption, in case an accident should occur to the large pump.

The filter plant was built in 1899. It consists of a coagulating basin, mechanical filters, and a clear water basin. The water is raised from the coagulating basin by low-lift pumps, situated in the filter house, and flows through the filters to the clear water basin, whence it flows by gravity to a pump well and is from there pumped to the city.

The results obtained at the plant are not as good as they should be. The reduction in color and turbidity is fairly satisfactory, but the bacterial removal is not as high as that obtained in plants operated under the best conditions. The number of bacteria in the effluent is higher than the best sanitary stardards permit.

The physical conditions of the filter plant are not good and improvements and repairs should be made if this plant is continued in use.

Mr. Hill proposes changes and extensions in the system which will provide for a reasonable growth in population and will provide a fire delivery of 7,000 gallons per minute in the congested district. The cost of the proposed work, including hydrants, gate valves, and changes in and replacement of service connections, has been estimated at $216,378, which, together with $15,981 for additional hydrants and valves to be placed on present large mains, involves a total capital outlay of $232,353.99.

Water Works Improvements in Rockford.

A committee has recently returned a report to the city council of Rockford, Ill., proposing plans for the supplementing of the present water supply system. The necessity for the improvement comes through the water shortage in the summer time, or in event of a conflagration; the present system of deep wells being adequate, but the pumping equipment insufficient.

It was recommended by the committee that the present system of wells, which consists of wells Nos. 2, 3 and 5, equipped with the air-lift pumping system, shall be provided with more efficient pumping apparatus. Well No. 2 was thought to require only some repairs to the present equipment, but two plans were proposed for the improvement of the other two wells.

The first plan involved the installation of motor-driven vertical shaft-impeller pumps, the power to be procured from a local electric company. The estimate for this plan included the price of water-tight vaults in which to set the pumps and motors below the street, and suitable ventilating fans to be operated so as to prevent the collection of dampness; the access to these vaults to be provided between the curb line and the sidewalk.

The cost of the improvement under this first plan was itemized as follows:

Two 8-inch pumps, with 75 horse-power motors, f. o. b. Rockford	$4,000.00
Drop pipes for accommodating motor and shaft	200.00
Two vaults under street	600.00
Ventilators and fans	150.00
Erecting and connecting to present pipes	800.00
Totals	$5,750.00

The second plan involves the use of the air-lift system and involves the purchase of a new compressor and a boiler. The cost of the second plan is estimated to be as follows:

One steam crank and fly wheel simple compressor, non-condensing	$5,000.00
Foundation, erection and air pipes	1,500.00
Addition to building for compressor	1,000.00
One new 150 horse-power boiler	2,300.00
Addition to building for boiler.	1,200.00
Total	$11,000.00

The cost per month of operating Nos. 2 and 3 by the air lift, delivering two million gallons per twenty-four hours into the present reservoir is estimated to be as follows:

378 tons of coal at $2	$ 755.00
Three extra engineers at $65 per man	195.00
Total	$ 950.00

A comparison was made of the two plans, an allowance of 10 per cent per annum being made for interest and depreciation. This comparison is briefly:

	Plant No. 1	Plant No. 2
Operating cost, power.	$2,460.00	$2,850.00
Operating cost, ventilating fans, approximate)	150.00	
Interest and depreciation at 10 per cent.	575.00	1,100.00
Maintenance, per annum	150.00	50.00
Total	$3,335.00	$4,000.00

The two plans above discussed are offered only as a temporary expedient, as further extension of the present system will be necessary in a few years.

HIGHWAYS AND LIGHTING

Arkansas Good Roads—English Macadam Maintenance—Cement in 1910—Ornamental Street Lighting

Maintenance of Macadam Roads in England and Scotland.

The report of U. S. Consul Fleming from Edinburgh contains an account of road construction and maintenance in England and Scotland, a short abstract of which report is as follows:

The use of tar and pitch as binding materials is becoming more general. There are four methods of applying the tar, namely: (1) Tar spraying; (2) Tar macadam; (3) Pitch grouting; (4) Tar matrix.

The methods and cost per superficial yard over ordinary macadam, detailed by the county road surveyor, are here summarized.

Tar Spraying.—It is essential that all dust and caked mud be removed from the road before the liquid is applied. After tarring, a slight sprinkling of whinstone screenings is spread over the surface. Hand tar spraying is considered superior to machines, although it costs slightly more and takes longer. In this process tar is not so much a binder as a waterproof protection to the road surface. It is soon worn away, however, and when broken up the road is thrown into an uneven and dirty condition. It is now admitted that tar spraying lasts only for one season. The life of a road subjected to much fast motor-car traffic is increased by 15 to 20 per cent. when tar sprayed. One of the main thoroughfares in Edinburgh county costs on an average $1,460 per mile per annum to maintain as at present. If tar sprayed its whole width the cost would be $1,800 per mile, after allowing for the increased life of the road, as above indicated.

Tar spraying is most suitable for county roads where expenditure is limited, and although tarring the entire surface would be preferable, a width of 10 to 12 feet in the center would accommodate motors and protect the metal bed, allowing at least double the length being sprayed, and leaving the sides with a better foothold for horses during frost.

Tar Macadam.—This consists of thoroughly mixing the stone with tar and pitch previous to its being laid on the highway. All stones should be dry, which necessitates preparation of the material under a covered structure. Tarring may be done by hand or machinery. It is usual to allow the material to lie in heaps one to three weeks to mature before applying. The coatings are applied in three layers of 2½ and 1½ inches and ½ inch stone, rolled separately, and finished with a thin layer of fine dry screenings. Tar macadam roads are easily cleaned, and the cost of maintenance on an average of years is less than ordinary macadam. It is slippery during frost and unsafe on gradients steeper than 1 in 20. Under very heavy traffic it loses its bituminous surface in two or three years, and the top layer becomes separated from that below. This system involves a comparatively heavy initial expenditure, and its general adoption on county roads would appear to be impracticable.

Pitch Grouting.—This consists of application to a scarified road, rolled smooth, of a 3 to 4 inch coat of whinstone metal, consolidated in a dry state, after which boiling pitch and tar is poured into the joints, sprinkled with small whinstone or limestone gravel, and rolled until thoroughly hard. The composition is made up as follows: Pitch (best coal tar), 1,100 pounds; refined tar, heavy bodied, 800 pounds; creosote oil, 100 pounds; total, 2,000 pounds. The mixture is applied to the roads at boiling point with spray cans, whinstone chips are immediately applied, and rolling at once undertaken. This composition is of a quick-setting nature, but retains considerable viscosity. The surface must be thoroughly dry before it is applied. The surface is smooth, but not slippery. The traffic is carried on the metal and not on the tar, as is the case with tar macadam, tar painting, or tar matrix. This is regarded as the best system for tarring county roads, as it makes them almost dustless, effects a great economy in cleaning, is easily repaired, and the life of the road is increased by at least one-third.

Tar Matrix.—There are three methods of applying tar matrix. It is usual to slightly scarify the existing road surface. The first is to spread a layer of small gravel, previously tarred, to a depth of 1 inch to 1½ inches, on which is laid ordinary road metal. This is rolled until the matrix is forced to the surface. In the second the road metal is spread first and well rolled in the dry state before the matrix, composed of tarred materials up to 1 inch in size and to the foregoing depth, is applied. This is rolled until the interstices are filled with the matrix and a smooth surface has been obtained. A thin finishing coat of finer tarred materials is usually applied, sprinkled with dry sand or chippings, and rolled until thoroughly hard. The third or Gladwell system is a combination of the first two, having a matrix both above and below the metal.

Rocmac.—Roads made on the Rocmac system are claimed to be dustless, waterproof, economical, durable, and nonslippery. The solution is a chemical composition, made under presesure, the foundation of which is silicate of soda and sugar. The solution is mixed with high-class ⅞-inch limestone and gravel free from impurities. This is laid about 1 inch to 1½ inches deep on the road surface, which has been slightly scarified. On this is spread the ordinary macadam metal, about 3 inches thick, and thoroughly rolled until the matrix entirely fills the interstices and comes to the surface. Owing to the simple preparation of the matrix and small plant required, the work can be undertaken by ordinary workmen, but experiments have proved expensive compared with pitch grouting.

In Scotland, as well as England, county road boards that have experimented with tar macadam in constructing new roads and maintenance of old have practically abandoned it, the cost being prohibitive. Tar spraying of 10 to 12 feet in the center is generally regarded as the limit of economical treatment of macadam roads in outlying districts, and this has been restricted to main thoroughfares and village roads. For suburban roads it is likely that the use of pitch grouting will increase.

Cement Used in 1910.

The importation of cement has steadily declined for several years; for example, from 883,418 barrels in 1908 to 454,614 barrels in 1909, and 307,699 barrels of 380 pounds each in 1910. The re-exportations in 1909 were 4,418 barrels and in 1910 were 18,856 barrels, leaving the net importations 450,196 barrels in 1909 and 288,843 barrels in 1910.

Exports of domestic cements were 846,785 barrels in 1908, 1,056,922 barrels in 1909 and 2,475,957 barrels in 1910. Exports therefore exceeded net imports by 606,726 barrels in 1909 and 2,187,114 barrels in 1910. Of the exports of domestic cement 75,666 barrels went to Panama in 1908, 438,876 barrels in 1909 and 1,528,497 in 1910. Since this cement is used on construction of works under the United States, the actual increase in exports is not indicated by the above figures. Making the deductions of exports to Panama from the total exports, the real exportation to foreign countries becomes 771,119 barrels in 1908, 618,046 barrels in 1909 and 947,460 in 1910, and it is shown that the growth in foreign trade is not as yet notably large although it shows a tendency toward an increase.

Counting the Panama shipments as domestic consumption, the excess of exports over imports is 167,850 in 1909 and 658,617 barrels in 1910.

A preliminary estimate of the production of Portland cement in the United States in 1910, made by the U. S. Geological Survey from returns made by producers of about half the amount manufactured, shows nearly 75,000,000 barrels, an increase of nearly 20 per cent. over 1909. The preliminary estimate made last year was quite far from the truth, but the returns upon which the above estimate is based are from all parts of the country and are probably within 5 per cent. The error may be greater than the total excess of exports given above.

Good Roads for Arkansas.

The *Arkansas Gazette*, Little Rock, has issued a "Good Roads" number, a prominent feature of which is a map of a system of state pikes connecting most of the county seats of the state, and a system of county pikes supplying the omissions of roads to county seats and large towns. Sand-clay roads, macadam roads, dragged roads in Arkansas and elsewhere, are described. The provisions of a proposed good roads law are given. Much work on this line will be necessary, and the newspapers of the states can hasten the day of good roads, which can only be obtained under competent state supervision, if they will devote a page or a supplement to the question at frequent intervals, and will secure technical advice as to the material they wish to publish.

Ornamental Street Lighting Advance.

At the present rate of regular advance in the installation of ornamental street lights, by the end of five years every city in the United States will have adopted the improved type of unit. The movement has been remarkable from the fact that instead of being first adopted by the larger cities to be later taken up by the smaller, it is finding favor with the small cities simultaneously with its approval in the larger.

In Brooklyn the Edison Electric Illuminating Co., realizing the advertising value of the decorative lighting system, caused to be printed in a local paper an attractive notice of the installation of the improved system around a building which was then in the course of construction. This advertisement had a definite publicity value to the owner of the building, the lighting company and to the company furnishing the ornamental posts. But the permanent value is entirely to the credit of the building owner.

In Prospect Park, Brooklyn, 150 gasoline lamps have been replaced by 750 ornamental standards, carrying lanterns, in which are placed 85 watt tungstens. The Municipal Art Commission furnished the design for the poles.

Illinois cities have been particularly

active of late in agitating more advanced street lighting. In Decatur, Ill., the Retail Merchants Association have planned to place 16 ornamental lights on the public square, in addition to the old arc light installation, in order to give the new system a trial. In Peoria, Ill., a petition is being circulated to extend the boulevard system, which is at present in use on S. Adams street, to Glen Oak avenue. The petition proposes that the city shall furnish the current and the property owners the lamps. Mattoon, Ill., has installed several blocks of five-light ornamental standards, and with the change to a more progressive administration in the spring election, will no doubt extend the system. Bloomington, Ill., has commenced the installation of the boulevard lights on six blocks. Five-light standards are being used, being spaced about 60 feet apart. The money for this improvement is furnished by the business men who are personally interested, and by the city. The cost of installation, of wiring and of securing the standards has been furnished by the men whose places of business will thus be made more attractive at night, and this cost has been equally divided among all who would agree to help with the plan. The city is to furnish the current, and to maintain the up-keep of the standards and lights. The system is attracting much attention and will no doubt be extended.

In McPherson, Kan., the effect of the improved lighting system on the civic pride may be noted. The town has started negotiations to procure the "White Way" system. With the possibility of obtaining these lights, and the improved appearance that it would give to the streets, local papers at once took up the matter of widening the sidewalks, the better to harmonize with the artistic lighting system.

In Dallas, Tex., a campaign has been under way to install the ornamental lights. About six months ago a meeting of property owners was called, and the ornamental street lighting of Elm street, from Austin to Ervay, considered. A special committee was appointed to visit the various business houses and solicit contracts. Exclusive of the crossings of intersecting streets, the space which is included in the boundaries set is 4,549 front feet. Contracts have been secured by which property owners have agreed to pay $2 per front foot for the installing and maintenance for one year of such devices as may be decided upon for lighting 3,193 feet. This is more than half of the total frontage within the proposed area, and it is said that the property owners of the remaining portions will doubtless sign.

Two propositions for this lighting have been submitted, one by the Dallas Gas Company and one by the Dallas Electric Light and Power Company. Mr. Babcock has mailed to the property owners blanks upon which they may express their preference. That which receives the highest number of votes will be adopted, it being understood, however, that the type of ornamental post to be used will be determined by the Chamber of Commerce.

Denison, Tex., has commenced the installation of 75-watt lamps, to replace the arc lights formerly used. According to the contract, there will be at least 239 of these lights and not more than 450. These will cost the city $1.05 each a month.

An ornamental system of street lighting has been adopted for the business district of Burlington, Ia. The cost to each merchant will be $33.33 for installation and $1.18 per month for each 20 feet of frontage.

Other cities which are contemplating the boulevard system are: Detroit, Mich.; Lawrenceville, Pa.; New Brunswick, N. J.; Mill Hall, Pa.; Altoona, Pa.; Fort Worth, Tex.; Lodi, Cal.; Dubuque, Ia.; Joplin, Mo.; Duluth, Minn.; Redlands, Cal.; Wilmington, Del.; Toronto, Can.; El Paso, Tex.; Austin, Tex.; San Diego, Cal.; Portland, Ore.; Rochester, N. Y.; Rock Island, Ill.; Freeport, Ill.; Elgin, Ill., and St. Paul, Minn.

A Purchaser Must Pay for Property Purchased.

In the case of the International Harvester Company of America vs. Charles Cater, the United States Circuit Court, at Fergus Falls, Minn., Judge Willard presiding, on January 28, held that the defense that a company is a "trust" or "illegal combination" is not a good defense, either under the Sherman anti-trust law or under the laws of Minnesota.

Cater was administrator of the estate of F. L. Wilkins, deceased, of Marshall, Minn. Wilkins was an agent for the company, and the proceedings was to compel Cater to turn over the proceeds of sales that had been made by Wilkins pursuant to the terms of a commission agency contract, also to recover property and for implements sold to Wilkins.

It has also been decided recently in Michigan, Indiana and Ohio that a purchaser of an article cannot avoid paying for the property purchased by undertaking to plead the illegality of the contract of purchase and sale.

Justice Holmes of the Supreme Court of the United States, in one of his recent decisions, said: "The policy of not furthering the purpose of the 'trust' is less important than the policy of preventing people from getting other people's property for nothing when they purport to be buying it."

MUNICIPAL AND TECHNICAL LITERATURE

Books for Engineers—Publications Received

Books for Engineers.

The Encyclopaedia of Municipal and Sanitary Engineering. A handy working guide in all matters connected with municipal and sanitary engineering and administration. Edited by W. H. Maxwell, A. M. Inst. C. E., and J. T. Brown, M. R. San. Inst. Cloth, 561 pp. quarto, $10. D. Van Nostrand Company, New York.

The titles of the longer articles in this volume will indicate its scope. Water supply and water analysis take the most space of any one subject, unless possibly sewerage and sewage disposal. Then follow roads, streets and pavements. Other lengthy articles are on baths, conveniences underground, destructors, disinfection, distributors for sewage, electricity, flow in pipes and conduits, gas, heating, indicator, plumbing, pumps and pumping machinery, retaining walls, ventilation, etc. Numerous short articles cover the field with very reasonable completeness.

In so small a number of pages of large type with numerous illustrations it is, of course, impossible to cover the field thoroughly, and the treatment of subjects must therefore be somewhat elementary in its nature. The subjects seem to be cross-referenced quite well. There is one peculiarity about the arrangement of subjects which must be recognized before searching for a subject not likely to be cross-referenced. It may, perhaps, be stated as a tendency to enter the subjects under a principal adjective rather than the fundamental substantive. Thus, what the American world call a driven well is to be found under Abyssinian and under American tube well with a cross reference to Abyssinian tube well, and is not to be found under driven, tube or well. Adams' sewage lift, aerating tiles, air compressor, artisan's dwellings, and the like are found under the first word of the title and not under any other word thereof. This is perhaps not objectionable when one learns the system.

Handbook of Cost Data for Contractors and Engineers. A reference book giving methods of construction and actual costs of materials and labor on numerous engineering works. By Halbert P. Gillette. Cloth, 1900 pp., $5. Second edition. The Myron C. Clark Publishing Co., Chicago, Ill.

This second edition is vastly larger than the first and may be more valuable if one knows how to use the information it contains and is careful to check up before applying it to any particular case.

The book is practically all the product of the scissors and paste pot, and the attempts at correlation of the data thus put together are not always happy or safe. Authority for much of the material is given, but the date and place are not always definite and the place to find the original publication is very often not mentioned. Credit is given to numerous periodicals and society publications in a wholesale manner in the preface, but it should be possible to trace to their original source such data as are given in this book, and there should have been the most punctilious reference in every case, not only to the author or compiler, but to the exact location of its published forms, that the reader may be able to follow up any detail or statement concerning which he has doubts or desires for further information. Numerous references are made to the periodical of which the author is an editor, but many of them are to republications, often in condensed or rearranged form rather than to the originals, and are, of course, no nearer originals than the statements made in the book.

Within the limits thus set, the book will be found of great value and the engineer possessing it will find it one for constant reference, even if he does find it to fail him on just the detail for which he specially needs help.

To show the scope of the book, the following abstract of the table of contents is made:

The introduction, 6 pages, gives the argument for cost keeping and the publication and use of cost data.

The first section, 112 pages, states the principles of engineering economics and cost keeping and is taken largely from the author's book on that subject.

The second section, 52 pages, covers earth excavation; the third, 87 pages, rock excavation, quarrying and crushing; the fourth, 217 pages, roads, pavements and walks; the fifth, 55 pages, stone masonry; the sixth, 111 pages, concrete and reinforced concrete construction; the seventh, 161 pages, water works; the eighth, 143 pages, sewers; the ninth, 124 pages, timber work; the tenth, 109 pages, buildings; the eleventh, 293 pages, railways; the twelfth, 246 pages, bridges and culverts; the thirteenth, 28 pages, steel and iron construction; the fourteenth, 34 pages, engineering and surveys; and the fifteenth, 62 pages, such miscellaneous data as could not be classified under any of the foregoing headings.

Publications Received.

Education Department Bulletin, New York State Library, February 1, 1911, containing American Ballot Laws, 1888-1910.

Thirty-Seventh Annual Report of the Secretary of the State Board of Health of Michigan, year ending June 30, 1909. Frank W. Shumway, Secretary, Lansing, Mich.

Annual Report of the Board of Public Works of the City and County of San Francisco, Cal., year ending June 30, 1910. Marsden Manson, City Engineer.

A City Plan for Rochester, N. Y., a report prepared for the Rochester Civic Improvement Committee by Arnold W. Brunner, Frederick Law Olmsted and Bion J. Arnold. Charles Mulford Robinson, Secretary.

Twenty-Fifth Annual Report of the Bureau of Water, Schenectady, N. Y., year ending November 1, 1910. George Haltzmann, Superintendent.

Transactions of the Appalachian Engineering Association, parts 2, 5 and 6. Henry M. Payne, Secretary, Morgantown, W. Va. Quarterly, $5 a year.

Report of Council of Canadian Society of Civil Engineers for 1910. C. H. McLeod, Secretary, Montreal, Que.

Annual Report of the Municipal Officers of Eden, Me., for 1910. Edgar I. Lord, town engineer, Bar Harbor, Me.

How to Read Plans. A simple practical explanation of the meaning of various lines, marks, symbols and devices used on architectural working drawings, so that they can be correctly followed by the workman. By Charles G. Peker. Second edition, revised and enlarged. Fifty cents. Industrial Book Co., New York.

Report of work accomplished from August 1 to December 31, 1910, by the Mine Rescue Commission of Illinois. H. H. Stoek, Secretary, Urbana, Ill.

Statistics of Cities having a population of over 30,000 for 1908. U. S. Department of Commerce and Labor, Bureau of the Census. E. Dana Durand, Director.

Sixth Annual Report of the State Highway Department of Ohio, year ending November 15, 1910. James C. Wonders, State Highway Commissioner, Columbus, Ohio.

ORGANIZATIONS AND INDIVIDUALS

Ohio Engineers—Mechanical Engineers—City Planning Conference—Technical Associations—Calendar—Technical Schools—Civil Service—Frederick L. Ford—J. T. Fanning—W. Fred Main—Personal Notes

Ohio Engineering Society.

The annual convention of the Ohio Engineering Society was of unusual interest.

Considerable time was devoted to consideration of the proposed bill, providing for the registration and examination of civil and mining engineers and surveyors, which was introduced in the state legislature following its indorsement by the society.

The president, E. G. Bradbury, of Columbus, in his address, pointed out some of the causes of unsatisfactory professional conditions, especially calling attention to the frequency with which engineers permit themselves to be handicapped by insufficient force, and the evils of price competition.

The construction of bituminous macadam roads was treated by James T. Voshell, assistant engineer Office of Public Roads, United States Department of Agriculture. Will P. Blair, secretary National Paving Brick Manufacturers' Association, presented a paper on the manufacture of paving brick and their use in street and road construction.

The road laws of Ohio were outlined by James C. Wonders, State Highway Commissioner, who also described proposed legislation prepared by him under instructions of the legislature. The location of roads is to be placed in the hands of the county surveyor, and a highway superintendent will be placed in charge of all completed roads, and will detect and repair defects. The county surveyor will act as such superintendent on county roads, and an elected official on township roads, under the supervision of the surveyor.

D. W. Seitz, assistant State Highway Commission, presented a paper on the maintenance and repair of macadam roads.

A novel arch concrete bridge near Cincinnati was described in a paper by E. A. Gast. The bridge has a span of 73 ft., with 31 ft. roadway and 50 ft. over all width. The concrete floor slab is supported on transverse reinforced girders hung from two reinforced hingeless arches built entirely above the floor level. Thrust is provided for by tension steel in the floor slab, thus relieving the abutments. The bridge is designed to carry two 40-ton traction cars. The floor and haunches were built on falsework, and the arches constructed last. The cost of the bridge was about $7,200.

Paul Hansen, State Sanitary Engineer of Kentucky, Wm. H. Dittoe and R. W. Ferris, assistant engineers Ohio State Board of Health, presented a symposium on the operation of sewage purification works. Mr. Hansen urged the employment of competent men, the keeping of records, the use of measuring devices and careful attention regarding neatness and appearance. Mr. Dittoe discussed in detail the operation of sedimentation tanks and sprinkler nozzles, and called attention to the intelligence and care necessary for their maintenance. Mr. Ferris treated the operation of the intermittent sand filter and contact bed in a comprehensive manner.

"The Province of Disinfection," was the title of a paper by Clyde Potts, consulting engineer, New York. Mr. Potts considers sodium hypochlorite preferable to calcium hypochlorite for use in connection with water supplies, but believes that chloride of lime at $30 per ton is cheaper than sodium hypochlorites where electric currents can be obtained for 1 cent per k. w. hour. The use of hypochlorites is recommended as an emergency measure in case of epidemic, and in small proportions for the treatment of filtered water, thereby avoiding the necessity of overdosing with alum to secure bacterial efficiency. Dininfection of sewage effluents discharged into potable waters or waters containing shell fish is also advised.

Philip Burgess, consulting engineer, Columbus, read a paper entitled "Some Features of the Design of Infiltration Plants," in which he called special attention to the fact that water drawn from sand or gravel deposits beneath the bed of a river frequently proves to be ground water flowing to the river rather than filtered river water, and outlined the studies and tests necessary for proper design of a plant of this type. Where a permanent supply can be thus obtained, Mr. Burgess considers infiltration plants very satisfactory and economical, assuming that disinfection be resorted to when necessary to produce proper bacterial results.

Several other very interesting papers were read and discussed.

The following officers were elected for the ensuing year: President, Hugh K. Lindsay, Columbus; vice president, Frank R. Landor, Cleveland; secretary-treasurer, C. J. Knisely, New Philadelphia.

The following resolution was adopted by the society:

Be it resolved, by the Ohio Engineering Society in convention assembled, that it is the sense of this society that the employment of any expert or consulting engineer by any municipality, having a regularly employed engineer, should be only undertaken on recommendation of such regularly employed engineer, and that the selection of such consultant or expert should be by him; and that the committee on legislation be instructed to consider the feasibility of preparing and introducing such measures before the General Assembly of the State of Ohio as will render the procedure herein outlined mandatory upon the officials of any municipality within the State.

The American Society of Mechanical Engineers.

The sixty-third meeting of the American Society of Mechanical Engineers will be held in Pittsburg, Pa., from May 30 to June 2, inclusive.

The American Society of Mechanical Engineers is one of the foremost organizations of technical and professional engineers in the world, with a membership of over 4,000 in this country and abroad. The headquarters of the society are in New York City. Col. E. D. Meier, of St. Louis, is president this year. The society has in the Pittsburg district alone a membership of about 160.

An executive committee consisting of E. M. Herr, chairman, George Mesta, J. M. Tate, Jr., Chester B. Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary, will have charge of the Pittsburg meetings. There will be professional sessions, when papers will be read and discussed. There will also be inspection trips through the leading local industrial establishments, besides automobile trips through the parks, a visit to Carnegie Institute, Memorial Hall, etc.

National Conference on City Planning.

The Third National Conference on City Planning will be held this year at Philadelphia, May 15, 16 and 17. Since the very successful conference at Rochester in May, 1910, the value of such a meeting is becoming more generally recognized not only among architects and engineers, but among city officials of broad view, and business organizations of progressive spirit. Prepared papers will serve merely to guide the discussion into specific channels and avoid waste of time in random talk.

Among the papers which will be presented are the following: "Street Widths and Their Subdivisions for Various Purposes," Mr. Nelson P. Lewis, Chief Engineer Board of Estimates and Apportionment, New York City; Mr. John Nolen, Fellow A. S. L. A., Cambridge, Mass.; Mr. Charles Mulford Robinson, Rochester, N. Y. "The Principles of a Uniform American City Planning Act," Andrew Wright Crawford, Esq., Associate City Solicitor, Philadelphia; and "Taxes, Assessments and Condemnation," Hon. Lawson Purdy, LL. D., President Department Taxes and Assessments, New York City.

In connection with the conference the first municipal exhibit of city planning will be held at City Hall, to which councils have appropriated $10,000. A city planning automobile tour of the city is being planned for the members of the conference and specially invited guests.

A cordial invitation is extended to all who are interested in city planning to attend the sessions of the conference. For further information regarding the program, or details of membership, inquire of the secretary, Flavel Shurtleff, 19 Congress street, Boston, Mass.

Technical Associations.

The Northwestern Cement Products Association held their seventh annual convention at Minneapolis, Minn., February 28 to March 1. Among the papers presented were the following: "Stucco Finishes," Ernest McCullough, Chicago; "Cement Drain Tile Plants," C. M. Powell, Chicago; "Economics in Concrete Construction," Albert A. Pollard, Minneapolis; "Manufacturers of Cement Drain Tile," Chas. E. Simms, Worthington, Minn.; "Cast Stone Work," C. A. Turner, Minneapolis, and "Concrete Highway Bridges," A. E. Lindau, St. Louis, Mo.

The Lake Michigan Sanitary Association, composed of representatives of municipalities and states fronting on the lake, engineers, health officers, etc., held their fifth annual meeting at Chicago, February 13. W. D. Weiss was elected president, and W. P. Humphrey, secretary.

At the monthly meeting of the New England Water Works Association, held in Boston on March 8, the following papers were presented: "The New England Portion of the Proposed Atlantic Inter-Coastal Water Ways," Edward Parrish, assistant U. S. engineer, Newport, R. I.; "The Reforestation of Watersheds for Domestic Supplies," F. W. Rane, state forester of Massachusetts.

At the twenty-seventh annual meeting of the Connecticut Society of Civil Engineers the following officers were elected: Charles A. Ferry, New Haven, president; A. W. Sperry, New Haven, first vice-president; S. E. Minor, Greenwich, second vice-president; J. F. Jackson, New Haven, secretary.

At the organization of the Association of Borough Officials of Pennsylvania the following officers were elected: President, T. F. Chrostwaite, Hanover; secretary, Raymond Staub, New Oxford; treasurer, John C. Nissley, Harrisburg.

At the organization of the South Dakota Engineering Society at Pierre recently, the following officers we erelected: President, S. H. Lea, state engineer, Pierre; vice-president, A. B. McDaniel, professor of civil engineering, State University, Vermillion; secretary-treasurer, R. G. Gulbertson, secretary the Missouri Valley Engineering Company, Mitchell.

The Oregon Society of Engineers was organized on February 6. A charter membership of 160 is recorded. The following officers have been nominated: D. C. Henry, consulting engineer U. S. Reclamation Service, president; C. E. Bliven, secretary; F. A. Naramore, assistant engineer Northwest Bridge Company, treasurer.

The New England Contractors' Association was organized at Boston recently with a membership of about 25. Among the supporters of the organization are the following well-known firms: Holbrook, Cabot & Rollins Corporation, Stone & Webster, W. L. Hiller, Warren Brothers, Ward Brothers, Hanscom & Co., Fred T. Ley & Co., Charles R. Gow, Stewart & Sons Co., H. P. Converse, A. D. Fuller, Eastern Bridge Company, P. B. Elkins, Osgood Construction Company and Messrs. Smith, Cashman & Gray.

The Engineers' Club of Minneapolis held a meeting on March 14. A movement was started to unite this club with that of St. Paul into one organization. Capt. George R. Freeman, U. S. Army engineer, gave a description of the construction of a high dam at Minnehaha Park, and Walter Goodenough, of Boston, spoke on "The Construction of a New Power Plant for a General Company."

At the meeting of the Municipal Engineers of the City of New York, held on March 22, a paper was presented on "A Proposed Method of Interpolating the Elevation of all Portions of a Street Surface from the Established Grade," by Vernon S. Moon, M. M. E., N. Y.

At the first annual meeting of the County Engineers of Montana the following officers were elected: L. S. Ropes, Helena, president; Frank Corr, Butte, vice president; James Bonner, Missoula, secretary and treasurer.

At the annual meeting of the Illinois Water Supply Association, held at the University of Illinois on February 21 and 22, the following officers were elected: O. T. Smith, superintendent Water Company, Freeport, Ill., president; R. R. Parkins, superintendent Water Company, Elgin, Ill., first vice president; C. H. Cobb, superintendent Water Company, Kankakee, Ill., second vice president; H. M. Ely, superintendent Water Company, Danville, Ill., third vice president; E. Bartow, secretary-treasurer. Among the papers presented were: "Rate Making," by F. C. Jordan, of Indianapolis, given on another page of this issue; "The Water Supply and Public Health," T. W. Bath, M. D., commissioner of health, Bloomington, Ill.; "A Simple Orifice Bucket for Measuring Water," M. L. Enger, associate in theoretical and applied mechanics, University of Illinois; "Ozone Experiments in Water Treatment," W. F. Monfort, chemist St. Louis water department, St. Louis, Mo.; "Some Notes on Deep Well Pumps," F. C. Amsbury, superintendent and manager C. & U. Water Company, Champaign, Ill.;

"Diagram for Friction Loss in New Cast-Iron Pipe," A. N. Talbot and M. L. Enger, University of Illinois; "Fallacies in the Bacterial Control of a Sewage Purification Plant," Dr. Arthur Lederer and Frank Bachmann, sanitary district of Chicago; "The Action of a Slow Sand Filter During the Process of Filtration," F. D. West, chemist in charge, Torresdale Laboratory, Philadelphia, Pa.; "Uncertain Yield in Drift Wells," G. C. Habermeyer, Assoc. in Mun. and San. Engr., University of Illinois.

The third annual convention of the American Highway League was held in St. Louis on February 23 to 25. A number of papers of technical interest were presented.

At the regular meeting of the Engineering Society of Wisconsin the following officers were elected: President, Fred G. Simmons, Milwaukee; vice president, P. H. Commonway, Racine; trustees, G. H. Randall, Oshkosh, and F. A. Vaughan, Milwaukee. Mr. W. G. Kirchoffer declined re-election as secretary and treasurer.

At the meeting of the Western Society of Engineers, held in Chicago on March 15, Dr. W. F. M. Goss, dean of the College of Engineering, University of Illinois, presented an interesting paper on the Illinois experiment station in its relation to the public. The paper dealt with the testing and research work of the station and was illustrated by slides.

Calendar of Technical Meetings.

American Electrochemical Society.—Annual meeting at New York City, April 6-8. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

National Fire Protection Association.—Annual meeting at New York City, May 23-25. Secretary, F. H. Wentworth, 87 Milk street, Boston, Mass.

National Electric Light Association.—Annual convention at New York City, May 29 to June 2, inclusive. Secretary, T. C. Martin, 29 W. 39th street, New York City.

American Water Works Association.—Thirty-first annual convention, Powers Hotel, Rochester, N. Y., June 6-10. Secretary, John M. Diven, 14 George street, Charleston, S. C.

International Association of Chiefs of Police.—Eighteenth annual convention, at Rochester, N. Y., June 11-16. President, Major Richard Sylvester, Superintendent of Police, Washington, D. C.

New York Association of Chiefs of Police.—Annual convention, Rochester, N. Y., June 13-18.

Technical Schools.

"An Investigation of Built-Up Columns Under Loads," by Arthur N. Talbot and Herbert F. Moore, is issued as Bulletin No. 44 of the Engineering Experiment Station of the University of Illinois.

Sanitary analyses for Michigan state institutions and public corporations will be made free of charge by the University of Michigan. The work of analysing drinking water, etc., for communities throughout the state has long been recognized as part of the university's work for the people of the state, but hitherto ten dollars has been charged for each test made. By resolution of the board of regents, at their January meeting, "all sanitary analyses for state institutions, municipalities, villages, counties, and townships of the State of Michigan shall be furnished, without charge, from the university laboratories."

The February number of *The Wisconsin Engineer* contains two articles of particular interest. The first of these, "Refractory Materials," is a very complete illustrated discussion of the subject of materials used in the walls, hearth and roof of a reverberatory furnace, by F. T. Harvard, assistant professor of mining. The second is a complete description with diagrams of the organization of the University Extension Division, by E. D. Norris, assistant professor of mechanical engineering.

The March number of the *Wisconsin Engineer* contains among other articles of interest: "The Removal of Brass from Iron;" "The Development of the Metal Filament Lamp;" "An Engineering Trip Through Europe;" and "Technical Journalism."

Purdue University has issued a booklet, illustrated with photographs and descriptions of their various shops and mechanical laboratories.

There have recently been installed at the University of Illinois, two electric furnaces. One of these is a Hoskins resistance furnace and the other a Colby induction furnace. Both are of 20-k. w. capacity. The furnaces will be used for the purpose of studying the changes that can be brought about in the mechanical and physical characteristics of cast-iron through the influence of the soaking process.

Moses Nelson Baker, editor of *Engineering News*, New York, and a widely known author of technical books and articles, on March 17, delivered an address at the Clarkson Memorial School of Technology on the subject of "The Engineer and Social Service." The occasion was the celebration of the fifteenth anniversary of the founding of the institution.

The Congress of Technology with which the Massachusetts Institute of Technology will celebrate on April tenth and eleventh the fiftieth anniversary of the granting of its charter, promises to be of unusual interest, not only as marking a period in the development of one of the world's greatest technical schools, but because it marks also the rise and high development of all that is now included under the names of "engineering," and "applied science." The sessions of the Congress, all of which will be held in the buildings of the Institute of Techology, will open on Monday afternoon, April 10, with an address by the president of the institute. On the second day, papers of general engineering interest will be presented in the various buildings of the institute.

The Board of Trustees of the University of Illinois announces a gift by Mr. Francis John Plym of the class of '97, amounting to one thousand dollars per annum for a term of years, for the purpose of establishing an advanced fellowship in Architecture. The name adopted by the trustees to designate this gift is the Francis J. Plym Fellowship in Architecture. The administration of the Fellowship, and the nomination of candidates have been placed in the hands of a committee to be known as the Francis J. Plym Fellowship Committee, and to this committee there have been appointed, for the current year, Messrs. J. C. Llewellyn, I. K. Pond, George C. Nimmons, practising architects, and Professors F. M. Mann and C. N. Ricker of the Department of Architecture of the University of Illinois. The award of the Fellowship will be for the year 1911-'12.

Civil Service Examinations.

The United States Civil Service Commission announces examinations at the usual places, as follows:

April 12: Junior engineer (mechanical), bureau of mines, at from $900 to $1,380 per annum.

April 22: Assistant director office of public roads, Department of Agriculture, at $3,000 per annum. Draftsman, cartographer (male), Philippine service, at $1,800 per annum.

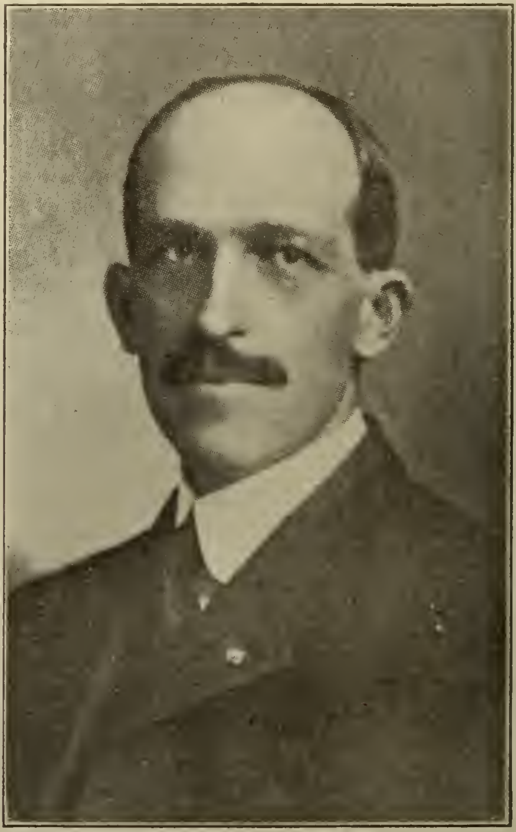
Frederick L. Ford.

City Engineer Frederick L. Ford, for the past fifteen years in the service of the city of Hartford, has resigned to go into business on April 1 as a member of the engineering firm of Ford, Buck & Sheldon; his associates being the members of the present firm of Buck & Sheldon, Henry Robinson Buck and Paul Sheldon, formerly in the office of the city engineer.

Mr. Ford was born May 1, 1871, at North Branford. He was graduated from the Hillhouse High School, Ned Haven, in 1890, and from Sheffield Scientific School, Yale University, in 1893. The next three years he was in the office of Albert B. Hill of New Haven, doing general engineering work on trolley surveys and construction, state highway work, sewage disposal, etc. In 1896 he became assistant city engineer of Hartford, and in 1902 he was made city engineer, succeeding C. H. Bunce. Besides the offices in this city which he has been mentioned as holding, he is a member of the state arsenal and armory commission and had important work to do at the time of the dedication of the building.

Mr. Ford has been president of the Connecticut Society of Civil Engineers, and is a member of the American Socity of Civil Engineers. He has been prominent in the work of the American Civic Association and the National Conference on City Planning and is known in his profession throughout the country.

Engineer Ford has many publications to his credit, dealing with various matters of importance in city development. He has discussed overhead wires, public comfort and trolley waiting stations,



FREDERICK L. FORD.

grouping of public buildings and many other subjects, his discussions being in print and on the platform. His lectures have been illustrated by photographs which he has taken on his travels in this country and abroad. He has been especially interested in matters connected with city planning, and in his new connection will make a specialty of that line of work.

W. Fred Main.

W. Fred Main, of the Chicago Portland Cement Co., one of the best known cement salesman in the middle west, died at his home, 2921 Washington Boulevard, Chicago, March 15, after a brief illness. Born in Chicago in 1855, Mr. Main grew up with the city, and was educated in its schools. Mr. Main became connected with the Chicago Portland Cement Co. about 1902. His efforts in recent years have been mostly confined to Chicago and adjacent territory, but at conventions and shows held further afield, Mr. Main was always on hand to greet his many friends. He was a member of the National Association of Cement Users, Iowa Association of Cement Users and similar organizations and as a lumberman, Mr. Main was identified with the Illinois Lumber and Builders Supply Dealers Assn. and

W. FRED MAIN

the Wisconsin Retail Lumber Dealers Assn.

J. T. Fanning.

John Thomas Fanning, M. Am. Soc. C. E., for many years one of the most noted hydraulic engineers of the country, died at his home in Minneapolis, Minn., on February 6, after a very short illness.

Mr. Fanning was born at Norwich, Conn., on December 31, 1837. He studied engineering and architecture, enlisted in the Third Connecticut Volunteer Infantry, and, returning to Norwich after the war, practiced his profession there for about twenty years, specializing in hydraulic work.

In investigating the St. Anthony Falls water power improvements, Mr. Fanning was impressed with the features of the western country, and moved to Minneapolis in April, 1886, devoting himself almost entirely to hydraulic work. Among some of his notable works may be noted the development of water power at St. Anthony Falls, the Big Hole river in Montana, at Great Falls and Helena, Mont., and Spokane, Wash.

He has also been connected with the planning and construction of numerous water supply and purification systems.

He was the author of the well-known text book, "A Treatise on Hydraulic and Water Supply Engineering," and contributed a number of papers to the transactions of the American Society of Civil Engineers, of which society he had been a member for 38 years, and at the time of his death was a vice president.

Personal Notes.

William Hoffman has been appointed by Mayor Kreismann, of St. Louis, to be chief mechanical engineer of the Water Department.

James L. Ferebee has been appointed resident engineer, Atlantic City drainage, Atlantic City, N. J. He had formerly been connected with the water department of Wilmington, Del.

Leo Hudson, consulting engineer, Haverstraw, N. Y., has been retained by the cities of McKeesport, Pa., and Beaver Falls, N. Y., to design systems of sewerage and sewage disposal.

Prof. W. F. Schaphorst of the Mechanical Engineering Department of the New Mexico College of Mechanic Arts, has resigned his position there to become a technical writer on the staff of A. Eugene Michel, advertising engineer, New York City.

O. S. Doolittle, for over twenty-five years in the service of The American La France Company, for the last twelve years its general manager, has resigned to accept the management of The Webb Motor Fire Apparatus Company, of St. Louis.

H. P. Mobberly, Assoc. M. Am. Soc. C. E., formerly Chief Engineer of the Paris & Mt. Pleasant R. R., at Paris, Tex., and W. A. Burton, have opened an office in the Woodruff Bldg., Springfield, Mo., under the firm name of Mobberly & Burton, for the general practice of engineering.

Prof. M. C. Whitaker, of the Department of Industrial Chemistry, of Columbia University, and formerly Superintendent of the Welsbach Co.'s works at Gloucester, N. J., has been appointed Editor of the *Journal of Industrial and Engineering Chemistry*. Professor W. D. Richardson, of Chicago, Ill., has retired as Editor because of the pressure of other work, but will continue as one of several associate editors.

George Alfred Goodenough, for several years Associate Professor of Mechanical Engineering of the University of Illinois, has been promoted to be Professor of Thermodynamics. Professor Goodenough was born in Davison, Michigan, in 1868. He was graduated from the Michigan Agricultural College in 1891, and received the degree of Mechanical Engineer from the University of Illinois in 1900. He was Instructor in Mechanics, Michigan Agricultural College, 1891-93; Instructor in Mechanics, International Correspondence Schools, 1893-95; Instructor in Mechanical Engfiineering, University of Illinois, 1895-97; Special Writer and Editor, International Correspondence Schools, 1897-99; Assistant Professor of Mechanical Engineering, University of Illinois, 1899-1906, and Associate Professor of Mechanical Engineering, 1906 to date.

F. L. Fellows, Assoc. M. Can. Soc. C. E., City Engineer of Westmount, Que., has been appointed Supervising Engineer of Vancouver, B. C. Mr. Fellows expects to take up his new work about the first of May. The appointment is said to be a contract for five years, whereby Mr. Fellows will have entire control of the Public Works Department, with full power to make and carry out all contracts and to engage all members of his staff.

Andrews Allen and John A. Garcia announce the incorporation of the Allen & Garcia Company, consulting and contracting engineers, McCormick Building, Chicago. They intend to carry on a general consulting engineering practice relating to engineering structures in wood, steel and concrete, steel bridges and foundations, draw bridges, coal mining plants and power plants. As contracting engineers they propose to design and construct coal mining, handling, storage and screening plants.

John M. Farley, M. Am. Soc. C. E., and P. L. Braunworth, Assoc. M. Am. Soc. C. E., have formed a partnership under the firm name of Farley & Braunworth, for the general practice of sanitary and hydraulic engineering. In addition to the New York office, now at 527 Fifth ave., long maintained by Mr. Farley, the firm will open another office at the Wilkinson Bldg., Trenton, N. J. Mr. Braunworth has for some years been Mr. Farley's principal assistant, stationed at White Plains, N. Y.

The Cleveland Branch of the American Chemical Society at their March meeting, was addressed by William R. Hulbert, manager of sales, Goldschmidt Thermit Company, on the thermit welding process. In addition to a general description of the process and its various applications, with lantern slides, Mr. Hulbert gave a demonstration of thermit welding, comprising a number of experiments to show how the process is used commercially for repairing wrought iron and steel sections, and for welding pipes up to 4 inches in diameter.

James Nisbet Hazelhurst and Charles Louis Bates Anderson, heretofore associated as consulting engineers, under the firm name of Hazlehurst & Anderson, of Atlanta, Georgia, and Wilmington, North Carolina, announce a dissolution of partnership which took effect March 1. Mr. Hazlehurst will continue the practice of his profession as heretofore, at Atlanta, Georgia, and will complete all engagements for which the firm was obligated. Mr. Anderson retires to become associated as chief engineer with the Clarendon Construction Company, of Wilmington, N. C.

Prof. Charles Russ Richards, M. Am. Soc. M. E., Dean of the College of Engineering of the University of Nebraska, has been appointed Professor of Mechanical Engineering in charge of the department, at the University of Illinois, effective Sept. 1, 1911. Prof. Richards graduated from Purdue University in 1890 and received the degree of Mechanical Engineering from the same institution in 1895. He has been with the University of Nebraska since 1892, when he was appointed Adjunct Professor of Practical Mechanics. The new Mechanical Engineering Laboratory at the University, dedicated on Jan. 18, 1911, was built and equipped under his direction.

MACHINERY AND TRADE

A Motor-Propelled Sweeping and Flushing Machine.

The accompanying photograph shows a motor propelled combination street sweeping and flushing machine, demonstrations of which are now being made in New York City.

The machines, which are manufactured and operated by the Emerson Contracting Company, No. 1 Madison avenue, as was shown in the tests, can, at the will of the operators, clean the streets, either by a sweeping or a flushing process.

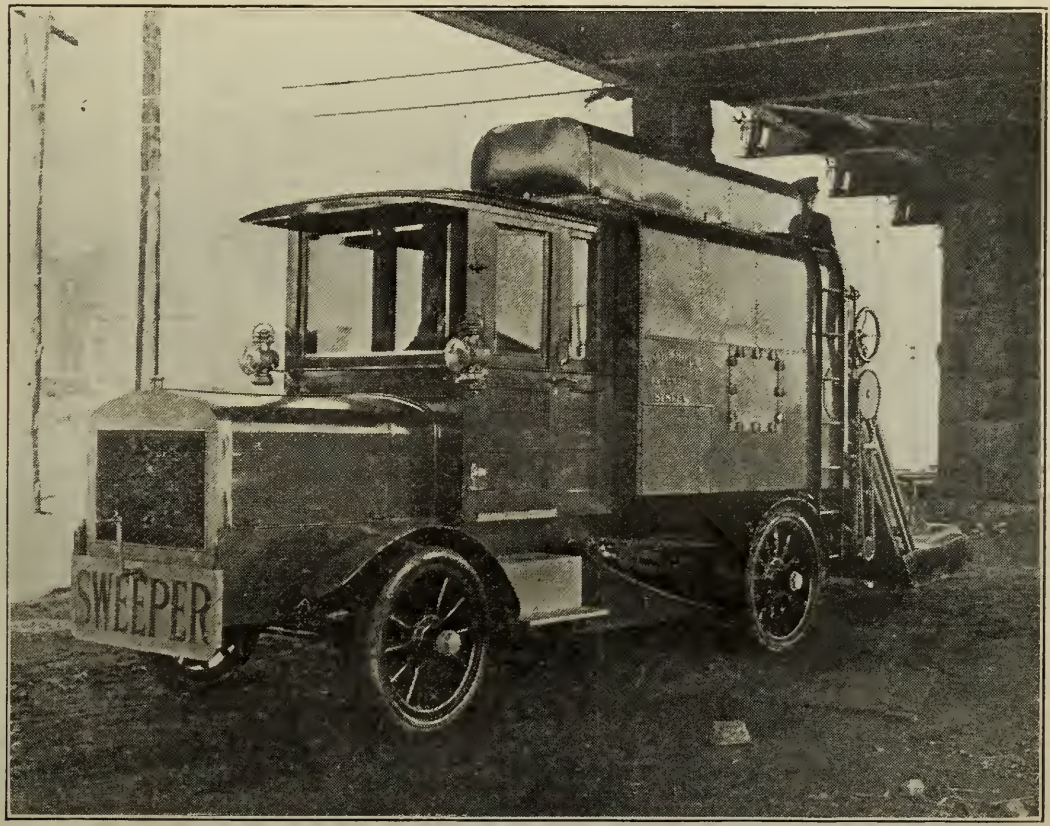
There is now a request before the board of estimate from the street cleaning department for $100,000 with which to purchase flushing machines. Presidents Mitchell and McAneny, in conjunction with Commissioners Edwards and Thompson, are the committee named by the Mayor to consider the advisability of the city investing in machines, and they will submit their recommendations to the board within a few weeks.

It is not intended that the machines are to be purchased by the city. The Emerson Company's offer is that the street cleaning department shall lease these machines for the use of the department and pay for such use at a stated price per 1,000 square yards of street cleaned, the Emerson Company paying all costs of operation and maintenance.

The machines, which require two men to work them, are motor-driven, and built in different sizes, and suit different conditions of traffic and street width, with a carrying capacity for sweeping proportional to the widths of brooms. The brooms are five and nine feet in width, and the sweepings are instantaneously thrown into conveyors that carry the sweepings to the body of the machines, which hold five and ten cubic yards, respectively. The process raises absolutely no dust, thus avoiding the spreading of germs and doing away with other objectionable features of the present-day method of cleaning the streets. The machines when filled can be driven to the nearest dumping station, emptied and the work resumed.

One of the claimed advantages of the machine for flushing purposes over other types now on the market is that it will clean 1,000 square yards with 40 gallons of water, as against 400 to 650 gallons used by other machines, and wet sweepings, too, are taken up into the machine just as expeditiously as are the dry. No sweepings are washed into the gutter, catch basin or sewer.

Commissioner Edwards and his deputies, Lynch and O'Brien; Commissioner Thompson, of the department of water supply, gas and electricity; subordinates of President McAneny, of the Borough of Manhattan, and President Mitchell, of the board of aldermen; Borough Presidents Steers and Miller, of Brooklyn and the Bronx, respectively; superintendents of the various bureaus of sewers, and a host of engineers of the various departments have witnessed the demonstrations. They all agree that the machines clean the streets thoroughly, noiselessly and dustlessly.



EMERSON STREET SWEEPER.

The M. & M. Meter Box.

The Clarksville Foundry Machine Company of Clarksville, Tenn., are making an unusually liberal offer to introduce their M. & M. meter box. This offer is to the effect that they will ship one of their boxes on free trial to responsible parties desiring to investigate it, payment to be made after its acceptance as fulfilling their statements.

The box in question consists of only four pieces, namely: a cast-iron ring, a cast-iron lid, a cast-iron latch and a brass bolt. The cast-iron ring sets over an ordinary vitrified sewer pipe, and is held securely down by a lug on one side of the lid and the latch on the other side. The head of the brass bolt, which operates the latch, has five sides or faces, and requires a special wrench to operate it. The head of the bolt is set in a depression in the lid so that it comes flush with the top of the lid.

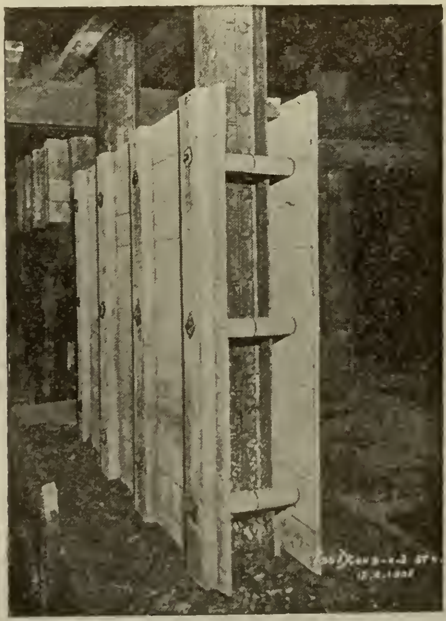
To remove the lid all that is necessary is to place the wrench on the head of the bolt and turn it about a quarter turn, until the latch is disengaged from the ring; the entire lid can then be removed, leaving the opening to the full size of the box, thus affording plenty of room for the removal of the meter, so that the whole box does not have to be dug up.

The tops are made to fit 15, 18 or 28-inch sewer pipe; or if so desired the box may be made of brick or concrete, and be brought to the necessary size at the top. It is recommended that the meter be installed about midway between the bottom and the top of the box, thus providing an air space above and below the meter, and placing it in the warmest part of the box. This also allows of a space beneath for the collection of any waste or seepage water; or, if so desired, the bottom may be concreted and the joints filled, assuring a water-tight box.

The notable features of the M. & M. box are its cheapness, accessibility for reading and the facts that it does not have to be dug up for the purpose of removing or repairing the meter, protects the meter from frost, and is easily installed by ordinary workmen.

McCarty Patent Concrete Separator.

The accompanying photograph shows the McCarty Patent Concrete Separator



McCARTY PATENT CONCRETE SEPARATOR.

in use upon wall forms. As will be noted, the separator consists of a concrete tubelike device through which bolts are passed, allowing the forms to be held tightly together, offering the required resistance to compressive action between them. The separators are manufactured in standard lengths of 4, 5, 6 and 8 inches, which sizes are kept in stock. When the distances between forms are greater than 8 inches, the separators may be used in combination to secure the desired length. The holes through the separators are ⅞ of an inch in diameter, giving ample clearance for ⅜ inch bolts to be passed.

They are made of a rich grade of concrete by an especially designed machine. By reasons of the material of their construction, they make a bond with the concrete in the forms and become an integral part of the structure and being of exact length, they give a uniform distance between forms. Another advantage of the concrete separator is the fact that as there is an absence of metal in their construction, there will be no rust streaks upon wall surfaces due to rusting, as is sometimes noted when iron separators are used. Upon removal of the forms the resultant holes may be left for the passing of wire or pipes through the wall or to support temporary scaffolding; or they can be entirely filled with concrete.

The separators are convenient for use in connection with the various systems of metal and collapsible forms now on the market.

More complete information may be had upon application to the Concrete Separator Co., 1123 Broadway, New York City.

The Record of Pitch Filler in Akron, Ohio.

At the close of the year 1910 the city of Akron had over 65 miles of paved streets, of which over 80 per cent. are of brick. The first brick pavements laid in Akron were put down in 1890 on a sand base and paving pitch was used for a filler. These streets after twenty years of continuous usage are in good condition today, and not one cent has been spent for repairs other than to replace portions torn up to make water, gas, sewer and electric connections. Pavements have been laid on crushed slag, crushed stone, gravel and cement concrete foundations, and the pitch filler used has proven satisfactory on all kinds of foundations.

One of the things on which the Akron authorities base their preference for pitch filler is a direct comparison of results on Main street. In 1891 Main street, north of Thornton, was paved with brick with pitch filler. Five years later the adjoining section south of Thornton was paved with brick with cement filler. It would be logical to suppose that the pitch-filled section, being five years older, would wear out first. The reverse, however, is true, and the cement-filled section, as shown by the photographs, is in very inferior condition as compared with that where the pitch was used. The comparison is more than fair to the cement filler, as the pitch-filled section is nearer the center of the city and receives more traffic than the grouted section. Cement was used elsewhere in Akron about the same time, and the results were everywhere so disastrous that for the last ten years paving pitch has been used almost exclusively.

The grade on these streets varies from less than 1 per cent. to over 9 per cent., yet the pitch filler has been found well adapted to all conditions, keeping the foundation dry, and therefore firm, affording a good foothold to horses; and when necessary to take up the pavement for any reason the work can be done without breaking the brick, and when

MAIN STREET, NORTH OF THORNTON STREET, AKRON, O.
Twenty Years Old. Pitch Filler

MAIN STREET, SOUTH OF THORNTON STREET, AKRON, O.
Fifteen Years Old. Cement Filler

properly relaid it is impossible after a few weeks to tell where the pavement has been relaid. During the year 1910 about 2,000,000 pounds of paving pitch were used in the city, while plans for 1911 call for an additional large quantity.

In addition to the work done by the city authorities quite an amount of paving has been laid by private concerns, especially in new allotments, in which pitch filler has been used in preference to any other. The largest private user in the city is the Street Railway & Light Company in paving between tracks. Ninety per cent. of the million or more square yards of brick and stone pavements in Akron have their joints filled with pitch filler.

Official Report of a Test of the Sieben Sewer Cleaner.

Mr. Theodore S. Jones, Superintendent of Repairs of Kansas City, Mo., has submitted to the Board of Works of that city an official report of the test of the Sieben Sewer Cleaning System, which was held in Kansas City recently. The machine, which is manufactured by the Sieben System of Sanitation Company of Kansas City Mo., was described at some length in the January issue of MUNICIPAL ENGINEERING.

The following is a tabulated estimate of the number of feet cleaned, labor and net cost per foot, as contoined in the report:

Cost Per Foot.	Feet Cleaned.	Cost Per Day.
04.40	970	$42.00
Cost of moving machine and preparing for other work..		14.00
04.90	290	14.00
04.90	290	14.00
02.50	324	8.12
04.51	309	14.00
02.58	580	15.00
03.80	314	12.00
01.72	667	11.50
02.65	832	22.00
02.60	675	18.00
01.85	683	16.00
02.86	572	16.00
02.65	565	15.00
02.35	548	15.00
	7,801	$246.62

Average cost of cleaning sewer per foot, 3.15 cents per foot. Former cost averaged from 40 to 80 cents per foot.

Attached hereto find specified number of feet cleaned, location of same and cost of laor for each day.

Number of feet of sewer cleaned by the Sieben system in 14 days, 7,801 feet.

Cost of cleaning the same number of feet by the old method, average between 40 and 80 cents per foot. Total cost, $3,960.50.

Cost of cleaning the same number of feet under the same condition by the Sieben system at the net cost of 3.15 cents per foot. Total cost, $246.62.

A total saving to the city in 14 days of $3.713.88.

The Twentieth Century Road Oiler.

The use of oil as a dust layer and as a binder to provide against the abrasion of top surfaces of roads is becoming standard. There have been, however, a number of objections to this use, chief among them being the fact that it is difficult to secure an even and thorough distribution of the oil over the road surface.

The Twentieth Century Road Oiler, manufactured by Walter S. French and Company, Moorestown, N. J., seems to have overcome most of the difficulties experienced in applying the oil. It consists of a tank wagon, attached to the rear of which is a motor engine driving the oil out at a high pressure upon the surface of the road. The water from the water-jacket of the engine is carried through radiators into the bottom of the tank by large pipes which radiate heat through the oil. This decreases the viscosity of the oil and raises its temperature to a higher degree than that of the road surface, causing it to be absorbed more quickly by the road material. The system of nozzles through which the oil is forced is controlled by a single lever acting instantaneously on the flow of oil, which is easily controlled by the operator, allowing the oil to be shut off at cross walks. This control allows of the oil being shut off or turned on within one inch of a given line.

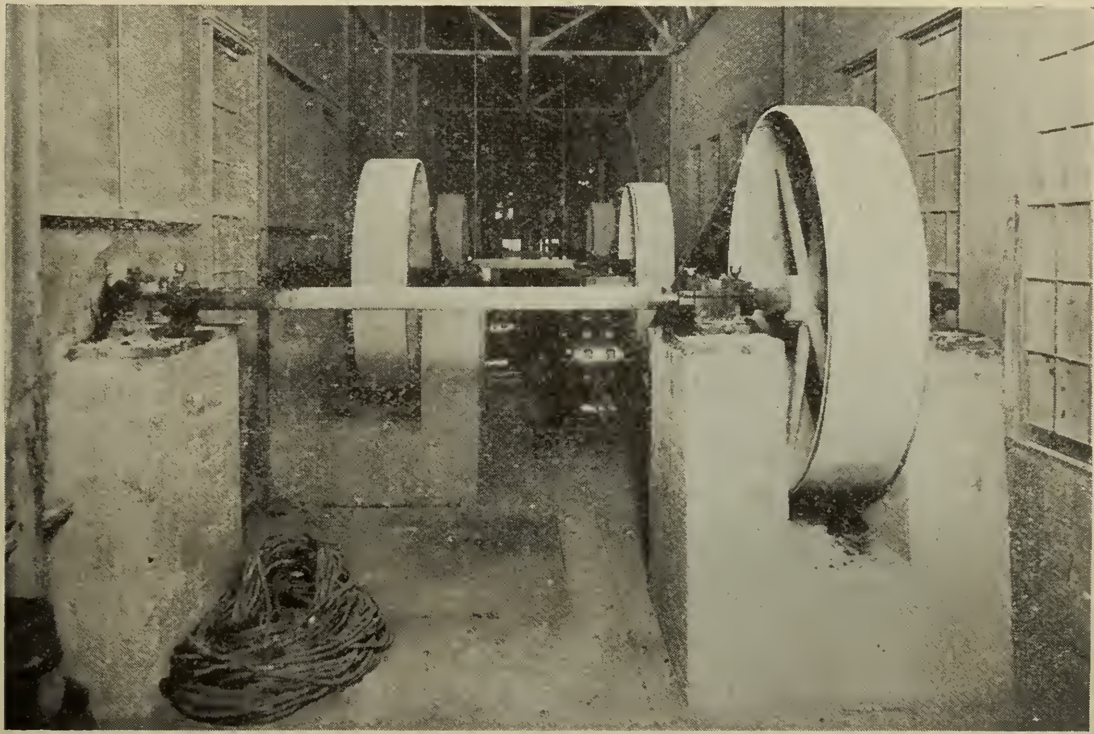
The advantages of the oiler are that it gives an even distribution over the surface of the road with no pools or puddles of oil which are so objectionable in most systems; delivery at such a temperature that it is absorbed directly into the road surface; and such control that the oil may be placed exactly in the places desired without any being distributed over cross-walks or gutter tops.

The Matchless Patented Sanitary Street Cleaning Machine.

The Matchless Patented Sanitary Street Cleaning Machine, manufactured by the Menzies Street Cleaner Company, 14 Maple street, Glen Falls, N. Y., has come to be so much a part of the street-cleaning equipment of the larger cities that its appearance is as familiar as the "White Wings" themselves. The machine consists of a two-wheeled cart, strongly built of steel throughout, and with wooden wheels especially built for the purpose. The dust pan, which is the distinctive feature of the machine, is constructed of galvanized iron, the blade of steel spring, 28 inches long and 6 inches wide.

The method of using the machine is so simple as to makes its efficient use possible even with the most unskilled lobar. The cart is pushed to the part of the street to be cleaned, and the dust pan lowered to rest upon the pavement a short distance beyond the dirt to be gathered up. The dirt is then swept over the blade, which rests close to the pavement, into the dust pan. With the last push of the broom the brush is left on the dust pan and the machine is pushed to the next portion of the pavement to be cleaned. When the dust pan is nearly full, the mere action of taking the handle to pull it forward raises the pan and dumps its contents into the storage can. When the storage can is full it may be removed and hauled away to be emptied, a new one being substituted.

While the machine is designed essentially to clean streets, it may be used to advantage in parks, cemeteries, depots, hotels and public buildings. A workman can keep clean about 50 per cent. more street surface than can be accomplished by the ordinary hand cart and shovel method, and the item of saving in supplying the street department with shovels is considerable. It dispenses entirely with the use of shovel and scraper; and the saving of time, as the placing of the material in the can is continuous with the moving of the machine, is an item which will materially increase the street area cleaned.



MOTOR DRIVING CEMENT FINISHING TUBE MILLS.

From the Raw to the Finished Product.

The accompanying illustration is taken from a booklet entitled "From the Raw to the Finished Product," recently published by the Chicago Portland Cement Company, 108 LaSalle street, Chicago. This booklet contains more than 100 halftone illustrations, and describes in detail the manufacture of Portland cement from the stripping of the soil down to the final grinding of the clinker, a subject of supreme importance to engineers, contractors and all users of cement. It is for free distribution.

Granite Pavement.

The term granite pavement to most individuals means merely the designation of a certain kind of stone pavement; and few stop to consider that there may be as much difference in the quality of granite as there is in paving brick. The United States Arsenal at Watertown, Mass., made some tests recently of the comparative compressive strengths of various kinds of granite, which show the differences to a marked degree. Under these tests there were samples from one quarry which stood out strongly in advance of any others submitted.

These samples were from the Balfour quarry, Rowan county, North Carolina, controlled by the Harris Granite Quarries Co., Salisbury, N. C. Of six samples tested the ultimate strength per square inch ranged from 43,670 to 51,990; while the next strongest samples broke at from 27,279 to 29,347 pounds per square inch; and the others, of 16 varieties, did not approach these values.

Careful consideration of these figures will make the significance of the tests apparent. This granite is 65 per cent. stronger than any other found in America. Its crystals are so interlocked that the tendency to crumble under traffic is reduced to a minimum. In addition to this the co-efficient of wear was found to be about 20.8, which is larger than that of trap (considered the best road metal in existence), having a co-efficient of wear of 20.6.

There are other important considerations which operate to make the product of the Harris quarries of exceptional character. The blocks are cut with true straight edges, and with faces practically at right angles with one another. This gives four serviceable heads, reducing the cost of handling in laying them; does away with the necessity of redressing them, when, after long years of service, it is necessary to relay them; and in addition there is a marked saving in the quantity of filler demanded in making the joints flush and true. This latter item reduces the maintenance expense, as the quantity of filler demanded is not sufficient to cause the blocks to float up as the filler settles.

These features are only some of the many that are noted in connection with the Harris product; and the conditional economies arising from the above may be noted upon further consideration.

Hendricks' Commercial Register.

The nineteenth annual revised edition of Hendricks' Commercial Register of the United States for Buyers and Sellers has just been issued. It requires just one hundred index pages, or thirteen additional pages over last year, representing the manufacturers of over five thousand articles, none of which have appeared in any previous edition. The total number of classifications is 35,481, each representing some machine, tool, specialty or material required in the architectural, engineering, mechanical, electrical, railroad, mine and kindred industries. There is a total of 238 pages of new matter, the whole representing upwards of 350,000 names and addresses. An important feature is the simplicity of classifications. They are so arranged that the book can be used for either purchasing or mailing purposes.

The book is revised, improved and issued annually, and has been since 1891. It is expressed to any part of the country on receipt of ten dollars by S. E. Hendricks Co., Publishers, 74 Lafayette st., New York.

Eastern Mfg. Company's Wood Pipe.

The drawing here reproduced shows a section of the Eastern Manufacturing Company's wood water pipe. The enduring properties of wood pipe are too well known to need comment, but the particular feature of this pipe makes it exceptionally lasting.

The pipe is made in sections of from 4 to 8-foot lengths of well-seasoned white pine or cypress staves, double-tongued together, so that they interlock and mutually support one another. The entire inner and outer joints are dressed to conform to the exact curve of the diameter of the pipe to be constructed, after which the sections are spirally banded with galvanized steel wire of 1 to 1½ inches in width, having a tensile strength of 58,000 to 65,000 pounds to the square inch. The winding is fastened to the staves by means of two galvanized nails or screws. Before the wire or banding reaches the staves of the pipe it travels through a bath of asphaltum so that the wood beneath is thoroughly covered. After banding it is coated with two coats of the best grade of asphaltum and then rolled in sawdust until the coating becomes entirely hard.

Sections of the wood pipe have been taken from the ground which have been in use for fifty-two years, and even the iron bands were in an excellent state of preservation, rust and electrolysis having had no effect.

The pipe is manufactured by the Eastern Manufacturing Company, Clinton street and Duvit avenue, Elmira, N. Y.

Texaco Publications.

The Texas Company, New York City, have a number of publications which will prove of particular interest and value to the road builder. The first of these, "Texaco, the Road Builder," deals with the construction of the road, the best practice in building the surface, and the application of the binder. A number of very excellent illustrations are given throughout the books. The second booklet, "The Proof of the Pudding," is devoted to the merits of Texaco paving cement. This is also very completely illustrated. The third pamphlet deals with Texaco road oil for cold application.

In addition to these the Texas Company is issuing a regular monthly publication known as "Paving and Roads." This publication is devoted to the interests of good roads, and contains much of interest. Among the articles given in this month's issue are: "Heating and Unloading Texaco Materials when Delivered in Tank-cars," "Notes on Construction," "Quantity of Oil Required for Road Surfacing," "Road Surfacing at Glen Head, L. I.," "Cold Mixing Method," "A Picture Lesson in Good Roads" and "A Striking Example of the Use of Texaco Products."

Concrete Mixer Transportation by Automobile.

In order to make prompt delivery of concrete mixers, the Standard Scale & Supply Company used a new method of handling one of their Eclipse mixers. A customer at Gary, Ind., had a breakdown on a tilting type mixer and it was necessary to have another machine on the job the next morning. The subject was taken up with the railroad company and they could not guarantee delivery by freight, and the mixer, which was mounted on truck and equipped with gasoline engine, was too large to conveniently load in express cars, so an automobile moving van was secured and the complete mounted outfit loaded on this van at 6 o'clock in the evening and the next morning at 8 o'clock it was delivered at Gary, Ind., about 30 miles from Chicago, complete and ready for operation.

The mixer referred to has a capacity of about 100 yards per day and because of the simple construction it was possible to load the complete outfit without taking it apart and the machine being of moderate weight, enabled the automobile to handle it without any difficulty even on the country roads.

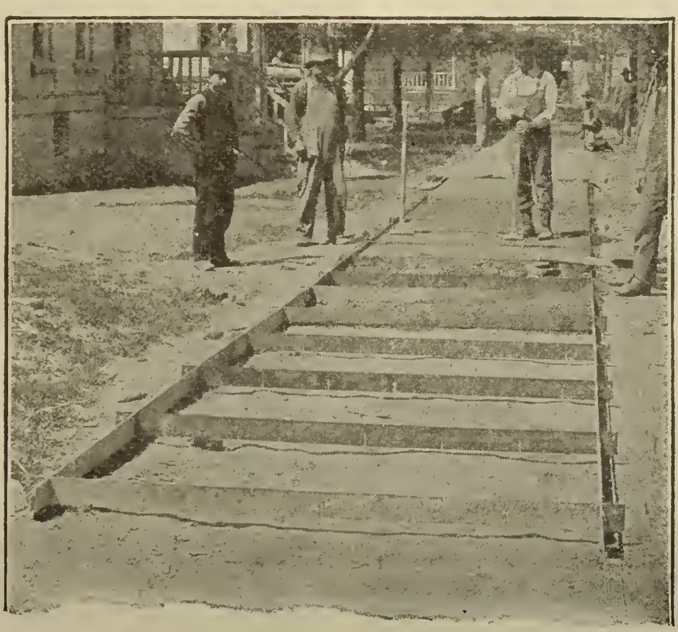
The Standard Scale & Supply Company always make special efforts to deliver promptly, mixers on rush orders and for this reason carry a large stock at their factory, branch houses and agencies and have about 25 mounted outfits ready for immediate shipment at their Chicago store and warerooms, 1341-1347 Wabash ave.

An Adjustable Steel Sidewalk Form.

There has been placed on the market recently, a system for building sidewalks with adjustable forms which possesses many features of superiority over the old method of using boards and stakes. These forms are shown in the accompanying illustration. They are so made as to be adjustable to any size of walk desired; for example, the six-foot cross pieces may be adjusted to range anywhere from two feet, six inches, to a full six feet. Steel spring side pieces are provided, by means of which any desired curve may be obtained. These curve forms are much more rigid and true to the desired line of curve than the old style wood strip.

The forms are manufactured by Joe Ubbink, Port Washington, Wisconsin. A ten-day free trial may be obtained upon request, with a guarantee that the purchase price will be refunded in event that they prove unsatisfactory. It is claimed that a saving of 2 cents per lineal foot can be made on all sidewalk built by these forms, as there is the saving of the initial cost of the wood forms (which are very short lived) and in addition, the labor of their construction is very much lessened. Catalogus and full information regarding the forms will be sent upon application to the above address.

An adjustablo combination curb and gutter form is also manufactured by Mr. Ubbink, and is described at length in his catalog upon that subject.



UBBINK STEEL CURB AND GUTTER FORMS.

Race Track Construction.

"How the Race Was Run and Won" does not sound like the title of an advertising publication. Nor would the attractive three-color cover with its representation of a racing automobile impress one at first sight with the fact that the Indian Refining Company products were used in the preparation of the track for the grand prize race in Savannah, Ga., in 1910. But the attractive book, with the title above noted, is issued by the Indian Refining Company, First National Bank Building, Cincinnati, O. Almost the only evidence of this fact is the tiny copyright note on the fly-leaf.

The publication in itself is most attractive in its design and execution. It is excellently printed on heavy paper which is admirably suited for the photographs of the race and the course, which comprise the greater part of the book. The story of the great race, the official record, an historical sketch of the Savannah Automobile Club, a map of the course, photographs of the officials and drivers, together with the photographs above noted are the contents. The borders around the pictures and reading matter are embellished with two-color drawings of the various semi-tropical plants and flowers found along the course.

The book is exceedingly original in its conception and excellently well executed in all its details.

Mueller Sprinkling and Flushing Hydrant.

The Mueller Manufacturing Company, Decatur, Ill., and New York City, has placed a new sprinkling and flushing hydrant on the market. It is designed for either public or private use. It is especially urged for public use to obviate the use of fire hydrants for any other purpose than that of suppressing fires.

In private installations it is of service in garages, markets and manufactories or in fact wherever large quantities of water are needed for flushing or sprinkling. The connection at the main is made with a Mueller corporation cock. The top of the box is flush with the curb.

All iron parts are galvanized, and the other parts are of brass. This box delivers a two-inch stream and is made in lengths of 2½ to 8 feet.

Cement That Will Stand 3,000 Degrees F.

For many years engineers have experienced great difficulty in proper maintenance of brick settings of furnaces of all types. They have been compelled to depend very largely upon the ordinary fire clay as a bonding material, and as this fuses at a comparatively low temperature, the bond between the bricks is rapidly destroyed, and the result is that the cracks are opened up between the bricks, through which the gases of combustion enter, eventually weakening the brick and causing the walls to collapse.

Every engineer realizes the annoyance and expense occasioned by occurrences of this kind.

Another feature which has been objectionable is the fact that refractory bricks become very porous on the surface and very soon the clinkers from the coals attach to the surface of the brick, and in removing these with tools the bricks are broken.

After several years devoted to research work on refractory cements to overcome these troubles, the H. W. Johns-Manville Co., New York, are now offering to the trade a line of cements called J-M Refractory Cements for furnace setting of various types, cupolas, lining brass furnaces, assayers' crucibles, oil burning, tilting and rotary furnaces, and for patching and facing bricks in place in the fire zone under various conditions.

These cements are rated to resist temperatures as high as 3,000 degrees F.

They have also produced a coating for walls known as J-M Brickline Cement, which prevents clinkers from adhering and to seal the pores of the brick.

Realizing that the conditions under which these cements are used are variable, they have been made capable of modification to meet conditions as they come up, and the Johns-Manville Co. invite the trade to place before them any conditions that are troublesome and they will be very glad to make a careful investigation and offer suggestions which will tend to overcome the difficulty.

Trade Publications.

The American Asphaltum & Rubber Co., 600-614 Harvester Building, Chicago, Ill., have a leaflet descriptive of a practical engineering test demonstrating the efficiency of "Pioneer" mineral rubber pipe coating for the protection of underground steel pipe lines against electrolytic action. The tests were made by E. E. Brownell, consulting electrical engineer, of Philadelphia.

The Chicago Portland Cement Co. has an illustrated booklet which deals particularly with the seventh annual convention and show of the Iowa Association of Cement Users, held in Cedar Rapids

The Marquette Cement Manufacturing Co. have a booklet of half-tones of the bridge built for the Iowa Central railway at Keithsburg, Ill.

The Atlas Portland Cement Co., 30 Broad st., New York City, has issued a small book with a description, tests and specifications for the use of stainless Atlas-White Portland cement.

Catalogue No. 6 of the Keystone Driller Co., Beaver Falls, Pa., a most complete and minutely detailed description of the Downie deep well pumps. All parts are illustrated and described in detail. In addition useful information relative to pumps in general is given.

The sixtieth year book of the Port Huron Line, issued by the Port Huron Engine Co., of Port Huron, Mich., is devoted principally to threshing machinery, though there is a small section given over to the well-known Port Huron good roads machinery. The book in itself is attractively illustrated and contains much of interest in connection with the subjects mentioned.

The McCarty patent concrete separator is described in a booklet by the Concrete Separator Co., 1123 Broadway, New York City.

The Blau Gas Company of America, 19-23 Sixth st., Long Island City, N. Y., have an attractive and instructive book upon liquified gas in steel bottles for use in illuminating country homes.

The Studebaker Co., South Bend, Ind., in the nineteenth number of their interesting little publication continue the illustrated article on the making of a wagon, this number being devoted to the number of processes involved in the manufacture of the wheels.

The Allis-Chalmers Co., of Milwaukee,

Wis., have for distribution a reprint describing the Allis-Chalmers direct connected Reynolds Corliss engines. heavy duty pattern. These engines have been on the market for about fifteen years and are used in electric power and lighting stations. The reprint also contains information required in making estimates and a discussion of direct connected vs. belt-driven units.

The Roughen adjustable street gauge, manufactured by P. Roughen, Fond du Lac, Wis., is described in a pamphlet, which is illustrated with photographs. The device is used for grading the streets after the curb and gutter are built and the concrete base is placed.

The Yellow Pine Manufacturers' Association, seventh floor, Wright Building, St. Louis, Mo., have two valuable booklets for distribution. The first of these is descriptive of "The Modern Perfect Pavement," and contains much data of value to the engineer. The second is devoted to creosoted yellow pine blocks for use in floor coverings, bridge floors, etc.

The Menzies Street Cleaner Co., 14 Maple st., Glens Falls, N. Y., have a small booklet devoted to their patented spring steel snow shovel. The tool described consists of a steel spring blade fastened to a wooden handle in such a manner that it may be easily removed when desired.

The Vulcan Portland Cement Co. have a booklet devoted to cement sidewalk paving. Full details are given concerning the method to be followed in sidewalk construction, and the points noted are illustrated by photographs from actual work.

The Fort Wayne Electric Works, of Fort Wayne, Ind., have a number of excellent pamphlets descriptive of their products.

The Universal Portland Cement Company, Chicago, Ill., have a very attractive booklet illustrated by half-tones and drawings showing the uses of concrete in the country. The material for this publication is furnished by the Association of American Portland Cement Manufacturers, Philadelphia, Pa.

The Sandusky Portland Cement Company, of Sandusky, O., have two very attractive booklets for distribution. The first of these deals with Medusa Portland cement and of the artistic effects to be obtained through its uses. The second contains a complete summary of tests and descriptive matter relative to Medusa waterproofing.

The March publication of the Lehigh Portland Cement Co. contains among other things a description of the Niles Tool Foundry at Hamilton, O., and a number of residences upon which Lehigh Portland cement was used. The April issue deals particularly with reinforced concrete bridges, and is of interest and value to the engineer.

The Buffalo Pitts Steam Roller Company, of Buffalo, N. Y., have a complete catalogue of their machinery, showing a number of rollers especially designed for road construction. Photographs are given which completely illustrate the uses and advantages of their machines.

The Canton Culvert Company, Canton, O., have a booklet which gives description, analyses and tests made upon their culvert metal known as "No Co Ro" metal.

The Reisert Automatic Water Purifying Company, 30 Church street, New York, have a pamphlet containing a complete description of their new improved Reisert patent filter. Drawings are shown to illustrate each of the points noted.

An illustrated pamphlet or catalogue describing street cleaning machines, asphalt and concrete wagons, some of them motor-propelled and some horse-drawn as well as a number of other contractors' supplies, is issued by the Briggs Labor Saving Specialty Company, Waterloo, Ia.

Catalogue "M" of the Frick Company, Waynesboro, Pa., shows a complete line of traction engines. There are particular types suitable for road construction uses which possess features of value for that type of work.

The L. M. Booth Company, New York, have an illustrated catalogue which not only describes their different types of water softeners, but which gives some valuable material on the general features of the water softening problem.

Earth handling and road building machinery are described in an illustrated catalogue by the Russel Grader Manufacturing Company, Twenty-fourth and University streets, Minneapolis, Minn. Several new types of elevating graders and ditching machines are illustrated and full described.

Trade Notes.

ASPHALT.

Chicago, Ill.—The Impson Asphalt Co. has been incorporated for the mining and manufacture of asphalt and other minerals, by Wm. S. Corbin, Joseph P. Eames and Earl F. Tilley.

BRICK.

Broad Brook, N. J.—The Concrete Unit and Construction Co. has been incorporated by Houghton Wheeler, Elbert V. D. Rousseau and Charles G. Little. Manufacture of concrete blocks, bricks, etc.

Houston, Tex.—Special.—The Texas Terra Cotta Tile and Pressed Brick Co. has been formed, with a capital stock of $100,000, 75 per cent. of which has already been subscribed. The incorporators of the company are Geo. Gwilt, formerly of British Columbia; Milton McConnell, of Dallas, Tex., and Clement Watson, New Waverly, Tex.

Huntsville, Tex.—Special.—Machinery for a brick plant near this city is being installed and the work of making brick will begin at an early date.

CEMENT.

Hammond, Ind.—Special.—The Calumet Concrete Construction Co. has been incorporated by Conrad Markmueller, A. P. Larson and Albert Rose.

Indianapolis, Ind.—Schuyler C. Hubbell has been appointed agent for the Raymond Concrete Pile Co., of Illinois.

Minneapolis, Minn.—The contract for furnishing 105,000 barrels of cement was awarded to Huron Portland Cement Co., Alpena, Mich.

Bellingham, Wash.—The erection of a cement plant is contemplated by Balfour, Guthrie & Co.

Denver, Colo.—Special.—Bids will be received until April 3 for furnishing 130,000 barrels of Portland cement by the United States Reclamation Service, Denver, Colo.

Chicago, Ill.—Special.—Bids will be received until April 19 for furnishing and delivering Portland cement, crushed limestone, building sand, torpedo sand and sewer pipe. Certified check, 15 per cent. South Park Commissioners.

Indianapolis, Ind.—Special.—The Security Trust Company, of Indianapolis, will offer at public sale at the court house of Bedford, Ind., at 1 p. m., April 15, 1911, the plant and property of the United States Cement Company, near Bedford, consisting of buildings, mills, machinery, tools, fixtures, real estate on which the plant is situated, consisting of about 260 acres of land, and also of shale land in Jackson county, Indiana. Said sale will be for cash or in lieu of cash, securities that are liens on the property.

Haverhill, Mass.—Special.—The contract for furnishing cement for the year was awarded to the Haverhill Cement Co., Haverhill, Mass.

Holyoke, Mass.—Special.—Bids will be received until April 7 for furnishing curbing, cement and trap rock. Cy. clk.

Chicago, Ill.—The Lehigh Portland Cement Co. have discontinued their Indianapolis and Cleveland offices and have combined them in the Chicago office.

Pittsburg, Pa.—Special.—Mr. Charles T. Topping, representing the Chicago Concrete Machinery Company in Pittsburg territory, has opened an office in the Bessemer Building, Pittsburg. He will handle Chicago mixers, Smith hand mixers, Symons crushers, Sterling wheelbarrows, concrete cars and other contractors' equipment and supplies.

PURCHASE OF MACHINERY.

Redondo, Cal.—The Warman Steel Casting Co., of Los Angeles, has been incorporated, with a capital of $50,000, by G. B. Warman, N. W. Warman, N. C. Heron and others, and contemplates erecting a steel manufacturing plant here.

Buffington, Ind.—The Universal Portland Cement Co., has placed an order with the Westinghouse Electric and Manufacturing Co. for motors to operate its No. 6 plant at Buffington, Ind. The motors range from 5 to 200 horsepower and aggregate 11,500 horsepower.

Wabash, Ind.—The Ford Meter Manufacturing Co., of Wabash, has been incorporated to establish and equip a factory to manufacture water, gas and electric meters. E. H. Ford, T. W. and W. A. McNamee, directors.

Ft. Wayne, Ind.—The Siler-Pettitt Manufacturing Co. has been incorporated with a capital of $250,000, to establish and equip a plant for the manufacture of pumps. E. E. Siler, B. F. Pettitt and G. S. Sanford, directors.

Clarksville, Tenn. — Special. — The Clarksville Foundry and Machine Co. have taken up the manufacture of the Morris and the Ryder meter boxes, and a number of other castings for municipal uses.

Winnipeg, Can.—The contract for furnishing two 500-k. w. generators was awarded to Siemens Bros. Dynamo Works, Toronto, Ont.; 016,410.

The following purchases of Heenan destructors, managed by the Power Specialty Co., 111 Broadway, N. Y., have been made:

San Francisco, Cal.: Two complete plants, one for Islais Creek district of 120 tons capacity per day, the other for North Beach district of 360 tons capacity per day. These two plants are designed on the unit principle, the former containing two 60-ton destructors, and the latter designed to contain six 60-ton units, only two of which, however, are being constructed at this time. New York City: One 90-ton plant for the Clifton district, containing two 45-ton units. The City of Havana, Cuba, has also placed a contract for one of the largest destructor plants ever built. This plant has a capacity of 500 tons per 24 hours, and consists of four Heenan destructor units of 125 tons each.

SEWER PIPE.

Colville, Wash.—Special.—The contract for furnishing 3,200 feet of wood pipe and a quantity of wrapped copper pipe was awarded to George Van Tuyl, Colville, Wash., for $1,120.

ROADS AND PAVEMENTS.

Indicating that there is to be no cessation in road construction and improvement in the Philippines, the Iroquois Iron Works, of Buffalo, has just received an order for six ten-ton macadam steam rollers for immediate shipment to Manila. At the same time the United States government ordered a ten-ton Iroquois macadam roller for delivery at Washington, D. C.

MISCELLANEOUS.

Randolph, Mo.—Special.—Matt & Bemis, general contractors, Seward, Neb., have secured the contract to quarry and deliver at the work along the river, 40,000 yards of rock to be used in the construction of two and one-half miles of standard revetment work being put in at Randolph, Mo., opposite Kansas City, by the United States government.

The contract was awarded to Rust, Swift & Co., of St. Louis, Mo., and the rock end "subbed" to this firm. They expect to commence operations at the quarry in a very short time and begin to move the rock to the work. All of this work at Randolph will be under charge of Maj. Edward H. Schultz, engineer, United States War Department, Kansas City, Mo.

Texas City, Tex.—Texas City Electric Light and Water Co.; capital stock, $100,000. Incorporators, William Dorsett, R. C. Trube, F. N. Danforth, Clyde Amburn and Harvey A. Thomas.

Texas City Sewerage Co., capital, $50,000. Incorporators, William Dorsett, R. C. Trube, F. N. Danforth, Clyde Amburn and Harver A. Tohmas.

Columbus, O.—Special.—The contract for furnishing and delivering soda ash was awarded to Isaac Wrinkler & Bros., Cincinnati, O.; furnishing 1,400 tons of lime was awarded to American Stone & Lime Co., Tyrone, Pa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Cullman, Ala.—Plans are being prepared for the construction of about 5 mi. of pavement. M. L. Robertson, myr.

Demopolis, Ala.—Contemplating the construction of about one mi. of cement sidewalks along Maine st. Jesse B. Hearin, mayor.

Fairfield, Cal.—Plans are being prepared for macadamizing 8 blocks of street in the business section. City Trustees.

Hermosa Beach, Cal.—Bids will soon be received for paving about six streets with asphalt.

Martinez, Cal.—Contemplating the construction of a road from Martinez to Bay Point. Board supervisors.

Oroville, Cal.—Contemplating the construction of a road near Swede's Flat. Board supervisors.

Pomona, Cal.—Contemplating paving Park ave. from 2nd st. to Gay ave.

San Bernardino, Cal.—Bids will soon be requested for the construction of a vitrified pipe sewer in B st. and 2nd st. Cy clk.

Jacksonville, Fla.—Plans are being prepared for paving Riverside ave. from Roselle to King sts. with asphalt.

Chicago, Ill.—March 15, constructing improvements on 23 streets. Board local improvements.

Springfield, Ill.—The paving of Pasfield and 14th st. with brick is contemplated.

Boonville, Ind.—Bids will soon be received for gravel road improvements. N. M. Spradley.

Indianapolis, Ind.—Bids were received for laying 278,000 ft. of cem,ent sidewalk in Warfleigh add., the lowest being that of Harding for about $17,500. Jeup & Moore, engrs.

Kendallville, Ind.—The paving of North Main st. is contemplated. City council.

Lagrange, Ind.—Plans are being prepared for paving Lafayette st.

Michigan City, Ind.—City engineer Miles will prepare plans for the paving of Baltimore st. from Michigan to Chicago st.; Wabash st. from Barker ave. to Earl rd.; and Willard ave. from 4th to Green sts.

Carroll, Ia.—Contemplating the paving of 5th, Main and Adams sts. City council.

Clinton, Ia.—City Engineer R. C. Hurt, has been ordered to prepare plans and specifications for paving 5th ave. from 2nd to 5th sts. with creosoted wood block paving. 12,000 sq. yds. required.

Des Moines, Ia.—Plans are being prepared for laying 14,000 sq. yds. of creosote block and 30,000 sq. yds. of asphalt. Horace Susong, clk.

Hampton, Ia.—Contemplating the paving of various streets with brick and alleys will be paved with concrete.

Indianola, Ia.—Contemplating the paving of various streets.

Villisca, Ia.—Contemplating the construction of 16,505 sq. yds. brick paving. 4,053 lin. ft. combined curb and gutter and 1,195 lin. ft. curb. Theodore S. DeLacy, Creston, Ia., engr.

Waterloo, Ia.—Contemplating the expenditure of $150,000 for paving during the coming season.

Oak Bluffs, Mass.—Voted $2,000 for road inprovements. Cy. coun.

Mankato, Minn.—The paving of five blocks with tar macadam is contemplated.

Great Falls, Mont.—The construction of 72 blocks of concrete pavement is contemplated.

Newark, N. J.—Paving amounting to $830,000 is contemplated during the present year.

Dunkirk, N. Y.—The paving of 6th st. is contemplated. Cy. engr.

Lenox, N. Y.—Voted $4,490 bonds for road improvements.

Poughkeepsie, N. Y.—Plans will be prepared for paving N. Clinton st. with brick, and Mansion st. with macadam.

Bellaire, O.—Contemplating the construction of sidewalks and curbs on various streets. G. W. Althar, clk. cy. coun.

Bucyrus, O.—Contemplating improving various highways to cost $15,000. G. F. Achermon, audt.

East Palestine, O.—Ordinances have been passed providing for the construction of sewers and paving various streets. C. L. Butts, cy. clk.

Franklin, O.—Ordinances have been passed for the paving and curbing of various streets. Cy. coun.

Portsmouth, O.—Contemplating paving Brown, Lawson and 8th sts. Cy. coun.

Youngstown, O.—Ordinances have been passed providing for the paving of various streets. Cy. coun.

Oklahoma City, Okla.—Ordinances have been passed providing for the paving of Byers and Lee avenues.

Latta, S. C.—Bids will soon be received for sidewalk construction.

Chattanooga, Tenn. — Voted $45,000 bonds for paving various streets. Cy. coun..

Brownsville, Tex.—Voted $80,000 bonds for paving various streets.

Dallas, Tex.—Bids will soon be received for paving portions of 16 streets.

Pasco, Wash.—Constructing cement sidewalks to cost $40,000 is contemplated.

CONTRACTS TO BE LET.

Wetumpka, Ala.—Bids will be received until April 4 for grading and surfacing about 30 miles of sand clay road. Com., Elmore co.

Jacksonville, Fla.—Bids will be received until April 5 for keeping in repair the hard surfaced road known as Atlantic boulevard for a period of one year. P. D. Cassidy, clk.

Atlanta, Ga.—Bids will be received until April 3 for paving North boulevard with creosoted wood blocks. Certified check required. Mayor and gen. coun.

Dublin, Ga.—Bids will be received until April 18, 12 m., for paving about 600 sq. yds. with vitrified brick. A. P. Hilton, cy. clk.

Bedford, Ind.—Bids will be received until April 4 for constructing two gravel roads. Ezra W. Edwards, audt.

Bloomington, Ind.—Bids will be received until April 5 for constructing a road in Clear creek township. Horace Blakely, audt.

Bloomfield, Ind.—Bids will be received until April 4 for constructing two macadamized roads in Stockton township. Caswell H. Jennings, audt.

Brookville, Ind.—Bids will be received until April 7 for constructing highways in various townships. Chas. A. Miller, audt.

Brownstown, Ind.—Bids will be received until April 4, 1:30 p. m., for constructing a gravel road in Owen township. H. W. Wacker, audt.

Danville, Ind.—Bids will be received until April 4 for constructing a road in Union township. W. H. Nichols, audt.

Decatur, Ind.—Bids will be received until April 3 for constructing a macadam road in St. Mary's township. H. S. Michaud, audt.

Fowler, Ind.—Bids will be received until April 3 for constructing macadam roads in Beaver township. E. R. Bringham, audt.

Goshen, Ind.—Bids will be received until April 3, 3 p. m., for improving N. Main st. Geo. H. Rimpler, cy. clk.

Hamilton, Ind.—Bids will be received until April 6 for constructing stone and gravel roads. Geo. Griffin, audt., Noblesville, Ind.

Kentland, Ind.—Bids will be received until April 4 for constructing a macadam road on line between Washington, Iroquois and Jefferson townships. E. R. Bringham, audt.

Madison, Ind.—Bids will be received until April 4 for constructing a road in Madison township. Andrew M. Taff, audt.

Monticello, Ind.—Bids will be received until April 4 for constructing a gravel road between West Point and Round Grove townships. A. G. Fisher, audt.

Paoli, Ind.—Bids will be received until April 5 for constructing a gravel road in French Lick township. Alvin B. Ham, audt.

Rushville, Ind.—Bids will be received until April 15 for constructing two gravel and one macadam. Jesse M. Stone, audt.

Sullivan, Ind.—Bids will be received until April 4 for constructing roads in Cass township and one stone, sand, clay and oil road in Hamilton township. Ben C. Crowder, audt.

Wabash, Ind.—Bids will be received until April 4, 1:30 p. m., for improving a highway in La Gro township and April 5 for constructing a gravel road in Chester township. J. P. Noftzger, audt.

Washington, Ind.—Bids will be received until April 3 for constructing 3 gravel roads in Elmore township. Thos. Nugent, audt.

Winamac, Ind.—Bids are received until April 5 for improving four public highways. W. E. Munchenburg, audt.

Bronson, Ia.—Bids will be received until April 3 for road construction. William Pickett, cy. clk.

Cresco, Ia.—Bids will be received until April 10 for constructing about 5,500 lin. ft. cement concrete curbing and 11,500 sq. yds. cement concrete paving. Cy. clk.

Davenport, Ia.—Bids will be received until April 4 for paving and curbing various streets. Certified check, $100. Bd. pub. wks.

Cambridge, Md.—Bids will be received until April 6 for grading, curbing and paving various streets. The work includes: 16,876 sq. yds. vitrified fire clay or shale block pavement, 2,600 sq. yds. granolithic or concrete gutter, 6,400 lin. ft. straight concrete curb, 4,150 lin. ft. reinforced straight concrete curb (corner bar), 1,733 lin. ft. reinforced curved concrete curb, 32 storm-water inlets. Cambridge st. imp. com.

Ft. Hawood, Md.—Bids will be received until April 7 for constructing concrete walks. Const. q. m.

Breckenridge, Minn.—Bids will be received until April 3, 8 p. m., for constructing cement sidewalks, curbing, crossings and gutters. Check, $200. D. J. Jones, cy. clk.

Hallock, Minn.—Bids will be received until April 3 for constructing state roads and culverts. Certified check, 10 per cent. C. J. Hemingson, audt.

Fulton, Mo.—Bids will be received until April 6 for constructing 5,000 sq. yds. macadam with a binder and 3,500 ft. of concrete curb. Cy. coun.

Swedesboro, N. J.—Bids will be received until April 15 for improving Railroad avenue. Milmer Egee, mayor.

Port Jervis, N. Y.—Bids will be received until April 3 for paving portions of various streets. John F. Cleary, cy. clk.

Wahpeton, N. D.—Bids will be received until April 3, 7 p. m., for constructing sidewalks, curbs, gutters and crossings. Clark M. Olson, cy. clk.

Bismark, N. D.—Bids will be received until April 4, 2:30 p. m., for furnishing galvanized or steel culverts. I. M. Healy, audt.

Casselton, N. D.—Bids will be received until April 3 for constructing and repairing sidewalks. Certified check, $50. B. D. Youells, aud.

Grafton, N. D.—Bids will be received until April 3, 1 p. m., for constructing sidewalks, alley crossings, and street crossings. Certified check, $100. J. H. Johnson, audt.

La Moure, N. D.—Bids will be received until April 4 for furnishing sidewalks and curbs at new court house. Certified check, $100. C. J. Alister, audt.

Park River, N. D.—Bids will be received until April 3 for constructing sidewalks, crosswalks, etc. Certified check, $50. F. J. Prochaska, audt.

Canton, O.—Bids will be received until April 6 for paving various streets to cost $43,000. R. F. Hurbert, dir. pub. ser-

Cleveland, O.—Bids will be received until April 3 for furnishing material and laying cement sidewalks for one year. A. B. Lea, dir. pub. ser.

Columbus, O.—Bids will be received until April 5 for grading roadway and constructing approaches to various bridges. F. M. Sayre, audt.

Youngstown, O.—Bids will be received until April 3 for furnishing material and constructing sidewalks. Certified check, $100. H. W. Williams, cy. clk.

Lawton, Okla.—Bids will be received until April 10 for paving about 5 miles rock asphalt, base, concrete curb and gutter. Z. M. Scifres, cy. engr.

Ingram, Pa.—Bids will be received until April 3 for grading, curbing and paving Hodgon ave. D. H. Hainer, clk.

Charleston, S. C.—Bids will be received until April 4 for furnishing and constructing a vitrified brick roadway. J. H. Dingle.

Knoxville, Tenn.—Bids will be received until April 5 for constructing pavement, curbing and guttering various streets. W. P. Chandler, recdr.

Coupeville, Wash.—Bids will be received until April 5 for improving Hinman road No. 32. H. T. Wanamaker, audt.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for paving on S. 18th st. was awarded to the Andrew Asphalt Paving Co., Birmingham, Ala., $49,000.

Birmingham, Ala.—The contract for paving Avenue F, from 18th to 27th sts., with bitulithic was awarded to Southern Bitulithic Co., Birmingham, Ala.

Eutaw, Ala.—The contract for paving the public square and Main st. was awarded to Tuscaloosa Concrete & Construction Co., Tuscaloosa, Ala., $12,000.

Los Angeles, Cal.—The following contracts were awarded: Improving San Pedro st., to Benj. F. Ford, Los Angeles, Cal., $35,295. Improving Rico st., to Barber Asphalt Paving Co., Los Angeles, Cal., $5,621.

Pasadena, Cal.—The contract for paving with oil macadam and constructing cement gutters on Orange Grove ave. was awarded to Cox & Mathews, Pasadena, Cal., $25,838.

Riverside, Cal.—The contract for macadamizing and constructing curbs and gutters on Park ave. was awarded to Johnson Shea Co., Riverside, Cal., $29,-173.

Santa Monica, Cal.—The contract for grading, paving cement curbs, sidewalks and catch-basins on Vicente Terrace Tract was awarded to Fred H. Stout, 4246 S. Grand ave., Los Angeles, Cal.

E. St. Louis, Ill.—The contract for improving Wimmer place and Alexander st. was awarded to O. T. Dunlap, Edwardsville, Ill., $33,790.

Chicago, Ill.—The following contracts were awarded: Furnishing 40,000 sq. yds. of sectional wood pavements to be delivered, to Geo. P. Cullen & Co., 78 La Salle st., Chicago, Ill.

Maywood, Ill.—The contract for paving portions of N. 6th, 9th and 11th aves. with Bessemer block was awarded to A. M. Todd, Maywood, Ill., $65,534.

Moline, Ill.—The contract for paving S. 15th st. with vrick was awarded to Britt & Layden, Davenport, Ia., $27,493.

Elkhart, Ind.—The contract for paving various streets was awarded to Daniels, List & Douglass, Anderson, Ind., $47,280.

Indianapolis, Ind.—The contract for furnishing asphalt for the city plant was awarded to California Asphaltum Sale Agency, R. R. Exchange Bldg., Chicago, Ill.

Jeffersonville, Ind.—The contract for constructing a free gravel road in Owen township was awarded to W. W. Taggart, Jefferson, Ind., $5,868.

Lapel, Ind.—The contract for constructing cement walks along Pendleton ave. was awarded to A. W. Doan, Lapel, Ind., $5,812.

Logansport, Ind.—The contract for constructing Sheetz road in Jefferson township was awarded to J. H. Nulls, Winfield, Ind., $6,743.

Portland, Ind.—The contract for constructing a road on the line between Jay and Randolph counties was awarded to Wallace & Schlechty, Portland, Ind., $17,-749.

Richmond, Ind.—The contract for paving N. D st. was awarded to Trippier & Son, Peru, Ind.; paving N. E st. was awarded to L. P. Meredith, Richmond, Ind., $21,851.

Shelbyville, Ind.—The contract for improving the Ira L. Pritchard road was awarded to C. W. Folger & Co., Columbus, Ind., $10,950.

Wabash, Ind.—The contract for improving Laketon road was awarded to Conover & Tabor, Wabash, Ind., $19,480.

Washington, Ind.—The contract for constructing the Alexander road was awarded to Mathew McGulie, Washington, Ind., $8,940.

Williamsport, Ind.—The contract for constructing a gravel road in Warren township was awarded to Haynes & Wayman, Independence, Ind., $11,439.

Corning, Ia.—The contract for constructing 12,000 sq. yds. of brick paving, 189 sq. yds of concrete paving, 4,232 lin. ft. of combined curb and gutters was awarded to Capitol City Concrete Construction Co., Springfield, Ill.

Muscatine, Ia.—The contract for paving 23,283 sq. yds. with bitulithic, 12,648 lin. ft. combined curb and gutter, etc., was awarded to Wm. Horrabin, Iowa City, Ia.

Manhattan, Kan.—The contract for paving 13,350 sq. yds. with brick, asphalt filler, 1,000 ft. 48-in. gutters, 500 ft. 12-in. face curb, 36 headers and 500 sq. ft. of slabs for crossings was awarded to W. W. Cook & Son, Manhattan, Kan.

Wichita, Kan.—The contract for paving 25 blocks with brick and cement and asphalt filler was awarded to John Ritche & Sons, Topeka, Kan., $46,000.

Louisville, Ky.—The following contracts were awarded: Furnishing 200,000 vitrified blocks, to Peebles Paving Brick Co., Portsmouth, O. Furnishing a quantity of vitrified bricks, to Kentucky Vitrified Brick Co., Louisville, Ky.

Crowley, La.—The contract for constructing 8 miles of 4-ft. cement sidewalks was awarded to De Jersey & Bernard, Crowley, La.

Ft. Andrews, Mass.—The contract for constructing roads, walks, gutters, catch-basins and drains was awarded to Thos. Fitzgibbons, Beverly, Mass., $6,630.

Menominee, Mich.—The contract for constructing bay shore road was awarded to Robert Rick, Menominee, Mich., $12,-634.

St. Paul, Minn.—The contract for constructing cement sidewalks was awarded to St. Paul Cement Works, E. 4th st., $30,000.

Atlantic City, N. J.—The contract for paving Albany and Pennsylvania aves. was awarded to United Paving Co., Atlantic City, N. J., $66,157.

Bernardsville, N. J.—The contract for constructing stone roads with asphaltic binder was awarded to A. C. Denahan, Yardley, Pa., $5,070.

New York City, N. Y.—The following contracts were awarded: Improving Muscouta st., to Ames Transfer Co., Kingsbridge ave., Bronx, $41,638; repairing asphalt block pavement, to Harlin Construction Co., 2 Rector st., New York, $43,235.

Akron, O.—The contract for paving 3½ miles Akron-Hudson road was awarded to Pickett & Faust, Martin's Ferry, O., $75,-000.

Cincinnati, O.—The following contracts were awarded: Furnishing 200 tons of asphalt, to Barber Asphalt Co., Cincinnati, O.; 200 tons of Maltha brand, to Union Oil Co., Los Angeles, Cal.

Wapakoneta, O.—The contract for paving Mechanic st. was awarded to J. E. Conley & Co., Dayton, O., $38,065.

Youngstown, O.—The following contracts were awarded: Crosswalks and sidewalk repairs, to Turner & Olsen; paving Griffith st., to Chas. Harris, $6,383; paving Milicent ave., to James McCarron, $10,343; paving Williamson ave., to H. A. Miller; paving Jefferson st., to Joseph P. Morrison, $11,498; paving Hillman st., to J. M. McCraw, $12,424; paving South ave., to Kennedy Bros.; paving Spring Common bridge approaches, to S. H. DeGroodt, Youngstown, O.

Alva, Okla.—The contract for paving 23,000 sq. yds. with Hassam pavement was awarded to Rackliffe Gibson Construction Co., St. Joseph, Mo.

Wilson, Pa.—The contract for paving

Mendelssohn ave. was awarded to Maynard & Flynn, Pittsburg, Pa., $12,173.

Knoxville, Tenn.—The contract for constructing a road in Hamblen county was awarded to French Bros., Knoxville, Tenn., $15,000.

Lynchburg, Va.—The contract for laying tar macadam on Wist st. was awarded to S. B. Bennington, Lynchburg, Va., $16,517.

Spokane, Wash.—The contract for paving, grading and curbing Hamilton st. was awarded to Barber Asphalt Paving Co., Spokane, Wash., $65,448.

Waterville, Wash.—The contract for constructing 9 miles of county road was awarded to J. J. McNerney, Wenatchee, Wash., $38,000.

Hunt, W. Va.—The contract for laying about 8,500 sq. yds. of vitrified brick on various streets was awarded to Louis S. Lawson, Hunt, W. Va., $25,000.

Huntington, W. Va.—The following contracts were awarded: Constructing 38,000 sq. yds. of street pavement, to Harrison & Dean; 46,000 sq. yds., to Freshwater & Son; and 22,000 sq. yds., to Geo. Hinkle, Huntington, W. Va.

Neenah, Wis.—The contract for constructing tar macadam pavement on S. Commonwealth st. was awarded to Christ Johnson, Oshkosh, Wis., $14,000.

SEWERS.

CONTEMPLATED WORK.

DeQueen, Ark.—Contemplating the construction of a sewer system to cost about $50,000. W. D. Garrison, mayor.

Terra Bella (Plano P. O.), Cal.—Plans are being prepared for the construction of a sewer system. Engineer Althouse, Porterville, Cal.

Bakersfield, Cal.—Plans are being prepared for sewer construction to cost $25,000.

Berkeley, Cal.—Voted $250,000 bonds for storm sewers.

Corning, Cal.—Plans are being prepared for a complete sewer and water system to cost $70,000. Cy. engr.

San Francisco, Cal.—Water works, sewers and street improvements to cost $3,000,000 are contemplated.

Galva, Ill.—Contemplating the construction of a sewer system. W. S. Shields, cy. engr.

Wapella, Ia.—Plans are being prepared for the construction of 5,000 ft. of 10 to 24-in. pipe sewers. J. G. Keck, cy. recdr.

Nevada, Ia.—Plans have been prepared for the construction of a sanitary sewer and disposal plant, to cost $40,000.

Mansfield, La.—Plans are being prepared for the construction of a sewer system. W. E. Singleton, cy. clk.

Fitchburg, Mass.—Plans are being prepared for the construction of a portion of the main intercepting sewer.

Virginia, Minn.—Bids will soon be requested for the construction of a sanitary sewer.

Carthage, Mo.—Plans have been prepared for the construction of a new sewer district. Frank B. Newton, cy. engr.

Gordon, Neb.—Voted bonds for the construction of a sewer and water works system. Cy. coun.

Nebraska City, Neb.—Plans have been prepared for a sanitary sewer to cost about $80,000. Chas. A. Shannon, cy. engr.

Omaha, Neb.—The contract will soon be let for the construction of brick and concrete main sewers to cost $100,000.

Las Vegas, N. M.—Contemplating the construction of sewer system in various streets. Cy. coun.

Syracuse, N. Y.—Contemplating sewer construction to cost $20,000.

Amherst, O.—Plans are being prepared for the construction of gravity sewers and disposal plant. C. S. Aschenback, clk.

Beach City, O.—Bids will soon be requested for constructing sewers to cost about $13,000. H. B. Ward, cy. clk.

Corey, O.—Plans have been prepared for the construction of a sewer system. C. S. Spencer, cy. clk.

East Palestine, O.—Ordinances have been passed providing for the construction of sewers and paving various streets. O. L. Butts, cy. clk.

New Berlin, O.—The construction of a sewerage and water works system is contemplated. Cy coun.

Steubenville, O.—An ordinance has been passed providing for improvement of sewer in the alley between White Market and Belleview boulevard. Cy. coun.

Rosebury, Ore.—Plans are being preparedd for the construction of a sewer system. Cy. engr.

McKees Rocks, Pa.—An ordinance has been passed providing for the construction of a sewer in Jenk alley.

Pittsburg, Pa.—Improvement of the Try st. sewerage system, to cost $144,000, is contemplated. City Council.

Pleasantville, Pa.—Contemplating the construction of a sewage disposal plant.

Ft. Worth, Tex.—Contemplating the construction of storm sewers to cost about $120,000. W. J. Estes, cy. sec.

Wennewick, Wash.—Voted $20,000 bonds for the construction of a sewer system.

Battleford, Alberta, Can.—The construction of a sewerage system is contemplated.

CONTRACTS TO BE LET.

Clinton, Ia.—Bids will be received April 4 for constructing lateral sewers consisting of 2,543 ft. of 10- to 36-in. pipe sewer, 14,800 cu. yds. rock excavation, 76 manholes, 62 catch basins, 122 inlet basins. W. E. Hayes, cy. clk.

Brainard, Minn.—Bids will be received until April 17, 1 p. m., for constructing sewers. V. N. Broderick, cy. clk; certified check 15 per cent.

South Orange, N. J.—Bids will be received until April 11 for constructing 18,618 ft. of 8 to 12-in. sanitary sewers, 59 manholes, 4 flush tanks. Certified check, $5,000. Edward Arcularius, town clk.

East Aurora, N. Y.—Bids will be received until April 18, 8 p. m., for furnishing material and constructing a sewer system and sewage disposal plant. Certified check 2 per cent. Bd. trus., D. N. Rumsey, clk.

Amherst, O.—Bids will be received until April 20 for constructing sewage disposal plant and a sewer system. City council.

Berea, O.—Bids will be received until April 24 for furnishing material and constructing a sewer in Waite st., including manholes, etc. Certified check, $100. O. R. Stone, clk.

Cleveland, O.—Bids will be received until April 5 for constructing sewer system. John Goldenbogen.

Youngstown, O.—Bids will be received until April 10 for sewer construction. Certified check, $300. James E. Sottler, cy. clk.

Chambersburg, Pa.—Bids will be received until April 10, 8 p. m., for constructing a system of sanitary sewers, a main outfall sewer and sewage disposal plant, consisting of the following: 84,700 ft. of from 8 to 24-in. terra cotta pipe, manholes, Y branches and accessories.

460 cu. yds. concrete or retaining walls, 1,400 ft. of 20 to 30-in. concrete sewer, 72 ft. 24 in. cast iron pipe, 900 ft. 16-in. force main, 960 ft. 12-in. cast iron siphon line, 1 pump house and collecting valve, equipped with three electric-driven centrifugal pumps, capacity 1,000 gal. per min.; 5 concrete settling tanks, 1 sprinkling filter bed, 160 ft. by 125; 1 sand filter for sludge, grading and other work. Certified check, 5 per cent. S. K. Shryock.

Moose Jaw, Sask., Can.—Bids will be received until April 10 for furnishing and laying about 30,700 lin. ft. tile pipe sewer, manholes, etc. W. F. Heal, cy. clk.

Saskatoon, Sask., Can.—Bids will be received until April 14 for furnishing material and constructing intercepting sewer. James Clinkskill, mayor.

CONTRACTS AWARDED.

Calexico, Cal.—The contract for constructing sewer system was awarded to Watson & Spicer, Colorado Springs, Colo., for $26,600.

Fresno, Cal.—The constract for constructing main sewers was awarded to Jos. House, Fresno, Cal., for $37,900.

San Francisco, Cal.—The contract for constructing sewers in Section B of Sunnyside sewer was awarded to F. Rolandi, 550 Montgomery st., San Francisco, Cal., for $59,403.

Turlock, Cal.—The contract for sewer construction was awarded to E. E. Paxson, Turlock, Cal., for $8,668.

Washington, D. C.—The contract for constructing various sewers was awarded to Warren T. Brenizer Construction Co., Washington, D. C., for $13,745.

Atlanta, Ga.—The following contracts were awarded: Constructing the Intrenchment creek disposal plant, to Chester A. Dady, New York City, N. Y., for $171,818; constructing intercepting sewer, to Moll Construction Co., Atlanta, Ga., for $65,663; constructing DuBois aqueduct, to Nichols Construction Co., for $7,170; constructing the Collier aqueduct, to Mackle-Crawford Co., for $7,400; constructing the Parker aqueduct, to Dysard Construction Co., for $5,400.

Pocatello, Ida.—The contract for furnishing material and constructing sewer system was awarded to R. M. Bardsen & Co., Pocatello, Ida., for $69,493.

Bement, Ill.—The contract for constructing storm sewer system was awarded to Arthur Bert, Decatur, Ill., for $22,145.

LaGrange, Ill.—The contract for constructing an outlet sewer was awarded to H. McNichols, 217 LaSalle st., Chicago, Ill., for $95,107.

Paris, Ill.—The contract for furnishing and laying about 4,544 ft. 36 and 60-in. reinforced concrete or brick sewer, including 10 manholes, was awarded to Frank Payne, Paris, Ill., for $14,980.

Rock Island, Ill.—The contract for constructing Seventh ward sewer was awarded to D. Keeler Co., Davenport, Ia., for $55,697.

Elkhart, Ind.—The contract for constructing one mile of pipe sewers was awarded to Frank J. Miller, Elkhart, Ind., for $6,782.

Mt. Vernon, Ia.—The contract for constructing tower and outlet sewers, for $22,106.75, and septic tank and dosing chamber and filter beds, for $6,486.82, was awarded to Henning-Vineyard Co., Evansville, Ind.

Sac City, Ia.—The contract for sewer construction was awarded to Lytle Construction Co., Sioux City, Ia., for $5,205.

Sigourney, Ia.—The contract for constructing sanitary sewers was awarded to Bash & Gray, Joplin, Mo., for $39,741.

Baltimore, Md.—The following contracts were awarded: Laying trunk sewer in Pratt st., to McCoy Engineering Co., Baltimore, Md., for $85,751; lateral sewers in district No. 15, to William McCortley & Co., Baltimore, Md., for $75,187.

Niles, Mich.—The contract for constructing a main trunk sewer in various streets was awarded to Heystek Co., Kalamazoo, Mich., for $18,879.

St. Paul, Minn.—The contract for constructing storm sewer on Grove st. was awarded to John Lind, St. Paul, Minn., for $12,500.

Sedalia, Mo.—The contract for constructing South-East Sedalia sewer and septic tank was awarded to W. E. Hall, Clinton, Mo., for $40,000.

Tracy, Minn.—The contract for sewer construction was awarded to G. S. Redmon, Pipestone, Minn., for $5,500.

Kansas City, Mo.—The contract for constructing storm water sewer, to extend from Winchester ave. to Blue river, was awarded to Michael Walsh, Kansas City, Mo.

Jamaica, L. I., N. Y.—The contract for constructing sewer in Liberty and Stoothoff aves. was awarded to Litchfield Construction Co., Jamaica, L. I., N. Y., for $51,395.

Canton, O.—The contract for constructing storm water sewer was awarded to Calvin Turnbull and Joseph Delm, Canton, O., for $25,528.

Cleveland, O.—The contract for constructing a portion of the West 25th st. main sewer was awarded to William Lehmann, Cleveland, O., for $28,107.

Niles, O.—The contract for constructing main trunk sewer was awarded to C. H. Defrees, South Bend, Ind., for $22,000.

Erie, Pa.—The following contracts were awarded: Constructing a sewer in Cranberry st., to J. & M. Doyle, Erie, Pa.; Mill creek intercepting sewer, to V. D. Eichenlaub, Erie, Pa., $10,415.

Charleston, S. C.—The contract for sewer construction was awarded to Guild & Co., Chattanooga, Tenn., for $51,639.

Dallas, Tex.—The contract for laying a storm sewer in Columbia ave. was awarded to Dallas Lime and Gravel Co., Dallas, Tex., for $9,097.

Moundsville, W. Va.—The contract for constructing sewerage system was awarded to B. F. Sweeten & Son, Camden, N. J., for $121,180.

Milwaukee, Wis.—The contract for constructing sanitary sewers was awarded to Mullholland & Son, Kaukauna, Wis., for $9,062.

WATER WORKS.

CONTEMPLATED WORK.

Huntsville, Ala.—Contemplating the construction of a purification plant for the water works system. City council.

Corning, Cal.—Plans are being prepared for a complete sewer and water system to cost $70,000. Cy. engr.

Dorris, Cal.—Contemplating the construction of a municipal water works.

San Luis Obispo, Cal.—Plans have been prepared for the construction of a 5,700,000-gallon earthen reservoir.

San Francisco, Cal.—Water works, sewers and street improvements to cost $3,000,000 contemplated.

Ft. Lupton, Colo.—Contemplating the construction of water works system.

St. Petersburg, Fla.—Contemplating the construction of a reservoir. Water works com.

Titusville, Fla.—Voted $30,000 bonds for construction of water works. City council.

Pelham, Ga.—Contemplating water works improvements. City council.

New Athens, Ill.—Plans are being prepared for water works system to cost about $28,000.

Evansville, Ind.—Contemplating the installation of a water works pump to cost about $10.000. Bd. pub. wks.

Monticello, Ind.—Improvements to the water works are contemplated. Bd. pub. wks.

Canton, Kan.—Plans are being prepared for the construction of water works system. C. M. Gray, cy. clk.

Luray, Kan.—Voted $20,000 bonds for water works construction. P. E. Moss, cy. clk.

Owensboro, Ky.—Plans have been prepared for the construction of a water softening plant.

Mingo, Ky.—Contemplating the construction of a water works system.

Butterfield, Minn.—Contemplating the construction of a water works system. City council.

Moberly, Mo.—The construction of about 8,000 ft. of 6-in. water main is contemplated. S. McDonald, cy, engr.

Gordon, Neb.—Voted bonds for the construction of sewer and water works system. City council.

Morrill, Neb.—Information is requested for prices, etc., on pumping plants for irigation. A lift of 10 to 30 ft. contemplated, to irrigate about 1,000 acres. H. A. Mark, Morrill, Neb.

Albuquerque, N. Mex.—The laying of water mains in various streets is contemplated.

Jamestown, N. Y.—Contemplating the construction of a storage reservoir with a capacity of 15,000,000 gallons.

Mount Morris, N. Y.—Voted $100,000 bonds for water works construction.

Syracuse, N. Y.—Contemplating the expenditure of $25,000 for water works improvements.

Canton, O.—An ordinance has been passed providing for water works improvements, including a reservoir to cost $40,000.

New Berlin, O.—The construction of a sewerage and water works system is contemplated. City council.

Springfield, O.—Contemplating the extension of water mains. City council.

Stonewall, Okla.—Voted $30,000 bonds for water works construction.

Schuylkill Haven, Pa.—Voted $50,000 bonds for the construction of an additional reservoir.

Rusk, Tex.—Voted $18,000 bonds for water works construction.

Park City, Utah.—Plans have been prepared for the construction of a water works system.

Marcus, Wash.—Contemplating the construction of wâter works and electric system.

Battleford, Alberta, Can.—The construction of water works is contemplated.

Welland, Ont.—Voted $52,000 bonds for water works construction.

CONTRACTS TO BE LET.

Ft. Baker, Cal.—Bids will be received until April 4 for constructing pump house, installing machinery, laying water mains and erecting steel water tank. Maj. Geo. McK. Williamson, Ft. Mason, Cal.

Ft. McKinley (Portland P. O.), Me.—Bids will be received until April 15 for constructing and installing a chemical water softening plant of 15,000 gals. capacity per hour. Capt. Joseph F. Gohn, Portland, Me.

Helena, Mont.—Bids will be received until April 20 for constructing water works reservoir pipe line and distributing system. J. A. Mattson, cy. clk.

Keeseville, N. Y.—Bids will be received until April 5 for laying cast iron pipe and constructing a reservoir and standpipe, etc. Bd. wat. comrs.

Cleveland, O.—Bids will be received until April 4 for furnishing material and constructing an elevated steel water tower. Certified check, $1,000. E. R. Lieblein, clk.

Ada, Okla.—Bids will be received until April 15 for constructing water works. Estimated cost, $140,000. W. B. Jones, cy. clk.

Galveston, Tex.—Bids will be received until April 3 for furnishing material and constructing about 10,766 lin. ft of 30-in. water main. Certified check, 5 per cent. Bd. of cy. comrs. John D. Kelley, cy. sec.

Moose Jaw, Sask., Can.—Bids will be received until April 10 for furnishing and laying about 29,700 lin. ft. cast iron water main. W. F. Heal, cy. clk.

Rouleau, Sask., Can.—Bids will be received until April 4 for furnishing pumping and electrical machinery, producer gas plant, cast iron or steel water mains, valves, etc. W. H. Stewart, cy. sec.

CONTRACTS AWARDED.

Alameda, Cal.—The contract for furnishing a new boiler for the municipal electric plant was awarded to Risdon Iron Works, San Francisco, Cal., for $5,585.

Ontario, Cal.—The following contracts were awarded: Laying water pipes, to Joe Clintok, Los Angeles, Cal., for $18,882; screw pipe and specials, to Cram Co., Los Angeles, for $70,375; riveted pipe and specials, to Western Pipe and Steel Co., Los Angeles, Cal., for $16,398.

San Francisco, Cal.—The contract for furnishing, testing and delivering gate and check valves, was awarded to Union Machine Co.; bolts, tie rods, etc., for water system, to Union Iron Works, San Francisco, Cal.

Turlock, Cal.—The contract for water works improvements was awarded to William Heafly, San Francisco, Cal., for $16,431.

Dalton, Ga.—The contract for constructing reinforced concrete reservoirs and filters was awarded to John W. Ash, Austell, Ga., $16,500.

Apple River, Ill.—The contract for constructing water works was awarded to T. H. Iglehart, Chicago, Ill., for $15,400.

Chicago, Ill.—The contract for furnishing and installing two electrically driven centrifugal pumps was awarded to Platt Iron Works, Dayton, O., for $53,940.

Joliet, Ill.—The contract for furnishing pumping machinery for artesian well was awarded to Hill-Tripp Pump Co., Anderson, Ind., for $5,985.

Adair, Ia.—The contract for constructing a combined electric light and water works plant was awarded to Des Moines Bridge and Iron Co., Des Moines, Ia., for $28,469.

Corydon, Ia.—The contract for water

works construction was awarded to Bash & Gray, Joplin, Mo., for $26,892.

Jefferson, Ia.—The contract for water works construction was awarded to C. W. Roland & Co., Des Moines, Ia., for $6,200.

Iola, Kan.—The contract for installing three new boilers was awarded to United Iron Works, Iola, Kan., for $6,844.

Fall River, Mass.—The contract for furnishing 172,000 ft. of 6 to 12-in. water pipe was awarded to R. D. Wood & Co., 400 Chestnut st., Philadelphia, Pa.

Minneapolis, Minn.—The following contracts were awarded: Fnrnishing 250 tons of special castings, to Diamond Iron Works, Minneapolis, Minn.; 1,000,000 red sand sewer brick, to Wisconsin Red Pressed Brick Co., Minneapolis, Minn.; sewer pipe, to Red Wing Sewer Pipe Co., Minneapolis, Minn., for $65,900.

Two Harbors, Minn.—The contract for installing pump at water works was awarded to La Vasque & Webster, Duluth, Minn., $11,042.

Bozeman, Mont.—The contract for enlarging reservoir was awarded to S. Birch & Sons Construction Co., Bozeman, Mont., for $6,972.

Great Falls, Mont.—The contract for furnishing 135 tons of 12-in. water pipe and specials was awarded to American Cast Iron Pipe Co., Birmingham, Ala.

Hurlowtown, Mont.—The following contracts were awarded: Constructing a reservoir, capacity 250,000 gals, and furnishing and laying 3,550 ft. 8-in. and 400 ft. 6-in. water mains, with hydrants, valves, etc., to R. M. Bordsen, Butte, Mont., for $7,800.

Townsend, Mont.—The contract for constructing water works was awarded to W. D. Lovell, Minneapolis, Minn., for $24,778.

Buffalo, N. Y.—The contract for furnishing 3 steam turbine electric generators for pumping station was awarded to Westinghouse Electric Co., Buffalo, N. Y., for $240,000.

Fort Terry, N. Y.—The contract for constructing a 200,000-gal. reinforced concrete reservoir was awarded to Connecticut Engineering Co., Norwich, Conn., for $6,750.

Hornell, N. Y.—The contract for constructing an earthen reservoir embankment, with concrete core wall and all accessories was awarded to Gary & Miller, Hornell, N. Y., for $39,420.

Canton, O.—The contract for constructing a 1,000,000-gal. reservoir was awarded to Chicago Bridge and Iron Co., Chicago, Ill., for $23,000.

Cincinnati, O.—The contract for laying water main in North Bend road, from Cheviot to College Hill, was awarded to J. J. Brown, Cincinnati, O., for $14,274.

Toledo, O.—The contract for constructing extensions to water purification plant was awarded to Norwood Engineering Co., Florence, Mass.

Zanesville, O.—The contract for constructing water works system was awarded to National Co., South Bend, Ind., for $62,164.

Haskell, Okla.—The contract for constructing water works was awarded to F. R. Stone, Haskell, Okla., for $28,200.

Hamilton, Tex.—The contract for furnishing 9,000 ft. of cast iron pipe, valves, etc., was awarded to American Cast Iron Pipe Co., Birmingham, Ala.

Temple, Tex.—The following contracts were awarded: Furnishing equipment for filtration plant, to Pittsburg Filter Co., Pittsburg, Pa.; construction work to W. C. Rittiger, Belton, Tex. Total cost, $27,190.

Ogden, Utah.—The contract for constructing a conduit from Cold Water canyon to city reservoir was awarded to J. P. O'Neil Construction Co., Ogden, Utah, for $67,463.

White Bluffs, Wash.—The contract for furnishing 50,000 ft. 12-in. wood standpipe was awarded to Pacific Pipe and Tank Co., Portland, Ore.

Sparta, Wis.—The contract for furnishing 1,500,000-gal. high duty pumping engine was awarded to Allis-Chalmers Co., Milwaukee, Wis., for $6,950.

Sheridan, Wyo.—The contract for installing water works system was awarded to Jas. Kennedy Contracting Co., Fargo, N. D., for $30,000.

Winnipeg, Man.—The contract for constructing a 1,000,000-gal. reservoir was awarded to I. Benoit, St. Boniface, Man., for $32,000.

BRIDGES.

CONTEMPLATED WORK.

Warren, Ark.—Contemplating the construction of a bridge across the Saline river at Reddings Ferry.

Los Angeles, Cal.—Contemplating the construction of a bridge across the Aroyo Seco at Garvanza, to cost $150,000.

Modesto, Cal.—Contemplating the construction of a bridge to cost $15,000 to replace one destroyed by high water.

Stockton, Cal.—Contemplating the construction of 25 bridges and culverts. R. M. Morton, highway engr.

Denver, Colo.—Contemplating the construction of a bridge over Platte river at Alameda ave., to cost about $49,000. J. B. Hunter.

Washington, D. C.—Plans have been prepared for the construction of a bridge across Rock creek, to cost $275,000.

Vinton, Ia.—Contemplating the construction of a number of concrete bridges and culverts. County comrs.

Valencia, Kan.—Contemplating repairing the bridge over Kansas river, to cost about $15,000.

Boston, Mass.—Plans are being proposed for the construction of a steel bridge to cost $125,000.

Lynn, Mass.—Plans are being prepared for the construction of a steel bridge over the Sangus river. W. Moody co. comr.

Baraga, Mich.—The construction of a steel bridge, 163 ft. long, to span the Sturgeon river, is contemplated.

Saginaw, Mich.—Contemplating the construction of a bridge 600 ft. long, to cost about $85,000. R. W. Roberts, cy. engr.

Rolla, Mo.—Contemplating the construction of a steel bridge across the Little Piney river, south of Newbury.

Virginia City, Mont.—The construction of a bridge over Jefferson river, near Silver Star, is contemplated. County comrs.

Claremore, Okla.—Contemplating the construction of 5 new bridges in Rogers Co. Co. clk.

Jacksonville, Ore.—Plans have been prepared for the construction of a bridge over Rogue river, at Gold Hill.

Fulton, N. Y.—Contemplating the construction of a concrete bridge, 50 ft. wide, with steel reinforcements, to cost about $170,000.

Syracuse, N. Y.—Contemplating the construction of a bridge to cost $80,000.

Chester, Pa.—Contemplating the construction of a bridge over Doe Run creek, near Springdale, in Chester Co.

Kittanning, Pa.—Contemplating the construction of a bridge over Rough run, near Winfield.

Pittsburgh, Pa.—Bids will soon be requested for the construction of the piers of the new Point bridge. Estimated to cost about $210,000. Bd. pub. wks.

Burnet, Tex.—Contemplating the construction of a bridge across the Colorado river. Co. comrs.

Menardville, Tex.—Contemplating the construction of a steel bridge across the San Saba river, to cost $20,000. Co. comrs.

Brigham, Utah.—Bids will soon be requested for the construction of a bridge over Box Elder canyon. Co. comrs.

Richfield, Utah.—The construction of a bridge over the Sevier river, between Redmond and Salina, is contemplated.

Milwaukee, Wis.—The construction of a pontoon bridge across the Milwaukee river at Oneida street is contemplated.

CONTRACTS TO BE LET.

Auburn, Cal.—Bids will be received until April 4 for constructing a steel bridge across the North Fork of American. Bd. of Supervisors, Placer Co., Cal.

Mackay, Ida.—Bids will be received until April 8 for constructing a steel bridge across Salmon river. Bd. cy. comrs.

Brazil, Ind.—Bids will be received until April 4 for constructing a bridge at Clay City. Edgar A. Stags, audt.

Ida Grove, Iowa—Bids will be received until April 3 for plans and construction of steel bridges in Ida Co. Bd. of supervisors.

Lagrange, Ind.—Bids will be received until April 5 for constructing 5 concrete and iron bridges and one wooden pile bridge. C. S. Willard, audt.

Rockport, Ind.—Bids will be received until April 5 for constructing 25 bridges. John T. White, audt.

Shelbyville, Ind.—Bids will be received until April 5 for constructing 4 reinforced concrete bridges. G. B. Huntington, audt.

Vincennes, Ind.—Bids will be received until April 8, 10 a. m., for constructing 3 bridges in Knox Co. John T. Scott, audt.

Clinton, Ia.—Bids will be received until April 11 for constructing a concrete steel culvert or bridge at waterway on 4th and Lumber sts. Bond $500 required. W. E. Hayes, cy, clk.

Hill City, Kan.—Bids will be received until April 4, 12 m., for constructing a bridge. Ben S. Smith, co. clk.

Cando, N. D.—Bids will be received until April 4 for constructing 150 ft. more or less of steel and concrete bridge. Certified check, $500. Frank Shanley, audt.

Xenia, O.—Bids will be received until April 12, 11:30 a. m., for constructing superstructure and approaches of the Louis Hill bridge. Board county commissioners.

Allentown, Pa.—Bids will be received until April 3 for repairing five wooden bridges. Board of commissioners.

Chambersburg, Pa.—Bids will be received until April 14 for constructing a reinforced concrete bridge over Muddy run at Rankin's Mill in Antrim township. Certified check, $500. E. K. Raff, clk.

Reading, Pa.—Bids will be received until April 4 for constructing 3 reinforced concrete bridges. County commissioners.

Kingston, Ont.—Bids will be received until April 5 for constructing the Catassaqui Bridge to cost about $18,000. H. B. R. Craig, cy. engr.

Minnitonas, Man.—Bids will be received until April 15 for furnishing and erecting a Warren truss steel bridge and two concrete piers. E. Widmeyer, secy.

Swan River, Man.—Bids will be received until April 15 for erecting a 94-ft. steel riveted Pratt truss bridge over Wood river. Joseph Armstrong, secy.

Winnipeg, Man.—Bids will be received until April 15 for constructing a 94-ft. steel riveted Pratt truss bridge. Municipal council. Joseph Armstrong, secy.

CONTRACTS AWARDED.

Corona, Cal.—The contract for constructing concrete piers on two bridges was awarded to Newton Construction Co., San Diego, Cal.

Fairmount, Ill.—The contract for constructing a bridge over Salt Fork river, was awarded to R. C. Spandau, Danville, Ill., $6,995.

Morris, Ill.—The contract for constructing a bridge over the stream between sections 23 and 24 in Grundy co., was awarded to Joliet Bridge & Iron Co., Joliet, Ill.

Greenfield, Ind.—The contract for constructing bridges in Hancock county, was awarded to Greenfield Bridge & Sewer Co., Greenfield, Ind.

Laporte, Ind.—The contract for constructing 3 iron bridges, was awarded to Rochester Bridge Co., Rochester, Ind.; constructing concrete abutments, was awarded to William A. Steigely, Laporte, Ind.

Waterloo, Ia.—The contract for constructing a 60-ft. extension to the east approach of the city bridge, was awarded to Retzinger, Waterloo, Ia.

Waverly, N. Y.—The contract for bridge construction was awarded to Climax Road Construction Co., Marathon, N. Y., $17,797.

Graham, Tex.—The contract for constructing bridge across Brazos river in Young county, to have four 185-ft. steel spans, 16-ft. road and concrete piers, etc., was awarded to M. S. Hasie, Jr., Dallas, Tex., $17,000.

Spokane, Wash.—The contract for construction of a reinforced concrete bridge over Latah creek, was awarded to C. F. Graff, Seattle, Wash., $42,900.

Menominee, Wis.—The contract for bridge construction, was awarded to Wausau Iron Co., Menominee, Wis., $24,468.

STREET LIGHTING.

CONTEMPLATED WORK.

Albertsville, Ala.—Voted $7,000 bonds for the construction of an electric light plant.

Albany, Ga.—Contemplating the construction of a gas plant. City council.

Doerum, Ga.—Voted $15,000 bonds for the construction of an electric light plant.

Pelham, Ga.—Contemplating lighting plant improvements. City council.

Ft. Wayne, Ind.—Contemplating installing tungsten or magnetite system of illumination on Calhoun st.

Canton, Kan.—Plans are being prepared for the construction of an electric light plant. C. M. Gray, cy. clk.

Kansas City, Kan.—Voted $350,000 bonds to purchase and construct a municipal electric light plant.

Spearville, Kan.—Contemplating the construction of an electric light plant.

Jeffersontown, Ky.—Contemplating the installation of a lighting plant to cost about $15,000.

Sterling, Mass.—The installation of an electric light system is contemplated.

Hillsdale, Mich.—Contemplating the construction of an electric light system.

Clinton, Minn.—Contemplating the installation of an electric light plant.

Tylertown, Miss.—Contemplating the construction of a lighting system.

Franklin, Neb.—Voted $8,000 bonds for the construction of an electric light plant. W. E. Donner, Grand Island, engr.

Gordon, Neb.—Voted bonds for the installation of an electric light plant. City council.

Olean, N. Y.—Contemplating the construction of a municipal lighting plant. Geo. M. Lundry, cy. clk.

Akron, O.—Contemplating the construction of a municipal electric light plant.

Dalles, Oreg.—Contemplating the construction of an electric light plant.

Hazeldell, Pa.—The construction of a municipal electric light plant is contemplated.

Royersford, Pa.—Contemplating the construction of a municipal electric light plant.

Draper, S. D.—Contemplating the installation of an electric light plant.

Hayti, S. D.—The installation of an electric light plant is contemplated.

Miller, S. D.—Contemplating the installation of a new 100-h. p. boiler and tungsten street lighting system.

Big Sandy, Tenn.—The construction of an electric light plant is contemplated.

Shelbyville, Tenn.—Contemplating installing a municipal electric light plant.

Brownsville, Tex.—Voted $15,000 bonds for extending electric light plant.

Marcus, Wash.—Contemplating the construction of water works and electric light system.

White Bluffs, Wash. — Contemplating the installation of an electric lighting system.

Baraboo, Wis.—Plans have been prepared for the construction of an electric light plant, to cost $45,000.

CONTRACTS TO BE LET.

Eveleth, Minn.—Bids will be received until April 4 for furnishing ornamental street lights for 6 blocks. D. P. McIntyre, cy. clk.

Omaha, Neb.—Bids will be received until April 11 for lighting streets for periods of both 3 and 5 years. City council.

Cincinnati, O.—Bids will be received until April 3 for lighting by electricity the streets, lands, lanes and squares and public places for a period of ten years. Certified check, $100,000. John J. Wenner, clk.

CONTRACTS AWARDED.

Phoenix, Ariz.—The following contracts were awarded: furnishing * motors and transformers to Wagner Electric Mfg. Co., St. Louis, Mo., $7,778; furnishing switchboards, to Westinghouse Electric & Mfg. Co., Chicago, Ill., $1,411.

Staunton, Ill.—The contract for installing electrical apparatus in municipal electric light plant was awarded to Wesco Supply Co., St. Louis, Mo., $6,725.

Adair, Ia.—The contract for constructing a combined electric light and water works plant, was awarded to Des Moines Bridge & Iron Co., Des Moines, Ia., $28,469.

Annapolis, Md.—The contract for furnishing electric current for lighting various sections of the city for five years, was awarded to Consolidated Gas & Electric Light Co., Baltimore, Md.

West Caldwell, N. J.—The contract for furnishing electric light for 3 years, was awarded to Public Service Electric Co., West Caldwell, N. J.

Yonkers, N. Y.—The contract for lighting streets for five years, was awarded to Westchester Lighting Co., Yonkers, N. Y.

Coraopolis, Pa.—The following contracts were awarded for furnishing machinery for municipall electric light plant: One 225-h. p. engine, to Buckeye Engine Co.; two engines, one 150-h. p. and the other 175-h. p., to Cruthers Wells Co.; three generators, to Crocker Wheeler Co.; and for a switchboard, to Westinghouse Electric Co., Coraopolis. Pa.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Lexington, Ky.—Bids will soon be requested for sweeping and cleaning all the improved sts. in the city, and furnishing and spreading 170,000 gallons of Ragland oil on the macadam sts. Board public works.

Cincinnati, O.—Contemplating the construction of a municipal reduction plant. Mayor Schwab.

Erie, Pa.—Charles Carroll Brown, consulting engr., 407 Commercial Club Bldg., Indianapolis, Ind., has been engaged to prepare plans and specifications for the construction of a garbage disposal plant to cost $52,000.

Seattle, Wash.—Contemplating the construction of a garbage incinerator to cost about $125,000.

Milwaukee, Wis.—The purchase of four flushing machines for street cleaning, is contemplated. J. J. Handley, supt.

Racine, Wis.—The construction of a Decarie garbage incinerator has been recommended by the special committee appointed for that purpose.

CONTRACTS AWARDED.

Waterbury, Conn.—The contract for collecting garbage for the year, was awarded to Hans Rassmussen, Waterbury, Conn., $12,000.

Cloquet, Minn.—The contract for furnishing a chemical fire engine, was awarded to W. S. Nott Co., Cloquet, Minn.

Fort Omaha, Neb.—The contract for constructing a garbage crematory, was awarded to Morse Boulger Destructor Co., 39 Cortlandt st., New York City, N. Y.

Schenectady, N. Y.—The contract for furnishing three new machines for sweeping streets, to Austin Western Co., Schenectady, N. Y.

FIRE APPARATUS.

CONTEMPLATED WORK.

Riverside, Cal.—The purchase of double jacket 3½-in. rubber-lined fire hose is contemplated.

Ansonia, Conn.—The purchase of a combination truck is contemplated.

Terryville, Conn.—Contemplating the purchase of a chemical engine, truck and fire hose and will establish and equip a fire department.

Brunswick, Ga.—The purchase of an auto truck is contemplated.

Belvidere, Ill.—Contemplating the purchase of an auto truck.

Bloomington, Ill.—The purchase of an auto truck is contemplated.

Waukegan, Ill.—The purchase of an auto truck has been recommended by the water committee.

Brunswick, Me.—The purchase of fire hose is contemplated.

Andover, Mass.—The purchase of a motor chemical is contemplated.

Bridgewater, Mass.—The purchase of fire hose is contemplated.

Cambridge, Mass.—The purchase of an auto chemical and hose truck is contemplated.

Chicopee, Mass.—The purchase of auto fire apparatus is contemplated.

Easthampton, Mass.—The board of engineers have recommended the purchase of an auto chemical and hose wagon.

Leominster, Mass.—The purchase of an auto chemical and hose wagon is contemplated.

Monson, Mass.—Contemplating the purchase of a motor-driven combination truck.

Saugus, Mass.—Contemplating the purchase of a combination chemical wagon.

Wakefield, Mass.—The purchase of an auto fire engine has been recommended by Chief Chase.

Weymouth, Mass.—The purchase of an auto combination chemical wagon is contemplated.

Flint, Mich.—The purchase of an aerial truck is contemplated.

Minneapolis, Minn.—The purchase of a high-speed emergency chemical and hose wagon is contemplated.

Anaconda, Mont.—Contemplating the purchase of more fire hose.

Hinsdale, N. H.—The purchase of fire hose is contemplated.

Long Branch, N. J.—The purchase of a fire engine is contemplated.

Millville, N. J.—The purchase of 1,000 ft. of fire hose is contemplated. Chief Ludlam.

Newark, N. J.—The purchase of another fire truck is contemplated.

Nutley, N. J.—The purchase of an auto truck is contemplated.

Phillipsburg, N. J.—Contemplating the purchase of a chemical engine.

Union, N. J.—The purchase of 1,000 ft. of fire hose, is contemplated. Robert Bond, fire chief.

Sea Cliff (L. I.), N. Y.—The purchase of a chemical fire engine is contemplated.

Seneca Falls, N. Y.—The purchase of a fire hose wagon is contemplated.

Cincinnati, O.—Bids will soon be requested for furnishing an auto fire engine.

Cleveland, O.—Contemplating the purchase of auto hose trucks with turrets for high pressure work. Chief Wallace.

Lorain, O.—Contemplating the purchase of an auto apparatus.

Mansfield, O.—The purchase of an auto combination chemical and a chief's auto, is contemplated. Chief Geo. Kofflock.

Warren, O.—An ordinance to issue bonds for the purchase of an auto combination hose and ladder truck and chemical fire engine has been passed. City council.

Astoria, Ore.—Contemplating the purchase of an auto chemical 800 gallons engine and pumping engine, combination chemical tank, two fire tugs, etc. Chief C. E. Foster.

Erie, Pa.—The purchase of motor trucks and fire engines is contemplated.

Hatboro, Pa.—Contemplating the purchase of a chemical fire engine.

Pawtucket, R. I.—The purchase of a gasoline motor fire engine is contemplated.

Woonsocket, R. I.—The purchase of an auto fire engine is contemplated.

Charleston, S. C.—The purchase of an auto combination chemical and hose wagon has been recommended by Chief Behrens.

Salt Lake City, Utah—Contemplating the following: A triple combination auto, hose pump and chemical for general service; water tower not less than 75 ft., equipped; three new hose companies be organized and equipped; all hose wagons to be rubbed-tired and that 35-gallon extinguishers be placed on all hose wagons and trucks, except aerial trucks; to buy 2½-in. hose up to 25,000 ft.; to install 6 additional alarm boxes, and to build 2 12x16-ft. cisterns in the business district.

Montpelier, Vt.—Contemplating the purchase of a chemical engine.

Aberdeen, Wash.—Contemplating the purchase of a fire-tug.

Racine, Wis.—The purchase of a truck and fire hose has been recommended by Chief Cape.

Ottawa, Ont.—Contemplating the purchase of auto equipment.

CONTRACTS TO BE LET.

Los Angeles, Cal.—Bids will be received until April 3 for furnishing a motor-propelled aerial hook and ladder truck. Lorin A. Handley, cy. clk.

Paterson, N. J.—Bids will be received until April 21 for furnishing auto hook and ladder outfit and converting 2 first-class fire engines into gasoline-propelled vehicles. E. M. Updike.

Princeton, N. J.—Bids will be received until July 5 for furnishing auto pumping engine. E. M. Updike, chr. fire and water commission.

New York, N. Y.—Bids will be received until April 3 for furnishing and delivering two 75-ft. aerial hook and ladder trucks. R. Waldo, fire commissioner.

Tacoma, Wash.—Bids will be received until April 6 for furnishing a third-size fire enginee. L. W. Roys, commissioner public service.

CONTRACTS AWARDED.

Hartford, Conn.—The contract for furnishing auto combination car and auto for officers of fire department, was awarded to Pope Mfg. Co., Hartford, Conn.

Washington, D. C.—The contract for furnishing an auto combination enginee, chemical hose cart and truck, was awarded to Watrous Engine Works Co., St. Paul, Minn., $6,950.

Millville, N. J.—The following contracts were awarded: furnishing 500 ft. fire hose, to Eureka Fire Hose Co., Boston, Mass.; 500 ft. to New Jersey Car Spring and Rubber Co., Jersey City, N. J.

Perth Amboy, N. J.—The contract for furnishing third-class steamer and combination hose and chemical wagon, was awarded to American La France Engine Co., Elmira, N. Y., $8,425.

White Plains, N. Y.—The contract for furnishing Locomobile Combination auto chemical and hose wagon, was awarded to Chas. Paul, White Plains, N. Y., $6,000.

Pawtucket, R. I.—The contract for furnishing an auto fire apparatus, was awarded to Webb Fire Apparatus Co., St. Louis, Mo.

Columbia, S. C.—The contract for furnishing auto hose wagon and chemical engine and auto fire enginee, was awarded to Webb Co. and American La France Co., Elmira, N. Y.

Municipal Engineering

VOLUME XL | MAY, NINETEEN HUNDRED ELEVEN | NUMBER FIVE

Contracting Practice

By DeWitt V. Moore, M. Am. Soc. Eng. Cont., Indianapolis, Ind.

A COMPLETE practical outline of practice from the time of preparation of an estmate on down through the actual construction and ending with the final analysis, is proposed in this article and others to follow.

There are books and books, but no where can one obtain a satisfactory outline of this subject so arranged that the contractor realizing the need of a more systematic organization or the young man, who desires to learn as quickly as possible in order to be of the most service, can find information so arranged and in such logical order covering the whole subject as to be of any value. A multitude of books and special articles are available giving some one man's idea of some one part of a contractor's work, such as "Office Systems," "Cost Keeping," "Field Management," etc., but this information, while possibly as good or better than average practice, can not be adopted, because all of these various ideas can not be thrown indiscriminately together as a basis of a working organization, and no one idea can be adopted without requiring a correlation of all other parts of the work. As such a procedure is considered too much of a task by the average man, he generally decides to let things drift along.

The writer has for a long time thought that in his own business if the system used was reduced to writing, so that each and every man employed, no matter in what capacity, could be referred to this standard practice, instead of having it verbally repeated time and time again, much good would result; first, in a closer harmony of relationship and a resulting greater output, and second, the larger opportunity and invitation for suggestions and improvement.

To Messrs. Taylor, Grant, Emerson, et. al., we are indebted for a systematic study of industrial organizations and a better management of shops with the idea of greater efficiency. Messrs. Gillette, Gilbreth, et. al., have carried the same ideas and same line of thought into the engineering and construction field, and yet in the opinion of this writer, neither "Costa Data," "Motion Study," or any of the numerous papers printed satisfy the general need of a comprehensive study of the whole subject of contracting, wherein a general scheme of practice from estimating to analysis is outlined.

The methods suggested in the articles to follow may not be the best, but they are offered as the result of a practical experience of several years, and should be of value, at least in forming the nucleus of any organization. Certain fundamental truths exist in all contract work and these facts can only be learned by experience. For this latter reason alone, if no other, this series of articles should be of value, especially to the young engineer and contractor.

There is no doubt of the present need and importance of systematic cost keeping, cost management and cost analysis in the majority of our existing industrial plants. If this is the case, how much more is the same procedure required in the contracting field, which covers the industrial line, only being complicated by the operations being confined. In other words, the contractor's work it truly industrial, but he is handicapped by the nature of the operations, inasmuch as he must work in the open, unprotected from the elements, must attempt to keep records of men and materials when same are shifting and difficult to locate; and in general, systematize an ignorant, carefree, low-grade force of laborers in such a manner as to secure adequate working results as well as obtain such data as will fix the special job as a permanent record of value as a profit-making proposition.

In construction work the whole field

must be considered, and this means that the same laborer may be moved from one class of work to another, even during the same day, and perhaps several shifts may be necessary. Along with these difficulties run the trials with union labor, with all its exacting stipulations as to rates of pay, hours of work, etc. It is all very well to talk or write regarding what can be done if all these obstacles are removed, but in ordinary work, the kinds of jobs we all experience, these things are not removed, and, as a result, ordinary circumstances and conditions must apply, and any system adopted must recognize same and adjust itself accordingly.

It is all right and proper to talk of "staff" vs. "line" and to encourage the civil instead of the military type of organization, but after all in ordinary construction work the laborer must be driven by an expert supervision and the results lie with the commander rather than the individual workman, and this is so because of the character of the labor available.

Under these conditions, all that can be expected is a fairly accurate checking of labor employed, and such cost data are not absolute in fact, but simply characteristic of the kind of work, and sufficiently close for all practical purposes and for guidance in analysis of like work. For these reasons, cost data, so styled, are of no value as they assume to be and report facts or truths, but they are of more or less influence, depending upon the elaborateness of the published data.

Contracting never can be an exact science or subject to exact rules, all writings as to principles to the contrary, notwithstanding. There are no five, ten or twenty principles involved. Contracting, like engineering, or even more so, is a matter of common sense or good judgment, but an understanding may be developed and mental analysis encouraged by a proper use of methods, standard forms, printed records and analysis. In other words, while preaching modern methods, requiring all that has been written as to office and field systems, and while advocating some such system as will be outlined hereafter, still the writer desires to be understood as emphasizing the fact that all goes to the mental discipline or building up of mental caliber and that, so far as records go, they are of questionable value. The engineer and contractor who will work and work the hardest to obtain system and records, does not profit so much by the actual records as he does by the development within his own brain cells. Do not overlook this point. Records are valuable only in their effect on the judgment which indicates that the treatment of a new proposition is the result of experience. Experiences may be fortified by a proper system of dividing, itemizing and recording costs of labor and materials. The series of articles proposed will be strictly in line with the foregoing ideas.

In the first place, three general divisions of contracting work are recognized, viz.: Estimating the job, construction of the job, and a final analysis and recording of costs. An attempt will be made to carry these three divisions through each monthly issue. Each one of these divisions carries with it sub-divisions which are directly related to like questions which exist all through the job, and therefore each issue will cover a certain sub-head, which will be given the prominence of title and then sub-divided as to its importance under the three main heads noted above. By such an arrangement, the estimating engineer or office force, the field engineer or the contractor, and the analysis man will find in each issue such matter as will, we hope, be of benefit, but above all, such statements along each line as will promote discussion and correspondence.

A further division will be made in these principles by sub-dividing under each heading into "material," "labor" and "general field charges." Running parallel with this idea a proper division will be made with consideration for the bookkeeping or clerical, engineering or planning and the field or executing departments.

The outline of this series of articles is a large one and the task set for ourselves is no small one, as is evidenced by the subject matter next following. As the series will require all of a year and possibly more for a complete handling, our readers are invited to contribute freely to the discussion month by month, and it is felt that such a forum as this will establish will be no small part of the value of this department.

1. *Estimating the job on a basis of a definite, well-considered plan, with reference to execution and definiteness in final analysis of results.*

Examinations of specifications for unusual clauses and abstract. Comparison of plans and specifications. Special note of peculiar features.

Proper method of taking off quantities, including checking; estimating blanks; lay out of work and method of operation; division of work; short cuts; approximations for check; when quantities important and when unit prices; labor and material separate; general charge methods; how general charges are affected by character of work; equipment required and how charged out; notes and sketches showing basis of estimate; filing of esti mates for reference; value of estimates regardless of execution; "dope" book.

2. *Executing the job, following as as closely as possible the estimated plan of operation and, where defective, requiring modification and change, revising or extending estimate to cover same.*

Equipment; organization and forces; timekeepers and field forces; progress plans and field engineer; forms for cost and quantity reports; division of work by sections; simplicity of items, but essentials separated; direct and indirect labor and materials; field approximations or units for reports; general office system of purchasing, distribution of cost of material and labor and making monthly estimates; better supervision by use of daily reports; instructions to (*a*) foremen, (*b*) timekeepers and clerks, (*c*) engineers and firemen, (*d*) mechanics, (*e*) yardmen, (*f*) general office, (*g*) weekly cabinet meetings.

3. *Analysis of job. Running entire job as far as possible according to estimate, but with due allowance for actual reports based on conditions as formed during execution.*

Cost and quantities and unit costs to date; rate of progress; revision of estimates from time to time; discovering of weak points; daily knowledge of work; time of completion; comparisons of sections, men and equipment; comparison with other jobs of like character; separation of ordinary from unusual units; tabulation of results; graphical chart results; results not absolute but mental discipline; danger of copying data; reducing to a fixed rate of pay; cost of materials f. o. b. job and not purchase price; danger of stop-watch methods; padded pay rolls.

Sewage Disposal With Respect to Offensive Odors*

By George W. Fuller, M. Am. Soc. C. E., New York City

Oxidation of Sewage Impurities

SEWAGE may be defined as the spent water supply of a community, together with those household and industrial wastes which are removed from their point of origin by water carriage in underground pipes.

For several generations it has been the custom in various localities to discharge sewage in the cheapest and most convenient way into the nearest available water course. During the past twenty-five years much progress has been made in the art of sewage disposal so as to guard against objectionable putrefactive odors in streams that are too small to receive untreated sewage. In some measure this progress relates to the disposal of sewage by dilution in fairly large streams; but it refers more particularly to advances made in the disposal of of sewage in works of artificial construction in which use is made of sedimentation, filtration and other methods.

Sanitarians are agreed that the proper disposal of sewage is of importance both as to prevention of putrefactive odors in streams and also as to the elimination of disease germs from some water courses which are related to either drinking-water supplies or shellfish layings. Developments in the field of sewage disposal have been accompanied by a peculiarly wide range in the opinion with which the plants are regarded by persons living in their general neighborhood. The opposition of various land owners around some plants is so marked that it is indeed stated that the sewage-disposal plants are themselves a nuisance, even in sparsely populated areas.

It is scarcely possible to install sewage-disposal plants to serve large towns and cities without there being some

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*Presented before the Congress of Technology at the Fiftieth Anniversary of the Granting of the Charter of the Massachusetts Institute of Technology.

noticeable odors and smells immediately at the plant. These odors, however, at some plants are not and indeed if the works are properly built and operated should not be offensive. Even at the works themselves the odors never should be as noticeable as the odors emanating from some fertilized lawns or industrial establishments.

On the other hand, it is unfortunately true that some sewage-disposal plants have been illy arranged as regards location and design, and that some of them have been poorly operated. The result has been that in some places objectionable odors undoubtedly have arisen and in consequence the offensive smells from such plants have been used with much force as arguments by land owners, who, for sentimental reasons, protest vigorously against disposal works being built within several miles of properties in which they are interested.

Many anomalous conditions of a complicated nature have arisen recently in America with respect to sewage-disposal projects. In nearby communities litigations and legislation have been directed to diametrically opposed propositions. Thus the contests are instituted in some instances to compel, and in other cases to prevent, the installation of disposal works; while elsewhere they relate to efforts to remove plants from the outskirts of a town or the converse; that is, to preventing an isolated site being adopted if it happens to be near some land owner of especial influence.

The question of offensive odors is but one feature, but it has been a bothersome one in some instances where persons have persistently exaggerated the shortcomings of some plants and converted the exceptions into the rule as regards sewage-disposal experiences.

Regardless of the unreasonableness and selfishness with which the opponents to sewage-disposal sites in their neighborhood may present their cases in some instances, it seems to be clear that those having to do with sewage-disposal works must increase their efforts towards building plants free of nuisance as to offensive odor when operated properly, and furthermore to see to it that plants are operated in such a manner that there is no just ground for complaint from residents in the neighborhood of such works which at best are open to sentimental prejudices.

The importance of disposing of sewage in a sanitary manner is so great in the interests of the public health that it is scarcely necessary for the writer to dwell further upon this introduction before proceeding to outline some of the principal features of our present understanding as to the processes by which sewage may be disposed of in a satisfactory manner, and the means by which such process may be utilized to best advantage.

COMPOSITION AND DECOMPOSITION OF SEWAGE.

As the nature and origin of sewage implies, it is a product that varies tremendously in its compositions. In a rough way it is about 99 to 99.5 per cent. pure water, but the fraction of 1 per cent. of impurities varies within very wide limits at different hours of the day and as between the sewage of different communities, due to the influence of the habits of the people, and also to the amount of industrial wastes, street wash, etc., that enter the sewers.

In a paper presented in 1903 by the writer to the Boston Society of Arts, these various features as to composition were detailed at much length. Here it may be said that it is the organic matter, widely varying in quantity and quality, which is of principal interest to those engaged in the field of sewage disposal. Some measures as to the quantity of the organic matter were applied with considerable accuracy years ago by those interested in ascertaining the fertilizing properties of sewage. As that aspect of the case did not yield practical results on a commercial basis, the sewage chemists of different countries have been content to follow the practice of using a series of arbitrary methods which give widely divergent results. The results have value, however, for comparative purposes if applied to samples which have been collected in a manner to make them representative of the sewage before and after treatment.

Recently knowledge as to the composition of sewage in more practical terms has received some impetus by studying the putrescibility of sewage and sewage effluents through bacterial agencies and in securing a measure of the amount of oxygen required for bacteria to oxidize the more unstable portions of the organic matter in sewage.

Such methods were suggested by the Royal Commission on Sewage Disposal, and have been applied at some places in this country. For instance, Mr. Clarence B. Hoover, Chemist in charge of the Columbus sewage-disposal works, has recently employed this method of measuring the strength of the local sewage, beginning in March, 1910.

To appreciate the composition of sewage from the standpoint of the prevention of odors, it is necessary to bear in mind that the organic matter of sewage comprises both living and dead matter. The living matter will thrive so long as the food conditions and other environments are favorable thereto. The dead organic matter, in the language of the chemist, is subject to reduction and oxidation according to the conditions surrounding it. In fact, the organic matter of sewage is made up of such complex molecules that it has a well-defined tendency to decompose; that is to say, to separate into molecules of simpler form.

Organic matter, as a general proposition, if resolved into simpler and more stable compounds through oxidizing agencies, will produce no offensive odors that are noticeable. On the other hand, if sewage decomposes in the absence of oxygen, the well-known reduction processes spoken of as "putrefaction" will set in with their attendant malodorous by-products.

The measure of success, therefore, attending the operation of sewage-disposal plants, relates essentially to guarding against the putrefaction of sewage. This means that there should be obtained not only a stable, non-putrescent effluent, but also that the steps in the process of sewage treatment should be free of putrefaction or, if putrefaction is used for especial purposes, it should be under such circumstances that the surrounding atmosphere will be substantially free of objectionable decomposition odors.

Quite recently the question of non-putrescibility and stability has been carefully discussed by Prof. Earle B. Phelps in one of the U. S. Geol. Survey papers, and some years before that time the scope of the problems was outlined by the writer in the paper before the Boston Society of Arts, above mentioned, and from which the two following paragraphs are taken:

"The limitation in the amount of sewage which may be discharged into a water course without putrefaction setting in depends upon the oxygen-consuming properties of the sewage measured against the oxygen in the water of the stream, after making due allowance for the consumption of oxygen by the constituents of the water and by the matters contained on the bottom and sides of the stream."

"In studying exhaustively the technical and biological changes which take place in polluted waters, and the conditions under which putrefaction may be avoided, it is believed that the relative significance should be studied of the 'absolute oxygen-consuming powers' of the organic matter in sewage or effluent expressed in terms which can be readily appreciated; of the oxygen dissolved in the sewage of effluent, together with that which may be yielded by nitrates, sulphates, and other constituents of the liquid; of the oxygen similarly contained in the water into which the sewage or effluent is discharged; of the oxygen which may be received in the water by means of aeration and from higher forms of vegetable life; and of the absolute oxygen-consuming powers of the organic matter in the water of the stream and in the sediment on the bottom and sides of the stream itself. To these factors should be added the effect of the very important items of temperature and the period of time during which biological changes may take place."

By "absolute oxygen-consumed," in the above quotation, it was the intention of the writer to refer to the amount of oxygen under conditions of nature which would be actually consumed by bacteria when they have a full sufficiency of time in which to act.

OXIDATION OF SEWAGE.

Organic matter, theoretically speaking, may be oxidized, as regards sewage disposal methods, in one of several ways, as follows:

1. By direct chemical means.
2. By indirect chemical means, such as through the aid of absorption.
3. Dy direct biological means.
4. By indirect biological means, such as through the aid of enzymes.

There are, of course, other means of freeing sewages from part of their organic matter, such as sedimentation with or without the aid of coagulants, and also such as serving as food for worms and other higher forms of life than the bacteria. It is not the scope of this brief paper, however, to enter into those subjects directly, but rather to confine the discussions to a brief statement of our present understanding of the chemistry and biology of the principal sewage processes. The several means of oxidizing the organic matter of sewage, so as to guard against putrefaction and to obtain a product which is truly stable and non-putrescent, will be taken up in turn, as follows:

DIRECT CHEMICAL OXIDATION.

Dozens of investigators in the field of sewage purification have made tests in various parts of the world with regard to the effect upon the organic matter in sewage of a liberal application of atmospheric oxygen, such as is secured by forcing air through the liquid. Usually there is a small quantity of organic substances of an unstable nature, in a gaseous or soluble form, which is removed by the application of air. How far this is direct oxidation, as distinguished from a physical removal of gases, is not definitely known. Some readily oxidized gases may quite likely come from intestinal discharges and disappear on the application of air. As a general proposition, however, it may be stated without qualification that the organic matter in sewage is not capable of direct oxidation by atmospheric oxygen.

This statement must not be confused, however, with the question as to whether or not sewage is rendered more stable by saturating it with atmospheric oxygen. Unquestionably, the more oxygen a sewage contains, whether it comes from the atmosphere or from oxidized salts such as nitrates, the more stable it is and the longer the period of time that is required for the sewage to reach a putrefying condition.

Thus, if a given sewage should contain 100 parts per million of "oxygen consumed," expressed in units of oxygen, which the bacteria would require to convert all of the organic matter to a stable form, then it is seen that if 10 parts or 20 parts of oxygen were to be introduced into the sewage, decomposition could proceed for some little time without putrefying conditions arising and, in absolute terms, the sewage treated in this manner would contain less "oxygen consumed" than would the same sewage without such treatment.

However, this leads us into the question of biological agencies which will be taken up later. Here it is sufficient to reiterate the statement above made, namely, that by direct oxidation with atmospheric oxygen the organic matter of sewage is but very slightly reduced, although its stability may be insured to a greater degree for some little period or time.

One additional comment may perhaps facilitate the present understanding of this subject by saying that even hypochlorite of lime and some other chemicals which are capable of releasing oxygen in a nascent or atomic form are scarcely capable of instantaneously oxidizing a substantial portion of the organic matter in sewage. This is substantiated by the ease with which the most powerful oxidizing chemicals may be detected in sewages when slight quantities of the chemical are added in excess of that needed to combine with small amounts of instable substances. Even prolonged boiling with powerful chemicals does not oxidize the main bulk of the organic matter.

Perhaps the most striking illustration of the failure of atmospheric oxygen to oxidize organic matter in a sewage-polluted water, was the observation of the late Prof. Albert R. Leeds, who found that there was no measurable difference in the organic matter of the Niagara River water before and after passage over the Niagara Falls.

INDIRECT CHEMICAL OXIDATION.

When sewage passes quickly over the surfaces of filters containing gravel or stone of considerable size, it is found that when the filters have become "ripened" the organic matter is directly oxidized to a considerable extent in an almost instantaneous fashion. Our knowledge of this phase of filtration is largely due to the efforts of Dunbar, who has shown that when sprinkling filters or contact filters are in good working condition, the gelatinous coatings seem to absorb atmospheric oxygen within their pores so that the organic matters passing over the surfaces are oxidized to a considerable degree.

It is unnecessary to enter the technical detail of this feature other than to show the importance of atmospheric oxygen and of using it to advantage by keeping the pores of a filter charged with it at all times rather than endeavoring to accomplish oxidation directly through aeration with atmospheric oxygen.

DIRECT BIOLOGICAL OXIDATION.

Certain species of bacteria unquestionably allow certain kinds of organic matter to become oxidized as the result of the direct action of the protoplasmic activity of the biological cell. For instance, sewage obtained fresh from the household and containing the oxygen of the water supply (of which it is largely composed) will show tremendous growths of the bacteria naturally present in the sewage. Among the results of this bacterial activity will be the oxidation of the carbonaceous matter to carbon dioxide. Some of the hydrogen, also, seems to oxidize to water. Other constituents of the organic matter seem to be released by cleavage or otherwise. Nitrogen, for instance, seems to be released in such a way that it combines with some of the hydrogen to form free ammonia. Sulphur apparently is released in the presence of oxygen as a cleavage product, although our knowledge of this element is not nearly so clear in connection with oxidation as it is with reduction. While it is probably released by cleavage in an oxidizing fermentation, it is also likely that the sulphur is oxidized to sulphate so that sulphuretted hydrogen does not appear as a conspicuous feature of fairly fresh sewage.

The main point that we do know thoroughly well, both from laboratory experience and from a study of sewage purification plants on a large scale, is that organic matter, in the presence of oxygen and of the kinds of bacteria that seem to establish themselves, undergoes a substantial oxidation. This is true particularly of the nitrogenous organic matter which passes through the well-known cycle of organic nitrogen, nitrogen as free ammonia, nitrites and nitrates. In the last form it is in the state of highest oxidation and this is the measure used for recording the degree of oxidation which has taken place in many styles of filters.

So long as bacterial oxidation takes place with the sufficient formation of nitrates, there is no fear as regards putrefactive odors from the effluent of a well-managed sewage disposal works,

INDIRECT BIOLOGICAL OXIDATION.

Some bacteria of an oxidizing nature accomplish the result, as above stated, through the direct protoplasmic action of the bacterial cells. Other bacteria do their work indirectly by excreting certain soluble chemical products known as enzymes and which, under conditions not known in all of their details, will produce a variety of chemical changes, amongst which may be mentioned oxidation.

FACTORS CONTROLLING BACTERIAL GROWTHS.

It is well to look somewhat into the conditions that affect the growth of bacteria since it is known that directly or indirectly bacterial growths have so much influence in the purification of sewage either for good or bad.

In the first place it is to be borne in mind that the amounts of organic matter in all sewages and many sewage effluents are very great, in fact, many times greater than is necessary to serve as a food for millions of bacteria per cubic centimeter. In fact, experiments made by the writer at the Lawrence Experiment Station more than 20 years ago showed that it was scarcely possible by distillation to obtain water so free from organic matter that it will not serve as a food for these tiny cells one twenty-five thousandths of an inch or so in size.

When bacterial growths come to an end in sewage and sewage effluents it is not because of lack of food, but for the reason that their environment becomes unfavorable owing to the amount of acid or other by-products that are secreted by bacterial cells in the process of their growth. In other words, bacteria come within the scope of that rule so generally applicable to living matter, namely, that life comes to an end when the growing cells are not freed in their surroundings from the products of their own growth.

To the laboratory observer this is well illustrated by a series of simple experiments, such, for instance, as the continuance of the fermentation of various carbohydrates resulting from artificial changes either in the acidity or the alkalinity of the liquid. Another simple observation noted in the early days of the Lawrence Experiment Station was that the boiling of ordinary river water caused it to serve as a medium for prolific bacterial growth, far beyond the limits of any bacterial growths noted in the unboiled water in question. This is detailed in the 1890 report of the Massachusetts State Board of Health, Part 11, page 593.

The explanation of the boiling experiment with Lawrence water is doubtless associated with the destruction of toxines which are products of decomposition that are unfavorable or inhibitive as regards the growths of the bacteria in question. This calls for a mention briefly of the important elements of symbiosis and antagonism with respect to the behavior of bacteria as they live in the organic matter of sewage and sewage-polluted waters. Symbiosis refers to the favorable influence which some species of bacteria have on the growth of other species. Conversely, antagonism refers to the retardation which some species of bacteria have on the growth of others.

Bacterial antagonism is doubtless of prime importance in explaining the fact that the specific germs of certain intestinal diseases, such as typhoid fever, not only do not multiply in natural waters, but will live, as a general proposition, for the shorter period of time in those waters which contain the greater amount of organic matter and the greater bacterial flora.

Before dismissing the subject of bacterial oxidation and passing to that of bacterial putrefaction, it may be stated briefly that bacteria are divided into two classes, namely, the aerobes and the anaerobes. The former grow in the presence of oxygen and the latter in the absence of oxygen. On strict lines, bacteria are divided into obligate aerobes, obligate anaerobes, and an intermediate or facultative class that can adapt itself to growing in either condition. Many of the sewage bacteria naturally being of intestinal origin, come under the facultative class and can adapt themselves to growth either in the presence or absence of oxygen.

It is possible to conceive that some suspended matters, such for instance as particles of feces, may contain bacteria which are thriving as anaerobes, although the particle of feces may be surrounded with water from which the dissolved oxygen has not been exhausted by the aerobic bacteria growing therein. As a broad practical proposition, however, it may be said that bacteria in sewage or a sewage effluent proceed either upon an aerobic or anaerobic basis. By that is meant that sewage decomposes through an oxidizing fermentation so long as oxygen is available either from atmospheric oxygen, nitrates or any chemical compounds which will release oxygen. When oxygen becomes exhausted the bacterial flora adjust themselves to the new environment and the anaerobic bacteria proceed with the reducing or putrefactive fermentation.

One of the most important observations ever made at the Lawrence Experiment Station was a demonstration of the fact that so long as some oxygen is present at all places and at all times within the filter, oxidization processes due to bacterial action directly or indirectly proceed at substantially as high a rate as if the bed were saturated with atmospheric oxygen instead of being provided with only a small supply. (See Massachusetts State Board of Health Report, 1890, Part 11, page 703.)

(This paper will be continued in a future number.)

The Squaw Creek Improvement at Lawton, Okla.

By Z. M. Scifres, City Engineer

THE city of Lawton, Okla., with a population of about 10,000, drains into Squaw creek, a stream about twenty-five feet wide and six feet deep where it winds its way snake-like through and across the southern portion of the city. The ground is flat on each side of the stream back for an average distance of about 600 feet. The greater part of the city lies north of Squaw creek on a gradually sloping hillside, rising about 80 feet to the mile, while the rise on the south side is much greater, yet gradual.

The drainage area of this creek above the city is approximated at 4,000 acres. The outlets for the storm water sewer system for the entire city were made into the old channel of Squaw creek, one outlet (48-inch brick sewer) emptied into the old creek a short distance below the west boundary of the city, and the other outlet (62-inch brick sewer) was designed to empty farther down the stream near the east boundary line.

On account of the very tortuous course of this creek, its uneven bottom and obstructed flow through the channel, due to rubbish, brush, etc., frequent overflows occurred during heavy rains, doing much damage to the surrounding property and shutting off that portion of the city lying on the south from the main part during such overflows. During the dry seasons pools of water were held by low places in the bottom of the creek and these, becoming stagnant, created a condition menacing the health of the neighborhood.

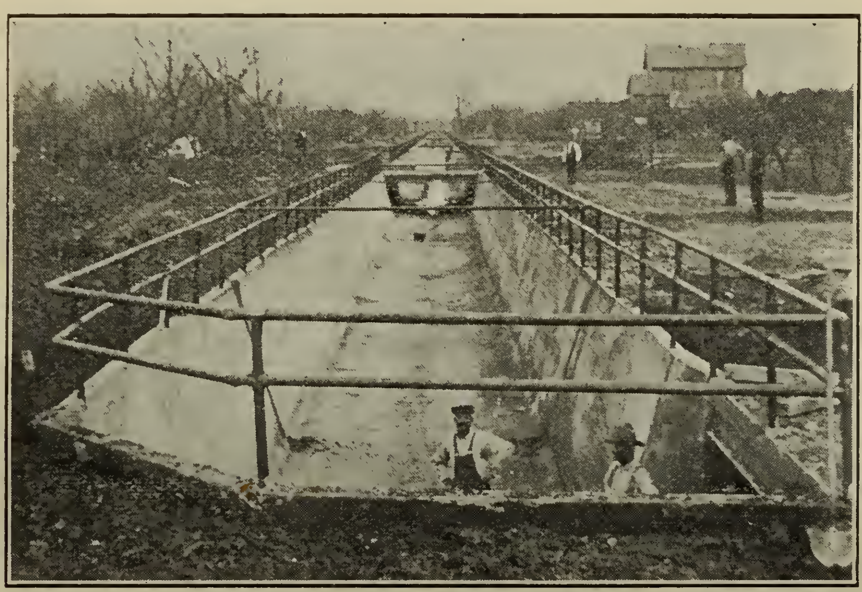
After many complaints from the citizens suffering these inconveniences, an attempt was made to partially remedy the condition by straightening the course in the extreme cases and filling the pools at as little expense as possible. But this was of no avail, and it was soon found that an improvement of a more permanent nature was absolutely necessary, as that portion of the city lying along this stream was becoming very valuable on account of its closeness to the business center.

About four years ago bonds were issued to improve Squaw creek, but the amount of the issue was found insufficient to meet the demands, and because all the property could not receive a portion of the benefits to come from the expenditure of this amount, some dissatisfaction arose over the proposed improvement, and the whole affair was dropped at that time. A second bond issue of $40,000 was voted about a year ago and plans were made to cover as much of the improvement as possible with this issue.

The city engineer was placed in charge of this work. Cross sections were taken 25 and 50 feet apart on various routes and all information as to existing conditions was obtained. It was decided, after thorough investigation, that the route should be along I avenue from the point where the creek touched the avenue between Second and Third streets to the point where the creek crossed the avenue, between Eighth and Ninth streets, and from these points the route would follow the general direction of the old channel of the creek, making the course as straight as possible. The street grades on I avenue and all cross streets had been previously established so that all street drainage was to the avenue, making this the proper route to be selected.

A plan for an open conduit of concrete bottom and sides such as shown was adopted. The conduit is eleven feet wide at the bottom and sixteen feet wide inside measurement at the top. Concrete-steel bridges span the conduit at each cross street and at alleys, the widths of the bridges on the streets being sufficient to include the sidewalks. A double railing of 2-inch gas pipe extends along each wall of the conduit and curb of the bridges, enclosing each block of the conduit from bridge to bridge.

I avenue is 80 feet wide. An ordinance was passed establishing the tree lines, sidewalk lines and curb lines on this avenue so that there would be a driveway approximately seventeen feet wide on each side of the conduit. The top of the conduit walls extends three inches above the crown of the street, forming a curb, in the same manner in which a center parking is enclosed in a pavement.



STORM WATER CONDUIT, LAWTON, OKLA.

At each bridge provisions for catch basins and outlets for future storm these outlets were provided at various places for the purpose of draining water from the old channel. However these outlets were planned only for sewers were made. In addition to temporary arrangement while the old creek was being filled.

The plans were approved by the mayor and council and contract was let to E. R. Kerby, a local contractor. Work on the actual construction began about the first of last November and was finished the latter part of January. Excellent weather conditions prevailed and the work was carried on at a very rapid pace.

Earth from the excavation was deposited along the banks of the old creek and in some places even in the old channel. Some risk was taken in the latter case, but connections with the stream were made in due time to avoid damage from obstructing the flow of the water.

A varying depth of the conduit, a constant width at the bottom and a constant width at the top made it somewhat difficult to design a form for use in the construction of the concrete walls. However, this difficulty was overcome by making the form for the inside walls in two sections, so that a slight change in batter could be made to secure the necessary width at top of the walls. A set of standard cross-struts were made in two sections also and these held the wall forms in a very rigid manner. Where possible the sides of the excavated ditch were trimmed and these used as back forms. In other places back-lagging was necessary. Sufficient amounts of these forms were made so that one set was being filled while the concrete was setting in the other. The bottom of the conduit was constructed in advance of the walls. The concrete mixer was moved along the side of the conduit and the concrete was run through an inclined trough into hand-cars and these carried the concrete to its place in the bottom or walls. During the construction of the walls runways were supported by the struts which braced the wall forms.

Expansion joints one inch in width at intervals of 100 feet were made by inserting a one-inch board, which was withdrawn and the space filled with an asphalt filler. The joint extended across the full section of the conduit and was supported by a six-inch concrete slab constructed in advance of the conduit proper.

ROOFING PORTION OF STORM WATER CONDUIT, LAWTON, OKLA.

By means of wooden pins holes for the posts for gas pipe railing were made. A crew cut the pipe and set the railing after the concrete walls had properly hardened for this work. A second crew followed, doing all the remaining back-filling, shaping up and placing the work in a presentable condition.

Since the conduit has been completed the old channel has been filled and the property once taken up by old Squaw creek is being reclaimed and improved extensively. It is proposed to extend the conduit to take the place of the tortuous channel in the remainder of its course through the city.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

The Power Plant Equipment

DIVERSION works. These may be an open channel or canal, a timber flume or pipe line, all serving the purpose to divert the water from the upper pool to the power station located at some point below the dam.

Diversion canals consist of bed, banks and superbanks, and their appurtenant works are the intake, headgates, waste weirs, culverts and bridges. The defects occurring in these are leaks, subsidences of banks and superbanks, erosions, damages to gates and bridges.

Leaks from canals, cut through lime or sandstone formations, may be due to the water finding passage through the stratifications. When the canal location is with or against the dip of the rock, the strata run out across the bed at intervals depending upon the thickness of the ledges, and these are places of probable leaks, as the level in the canal is probably considerably above that of the stream from which the water is diverted, and may be in close proximity to it.

Pipes are the last type of diversion conduits and are then known as pressure lines. These may be of wooden-stave, steel-plate, riveted or welded, and concrete-steel construction. The defects in pressure lines are chiefly leaks, sedimentation and distortion of flow section. Leaks are due to the opening of joints, which may be caused by settlement or faulty riveting, and can only be effectively remedied by emptying the line and resetting of rivets. Sedimentation reduces the flow area, increases the velocity and thereby the friction head. Mud boxes should be arranged at intervals of 1,000 feet to flush the silt out. Distortion of section is due to settlement of pipe and can only be remedied by withdrawing the water and reshaping, though this is not a serious defect. When pipe lines are laid with proper gradients, air cushions will not form; in the event that it becomes unavoidable to run lines with rises exceeding ten feet above the hydraulic gradient, air valves must be arranged at the peak of the rise and these should be frequently tested. Properly designed pressure lines are provided with stand pipes of ample dimensions, and in that case the pipe will not be injured by water-hammer. All this applies to the different types of pipe lines, excepting that leakage from wooden-stave pipes is generally arrested by the tightening of the steel bands at the point of leak, while there is no remedy for leakage from concrete pipes. Metal pipe must be kept well coated, preferably with a good quality of graphite paint.

The power station is located at the dam or the terminal of the diversion conduit. In the first position it may receive the water directly from the upper pool to form a forebay guarded by headgates. When taking water from the pond the power station stands on the dam alignment; when fed from a forebay it stands at some angle to the dam, the forebay paralleling it on the land side. In either position the power station is exposed to all the consequences of the fluctuating head and flow and, when on the dam alignment, to those growing out of floatage accumulations.

The power station rests upon a substructure whose upstream part, excepting when water enters in pipes, fills the office of a dam and is subject to the defects heretofore outlined for that structure. The superstructure houses the equipment and is not exposed to hydrostatic pressure. The power station proper is not likely to develop any serious defects unless there be leaks beneath or around it from the forebay, and their treatment must be by means of remedies already detailed. It is assumed that the walls and floors are properly designed not only to support safely the structure and equipment but also to be rigid against vibration.

The pit and tailrace are part of the power station, forming the exit passage of water discharged from turbines. The first is arranged in the substructure of the station, the second in the river channel below the power station. No serious defects are to be expected in either of these when, by proper design, they are of ample area and depth. When the equipment consists of several units, some of which are operated only for the generating of secondary power from higher than normal flow, it may be found that the tailrace under and from the idle units becomes silted, thereby reducing the depth under draft tubes to such an extent that the outflowing water backs up and reduces the effective head. The ready remedy is to operate each unit alternately to avoid long periods of idleness.

The equipment consists of the hydraulic, electric generating, auxiliary plant and electric transmission. The first two are always housed in the power station, the third may or may not be, while a portion of the fourth is also there located. All equipment is generally subdivided into units, those of hydraulic and generating electric corresponding in capacity, while the auxiliary installation may conform to the hydro-electric unit characteristics or differ, which is also true of the transmission plant as far as it relates to the transformers. The maintenance and operation of the equipment is wholly of a mechanical character and involves details which could be adequately treated only in a large volume, which will not herein be attempted. Only those essentials which relate chiefly to the hydro-electric end of it will receive attention with some general outline of the economical constitution of auxiliary power installation.

The hydraulic equipment consists of the turbines and governors. Reaction turbines are drowned, in open chambers or bays or encased in draft chests, so called, into which the water is fed by pipes; shafts may be horizontal or vertical. In either event the most frequent troubles are caused by floatage, principally small blocks of wood which find their way into the turbine runner, blocking it or chipping its buckets. This is a common occurrence when lumber mills are located on the stream above, and can be guarded against only by frequent raking of trashracks, which should contain an especially close-spaced section from low to high flow surface. Reaction turbine gates are of cylinder, register or wicket type, the last of which is more likely to develop leakages with time than the first two. Turbine gate shafts will develop defects before any other part by wear in the bearings, which have to be relined when this occurs. The causes of ice interference have already been mentioned; when anchor ice blocks the turbine gate opening, the safest method to secure relief is to close the penstock gate and disperse the ice accumulations by mechanical means or steam. If this is attempted by operating the turbine gates it is quite likely that some of the gate riggings will be injured and the turbine put out of commission for repairs. On multiple horizontal turbine lines the shafts may bind because of the uneven wear of some of the lignum vitae blocks. These are adjustable. If the stream carries much silt the runner blades will be ground off, thus enlarging the normal clearing between runner and case ring and increasing leakage. All means of intercepting sand before the water reaches the turbine should therefore be exhausted, as there is no remedy afterwards excepting runner renewal. Erosion and pitting of the runner blades is likely to develop when their design is faulty. When turbines are cased a pressure-gauge should be installed on the top of the draft-chest and its hourly reading recorded in the log. So should the gate openings and speed be subjects of hourly measurements and entry and water-gauges should be maintained in open penstocks. Impulse wheels receive the water from nozzles and are free from injuries caused by floatage or from interruptions by ice. The buckets, or cups, have a short life compared with that of reaction runners, but are readily renewed. Turbines should be frequently examined, and, by keeping a careful record of gate openings, active head and output, any considerable efficiency loss is readily detected, when the cause should be determined and corrected. The draft-chest, supply penstock and draft-tubes should be kept well coated with a suitable paint.

The turbine speed is controlled by hydraulic or mechanical governors, which regulate the supply of water passing through the gates to the runner or, in some later types, the head by admitting air into the draft-tube. Governors should be adapted to the speed regulation requirements of the plant, which are influenced by the character of the current service and load fluctuations. Governors require the same intelligent care as does any precisely operating machine.

The electric-generating equipment consists of exciters, generators and the regulating devices. Exciters are direct-current motors required to excite or magnetize the field magnets. These may be driven by individual turbines or by belting them to the generator or turbine shaft; their speed is generally three or four times that of the generator. Exciters are readily maintained in efficient operating condition; their only parts requiring frequent attention are the commutator brushes, which are adjustable.

The generators, which in hydro-electric plants are most generally of the alternator type, are not likely to develop defects, provided they are not overlooked beyond the safe heating limit. The armature is the part which may become injured by overheating, and it is proper practice to keep in reserve an extra one at the station.

The regulating devices are assembled on what is called the switchboard, generally a stone panel, on which are mounted the instruments which measure and indicate the exciter and generator output characteristics. When properly installed these will require little maintenance attention.

The important feature in the operating of the electric-generating equipment, whence the current is transmitted to a distant point, is to secure the best constant harmony of output characteristics of the different units. This is accomplished at the starting of a unit by aid of the governor, whose speed-balls can be standardized for the desired regulation scope, but, as the load and the power-generating factors fluctuate, it requires more or less constant attention. All electrical equipments need "blowing out" at frequent intervals, for which purpose a suitable air compressor should be installed, which is motor driven.

Auxiliary power equipment may or may not form a part of the hydro-electric station's outfit, but no station should be without some electric-storage capacity for station operating purposes, such as assisting in the regulation of the voltage on exciter outlets, operating of high-tension switches, and lighting the station. A storage battery will always prove a resourceful investment by taking care, in whole or part, of peak loads and supplementing the exciter units in case of need. Storage batteries require constant operating care in charging and proper maintenance of their elements. They should be housed separately from the other equipment, where the temperature may be regulated by the aid of motor-driven fans. When neglected the depreciation of storage batteries may become high.

The location of stream auxiliary should be decided largely by the conditions as to economical fuel supply, and in most cases these will point to the service rather than the hydro-generating end. The capacity of the auxiliary plant should be such as to guarantee the continuous power output which may be realized from the maximum hydro-motive equipment by supplementing deficiencies caused by flow and fall reductions. The auxiliary plant units should always harmonize with those of the hydro-electric installation. The make-up of the steam plant may differ greatly. The capacity being fixed upon, the steam consumption of the prime movers and auxiliaries must be determined in order to decide upon boilers: 0.73 boiler horsepower are required per kilowatt output, and 10 square feet of water-tube boilers heating surface per boiler horsepower. The boilers should be provided for each prime mover and one extra prime mover unit beyond the required capacity. The plant should be located convenient to ample water supply, and fuel tracks and fuel and ash handling should be planned for all obtainable economies. Steam turbines are the best prime movers, those of horizontal type with coupled generator mounted on the bed-frame.

Cost of steam auxiliary plants and of their output is an important topic when the provision of an auxiliary is to be determined from a searching analysis and when efforts are made to convince steam power users that it is much more costly than they believe and that the hydro-electric power current will bring a great saving to their business.

The steam engine or water turbine effective unit output is the mechanical horsepower which may be converted into electric horsepower with the loss of ten per cent. The commercial unit of electric energy is the kilowatt (1,000 watts), and, as one horsepower equals 746 watts, a kilowatt represents one and one-third electric horsepower or about one and a half mechanical horsepower. The final commercial measurement of electric service is the kilowatt hour, combining quantity and time of service, and this is therefore the proper comparative unit basis of power cost. The cost of power in manufacturing establishments is, as a rule, not definitely known to the operators. In most of them, no doubt, the total cost of the manufacturing product is conclusively established, but the segregating of the total into the component items, especially as relating to power, is only rarely sufficiently detailed. And it is therefore not to be wondered at that the actual cost, where generated by the plant, is greatly underestimated. The items of fuel, wages, oil and waste are probably entered in the power account, but those of maintenance, repairs, depreciation, interest on plant's cost, taxes, insurance, etc., are rarely found properly apportioned.

Transmission plant consists of line

and equipment. The maintenance of the line calls for its constant inspection. When the supports are steel towers they need repainting, unless they are constructed of galvanized material. Cross-arms, pins and insulators must be maintained at all times in best condition, and damages from storms promptly repaired.

Transformers should be separately housed from the station equipment.

The substation forms the terminal of the transmission line, where the hydro-electric product is received, transformed, converted and distributed for service. Its electrical equipment consists of stepdown transformers, oil switches, converters, regulating devices arranged on switchboards, which call for the same intelligent maintenance as the generating equipment.

The operation of a hydro-electric plant should be carefully systematized in order to secure the best results with economy. It is logically divided between the major parts of the plant, the hydraulic works, generating station and transmission, with substation as its destination. A comprehensive system of records kept separately for each of these is indispensable to satisfactory and economical results, and the old adage, "A stitch in time saves nine," applies to no other industrial property more forcibly than to a hydro-electric plant.

It is poor economy to entrust a cheap man with the charge of so costly a property where a good salary may be saved for its owners by competency, system and proper management.

Public Gain From Improved Efficiency of Electric Lighting*

By William H. Blood, Jr., Boston, Mass.

THE expression that "we make our profits from what our fathers wasted," is not a platitude. It is a scientific statement capable of demonstration. It is particularly applicable to the electric lighting industry and we are not obliged to go back even to the days of our fathers, for all of the important improvements have been made in the past twenty years.

These improvements have not been brought about by accidents or by revolutionary inventions or by chance discoveries, but have been secured through careful study by educated men applying scientific methods to the working out of definite problems. That some of the results accomplished are almost miraculous, we are forced to admit; but that they are haphazard we emphatically deny.

At the present time, when so much is being said about "efficiency" and "scientific management," and when the public service corporation is accused of being "greedy" and "unscrupulous," it may be well to spend a few moments in considering what the application of science to the electric lighting industry has accomplished and to what extent the public has been benefited thereby.

In 1888, two of us, for our thesis work, tested the largest dynamo that the Institute of Technology posesssed, and found the highest ratio of electrical output to mechanical input to be about 70 per cent. Today, machines of this size operate at about 85 per cent., while larger units give efficiencies of 95, or even as high as 97 per cent. Assuming that this improvement in efficiency amounts to 25 per cent., on the average (which is a low estimate), it would mean that we are today saving 25 per cent. of the fuel that we should have burned had there been no improvement in electrical efficiency since the year 1888.

Applying this figure to the industry as a whole, and basing our estimate upon figures given in the Census Reports on the cost of fuel used by the electric light and electric railway plants in the United States, we prove, without fear of contradiction, that our electrical engineers have brought about the conservation, for future generations, of some $12,000,000 worth

*Presented before the Congress of Technology at the Fiftieth Anniversary of the Granting of the Charter of the Massachusetts Institute of Technology.

of coal per year, and this solely on account of a single item—improvement in the efficiency of electric generating machines.

This improvement has been accomplished partly through the increase in the size of the units. The first commercial electric light plant in Boston, built in 1886, contained six machines having an aggregate capacity of about 230 h.p. Two of them were of 15 h.p., and four of them about 30 h. p. In 1888 the largest electric generators were of 100 h.p., and they were regarded as monsters. In fact, one machine of approximately this size was universally called a "Jumbo." It was thought that the limit in size had been reached when we built machines of 100 h.p.; in fact the writer of this article, when it was planned to build a 200 h.p. machine, protested, on the ground that if anyone required such a large amount of power he could readily use two 100 h.p. machines. Today, 15,000 h.p. machines are common, and we are beginning to install units of 25,000 h.p. This simply represents the evolution which the trained engineer has brought about. The new 25,000 h.p. generators, besides being more efficient, are much more reliable, and are little, if any, more complicated than the older and smaller machines.

Only a few days ago, it was my privilege to examine a plant built in 1893, in which the original installation consisted of several 3,500 k.w. engine-driven units. A year or two later, the plant was enlarged by adding 5,000 k.w. turbines. Today, the 5,000 k.w. machines are being replaced and upon the same floor space are being installed 15,000 k.w. units. These 15,000 k.w. units occupy less than one-half the room occupied by the original 3,500 k.w. units, which means that the operating company is getting eight times the capacity on the same floor space.

One of the early electric power plants, with which I had some connection, contained twenty dynamos of 100 h.p. capacity each, which gave a total capacity of 2,000 h.p., and the floor space required for the entire plant, including boilers and engines, as well as dynamos, was 9,000 square feet, which is equivalent to 4.5 square feet per horse power of capacity. This same company is today building, under the supervision of some of Tech's illustrious alumni, a new station which is to have an ultimate capacity of 140,000 h.p., which will require but slightly in excess of one-half a square foot per horse power of capacity.

The first plant represented an investment of approximately $225 per horse power, while in the latter case it will be about $45 per horse power. Had there been no improvement made along this line, and had the company been obliged to increase its capital account on the basis of $225 per horse power up to its present total capacity, it would have required an additional investment of some $12,500,000, which would entail additional annual interest charges of $750,000. But, as a matter of fact, this additional charge is obviated because the electrical and steam machinery has been improved and the costs of the plant have been reduced.

In the early days dynamos were of the belt-driven type, which means that the power was transmitted from the engines to the dynamos by heavy leather belts. In many cases the engines were belted to long shafts and the power again transmitted by other belts from these shafts to the dynamos. All this entailed not only large losses of power but heavy maintenance charges. This, in recent years, is eliminated by having the dynamos directly connected to the engines which drive them. Nor is this all. Instead of the simple, high-speed engines, which generally racked themselves to pieces, we now have compound condensing engines running at low speed with better than clocklike regularity.

A still further improvement in power-plant design requires the installation of steam turbines of either the horizontal or vertical type. These are self-contained, rotating units which utilize the expansion of the steam to convert potential into kinetic energy, thus obtaining much higher efficiencies than is possible with prime movers of reciprocating types. The steam room, as has been shown, uses higher turbine, besides requiring much less steam pressure and higher vacua on its condensers, and is, consequently, more efficient, and because of its constant rotating motion is better adapted to the generation of electricity than the old reciprocating engines.

There has been a great development in the boilers used in power stations. Instead of units of 100 to 125 h.p., today 600 h.p. is in general use, and boilers up to 2,000 h.p. have been made. In the old tubular boilers, 80 to 100 lbs. was the common pressure used. This was increased to 125, then 150, and in the water tube boilers to-day 200 is generally used. Improvements in superheaters, combustion chambers, automatic stoking devices, condensers, ash and coal-handling machinery, apparatus for analyzing flue gases, besides other miscellaneous devices, have all had their effect in cheapening the process of converting the heat units of coal into steam.

Turning again to the electrical end of the power station, the switchboard of today, though a much more elaborate affair, is, when once installed with its remote control switches and automatic regulating and protecting devices, simple of manipulation and arranged to give the plant the greatest flexibilty of operation.

With the increase in size of the units and with the development of the modern switchboard, has come a decrease in the number of operators needed, so that in the dynamo room in a plant of 5,000 h.p. capacity today there would be required two or three men on a shift, while two decades ago eight to ten men, at least, would have been required.

Now let us see how all these improvements affect the operation of a power station. We find, in looking up the back records, that in the early days it took, as a rule, ten or more pounds of coal to produce one kilowatt hour. In many modern stations is requires only three pounds of coal per kilowatt, and in some cases even less than this. This means that only 30 per cent. as much coal as was demanded twenty years ago is now used to produce a unit of electricity.

What effect does this have on the cost of electricity? Take for a concrete example an electric light plant of 5,000 k.w. capacity. Its first cost, including distributing lines, would be approximately $1,250,000, and under ordinary conditions the operating expenses, including taxes and depreciation, would be, say, 65 per cent. of this, or $202,800, which would leave for interest on investment and reserves, $109,200.

Now suppose that instead of having a power station which runs on three pounds of coal per kilowatt hour, it was like those in operation in 1888, and consumed ten pounds of coal per kilowatt hour. With the same output over 300 per cent. more coal would be required; or, without boring you with the details of calculation, instead of producing a return of 8¾ per cent. on the investment (which we assume is the same in both cases) there would be a deficit of about 6 per cent.; or, if you please, stating the results in another way, while the company has been making systematic reductions in the rates from 16 cents per kilowatt hour down to 10 cents per kilowatt hour, its stockholders have had to be content with a constant and low rate of return upon their investments. If you will study the records of the electric lighting companies given in the reports of the Massachusetts Gas and Electric Light Commissioners, you will find that this is exactly what has taken place in this state at least. During the last twenty years the rate of return on the money actually invested has not changed appreciably. As a matter of fact, it has decreased rather than increased, for electrical properties are fast getting out of the speculative class and are therefore satisfying their owners with a slightly lower rate of return.

A specific instance of this in the history of one of the larger Massachusetts companies may be of interest. In the first ten years of the company's existence, it paid dividends netting between 5 and 6 per cent., and the rate for electricity was then 25 cents per kilowatt hour. During the past few years the return has been about 4½ per cent., whereas the rates have been cut more than 50 per cent. and now the maximum charge is only 11 cents per kilowatt hour.

The effect, therefore, of all these improvements which have been brought about by careful scientific study and development, has been, by increasing the efficiency of the power stations, to reduce the cost of electricity to the public.

But we have not told the whole story yet. The development of alternating current apparatus has enabled the electric lighting companies to distribute their product from the power station to the consumers at a much less cost, and has made it possible to transmit it for distances which were not dreamed of in the early days. Twenty years ago what little electricity was used was distributed by direct current and the radius of activity was seldom more than half a mile, or a mile at the most. This forced the generating stations to be placed upon expensive land near the heart of the city, and since the voltage on a direct current system is limited it meant a large loss of power in transmission and required a large investment in copper. However, this has all been changed by the development of alternating current apparatus, and we now have high voltage transmission and distribution at a greatly reduced cost. The introduction of this system has also made it possible to locate factories, mills, and shops anywhere, instead, as in the old days, of at or near the source of power. This one fact alone has had a wonderfully beneficial effect upon the entire industrial problem of the country.

High voltage transmission has further enabled us to utilize what were heretofore useless and almost inaccessible water falls. Without this development, Los Angeles would be forced to burn thousands of barrels of oil each day instead of using the mountain streams two hundred miles away for making her streets at night almost as brilliant as in the day. But for this development Seattle would not be able to utilize the melting snow and ice from the glaciers of Mt. Rainier to operate all her street cars and other public utilities. Without high-tension, alternating-current apparatus, Niagara power could not be transmitted and used in the Lake cities of Canada, or in Buffalo, Syracuse or Rochester. The utilization of Niagara power alone means a yearly saving of at least 2,500,000 tons of coal, or the conservation of $6,000,000 to $7,000,000 of fuel annually. The development of the high-tension alternating-current system has, therefore, not only been the means of reducing the cost of distributing electric power and of preventing the congestion of manufactories, but has also been a great factor in conserving our natural resources.

Turn now to the apparatus by which the consumer transforms the electricity delivered to him into light, heat and power. Here again scientific study and research have done much to increase the efficiency of the apparatus used. The reduced price of electricity by itself, therefore, does not indicate the total saving to the consumer. We have today arc lamps of more than 100 per cent. greater efficiency than those of a few years ago. Incandescent lamps in the early days consumed six watts of energy per candle power. This consumption was soon reduced to three watts per candle, where it remained for many years and seemed to baffle further reduction, but after years of scientific experimentation this has been reduced to one and a half watts per candle, and today we have the Tungsten lamp which consumes only one watt per candle, and a still further improvement is promised in a lamp which is to consume not over one-half a watt per candle.

Today we have in common use electric heaters, stoves, irons and other special heating devices, which a few years ago were commercially impossible. The general adoption of these household conveniences has been brought about, not altogether by the reduction in the cost of electricity, but to a large extent by the development of efficient and durable heating elements, which, thanks to our heating engineers, are now sold at reasonable prices.

Motors for transforming electricity into mechanical power have been perfected and their efficiency is now from 20 to 50 per cent. better than in the early days, and they are so designed and constructed that they may be applied directly to the machinery which they are to drive, thus obviating the expense of shafting, pulleys and belting.

While all of the matters thus far discussed relate to improvements which have taken place in the physical apparatus of the property, we must not fail to give due credit for the development of the electric lighting industry, and for the reduction in the cost of light, heat and power, to the scientific management of electric lighting properties, which have been specialized to a remarkable degree and carried on with most satisfactory results for many years, in spite of the fact that the term "efficiency engineer" is just becoming known to the public. The improvements in electric lighting properties have been due fully as much to the trained engineer who operates the property as to the engineer who plans it or designs the apparatus used in it. It is the operating engineer who, in many cases, has pointed out opportunities for betterments and has suggested to the designing engineer where economies and improvements could be made in the physical apparatus. It is the operating engineer who, by careful study of men, machinery and methods, has brought about economies in the production of electricity which have resulted in reduced costs. He has scoured the country over for keen, careful men and has enrolled upon his staff the pick of the country. He has instructed them in their particular duties and has educated them so that they have become experts in their lines. He has selected the best machinery and apparatus that could be designed, and when changes in the art have dictated he has been quick to reconstruct his plant so as to produce maximum results at minimum cost. He has tested, and continues to test, the coal which he uses to make sure that it contains the number of heat units which he pays for. He weighs every pound of coal which is put under the boilers and he watches like a cat the electric meters in his power station, in order that he may know at all times the exact output of the station. If the coal consumption is too high, he investigates and determines where the waste occurs. He analyzes all his costs and compares them with the results of previous years and with the records of other companies. Through a study of his costs he is able to determine a system of rates based upon costs which is equitable and nondiscriminatory. He has, in establishing these rates, automatically improved his load factor, or, in nontechnical language, has increased the average use of his plant, and this has necessarily brought about lower unit costs of the article produced. He has classified his costs as fixed and variable, the fixed including interest, taxes, insurance, depreciation and the like; the variable including fuel, labor, maintenance, etc., and by this means has been able to differentiate his customers, basing rates not only on the actual amount of current used, but upon the cost of the plant, which is to be reserved for the special service. By the use of proper meters he has made it possible for his customer to buy a measured service and so get away from the unjust and unscientific flat-rate system of charging.

He has established a nomenclature of his own, and methods of analysis peculiar to the industry. Whoever heard of a load curve, load factor, maximum demand or diversity factor until the trained engineer showed that, in studying the costs of the various kinds of service and establishing equitable rates, these were necessary.

The operating engineer has not only brought about a great reduction in the cost of electrical energy itself, but as the result of a scientific investigation of the customer's needs he has effected, through the use of suitable electrical apparatus, what is in reality a still further reduction in the cost of light and power to the consumer.

With his knowledge of the underlying principles of illumination he has been able to advise his customers as to the best arrangement of lights, so that besides producing artistic and pleasing effects he has obtained the results sought at minimum cost.

By a study of the application of power in industrial plants, he has made further reductions in the cost of power by the use of the "direct drive." This means that the motors which transform the electrical energy into mechanical power are of exactly the right size and speed and are connected directly to the machine which requires the power, thus eliminating all belt and other transmission losses.

In many other ways he has applied his knowledge of scientific principles to the direct benefit of his customers.

The wonderful advance which has taken place in the last twenty years in the electric lighting industry has been due to the combined efforts of the operating engineer and the designing engineer. It has been a gradual and steady evolution and is still going on. The industry itself has not reaped all the benefits, for while the returns on electric light investments have been sure they have not been as large as the dividends which the public has received in the reduced cost of electric light and power.

Twenty years ago electric lights were high priced luxuries, today they are inexpensive necessities. In this wonderful transformation Technology men have played no small part. The success of many electrical undertakings may be credited to them, for they have entered every field of the industry and have done much to improve the efficiency of the apparatus, to broaden the use of electricity, to reduce the cost of production, and to make what were formerly hazardous undertakings safe and sure investments.

Asphaltic Oils Economical Wood Preservers

By Frank W. Cherrington, Cincinnati, O.

ASPHALTIC oils were first tried as substitutes for creosote oil on account of the excessive cost of high-grade creosote at interior points. In the spring of 1902 the Santa Fe Railroad placed in an experimental track in Texas, ties treated with asphaltic crude oil. The conditions in this track were such that untreated loblolly pine ties would not last over eighteen months, nor the long-lived long-leaf pine ties scarcely over two years. The ties placed in this track were given all the asphaltic oil which they would absorb—some of them taking as low as eight and one-half pounds per tie, and others as high as sixty pounds per tie. In all cases this was the maximum quantity of oil the ties would absorb, being dependent, of course, upon the structure of the wood being treated. These ties have been examined annually during the past nine years. The last report stated that all of the asphaltic treated ties were found to be in a state of perfect preservation, with no signs of decay. The records show that these ties have already last over four times the life of untreated ties, and are still perfectly preserved. Several specimens have been examined, and it has been found that the sap wood filled with the oil clear to the heart wood, and after nine years of constant service under abnormal conditions, the heart wood was found to be as sound as the day the ties were treated. At the same time these ties were inserted in this experimental track, 196 untreated ties of white oak were placed in the track, and practically all were found rotten and removed after six years' service.

These tests were so encouraging that in 1909 the Santa Fe Railroad employed the exclusive use of asphaltic oils on a large scale at their plant in Albuquerque, N. M. Since that time they have treated three-quarters of a million ties annually with asphaltic oil. The above facts conclusively prove the efficiency, value and practical application of asphaltic oils for the purpose of wood preservation.

The asphaltic crude oils found in sections of the country other than California and New Mexico are highly inflammable and very volatile, and, in their crude state, are not applicable for use as wood preservatives in any process. For these reasons, it is necessary to refine the asphaltic oils appearing in such unlimited quantities in the Central United States, in order to reduce their inflammability, volatility and viscosity. By submitting these asphaltic crude oils to a process of refining, the residuum secured is very similar, and in most cases superior, to the oil used in the West for the preservation of ties. After years of exhaustive research Indian Timber-asphalt has been placed on the market as a representative of what may be accomplished in the refining of the asphaltic oils so plentiful in the central regions of the United States. It may be purchased at about 3 cents per gallon, f. o. b. refineries, in practically unlimited quantities.

The steam railroads, with thousands of miles of track to maintain and millions of ties to be renewed annually, are able to install expensive pressure plants for the treatment of a portion of their annual requirements at the expense of hundreds of thousands of dollars. The electric railroads and small consumers of railway ties have been obliged to purchase their supply of treated material from outside commercial pressure plants or to use the alternative of substituting time for pressure in either the more economical low-pressure method or the open tank or immersion process.

The open tank or immersion process of treating timbers is one which has been successfully used by consumers of treated materials to whom the cost and capacity of a pressure plant has been prohibitive. Coal-tar creosote has not been used extensively in this method because of its tendency to evaporate when exposed to the atmosphere at a temperature of 215 degrees Fahrenheit. Several mining companies in the East have overcome this difficulty by boiling their timbers in closed retorts and collecting the volatile components of the creosote by allowing the fumes to pass through a still immersed in cold water, and thus condensing the volatile vapors into a tank and again utilizing them by pumping the condensation back into the original retort. Even with this method there is necessarily some loss by evaporation, as creosote will lose between 30 and 40 per cent. of its volume when exposed to the atmosphere at the above temperature. For this reason the use of creosote in the open tank process has not been considered by many consumers of treated materials to be economical, and since the advent of asphaltic oils as successful wood preservatives, their adaptability for substitution for creosote in this immersion process has been carefully investigated and substantiated.

The crude asphaltic oils of the West are exceedingly viscous and hard to handle by either the pressure or open tank equipment, but the refined asphaltic oils of the central United States have been found to be most excellent for use in this connection, as there is absolutely no waste by evaporation and no trouble whatever in their handling by the average equipment of any plant using either the pressure or immersion process.

Many preservatives are strongly advocated for use in the open tank process which have high boiling points and are non-volatile, but which call for an injection into the wood in small quantities, because of their extremely high cost. In treating timber with the best grades of creosote there is absolutely no question of the highest efficiency of the full-cell process, in which a maximum amount of creosote is injected. It is, therefore, reasonable to assume that the most efficient treatment with any other preservative would be one that would allow a maximum injection of preservative oil at the minimum expense. A superficial treatment with high-priced preservatives undoubtedly prolongs the life of untreated timber a few years by creating an antiseptic environment. In most cases the producers of high-priced wood preservatives contend that it is only necessary to immerse the timber for a few moments in a hot bath of oil and for a briefer period in a cold bath, in order to secure an absorption which would prolong the life of the timber indefinitely. But, as stated above, the most efficient treatment in any process has been found to be one that would allow a maximum amount of preservative to be absorbed by the timber. Low-priced asphaltic oils have been proven to be thoroughly effective wood preservatives when applied in maximum quantities by any process.

The rapid advancement of the preservative treatment is also greatly dependent upon the reduction in the initial cost of plant equipment necessary to secure thorough impregnation. With this end in view a plant was recently erected in Cincinnati consisting of two tanks equipped with steam coils and suitable lids for protection against inclement weather, a boiler and boiler pump, a stiff-leg derrick and derrick slings with which to handle ties in bunches of twenty-five at a lift. This plant has a capacity of 15,000 ties per month, and did not cost to exceed $3,000 complete.

The process used consists of immersing mixed oak, beeech, elm, gum, maple, etc., in hot oil at a temperature of 215 degrees Fahrenheit for a period of from eight to ten hours, dependent upon the previous seasoning of the timber. The steam is then shut off and the ties are allowed to cool in the asphaltic oil over night, when a drop in temperature of from 20 to 30 degrees Fahrenheit is recorded. The long hot bath at 215 degrees Fahrenheit heats the tie throughout and has a tendency to kill any germ life which may be present in the untreated tie, expands and expels any air which may be contained in the wood cells and boils out the moisture and sap juices. As the oil cools over night the cellular spaces within the tie contract, forming a vacuum which draws the oil into the wood by means of atmospheric pressure. In this way, the asphaltic oil takes the place of the air, moisture and sap which had previously been expelled in the boiling period.

The working tanks are carefully calibrated and readings of tank gauges and tank temperatures taken before the immersion and after the withdrawal of the ties. These readings are corrected to 60 degrees Fahrenheit, and as the number of ties, and thus the number of cubic feet entering each charge, are known, it is an easy matter to calculate the injection per tie or per cubic foot. This method of determining the injection per cubic foot of the preservative has heretofore been considered impossible with the open tank process. Checking the results secured from the calibration of the tanks by weighing individual ties has resulted in actual proof of its success. The average injection secured by this process at the above plant has been found to range between two and two and a half gallons per tie. The penetration secured on ties of mixed oak, beech, elm, gum and maple, etc., has been found to be most excellent on timber which has been air seasoned from four to six months. The actual costs of operation of a plant of the above capacity and design are as follows:

COST TABLE 500 TIES PER DAY.

		Per Tie.
2¼ gallons of oil at $0.035		$0.07875
Rental of ground		.003
1 ton of coal at $2.50		.005
Labor and superintendence—		
6 men at $1.75	$10.50	
1 superintendent	3.00	
1 engineer	2.50	
Incidental	.75	
	$16.75	.0335
Equalling a total of		$0.12025

(These figures are based on actual operations at the Cincinnati plant.)

The first cost of construction of such a plant could be easily reduced by many of the traction companies to $2,000 or $2,500 by placing the treating tanks adjacent to their power house, from which exhaust or surplus steam could be utilized for heating the oil. In this way the expense of boiler installation would be saved, besides securing a reduction in the cost per tie for treating by the elimination of fuel. If it were desired to lower the capacity of the plant from 15,000 to 7,500 ties per month, the first cost of erection could still be reduced by the elimination of one of the treating tanks.

Full sized, No. 1, first class ties of the above species may be secured along the right-of-way of any traction company, loaded on cars, at a maximum price of 30 cents each. In other words, by the erection of a plant cost-approximately $3,000, full sized, No. 1, first class, treated ties, of mixed oak, beech, elm, gum or maple may be secured at a total cost of 42 cents each, f. o. b. lines. Such treated ties would not have merely a superficial treatment, but would contain from two to two and a half gallons of heavy asphaltic oil, injected in a twenty-four-hour treatment, which would prolong their life many years beyond the eight-year life which is now obtained from the use of untreated white oak ties. The average cost of a white oak tie is 55 cents, and, as is well known, this grade of timber is becoming scarcer each year. Every traction engineer is surely familiar with the economies secured through the use of treated railway ties, as their use has been recommended by every engineering association and society in the country.

To reiterate:

First—Asphaltic oils have been thoroughly tried out and unquestionably proven to be efficient and economical wood preservatives.

Second—Asphaltic oils are obtainable in unlimited quantities and at exceedingly low cost.

Third—The cost of the less expensive plant equipment of the open tank or immersion type is comparatively low—the cost of a plant with a capacity of 15,000 ties per month ranges from $3,000 to $2,000, if surplus steam from power house boilers is utilized.

Fourth—Asphaltic oils are applicable to the open tank or immersion process of treating timber, because of their non-volatility and non-inflammability.

Fifth—The cost of white oak ties is approximately 55 cents, untreated.

Sixth—The cost of mixed oak, beech, elm, gum, maple, etc., ties, obtainable in such unlimited quantities along the right-of-way of every traction line, is approximately 30 cents, untreated.

Seventh—The cost of treatment per tie aggregates approximately 12 cents, bringing the cost of a full sized, No. 1, first class, treated tie to 42 cents, f. o. b. traction lines.

Therefore, well preserved railway ties, with a twenty-four-hour treatment and containing an injection of heavy asphaltic oil, in quantities of two or two and a half gallons per tie, with a resultant life at least equivalent to that of white oak, may be secured at approximately four-fifths the cost of standard first class, white oak ties. These comparative figures are based on actual costs of treated ties to individual traction companies performing their own treatment.

The Bond of a Road

By J. S. Robeson, Au Sable Forks, N. Y.

WHETHER the road is built of stone, of gravel, of sand-clay, of top-soil or of plain dirt, there is always in it, to a greater or less extent, in accordance with the particular materials used and the care with which it has been built, an adhesion or bond between the particles or pieces that form the body and the surface. The strength of this bond determines the value of the road.

More than fifty years ago the agricultural chemists in their study of the soil discovered that water has a very decided leaching action; that certain salts are thus extracted from the earth and that the degree or amount of this extraction is influenced, decreased or increased, by the absence or presence of certain compounds commonly found in the earth. Now, some of these matters capable of being thus leached or extracted by water are powerful adhesives. If it is borne in mind that all soil is but disintegrated, though sometimes, as well, decomposed rock, the possible connection between the knowledge of the agricultural chemist and the action that should take place in a stone road are seen.

It is well to confine this comparison, in this instance, to the macadam road surface, because that has been more carefully studied and is perhaps, therefore, better understood than any other style of road building in use today. It has been recognized for years that the wet-rolling of a macadam road was necessary in order to secure the most compact surface, and also that certain rocks would make such a dense road, while others, no matter how much they were wet-rolled, would never give this desired result. Analytical work in the physical and chemical laboratory eventually proved that the stones that made the well-bound road contained certain chemicals that did not exist in the stones that were used in the roads that failed to bind under the wet-rolling.

It has been thoroughly proven, by these and other tests, that the macadam road is held together by the two factors, (1) the mechanical mixture of the different sized pieces, so proportioned that the voids are well filled and the stones locked together in the arch, and (2) by the adhesive chemicals that are leached out by the water. These are rubbed off of the stone surfaces by the rolling during construction and the traffic afterwards, thus leaving fresh stone surfaces ready again for the action of the water, which as it sinks through the roadbed spreads out these binders and distributes them through the aggregate.

It has been distinctly proven that neither one of these two factors by itself and alone will give a road strong enough to stand the traffic. As a bit of circumstantial proof, note the English roads. They are often cited as being so good and so much better than those built during recent years in the United States. The casual road critic, and both the newspapers and the technical press are full of him today, invariably says that these good results are obtained because they have better road engineers than we, that they spend more money in heavy construction and better maintenance and then, if the critic be in a kindly frame of mind, he suggests that they are better because they are hundreds of years older. The English road engineers are good, painstaking, skilled men, but no better than those who are devoting their time to the work in this country. If, as is sometimes the case, the foundation is deeper and the road metal thicker than with us, it is not more than the greater traffic demands, and as to the great strength of the roads being due to great age, the most cursory study of English literature will show how few years have passed since the main highways of England were as bad as our worst dirt roads. With MacAdam came the first real roads for England and MacAdam is but little more than twice the span of a man's life behind us.

No, it is neither the skill, nor the cost, nor the age that makes the contrast between the American and the English road, but it is water, simply water. While the total rainfall during the year is not greater in England than on the American continent, there is the vital difference that in the United States the rain comes in great quantity at times with long dry spells intervening, while in England there is a little rain every other day. This little rain every other day keeps the stone road always moist, and with this moisture and the roll of the traffic there is a constant increase of the chemical bond leached from the stone.

On one point does the critic's reference to the age of these roads apply, though not then in the manner intended. All English roads are protected by trees and age has perfected this protection. It is one of the great errors made in road building in the United States that the specifications for construction do not include tree planting and that the builders are allowed to destroy trees already growing along the road side. The stone road needs moisture, but only enough to continue the formation of the binder, so that there must be proper drainage to remove the excess of water and shade to prevent an excess of sun. The American roads have the drainage, but hardly a tree, whilst the English roads have both, and in those two are found the main reason for the superiority of the over-sea roads to those on this side of the Atlantic. The climate is different in the two countries. It would be impossible to exactly duplicate in one land the condition in any other land, but advantage may be taken of as much as can be transplanted, and therein lies some part of the failure in that the value of the road-side tree has not been appreciated.

As a further bit of practical circumstantial evidence as to the existence of this leached chemical bond, look at the many miles of macadam road that have been built with ¾ to 1½-inch stone, the voids filled with loam instead of with some screenings. In the making this loam is watered until it is mud and the mass wet rolled until solid. These dirt-filled stone roads are as good roads as the stone-filled stone roads in many cases, and yet there must be a great difference in the mechanical bond or interlacing of the stones.

While it is true that the decomposition of rocks and the consequent formation of the soil is mainly brought about by water action and it would, therefore, seem that all of the leachable bond had been removed in this process, the bare fact is, that not all of the bond-making substances have been removed, consequently the contact of the fine particles of the loam with the stone surfaces in the road, always in the presence of moisture, will start up the reaction and produce the bond in a greater or less quantity in accordance with the character of the stone and the soil thus brought into contact. This is a fact of far-reaching importance when considering the possibility of building elastic, firm earth roads under conditions where the expense of a stone structure is not warranted. The bonding materials thus produced have one characteristic that is vital to success in road work, the power to re-cement again and again. This power they possess in an almost infinite degree.

It is well known that the increased use of motor vehicles during the past few years and the further increase in their number that may be expected in the coming years have so changed traffic conditions as to make the good road surface of the past too weak to stand the strain placed upon it by the additional weight and speed of these conveyances. Putting aside all question of the dust, since that in itself is but the symptom and not the disease proper, the main thought has been that the trouble could be cured by an increase in the strength of the bond.

Of all the multitude of methods that have been suggested and tried there remain, speaking broadly, but two. In one of these, that of the bond and matrix, the best type example is that one known as the bitumen top surface. In this the stone for the surface is set into a bitumen mass as in a matrix. There is then but little of the mechanical bond due to the different sized pieces being forced and compacted together under the roller nor any production whatsoever of the bonding materials existing in the stone. The life of such a surface is dependent on the strength and elasticity of the bitumen material that coats and surrounds the stone particles and fills the voids.

In the other of the two methods, that of the increased natural bond, the best type example is that one known as the glutrin-water-bound road. In this the production of the natural bonding materials that exist in the stone has been increased and assisted to such a degree as to make a surface that will withstand present day traffic conditions.

The material used and the action produced are, in almost every way, the direct opposite of the other or bitumen type. This is distinctively shown, in one way, by the fact that water is essential for the proper and complete action needed in a glutrin bound road. This fact, coupled with its complete solubility in water, have caused many engineers to form an erroneous idea regarding the permanency of its action. Experience, however, has shown that it is never completely washed out of the road bed, that it has a cumulative action, and that the amount required each year to maintain a good surface is but a fraction of the original application. This liquid, strongly adhesive in and by itself, is applied partly with the water during the wet rolling, the balance being sprinkled on the finished surface of the roadway. In addition to its inherent adhesive action, as of a gum, it exerts a certain influence on the leaching power of the water, causing a much greater production of the bonding materials from the stone or soil forming the bed.

Igneous and crystalline rocks are commonly used for road building and the feldspars are the most abundant minerals in these rocks. So abundant are they that collectively they form a very large part of the earth's crust. Now chemically, the feldspars are silicates of alumina, containing in addition soda, potash or lime, and from them come the powerful, re-cementing adhesives, the silicates of soda and potash, that act as the road bond. The feldspars decompose when exposed to the weather and produce the clays and soils. The decomposition by the weather is, in a sense, similar to the leaching action that occurs in the damp road, except that it is carried, in the course of a long time, to the complete destruction of the rock as a rock, leaving a residue of clay and sand, separated as two such named bodies perhaps, or mixed in varying proportions to form loam. Just as the agricultural chemist recognized that the presence of certain compounds in the soil made a difference in the leaching solution, so it has come to be understood that combinations of different stones would give a better bond in a water-bound macadam than when only one kind of stone is used. This fact is even more plainly noticed when glutrin is applied.

Now, while the exact reason for this is not known, it has been so clearly and frequently proved, that definite rules can be given, after an examination of the stones, for producing the result. The general method is to build the aggregate or body of the road of some tested stone containing feldspar, such as trap, gneiss, etc., this work being done in accordance with any good macadam specifications, suited for the amount of traffic in that particular instance. When the wet rolling commences, glutrin is mixed with the water, and when that is finished in a satisfactory manner, limestone screenings, containing the dust, are scattered over the surface, and the sprinkling with glutrin and water, about half of each, is continued until the road has absorbed about one gallon of mixture to each square yard of the surface over about two-thirds of its width. In localities where limestone is the cheaper the method has been reversed, so that the limestone forms the aggregate and the screenings and dust scattered over the top are of feldspathic rock. In either case, the result is a cement-like surface that resists the wear of the traffic very well and that, because of the great re-cementing power of the binder, is fresh, smooth, clean and absolutely free from dust after each rain.

Another method, not however as yet so extensively used as the first, consists in mixing limestone with the feldspathic stone in the aggregate, in addition to the surface sprinkling of the screenings. This has been done by using a mixture of the two different stones in the same sizes, as well as by using smaller sizes of limestone to fill the voids between the larger feldspathic stones, or the reverse. This seems to make, as would appear natural, an even more solid and resistant road. A comparison of the local costs of the two kinds of stone and of the difference in annual repair figures would determine the better method in any particular locality.

The repairs are slight on these glutrin-bound stone surfaces owing to the healing and re-cementing action of the bond. When necessary, however, they are made by cleaning out the hole or depression, putting in new fine stone and dust and sprinkling with glutrin, usually without dilution. This is packed by the traffic and soon cannot be distinguished from the rest of the surface. In this connection it may be noted that although this binder is very dark in color it changes the natural color of the road but slightly and that a few weeks after its application even this slight difference in shade cannot be detected.

The actual length of time before resurfacing is necessary depends on the hardness of the stone used in each case, but it has been found that as compared to the plain water bond, on similar stones, the period is increased by at least 50 per cent. A method of renewal that is giving good results consists in spreading over the center 7 to 9 feet on a 16-foot road, about 20 to 25 tons of limestone or feldspathic screenings and dust, as the aggregate may demand, to each mile. This is then sprinkled with glutrin water and packed by the traffic or rolled. This is done as soon as the road surface shows any signs of general wear, and seems to be a very economical method.

While all these details have been described as on stone roads, it is easy to see that, bearing in mind the close relationship between the rocks and the soils, similar results could be obtained with this binder on clay-gravels and other mixtures, such as sand-clay, etc. Such, indeed, has proved the case, and it has been demonstrated that earth roads of a smoothness and hardness never before supposed possible can be built with glutrin. It is, of course, necessary that they be properly graded and drained and that a careful selection of the soils be made for the mixture.

Methods for Testing Coal Tar and Refined Tars, Oils and Pitches Derived Therefrom

By S. R. Church, Barrett Manufacturing Company, New York City

THE tests described in this article are not put forward as methods for the scientific examination of, or reasearch into, the products of coal tar. An attempt has been made by a committee of chemists of this company to revise and standardize the every-day tests applied to the raw materials and products of the American tar distiller. The primary object of this undertaking was that concordant results might be obtained by the operators in the company's own laboratories. It is well known to those who have engaged in the testing of tar, pitch, creosote oil, etc., that results are absolutely not comparable in most cases unless both analysts have used the same methods. Even then great care is necessary to eliminate the personal element. The foregoing is much more applicable to these physical tests of complex hydrocarbons than it is to strictly chemical analyses, which involve definite reactions and are calculated according to formulae.

It is now over a year since these methods were adopted for use in our laboratories and the results have been encouraging. Many of the tests, particularly those of pitch, refined tar and creosote oil are of interest to the consumer as well as to the producer. In response to many requests from time to time we have furnished copies of certain tests to chemists and engineers who desired them. The melting-point test for pitch may fairly be called standard for designating and testing pitches throughout the country. The tests of creosote oil include the methods of the American Railway Engineering and Maintenance of Way Association, which are widely used by consumers of creosoted materials, and the methods of the United States Department of Agriculture, with slight modifications.

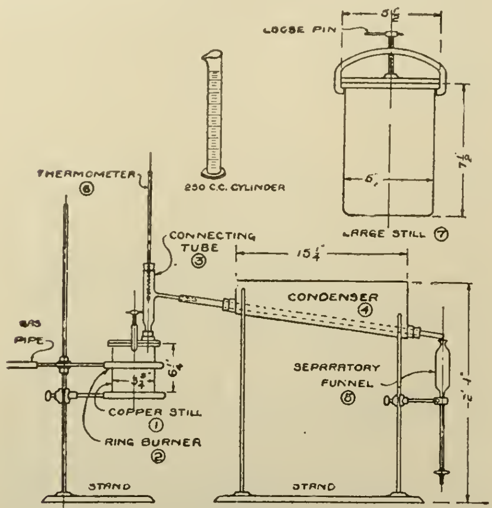
The tests are now described and illustrated in detail, in the belief that it will be a help to some who are called upon to test, or draw specifications for testing, materials concerning which little information is available in textbooks. It is not supposed that the methods are the best possible in every instance. In some cases concessions have been made to precedent, in others to convenience. They will undoubtedly be revised from time to time as valued suggestions come to us from the rapidly increasing number of chemists who are engaging in the examination of these materials.

(NOTE—Apparatus marked "Special" or "Standard" on drawings is made up to our order and we will advise any one interested where such apparatus may be obtained.)

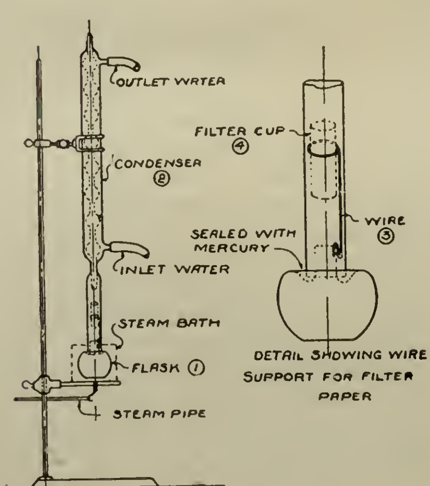
TAR.

(*a*) *Water in Tar.*

The apparatus used is illustrated in Drawing No. 1. Measure 50 cc. of coal tar naphtha or light oil (which must be tested to determine that it is free from water, whenever a new supply is required) in a 250 cc. measuring cylinder. (No objection is raised to meassuing the tar direct into the still or in other ways, but the measurement must be made as described in case of dispute.) Add 200 cc. of the tar. Transfer contents of cylinder to copper still and wash the cylinder with 50-75 cc. more of naphtha, adding the washings to contents of the still. Attach lid and clamp, using a paper gasket and set up apparatus as shown in drawing No. 1. Apply heat by means of the ring burner and distil until the vapor temperature, as indicated by the thermome-



DRAWING No. 1
CRUDE TAR DISTILLATION
No. 1 - COPPER STILL, SMALL SIZE SPECIAL
No. 2 - RING BURNER " "
No. 3 - CONNECTING TUBE "
No. 4 - CONDENSER WITH TUBE "
No. 5 - SEPARATORY FUNNEL "
No. 6 - THERMOMETER STANDARD
No. 7 - LARGE STILL FOR COMPLETE TAR TEST SPECIAL
No. 8 - RING BURNER, LARGE SIZE, SPECIAL (NOT SHOWN)



DRAWING No 2
EXTRACTION APPARATUS FOR FREE CARBON
No 1 - FLASK (E & A 3183A or 3188C
No 2 - KNORR EXTRACTION APPARATUS E & A 3183
No 3 - WIRE, COPPER AS PER SKETCH
No 4 - FILTER CUP, 2 SHEETS C.S. & S 575 PREPARED AS DESCRIBED

ter (in this and all other tests care must be used to have thermometer set exactly as shown in drawings) has reached 205 degrees C. (400 degrees F.). The distillate is collected in the separatory funnel, to which 15-20 cc. of benzol has been previously added. This effects a clean separation of the water and oil. The reading is made after twirling the funnel and allowing to settle for a few minutes. The percentage is figured by volume.

(b) *Specific Gravity.*

The tar is dried by taking 300-400 cc. in the apparatus used for water determination without the addition of naphtha. The distillation is carried to 170 degrees C. (338 degrees F.) vapor temperature. Any oil which has distilled over is separated from the water and returned to the still and thoroughly mixed in after cooling. Apparatus: A specific gravity bottle, Hubbard type (special), whose water capacity at 15.5 degrees C. (60 degrees F.) has been determined by experiment. Ten grams of tar are introduced at a temperature of 40-50 degrees into the weighing bottle and the weight taken after cooling. Then freshly boiled distilled water is added and the bottle kept in a bath at 15.5 degrees C. (60 degrees F.) until no further contraction takes place. The water is then adjusted to the mark and the bottle removed from the bath and weighed. Weight of tar divided by the weight of H_2O displaced gives the specific gravity. For rough determination, as of wet tar, a spindle may be used at any convenient temperature. To reduce the gravity as found to 15.5 degrees C., 0.000685 is added for each degree C. above 15.5 degrees C. (or 0.00038 for each degree F. above 60 degrees F.).

(c) *Free Carbon.*

Apparatus is shown in Drawing No. 2. Tar dried as under specific gravity must always be used. The dried tar is passed through a 30-mesh sieve to remove any foreign substances. In testing tars of 5 per cent. or more carbon content 5 grams are taken. On lesser percentages 10 grams are used. The amount is weighed out into a 50 cc. beaker and digested with C. P. toluol on the steam bath. Two 15 cm., 575 S. and S. filter papers, the inner one cut to 14 cm. diameter, are folded around a rod of about 1.5 cm. diameter, so as to form a long cylindrical filter cup. (These filter papers have been previously extracted with benzol to render them fat-free.) The cup is dried at 100-110 degrees C. and placed in weighing bottle and weighed after cooling. It is supported by a wire or some convenient method over a beaker. The toluol tar mixture is now decanted through this cup and the beaker washed with hot toluol until clean, all washings being passed through the cup. (A convenient "policeman" to use in cleaning the beaker is a stout chicken feather trimmed so as to have a small fan at the end.) The filtrate should be carefully examined for any particles of free carbon and if there is any evidence of same, should be refiltered. Finally the cup is washed two or three times with hot C. P. benzol and then is transferred to the extraction apparatus (see Figs. 1 and 2), the filter cup being supported by a wire (Fig. 3). C. P. benzol is used as a solvent, heat being applied by a steam bath and the extraction is continued a number of hours until the descending benzol is completely colorless. The cup is then removed, dried as before, and weighed in the bottle after cooling. The balance used for the above determination should be accurate to 0.5 mg. In removing the filter papers from the extractor care should be taken that no particles of mercury find their way into the precipitate. To prevent splashing the filter paper should be elevated as near to the outlet of the condenser as possible. A good precaution is to cover the top of the filter cup with a round cap of filter paper.

(*d*) *Fixed Carbon and Ash.*

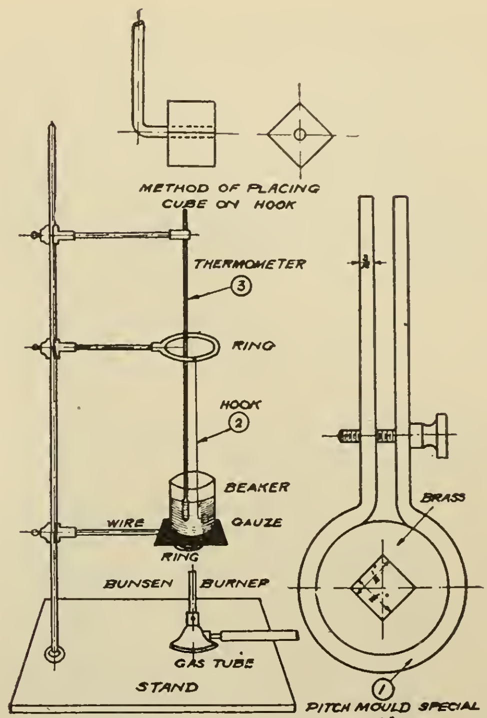
Fixed Carbon.—Based on report of committee on coal analysis. Place 1 gram of tar in a platinum crucible having a tightly fitting cover. Heat over the full flame of a Bunsen burner for seven minutes by the watch. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cm. above the top of the burner. The flame should be fully 20 cm. high when burning free, and the determination should be made in a place free from drafts. The upper surface should remain covered with carbon. To find "volatile combustible matter" subtract the per cent. of moisture from the loss found here. The residue in the crucible minus the ash represents the coke or fixed carbon.

Previous to applying the full heat of the Bunsen flame for seven minutes, as above described, the tar should be gently heated for a few minutes until the tendency to foam is passed.

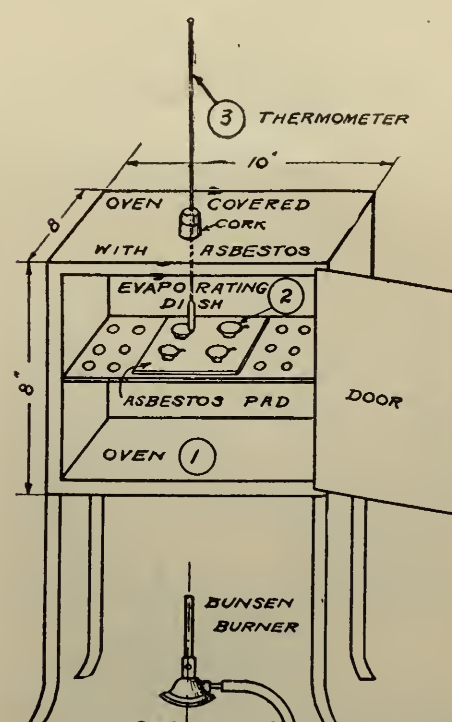
Ash.—Take 10 grams in an open platinum or porcelain crucible and incinerate to constant weight by any convenient method, being careful to avoid foaming at the start or carrying off ash at the end.

(*e*) *Viscosity.*

The Engler viscosimeter is used and time of flow of 200 cc. at 60 degrees C. (140 degrees F.) is taken. All directions for use of viscosimeter accompany the apparatus (E. & A. 7167, p. 393).



DRAWING No 3
MELTING POINT TEST
No 1 PITCH MOULD (SPECIAL)
No 2 HOOK; MAKE OF #12 COPPER WIRE
No 3 THERMOMETER (SPECIAL)



DRAWING No 4.
DRYING & EVAPORATING OVEN.
No 1- 8"x 8"x 10"-DRYING OVEN E/A 3030
ASBESTOS COVERED
No 2-DISHES- E/A 2376-2" DIA (SPECIAL)
No 3-THERMOMETER - STANDARD.

DISTILLED TARS.

Saturating Mixtures, Tarvia, Coatings.

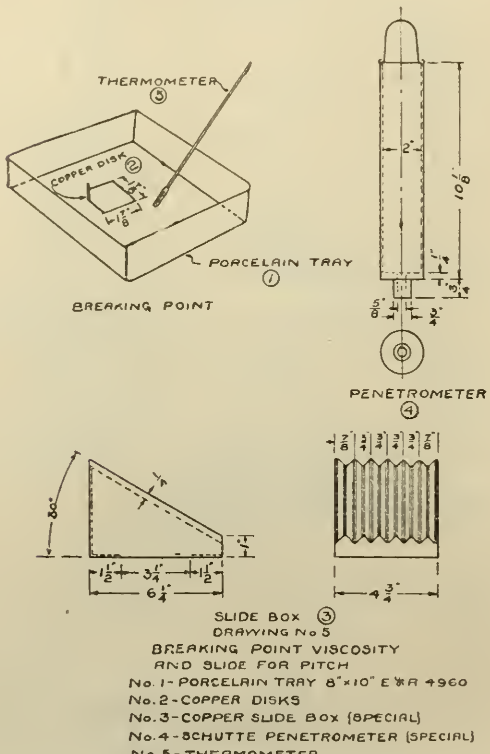
A. *Specific Gravity.*—(Same as Tar.)

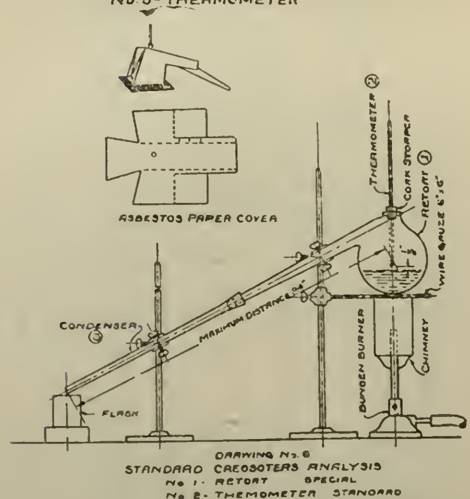
B. *Free Carbon.*—(Same as Tar.)

C. *Viscosity.*—

1. Saturating and light tarvias—Engler viscosimeter (same as Tar).

2. Tarvia X to soft pitch—Schutte penetrometer, Drawing No. 5.





[1] The fraction -170° C. shows crude benzol, toluol and solvent; 170-200° crude heavy naphtha.

[2] Distillation continued to dryness and drying point recorded.

The tests on the Schutte penetrometer shall be made as follows:

The plug used shall be of the following dimensions: Diameter, ⅝ of an inch; height, 1 inch.

In filling the plug, it shall be placed upon a flat tin roofing disc, which has been greased with vaseline. The material shall then be poured in and the plug placed in water of the required temperature, for at least ten minutes. The plug shall then be screwed into the tube while the tube is in position, and the plug submerged in the water. The tube shall be filled with water of the given temperature, and the disc removed by slipping it sideways. The time shall be taken from the moment of slipping the disc. Extreme care must be taken to take the temperature accurately and keep the water at the given temperature within ½ of a degree. An accurate thermometer shall be used. The water in the tank shall barely cover the shoulder of the tube. If care is taken to keep accurate temperatures, and the test is made with skill, successive determinations should agree within five seconds.

D. *Distillation.*—As under standard creosote method (see Creosote).

Temperature and fractions are to be taken as required.

PITCH.

A. *Specific Gravity.*—On soft pitch this is taken in a bottle as described under Tars. On hard pitch an alternative method is suspension of a lump from the balance beam by a thread and noting the weight in air and water, being careful to remove any air bubbles found on the lump.

B. *Free Carbon as in Tars.*—

1. Pitches from 43 degrees to 77 de- be ground.

2. The carbon residue should be examined for foreign matter.

C. *Melting Point.*—Apparatus shown in Fig. 3.

1. Pitches from 43 degrees to 77 degrees C. (100 degrees to 170 degrees F.). A clean-shaped ½-inch cube of the pitch to be formed in the mold, placed on the hook of No. 12 copper wire, and suspended in the 600 cc. beaker so that the bottom of the pitch is 1 inch above the bottom of the beaker. (A sheet of paper placed on bottom of beaker and conveniently weighted will prevent the pitch from sticking to the beaker when it drops off.) The pitch to remain five minutes in 400 cc. of water at a temperature of 15.5 degrees C. before heat is applied. Heat to be applied in such manner that the temperature of the water is raised 5 degrees C. (9 degrees F.) each minute. The temperature recorded by the thermometer at the instant the pitch touches bottom of the beaker to be considered the melting point.

2. Below 43 degrees C. (110 degrees

F.) the same method can be used except that at the start the water should have a temperature of 4 degrees C. (40 degrees F.).

3. For pitches from 77 degrees C. up (170 degrees F.), cotton-seed oil should be substituted for water; otherwise the method remains the same. With these harder pitches, it may be necessary to heat the pitch in order to form a cube. Care should be used not to heat it any higher than is necessary, or to continue heating it for any length of time. A hot knife blade will often assist this manipulation.

(NOTE.—To aid the removal of the pitch from the mold it may be greased with a very thin film of vaseline.)

D. Breaking Point.—Apparatus, Fig. 5, Figs. 1 and 2. A small piece of pitch is quickly melted directly on the copper disc on the steam bath to a layer of about 1-32 of an inch. The disc is then placed in the porcelain dish and well covered with water of about 10 degrees to 12 degrees C. above the breaking point of the pitch. The temperature is reduced 1 degrees per minute and tested from time to time by inserting a small, thin knife blade below the pitch and turning slightly until a point is reached at which the pitch snaps. This is taken as the breaking point. The copper disc should be held with a pair of tongs and not with the fingers.

E. Evaporation Test.—Apparatus as shown in *Drawing No. 4.* The oven should have the top and sides covered with ⅛-inch asbestos. The shelf is provided with a ¼-inch asbestos pad, large enough to accommodate the dishes. The bulb of the thermometer should be 1 inch above the shelf and the emergent stem must be within 10 degrees C. of 100 degrees. Not more than 4 tests should be run in oven at a time. Ten grams of pitch are weighed in the dish, placed in the oven and held exactly at 160 degrees C. for seven hours and after cooling in a desiccator, the loss in weight is noted.

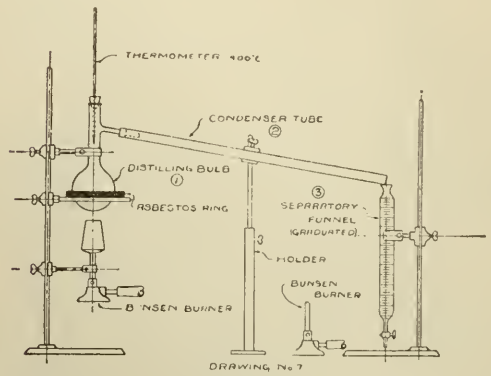
When accuracy is required the apparatus used shall be a circular oven of the type described in Eimer & Amend's catalog No. 2073 D, having double walls, circulating fan and self-contained burner.

F. Slide Test.—Apparatus as in Drawing No. 5, Fig. 3. A ½-inch cube of pitch, such as used for the melting point, is placed at the top of a depression in the corrugated plate (angle 30 degrees) and warmed slightly and pressed down so as to present a rounded top, care being taken to keep the front edge intact. A mark is made on the adjoining ridge parallel to the front edge of the cube. The slide plate is placed in an oven with a thermometer about 1 inch above the center of the slide and kept at 40 degrees C. for seven hours. The measurement it taken from the previous mark to the furthest point the pitch has reached.

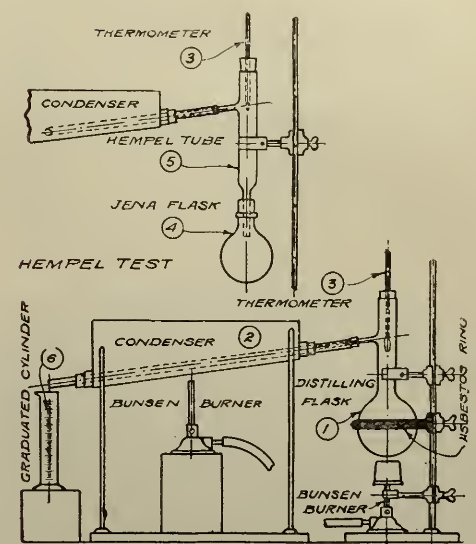
(NOTE.—Soft pitches which run beyond end of slide must be watched and the time they slide to the end noted.)

G. Fixed carbon as in tar.

H. Ash as in tar.



DRAWING No 7
HEAVY OIL TEST
No 1 - DISTILLING FLASK E & A 3866
No 2 - CONDENSER TUBE
No 3 - SEPARATORY FUNNEL (SPECIAL)



— DRAWING No 8. —
LIGHT OIL DISTILLATION
No 1 - DISTILLING FLASK (E & A - 3866).
No 2 - CONDENSER (SPECIAL)
No 3 - THERMOMETER (STANDARD)
No 4 - JENA FLASK (A H THOMAS - 1426, 200 C.C.)
No 5 - HEMPEL TUBE (SPECIAL)
No 6 - GRADUATED CYLINDER (100 CC)

LIGHT OIL.

A. Specific Gravity.—Taken with a hydrometer at 15.5 degrees C. For this and subsequent tests it must be dried if containing more than 1 per cent. of water. This is done as described under creosote.

B. Distillation.—Apparatus as in Drawing No. 8. 100 cc. are measured in a cylinder and transferred to the 200 cc. Jena glass distilling bulb and heated. The distillate is collected in a 100 cc. cylinder. The point where the first drop falls from the end of the condenser is noted and thereafter the cc. distilled noted at every even 10 degrees C. continuing until 95 per cent. of the oil has distilled. Toward the end, the condensing water must be heated to avoid separation of napthaline.

C. Tar Acids.—The distillate from B is taken in the separatory funnel (Drawing 7, Fig. 3) as used in creosote oil and the tar acids determined in the same way.

D. Redistillation.—The extracted oil is placed in the Hempel apparatus (Drawing 8, Figs. 4 and 5) and redistilled, noting the cc. that have come over at 170 degrees C., at which latter point the distillation is interrupted.

E. Naphthalene.—The residue above 200 degrees left in the flask in D is transferred to a copper breaker and cooled to 15.5 degrees C. for fifteen minutes and the dry napthalene determined as under creosote.

CARBOLIC ACID.

A. Specific Gravity.—Apparatus—see Drawing 8. If the oil is not limpid at 15.5 degrees C., the gravity is taken at a higher temperature and 0.0008 added to the specifis gravity for every degree above 15.5 degrees.

B. Distillation—same as "Light Oil."

C. Tar Acids—same as "Light Oil."

BENZOLS.

A. Distillation. — Apparatus — see Drawing 8. Same as light oil, with the water in the condenser always cold. With C. P. benzol or toluol readings are taken every 0.2 degrees C.; with commercial benzols every 10 degrees C. a reading is taken.

B. Gravity.—Hydrometer at 15.5 degrees C.

C. Wash Test.—Taken only on water white grades.

About 7 cc. of concentrated H_2SO_4 and 21 cc. of the benzol are shaken in a small glass stoppered French square bottle of 30 cc. capacity and the coloration of the acid and oil noted.

CREOSOTE OILS.

A. Standard Creosoters Distillation.—Apparatus. Drawing 6. Method as given in *Bull.* 65, American Railway Engineering and Maintenance of Way Association.

Before beginning the distillation, the retort should be carefully weighed and exactly 100 grams of the oil placed therein, the same being weighed in the retort. The thermometer should be inserted in the retort with the lower end of the bulb ½-inch from the surface of the oil, and the condensing tube attached to the retort by a tight cork joint. The distance between the bulb of the thermometer and the end of the condensing tube should not be less than 20 nor more than 24 inches, and during the progress of the distillation the thermometer must remain in the position originally placed.

The distillates should be collected in weighed bottles and all fractions determined by weight. Reports are to be made on the following fractions:

0 to 170 degrees Centigrade
170 to 200 degrees Centigrade
200 to 210 degrees Centigrade
210 to 235 degrees Centigrade
235 to 270 degrees Centigrade
270 to 315 degrees Centigrade
315 to 355 degrees Centigrade

For practical purposes there will be no need of reporting on all of these fractions. It will be sufficient to report on the fractions as follows:

Below 200 degrees Centigrade
200 to 210 degrees Centigrade
210 to 235 degrees Centigrade
235 to 315 degrees Centigrade
Above 315 degrees Centigrade

Reports to be made on individual fractions. In making such reports, it is to be disinctly understood that these fractions do not necessarily refer to individual compounds. In other words, the fractions between 210 and 235 degrees will not necessarily be all napthalene, but will probably contain a number of other compounds.

The distillation should be a continuous one and should take about forty-five minutes.

When any measurable quantity of water is present in the oil, the distillation should be stopped, the oil separated from the water, and returned to the retort, when the distillation should be recommenced, and the previous readings discarded.

In obtaining water-free oil, it will be desirable to free about 300 to 600 cc. of the oil by using the copper tar still and using 100 grams of the water-free oil for the final distillation. In the final report as to fractions, a correction must be made for the water content, so that the report may be made on the basis of a dry oil.

Determination of Specific Gravity of Oil.

In order to determine the specific gravity of any oil, heat the oil in a water bath until it is completely liquid. A glass stirring rod dipped into the liquid should show no solid particle on the rod when the same is withdrawn from the oil. When completely liquid, stir thoroughly and fill the hydrometer cylinder, which has previously been warmed. Insert a specific gravity hydrometer, taking care that the hydrometer does not touch the sides or bottom of the cylinder when the reading is taken. Take the temperature of the oil and make a correction for the specific gravity by reducing the same to the standard temperature of 15.5 degrees C. or 60 degrees F. The correct gravity is obtained by multiplying the correction figure 0.0008 by the number of degrees C., or 0.00044 by the number of degrees F., the oil is found to be above 15.5 degrees C., or 60 degrees F., and adding the product to the observed gravity.

Notes.

1. Emphasis is laid on attention to details and importance of a retort of the standard size.
2. The thermometer used must be of standard make, gas-filled and must be regularly tested for accuracy.

CREOSOTE OIL—ADDITIONAL TESTS.

A. Drying Oil.—Apparatus as in drying tar. 500 cc. are distilled up to 170 degrees C., the water noted and the oil distilling over returned to the still after cooling.

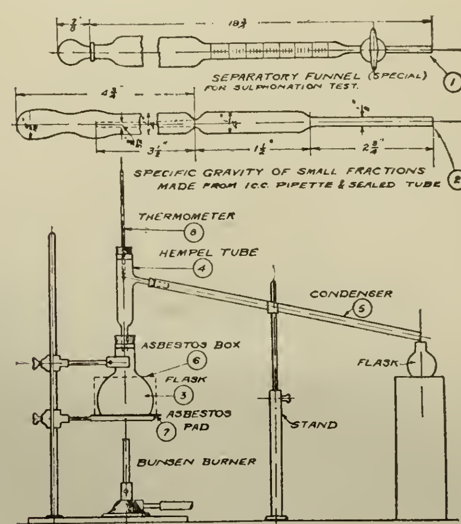
B. Tar Acids—Apparatus shown in Drawing 7. 100 cc. of oil measured at limpid point, placed in Jena glass bulb and distilled. The distillation is continued until at least 95 per cent. has distilled off. The time from the first drop to the end should occupy about twenty minutes. The condenser tube should be kept warm enough by a flame during the operation to prevent distillate from solidifying. Warm the contents of the separatory funnel to 60 degrees C. in water, and note reading. Add 50 cc. of a 10 per cent. caustic soda solution. Shake well and allow to settle, drawing off the clear soda, warming again to 60 degrees, and noting the shrinkage. Repeat, if necessary, until no further shrinkage is noted. Then the total shrinkage is the per cent. of tar acids in the heavy oil.

C. Dry Naphthalene.—The extracted oil from B is placed in a copper beaker and held at 15.5 degrees C., for fifteen minutes. The mass is filtered on a perforated funnel in a suction pump and sucked dry. The napthalene in the filter is then pressed between paper in a letter press to remove all oil and weighed. The percentage is figured on the weights of the original oil as given by the gravity at the limpid point.

D. Limpid Point.—About 5 cc. taken in a No. 4 or No. 5 test tube at 60 degrees C. are cooled, stirring with a thermometer until the first crystals begin to form. This point is taken as the limpid point. Cool in water only, if necessary.

CREOSOTE OIL—SPECIAL TESTS.

A. Distillation as in Circular 112, U. S. Department of Agriculture, except that instead of the Hempel flask as described there, a 500 cc. Jena flask with a Hempel tube (shown in Fig. 3, Drawing 9) attached is used.



~ DRAWING № 9 ~
SPECIAL HEAVY OIL ANALYSIS

№ 1- SEPARATORY FUNNEL (SPECIAL) № 5- CONDENSER
№ 2 SPECIFIC GRAVITY TUBE (SPECIAL) № 6- ASBESTOS BOX
№ 3- FLASK (A.H.T. 14246 - 500 CC) № 7- " PAD
№ 4-HEMPEL TUBE № 8- THERMOMETER (STAND)

B. Gravities.—(Apparatus, Fig. 2, Drawing 9.) This is standardized with the pipette filled with water at 60 degrees C. Oil at 60 degrees is drawn up to the mark in the pipette, replaced in the outer tube and weighed. This can be used when only one or two cc. of oil are available.

C. Sulphonation Test.—Apparatus, Drawing 9. The weighed fraction distilling between 305 degrees and 20 degrees C. is warmed with concentrated H_2SO_4 (About 4-5 volumes) to 60 degrees C. and the whole transferred to the separatory funnel (Fig. 1). The flask is rinsed three times with more H_2SO_4 and the rinsings added to the funnel. Then the funnel is stoppered and shaken, cautiously at first; afterwards vigorously, for about fifteen minutes. Then let settle over night. Then the acid is carefully drawn down into the graduated portion to within 2 cc. of where unsulphonated residue shows. Whether any is visible or not the test should be carried further as follows: Add about 20 cc. water and let settle for one-half hour. Then draw down water as close as possible without drawing out any supernatant oil or emulsion. Then add 10 cc. strong H_2SO_4 and let settle for fifteen to twenty minutes. Any unsulphonated residue will now settle out clear and give a distinct reading. If under 0.2 cc. it should be drawn down into the narrow part just above the stopcock where it can be estimated to 0.01 cc. The cc. are figured as percentages on the weight of the fraction taken.

If the unsulphonated oil is dark in color it should be treated with an excess of 10 per cent. sodium hydroxide solution. If the oil is soluble in this reagent, the test is regarded as negative.—*The Journal of Industrial and Engineering Chemistry.*

OHIO STATE HIGHWAYS.

View of East Avenue Road, Tuscarawas County.

EDITORIAL COMMENT

The Effect of Public Service Commissions Upon Securities of Companies Operating Thereunder

THE EFFECT OF PUBLIC SERVICE COMMISSIONS UPON SECURITIES OF COMPANIES OPERATING THEREUNDER.

What is the effect of the public service commission upon the securities of the companies operating thereunder is a question which has often been asked, and the answer has not yet been given definitely.

Massachusetts has had a gas and electric light commission for many years, and that commission has had close oversight of the operations of companies. Rates have not been unduly reduced, indeed, the reductions in cost of operation, particularly in the cost of producing electricity (as shown in one of the leading articles on a preceding page) have been so extensive that rates could be materially reduced and at the same time the net returns from operation could remain large. In fact, as stated in the article referred to, the returns on the capital have been but slightly reduced in the past twenty years and securities have reached the stability of municipal bonds, so that the offerings of stock and bonds are readily taken at the prices fixed by the commission, which are regularly at or above par. So far as Massachusetts is concerned, therefore, the answer to the question seems to be that values are steadier, speculative elements are removed, capital is more willing to offer itself and at lower net rates than formerly, because of the greater safety both as concerns the value of the investment, the adjustment of the income to the demands of the plant operation, through proper application to the commission for change of rates, and the knowledge that the relation of capital to possibilities of profit will not be objectionably affected by unauthorized or ill-advised issue of stocks or bonds, since these issues must be approved by the commission.

The condition in Wisconsin is somewhat different. There the companies have had the privilege of continuing operation under their charters as they existed before the public service commission law was passed, or of giving up those charters and accepting an indeterminate permit under the supervision of the State.

One of the early questions was as to the meaning of the term "indeterminate permit." Since it has been shown that this really means a perpetual franchise, or a purchase by the municipality at a valuation which takes into account all the conditions and insures a return to the capitalist equivalent to that which he gets from the operation of the plant, the terrors, simulated or real, which the words inspired have been allayed, and a large proportion of the public service corporations in the State have elected to serve under the commission and its indeterminate permit. So far as observation goes, therefore, the indications are that the public service commission law has had a beneficial effect upon the securities of companies operating thereunder. There is no means of measuring accurately this effect, but those who are studying the problem state that the securities of the corporations operating under the indeterminate permit of the Railroad Commission of Wisconsin are somewhat at a premium as compared with the securities of other corporations in the State, which are operating under the old franchises. The reason given for this effect is that any one familiar with the indeterminate permit would naturally prefer the securities of a company operating under it, since he would consider the security better for the reasons that the corporation can never be deprived of its property, except upon a fair value paid by the municipality when taking it over; that the depressing effect of contests over terms and conditions of franchises is completely eliminated; that securities can not be issued in excess of what the plant is actually worth; that the company is obliged to maintain the plant in efficient operating condition; that a depreciation reserve fund must be maintained so that replacements can be made out of operating revenues. These are certainly strong reasons for approval of the law, and they demonstrate the correctness of the position which capital seeking legitimate investments seems to have taken.

The confidence of the investing public in the salutary effects of the indeterminate permits and the control by the state commission of certain features of the operations of the companies accepting them will be strengthened by a recent decision of the Wisconsin Supreme Court in the case of the city of LaCrosse vs. the LaCrosse Gas and Electric Co.

Under the terms of the franchise granted the company by the city, the company was required to pay to the city 2 per cent. of its gross earnings in addition to other legal taxes. The company elected to give up this franchise and to operate under an indeterminate permit issued by the Railroad Commission of Wisconsin. Thereafter it failed to make to the city its report of earnings and to make the payment, and the city sued to recover, except as to a part of the first year of its operation under the new conditions, for which it paid under protest the 2 per cent. for the part of the year after it had received its indeterminate permit.

The opinion of the court demonstrates that such a feature in a franchise for a public service corporation inheres therein and is subject to the reserved power of the State under the constitution to alter or amend. The question whether operation of the company under the indeterminate permit is burdened by the requirement to pay 2 per cent. of gross earnings to the city is argued at some length in the light of previous practice concerning franchise provisions, whereby some of them were prescribed by the State and some by the city served; and in the light of the purpose of the statute establishing the public service commission duties of the Railroad Commission to substitute new direct grants from the State of a uniform character, free from the peculiarities of the old franchises, for the complicated and varied provisions of the latter.

The opinion gives high praise to the legislature for its method of dealing with the matter, stating that

The result stands significant as a monument to legislative wisdom. That such a complicated situation has been met by written law in such a way as to avoid successful attack up to this time on the validity of the law or any part of it, and avoid attack at all either upon the law or its administration, except in a very few instances, and secure optional submission by many owners of old franchises to a displacement of their privileges, is quite a marvel, reflecting credit upon the law-making power and the body charged with the onerous duty of administering the statute, and challenging judicial attention to the importance of not by construction reading out of the enactment any meaning not clearly found there—even to avoid a seemingly unlooked for disturbing consequence in a particular instance now and then—which would tend to defeat the object of the law.

The opinion, therefore, proceeds as follows:

The foregoing analysis of the public utility law seems to demonstrate that retention of the special feature of the surrendered franchise in question as a feature of the new one, differentiating it from indeterminate permits in general, affording the city, really at the expense of consumers, the benefit of 2 per cent. of respondent's gross earnings, is plainly inconsistent with "the terms, conditions and limitations" of the public utility law which, as we have seen, it is declared over and over again therein shall characterize every indeterminate permit, whether an original grant or a privilege given for an old franchise.

The protection of the public service commission law is thus made uniform for all public service corporations desiring it, and the stability of the structure which has been built so rapidly and so well within the past few years is thus greatly enhanced.

Those who are interested in the promotion of new public service industries and in the exploitation of those already in operation are not so well pleased with the law. In the words of one of them, "The promoters must now steer clear of Wisconsin." Happy Wisconsin! Most of the troubles with public service corporations have arisen from the sense of injustice which has been aroused in the minds of consumers of their products by imperfect knowledge of the manipulations of such promoters, their undue profits in some instances, their wrecking of properties in others, their undue influences upon municipal legislators in others. If the Wisconsin law has done nothing but force these men to steer clear of the State it has fully justified itself and all the expense of its operation.

Cities in other States not favored by such laws have been trying to secure like results by means of more or less close approximations to the practice of the Wisconsin commission, always far different, because of the extreme difficulty of establishing for a single city an independent, unimpeachable, competent expert body such as the State Commission of Wisconsin has proved itself to be. An arbitration on such lines is now in progress in one city and the results will be published later. Even if one such board happens to come into existence, the hand of the interested party gets into the municipal elections in time for the next question brought up for settlement and the people have the whole fight to go through again with the probability that they have on the other side, not only the public service corporation, but the city's own representatives. Pending the establishment of a state commission, there seems at present to be nothing else to do.

THE QUESTION DEPARTMENT

Cities Operating Garbage Incinerators.

Kindly give me the names of a few cities that successfully operated incinerators. I wish to look into the methods of operation, etc. B., ————, Pa.

The fullest list of incinerator plants is the chronological list in Morse's "The Collection and Disposal of Municipal Wsate" ($5). extending down to and including plants built in 1908.

Among those not included in the list are the following: The Decarie plants in Rankin, Pa., Richmond, Va., Portsmouth, Va., Lynchburg, Va., Wheeling, W. Va., E. Liverpool, O.; the Thompson plants in Houston and Austin, Tex.; the Dixon plant at Uniontown, Pa.; the Public Works Engineering Co. plants at El Paso, Tex.; Portland, Ore.; and Vancouver, B. C.; the Lewis and Kitchen plants at Terre Haute, Ind., and Topeka, Kan.; the Heenan-Froude plants at Milwaukee, Wis., and Montgomery, Ala.; the Morse-Boulger plant at Easton, Pa.

Cleaning Streets by Flushing.

In your issue of October, 1910, page 316, there is an article by J. W. Howard concerning the use of a flushing machine on pavements, in which he refers to a paper prepared by John Hittell of Chicago in 1907. I would like to know if you printed this paper in any edition of your magazine. Also I would appreciate any references to other articles in relation to the damage caused by street flushing machines which have appeared in your various editions.
F. L. J., Chicago, Ill.

The paper referred to is by John B. Hittell, chief engineer of streets, Chicago, Ill., and is entitled "Guarantee Clause in Paving Specifications." It was printed in full in the volume of proceedings of the American Society of Municipal Improvements for 1907. It is printed almost in full in

MUNICIPAL ENGINEERING, vol. xxxiii, p. 331. It makes no particular reference to street flushing, being confined to the ground covered by its title.

Information concerning street flushing and other methods of street cleaning can be obtained from the following additional articles in MUNICIPAL ENGINEERING:

In vol xl: "Cost and Efficiency of Street Cleaning Methods," p. 32; "Flushing Streets Under High Pressure," p. 132; "Flushing Streets With Water Under Pressure," p. 132; "A Motor-Propelled Sweeping and Flushing Machine, p. 372.

In vol. xxxix: "Street Cleaning by Vacuum Process," p. 115; "A High Pressure Street Flusher," p. 154; the above named "Flushing Pavements With Water Under High Pressure," p. 316; "Flushing Streets Under High Pressure," p. 393.

In vol. xxviii: "Methods and Cost of Street Cleaning and Sprinkling," p. 193, which gives a number of references to earlier articles on the subject; "Cost of Street Cleaning," p. 340.

In vol. xxxvi: "A New Sanitary Street Washing Machine," p. 333; "Street Cleaning in Detroit,' p. 383, giving experience with various methods, including flushing, in that city; "The Squeegee Street Washer," p. 399.

In vol. xxxv: "Information on Street Cleaning and Garbage Collection and Disposal," p. 179, giving a list of earlier articles.

In vol. xxxiv: "Street Cleaning," p. 184; " A Street Cleaning Automobile," p. 266; "Methods and Cost of Street Cleaning," p. 299, giving references to some earlier articles.

In vol. xviii: "Flushing With Water as a Means of Cleaning Paved Streets," p. 249.

Most of these articles can be supplied at 25 cents each.

Manufacturers of Garbage Disposal Plants.

The board of public works is considering the installation of a garbage disposal plant to take the place of the present unsatisfactory method of garbage disposal by dumping. Will you kindly put us in communication with any persons or firms who might be interested in this proposition? L., ———, Ky.

Reference should be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Garbage Disposal Plants," "Refuse Destructors," "Destructors."

Books on Sewers and Tunneling.

I am looking for the latest book on sewer construction. I want a book that will tell the best methods of tunneilng through earth in sewer construction.

H., Rochester, Ind.

The latest book on sewerage is Watson's "Sewerage Systems" ($4). It is the only book on this subject which covers the subject of tunneling for sewers, and it has ten pages giving brief and clear statements of the best methods. Folwell's "Sewerage" ($3) recently appeared in a new edition, but it contains very little on tunneling. Prelini's "Tunneling" ($3) or Stauffer's "Modern Tunnel Practice," ($3.50) may be consulted and some of the methods therein described may be applied to tunneling for sewers.

Value of Waterworks Franchise.

Did you not publish a decision relative to the value of a franchise in a water works case in the matter of appraisal of a franchise therein?

S. C. S., Waverly, N. Y.

The only decision of this nature published recently is that in the case of the Spring Valley Water Co., vs. the City and County of San Francisco, reported in 165 *Federal Reporter*, p. 667, and noted in MUNICIPAL ENGINEERING, vol. xxxvii, p. 44. This was a note from the syllabus of the case to the effect that a franchise has value which should be taken into account in determining the return allowable upon the value of the property when determining rates. That this value may be small is indicated by the following abstract from that portion of the opinion named concerning the value of the franchise as a part of the property of the company:

If when the franchise was acquired, or at any subsequent time, the city entered into a contract with the company providing for definite rates of income, and this agreement is now binding, and gives a present value to the franchise; or if for a number of years the aggregate market value of the stock and bonds of the company has exceeded the actual value of the physical plant; or if, as in the Consolidated Gas Co. v. New York, the franchise was capitalized for some fixed sum, it would be very easy to determine whether the franchise has value, and what that value is. But here it does not appear that the franchise is defined by any specific contract with the city; neither is it an exclusive franchise; and it is not shown that the market value of the stocks and bonds ever exceeded the value of the physical property. The water company's system probably has a value as a whole which exceeds the sum of the values of its several physical elements and characteristics. That value is affected by the franchise, by the fact that the concern is a going business. If the franchise and going business have ever had a distinct, independent, productive value, it should appear somewhere or at some time in an exhibition of distinct earning power.

The opinion also states that there is no authority for imputing to a franchise a value which did not accrue to it by the original terms of the franchise. Also, that the fact of assessment of the franchise value for taxation was not conclusive evidence of the value of the franchise.

Following are other articles in MUNICIPAL ENGINEERING with information on the same subject: Cases of no franchise value are reported in vol. xxxix, p. 45, regarding Carthage, Mo., and p. 300, regarding Omaha, Neb. Franchise provisions quoted in an article on p. 400 show no value allowed in Taylorville, Ill., and 10 per cent. of the cost of duplicating plant allowed in Mexico, Mo., for earning power, franchise value, going value and contingencies, which would leave little or nothing for franchise value, if reasonable allowances are made for the other items.

In vol. xxxviii, an allowance is shown in valuing the Richmond, Ind., water works of one-sixth for going concern value, which may or may not be considered to include the other items named in the Mexico, Mo., franchise.

There is a good article in vol. xxxvi, p. 247, on water works franchise covering this question and allowing no franchise value in determining rates for water. Other articles of similar nature and referring to special cases will be found in vol. xxxiv, pp. 28 and 296, and vol. xxxi, p. 135.

Several articles on the general subject of municipal franchises, discussing value incidentally, will be found in vol. xxix, pp. 340, 345, 353, 359, 442. Some brief notes will be found in vol. xxv, pp. 40 and 98, which will be of interest. Some data on taxing franchises will be found in vol. xxiv, pp. 41 and 42 and on the Omaha case, allowing no franchise value on p. 202.

A discussion of franchise values, giving some figures will be found in vol. xxiii, p. 248. A good general article is given on p. 337.

The Chicago street railway case, allowing no franchise value, but allowing compensation for compulsory sale, is considered in detail in vol. xxii, p. 34.

Some figures on values of water works franchises and references to authorities are given in vol. xvii, p. 146. The basis of the valuation of the Gloucester, Mass., water works, allowing no franchise value, but giving a going value, is given on p. 169.

There is a full discussion, with practical examples of the value of water works, particularly franchises, in an article in vol. xvi, p. 380. A valuation of the Indianapolis water works is given in vol. xv, p. 253, but does not include value of franchise.

Apparatus for Finding Leaks in Water Pipes.

Could you inform us of an instrument for detecting leaks in water mains and pipes, and where it could be purchased?

S., ————, N. Y.

The instruments for detecting flow of water in pipes by sound can be used to some extent in detecting leakage. They are of different degrees of elaboration up from a simple rod which can be put in contact with the pipe or valve and will transmit the sound of flowing water to the ear held at the other end. A common audiphone can be put in contact with the end of the rod to magnify the sound if desired. The real work of finding the leaks is more difficult than that of detecting the flow of water in the pipe. It will be found described in considerable detail in MUNICIPAL ENGINEERING, vol. xxxvi, p. 319. Further information will be found in vol. xxxvii, p. 329. Reference is made in the latter to Rodda's "Waste Water Detector," which is made in England and can probably be purchased of dealers in engineers' instruments. The Deacon instrument is another English piece of apparatus. Reference may be made to the "Business Directory," published in each number of MUNICIPAL ENGINEERING, under the headings "Engineering Instruments," "Surveyors' Instruments," "Testing Machinery" and some of those under "Water Works Supplies and Equipment," for names of those who can either supply the detectors named or can make them of designs equally serviceable. The pipe locater made by the Modern Iron Works, Quincy, Ill., may be found useful also.

What Is Westrumite?

Through your Question Department will you please give me some information regarding Westrumite pavement? I would like details regarding cost, durability, slipperiness, etc., etc., its composition and how it is generally received in the Eastern cities as a pavement.

M. B. G., Roseburg, Oregon.

Westrumite of the present day is very different from the material and process presented under that name perhaps eight or ten years ago. That was a process of applying an oil emulsion to roads already built, or of placing the wearing surface and later treating that surface, and was really one of the early varieties of bituminous or oil macadam produced by the so-called penetration process. This process was abandoned after a very few years as not available for city streets and it was in advance of the demand for such treatment of country roads, which is now becoming insistent.

The inventor then turned his attention to the construction of a pavement which is practically the same in all apparent features as an asphalt pavement, with less slipperiness perhaps, and somewhat less expense. The writer was very favorably impressed with one of the earliest of these streets, which he saw some four years or more ago. The asphaltic material is so prepared that it can be mixed cold by hand or in a concrete mixer with the broken stone, sand, and stone dust forming the aggregate, and the mixture rolled or tamped into place as the wearing surface of a pavement, using an old macadam, broken stone or concrete as the foundation. The character of the foundation to be chosen depends upon the nature of the traffic to be carried.

Westrumite asphalt pavement is preferably laid on a concrete foundation, and

Westrumite asphalt macadam is a lighter construction using the same materials.

The cost of the pavement depends so much upon the local cost of materials that definite figures for any locality can not be given by one not familiar with conditions. It may be said in general that the cost of the Westrumite asphalt pavement will be less than that of standard asphalt and that Westrumite macadam will compare with other bituminous macadams.

The pavement has been used in the beginning in suburban cities around Chicago, the inventor desiring to prove it out thoroughly before extending its use generally. Reports of municipal officials in East Chicago, and Hammond, Ind., state that the pavements are very satisfactory, and the same reports come from streets laid in Brantford, Ont. The sphere of activity is extending into neighboring states and new factories are being built as new centers.

Wood Block Paving Along Street Railway.

In continuation of my questions considered on p. 216 of the March number of MUNICIPAL ENGINEERING will you please give me some information on the following points?

How is a water tight joint made along the rail?

Is there any kind of drainage constructed to take care of the water along the rail? W., ———, Wis.

The making of a water tight joint between pavement and rail that will retain its water-tight quality is difficult, owing to the constant motion under climatic conditions and the action of traffic on both rail and pavement. An adhesive filler, tar or asphalt, is desirable, and one which will retain its ductility and adhesiveness under the changes in temperature to which it is subject. In a northern climate it is difficult to attain this result without making the bituminous mixture so soft that in hot summer weather it will flow away from its place into any open space in pavement or foundation due to defective construction or to loosening up of the same under the shocks of traffic. It is not so difficult to make the water tight joint. The difficulty is rather to keep it tight.

With streets of good gradients water will run down the street car tracks to points where reduction in velocity causes it to overflow the rails and find its way to the gutters. These points will be the only points where special trouble from lack of draining will occur. On a flat street where the drainage was forced by means of alternate ridges and hollows, noticeable on the street only when water was running, the writer has put at the bottom of each hollow a small collector in the middle of each track with a small grating on the surface of the street so that the water collecting there between the rails would drain through the collector into the sewer below. The space between tracks is so crowned that water from it runs over the rail into the channel made by the flange of the rail and runs thence to the low spot as described.

Will our readers report their experience in regard to both the problems presented?

Books on Reinforced Concrete Trestles for Railroads.

Will you advise me where I may obtain model plans and specifications for reinforced concrete trestles for railroads?
B., Carrollton, Ky.

Tyrrell's "Concrete Bridges and Culverts" ($3) contains several trestle designs and tables for designing them. The Atlas Portland Cement Co. publishes a booklet on "Concrete in Railroad Construction," which contains specifications and several designs for railroad trestles.

Tests for Asphalt for Standard Municipal Specifications.

At the recent convention of the American Society of Municipal Improvements at Erie, Pa., a report of which has recently been issued, they adopted a set of specifications for asphalt paving. In these specifications appears a clause which states that the tests called for in these specifications must be made according to the standard requirements on file in the office of the city engineer. I am writing to ask if this clause refers to any particular method of making these tests, and I infer that it does. If such is the case, I will be glad if you will advise me where and how I may obtain a description of the method of making the tests referred to. If no special method was referred to, can you advise me where a description of such tests as are called for can be had.
N., City Engineer, ———, Ala.

This provision was copied from the specifications adopted in 1910 by the Organization of City Officials for Standardizing Paving Specifications, and is understood to refer to no definite method of making tests. Indeed, in the report of the committee on asphalt to the meeting of the same organization held in New York in January, it is said that "the committee, in presenting its standard specifications realized the fact that many of the provisions were dependent on a definite method of test, and cognizance was taken of this fact by the insertion of the clause 'all tests herein provided for must be conducted according to official methods on file in the office of (proper official)'. However, it is suggested that all methods for making tests be defined as soon as possible and, doubtless, many of them can be defined at this meeting. But for those methods that cannot be definitely defined at present, there should be a working committee appointed to investigate methods of tests and also to work out new tests for asphalt. But for such tests as ductility, it is imperative to adopt a definite method at once; otherwise it is impossible to set satisfactorily a definite requirement for that test. Unless this committee completes its labors as to standard tests, it is suggested that cities have their testing laboratories add to these specifications whatever methods of tests that have been standardized locally."

In accordance with this recommendation the committee worked out the formulation of a number of tests during the January convention, which were adopted and have been printed in the volume of proceedings of the convention, which can be procured of John B. Hittell, secretary, City Hall, Chicago, Ill., for $5.

On another page of this number will be found the recommendations of Dow and Smith, asphalt chemists, concerning such tests.

Book on Cement.

I have been informed by one of the engineers of this city that you published a book on cement sometime ago, which contained information relative to the ingredients of slag, Portland and other cements. I represent the city engineer of the city in litigation relative to the paving of one of our city streets and am very desirous of obtaining information of any and all kinds upon the different grades, manufacturing processes, etc., of cement.

J., ————, O.

The "Hand Book for Cement Users" ($3) is the book desired and contains full information on the composition and characteristics of all classes of cement as well as specifications for cement and its uses.

Forms for Improvement Resolutions in Texas.

Have you any briefs on the acts of the Thirty-first Legislature and called session, page 402 and chapter 14? If so, I would like to have some and would like to have forms for ordinances and resolutions covering the proceedings from first step to last. S., City Attorney, ————, Tex.

Will our Texas readers be kind enough to send us the forms they use and copies of ordinances providing for public improvements for publication for the benefit of this aand other correspondents?

Machinery for Making Cement Tiles.

We have been referred to you for information regarding machinery for the manufacture of cement tiles for the purpose of conveying water from reservoirs to plats of ground to be irrigated. Tiles would want to be six to eight inches in size.

Any reliable data that you can give us as to cost and general feasibility of this tile for this purpose will be appreciated.

G. R., Kansas City, Mo.

There is much difference in the quality of work done by different machines, and the question of workmanship is one of the utmost importance with either machines or molds. With good materials and workmanship cement tiles are entirely satisfactory. The comparison of cost with other tiles must be made on the basis of local prices and a general statement might be quite different from the facts in a particular locality.

Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings "Tile Molds," "Culvert Forms," "Drain Tile Machines," "Irrigation Machinery," "Sewer Pipe Molds" for names of dealers in reliable machinery for making tile by which the best of work can be done.

Who Sells Natural Red Chalk or Ruddle?

I am still looking for information in regard to where I can get a good quality of *natural product* "red chalk" or "ruddle." My question was published in MUNICIPAL ENGINEERING of February, 1910, on page 113.

Perhaps it may be a good plan to give your readers another reminder and see if we can find some one who knows. I understand that both Wisconsin and Michigan produce the mineral, also that the material, and of a good quality, is found in large quantities in the State of Virginia.

L. C. H., Bellingham, Wash.

Perhaps some of our readers know this material as "keel." Is there any of it on the market?

Cities Having Commission Form of Government.

Would you be so kind as to furnish me with a list of the cities in the United States and Dominion of Canada that are governed by commissioners or by Boards of Control, and any suggestions which you might have in reference to this system of government, whether it is considered ahead of the old system of Aldermen and Councillors governing the cities?

F. J. GRIFFITH,
Secretary-Treasurer, Sherbrooke, Que.

Following is a recent list of the cities having the commission form of government. There are probably some additions to make to this list, particularly in Illinois, where elections are being held to dedetermine whether the cities shall join the list of cities governed by commission:

Alabama: Birmingham.

California: Berkeley, Modesto, Oakland, Riverside.

Colorado: Colorado Springs, Grand Junction.

Idaho: Boise, Lewiston.

Illinois: Moline, Rock Island, Springfield.

Iowa: Burlington, Cedar Rapids, Des Moines, Ft. Dodge, Keokuk, Marshalltown, Sioux City.

Kansas: Abilene, Anthony, Coffeyville, Cherryvale, Caldwell, Emporia, Girard, Hutchinson, Independence, Iola, Kansas City, Leavenwarth, Marion, Newton, Neodesha, Parsons, Pittsburg, Topeka, Wellington, Wichita.

Kentucky: Newport.

Louisiana: Shreveport.

Massachusetts: Gloucester, Haverhill, Lynn, Taunton.

Michigan: Harbor Beach, Port Huron.

Minnesota: Mankato.

Mississippi: Clarksdale, Hattiesburg.

Missouri: St. Joseph.

New Mexico: Roswell.

New York: Fairport.

North Carolina: High Point.

North Dakota: Bismarck, Mandan, Minot.

Oklahoma: Ardmore, Bartlesville, Duncan, Enid, McAlester, Miami, Muskogee, Sapulpa, Tulsa, Wagoner.

South Carolina: Columbia.

South Dakota: Dell Rapids, Huron, Pierre, Rapid City, Sioux Falls, Vermilion, Yankton.

Tennessee: Memphis, Richard City.

Texas: Austin, Beaumont, Corpus Christi, Dallas, Denison, Ft. Worth, Galveston, Greenville, Houston, Kennedy, Lyford, Marble Falls, Marshall, Palestine, Port Lavaca, San Antonio, Sherman, Terrell.

Washington: Tacoma.

West Virginia: Bluefield, Huntington.

Wisconsin: Eau Claire.

The original form of commission government, now known as such, was developed in Galveston, Tex., and as finally put into constitutional form, was simply a city council of five members, which, like the city councils of small cities, both levied the taxes and spent the money resulting from the levy. It developed the same lack of personal responsibility which is a defect in the system of government by common council or board of aldermen, or both, and did not have the checks of veto by the mayor which is common with the council form of government. It concentrated the power in the body of five men, but it gave too much opportunity for shuffling the responsibility among them. All subsequent forms of the so-called commission government have inserted numerous provisions which have the effect of materially modifying the power of the commission, and these have now become so numerous in some cases that the original commission form of government is almost lost sight of.

These additional provisions are quite as applicable to other forms of government as they are to the commission form, and many of them would have quite as salutary effect if applied to those forms, without including the objectionable features of the commission form. This is particularly true of the non-partisan nominations, the double election, the shortening of the list of officers to be voted for. The initiative, referendum and recall were in existence long before the commission form.

Further discussion of the subject will be found in MUNICIPAL ENGINEERING, and reference may be made to the following articles, among others:

Vol. xl: "Comparison of Des Moines and Indianapolis Forms of Municipal Government," p. 8; "The Des Moines, Indianapolis and Boston Plans of City Government," p. 30; "Commission and Other Forms of City Goveernment," p. 45, referring also to earlier articles on the subject; "Small Cities With Commission Form of Government," p. 124; "Information About Commission Form of Government," giving list of earlier articles on the subject, p. 126; "Best Form of Municipal Charter," p. 127; "Use of the Recall," p. 133.

Detroit's Proposed Municipal Creosoting Plant.

The department of public works of Detroit has asked the board of estimates for $30,000 for a municipal creosoting plant. Last spring $100,000 for this same purpose was requested and refused, and since then Commissioner Haarer has discovered that a plant suitable for the use of the city can be acquired for $30,000. This would be operated in connection with the city asphalting plant and no new boilers or power machinery would be necessary.

The city first used creosoted blocks in the paving of the Belle Isle bridge about 6 years ago. A portion of Park street was paved the following year and both pavements have endured without repair to the present time. Since the Park street paving a number of other streets have been paved with wood blocks until at the present time Detroit has about seven miles of wood pavement.

At present these creosoted blocks cost $1.65 a yard delivered here, the whole cost being about $3.50 a yard laid. Cedar blocks, although they have advanced greatly in price as cedar grows scarcer, can be delivered here and laid for about a dollar a yard less. It is figured that if the city makes these blocks, cutting out the profit and one set set of freight charges, they can be laid cheaper than asphalt.

The new plant will be under charge of the present superintendent of the asphalt repair plant, C. A. Proctor.

Shells a Cheap Road Material in Texas.

The counties of southern Texas are fortunate in possessing a cheap road building material, which is found almost at their very doors. This material, mud shell, is said to be very satisfactory for the purpose and has been adopted in some cases for city streets.

The cities of Houston and Galveston use a great deal of the shell, Houston's supply being obtained at Red Reef, about forty-five miles tow from the point where it is placed on cars and transported to Houston. It costs 70 cents per yard f. o. b. Houston, as against $2.80 for a grade of gravel suitable for road work. The city owns and operates two shell dredges, while Texas City and Galveston each have their own she'l plants. The International and Great Northern railroad has a plant of its own and uses this material for ballasting the roadbed.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Chemical Clarification of Water.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In the March number of MUNICIPAL ENGINEERING, in the question department, page 217, under the heading "Chemical Clarification of Water," I notice a question in regard to the number of cities who use sugar sulphate. What was meant by the question in all probability was the chemical in use in the clarification of the St. Louis water supply, in connection with lime; that is, sulphate of iron in the form of very small crystals of the size of ordinary sugar crystals, and which the manufacturers, the American Steel and Wire Company, call sugar sulphate in distinction from the ordinary large size crystals that they formerly manufactured. The sulphate of iron used for water purification in all probability is in the sugar sulphate form.

GURDON G. BLACK,
Engineer in charge, Supply and Purifying Division, Waterworks Office, St. Louis, Mo.

The American Steel and Wire Company writes as follows:

This is a product of this company that we are putting out for water purification and other purposes for which sulphate of iron is used. This sugar sulphate of iron was originated by this company, and we are the only manufacturers of this product in that form; and, because of its convenience, we furnish it in this shape for all the different municipalities where our system of water purification by sulphate of iron is employed, such, for instance, as St. Louis.

B. B. AYERS, Chicago, Ill.

Concrete Foundation Under Steam Railway Track.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Replying to City Engineer, ——, Va.: Two years ago, in building a brick street crossing (about 50 feet wide) of the track of the H. & D. Electric Railway (over which also pass daily a heavy locomotive and 4 to 7 loaded freight cars) the specification for the foundation was as follows: The ties (under 80 lbs. T-rail) shall be laid upon a continuous bed of broken stone 6 inches in thickness, and extending two feet beyond the rails respectively. The track shall be "lined" and packed up to the proper grade with broken stone, and after a locomotive has passed over the track *without causing further settlement* the broken stone under the ties shall be wet, and grouted with 1 to 3 Portland cement grout. It is not intended, however, to form a solid mass of concrete, the aim being to leave the lower inch or so as far as possible open to secure perfect drainage. When all the ties have been thus packed up and grouted and a locomotive has again passed over it *without producing any movement* the spaces between the ties shall be filled to the base of the rails with 1-3-6 Portland cement concrete tamped as directed by the engineer. The bricks are laid on 1 inch sand with joints filled with tar and pitch. The crossing is on 22 degree curve and 3½ per cent. gradient. Neither electric (passenger) nor steam (freight) traffic was interrupted by the work. At present it is apparently in perfect condition. I attribute this promise of permanency largely to the care taken to absolutely exclude water from the foundation.

J. F. ARMOUR, C. E.,
Dundas, Ont.

Method of Locating House Connections in Sewers.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We note in your last issue the inquiry of J. S. S., Summit, N. J., for a method of locating house connections in sewers. The writer had an occasion some years ago to locate some house junctions in a system of sanitary sewers and for this purpose had constructed an apparatus fitted with electric bells, which when pushed through the sewer with sewer rods would register the connections. A bell and a buzzer were used, one for the right and the other for the left hand junctions. If J. S. S.'s system is a separate system our apparatus would answer his purpose; if it is a combined system of larger sewers it will not.

THE W. S. SHIELDS CO.,
Consulting Engineers, Chicago, Ill.

Purification of Brewery Refuse.

The following is a description of an experiment by R. E. W. Berrington, an English sanitary engineer, upon the purification of brewery refuse:

The refuse from the brewery is derived from malting and from the brewing of beer and porter. The malting process is only carried on for part of the year, and at intervals, also, during part of the period of experiment, large quantities of waste yeast were discharged by the brewery drains to the purification works. All cooling and refrigerating waters are discharged by a separate outlet direct to the river. The quantity of refuse, as in all breweries, varies greatly from day to day and from hour to hour, but on an average amounts to 10,000 gallons a day.

The purification plant at the time the experiments were begun consisted of two settling tanks, each of a capacity of 4,680 gallons and four filters, each 22 ft. by 10 ft. by 3 ft. 3 in. deep, filled with washed coal of peanut size. The plant was arranged in duplicate series, and the refuse was passed through one or other tank, distributed by perforated half-pipe carriers on the surface of one filter, through which it was allowed to percolate continuously to under-drains of 9-in. perforated pipes, and treated again in the same way on a second filter, the effluent from which was discharged into the river. The distribution on the filters was never efficient, with the result that the greater part of the filtering material was not brought into use.

The chief peculiarity of brewery refuse is that it rapidly undergoes acid fermentation, and while in an acid condition is very refractory to the action of the ordinary purifying organisms.

In planning the experiments it was recognized that no efficient purification was to be looked for, so long as the refuse was allowed to undergo acid fermentation, and various methods were adopted to prevent this and to destroy any acidity already present in the crude refuse; and advantage was taken of the duplicate arrangement of the tanks and filters to carry out two sets of experiments side by side.

In one side the effect of a septic tank treatment of the refuse was thoroughly tried. On May 18, 15 cwt. of sludge obtained from a septic tank at a neighboring sewage works was placed in the tank and thoroughly mixed with the refuse. A small scum soon began to form on the surface of the tank, and increased after the addition of another 10 cwt. of septic sludge to the tank contents, but the tank effluent remained as acid as before, and as this scum consisted in great part of spent grains and hops it was certainly not entirely due to septic action. From the 23rd to the 29th of May a bucket of milk of lime was put into the septic tank daily by mistake. This caused the scum to disappear almost wholly, but reduced the acidity of the tank effluent slightly though not entirely. From the 3rd to the 12th of June additional quantities of septic sludge mixed with water were added to the tank and no waste was allowed to enter, the idea being to get septic action started and a scum formed; but very little scum formed even then, and the acidity was only temporarily neutralized when the whole of the tank contents were stirred up, returning again when they were allowed to rest.

The septic tank was then covered with boards, and after a few days a scum began to form, which gradually increased until it was 6 inches thick at the inlet end of the tank, thinning down to a mere skin at the outlet end; but this scum again was chiefly composed of spent grain and hops. The acidity of the tank effluent was moreover only slightly reduced, and never entirely neutralized, and the offensive smell arising from the works was so bad that continual complaints were made by the workmen and proprietors of a mill adjoining. On July 13 it was found that it was the practice to discharge all the waste yeast which could not be sold down the brewery drains, sometimes to the extent of six or seven casks a day. This, however, was then stopped, with the result that a much less acid tank effluent was obtained.

This tank was used as a septic tank from the 5th of May up to the 31st of July, and on no occasion had it produced an effluent free from acid, while the stench from it had become so bad that the brewery proprietors were threatened with an action for the abatement of the nuisance by the proprietors of the adjoining premises, whose workmen had all signed a notice to leave their work on this account. On July 31 the septic tank was emptied of sludge, when it was found that the scum at the inlet end was 6 inches thick, and that there was 22 inches of sludge in the bottom of the tank, of a black, putrid and most offensive character, but alkaline in reaction. This sludge was carted away during the night to a field 500 yards from the road, but even at that distance its offensive smell was so great that complaints were made by people passing along the road, and the whole of the sludge had to be covered with chloride of lime.

The only conclusion to be arrived at upon this experiment is that the method of attempting to deal with brewery refuse by septic tank treatment, even with the addition of a septic sewage sludge, is not one to be recommended. The process causes most offensive smells and does not produce an effluent free from that acidity which is the great hindrance to the bacterial treatment of the tank effluent. The chief good effected is the removal of suspended matters, an end which may be better attained by other methods.

While the foregoing experiments were being made, the other side was being used for the chemical treatment of the refuse. In the first place this tank, having been emptied and cleaned out, was filled up on May 15 with the crude refuse, to which 120 gallons of saturated lime water were added to render it alkaline. Half the refuse from the brewery was then passed through the tank and 30 gallons of lime water were added twice a day. This was not found sufficient to keep the tank effluent neutral, and for a time lime water in a constant flow, equal to 60 gallons for each tankful of refuse, was added to the tank effluent as it passed to the filters. Even this did not act satisfactorily, and by experiment it was found that 300 parts of saturated lime water were needed to render 400 parts of the crude refuse alkaline. Dry-slaked lime was then used and thoroughly stirred up with the refuse in the tank, when it was found that 72 pounds of lime were required in the first place to neutralize the tankful, equal to 107 grains per gallon, and after this 28 pounds of lime per day to keep the tank effluent neutral, this latter quantity being added to the tank at the inlet end. But at times when quantities of yeast were discharged from the brewery it was practically impossible to keep the tank effluent neutral, and for several days after such a discharge the tank effluent remained strongly acid. The discharge of yeast from the brewery was stopped, as has been stated, and it was afterwards found that milk of lime produced a better effect, although it had to be added in proportion of 30 to 150 grains of lime to the gallon of refuse. By keeping out the yeast and removing the sludge from the tank at frequent intervals, it was finally found that in the form of milk of lime about 45 grains of lime to the gallon of refuse was generally sufficient to keep the tank effluent neutral. This precipitation produced a large quantity of sludge, and after ten weeks of working the tanks were cleaned out, and it was found that they contained nineteen cartloads of solids. These, although rather offensive, were not nearly so productive of nuisance as the sludge from the septic tank.

Other experiments in chemical treatment of the refuse were made in a 36-gallon cask, which was filled with the refuse mixed with the precipitant and allowed to stand until the suspended solids had settled. For several weeks in November copperas in amounts varying from 5 to 11 grains per gallon, and afterwards manganate of soda, 8 grains per gallon, and aluminoferric in small amounts were at different times added along with the lime, but although these precipitants seemed to hasten the deposition of solids they made no practical difference in the tank effluent.

One of the greatest difficulties in the tank treatment of the refuse was the very irregular flow of the waste. Generally in the earlier part of the day the flow was comparatively small, sometimes not reaching more than about 10 gallons per minute, while during the afternoon it would more often be about 15 gallons, with occasional heavy flushes at the rate of 75 gallons. These flushes caused such a current through the tanks that the sludge in them was stirred up, and much of it carried on the filters, with the result that these were greatly choked up with a yeasty mass of fermenting matter, which doubtless led to the further production of acid in the effluent. Before commencing experiments upon the bacterial treatment of the tank effluent, the distributing pipes of the first filter were taken up and relaid in a bed of fine ashes about 6 inches deep, so as to insure a better distribution over the whole of the surface of the bed and to prevent suspended solids from getting into the body of the filter, and valves were placed at the outlets of the beds for the purpose of holding up the liquids, after Dibdin's method. The effect of double contact was first tried as follows:

The first filter was filled according to the flow of refuse, allowed to stand for two hours, emptied rapidly, and allowed to remain empty two hours, and the second filter was used in the same way. At night when little waste was being discharged from the brewery the valves from the filters were left open and the tank effluent allowed to percolate continuously through, while at the same time thorough aeration of the bed was insured.

It was found that the flow of refuse was at times too great to allow the ordinary cycle of filling, standing full, emptying and standing empty, to be carried out, and this sometimes caused the filters to be filled four or five times a day, between 6 a. m. and 5 p. m., although occasionally the filters could be allowed more than two hours' rest. The filtering material was periodically examined and found to have a large quantity of yeast adhering to its surface in a partly decomposed and most offensive state. It was thought that by laying a layer of fine ashes on the surface of the filter as stated, any further accumulation of this yeast deposit in the body of the filter would be prevented, and that already in the filter would finally be decomposed and disappear; but this result was not attained, and at the end of these experiments this coal filter remained clogged with offensive matter. On July 1, with a view of assisting the second bed in this recovery, perforated distributing pipes were fixed on it, through which the effluent from the filter could be sprayed, and a layer of limestone chippings about 2½ inches thick having been laid on its surface, the filter was used for a short time continuously. This reduced the acidity of the effluent for a time, but it soon returned, and the filter was again used as a contact bed.

This first series of filters was fed from May 18 to the end of July with an acid effluent from the septic tank, and good results were therefore scarcely to be looked for; but after the latter date the filters were fed with an alkaline effluent produced by the lime treatment of the refuse, and it was hoped that in time they would recover and be able to produce a considerable amount of purification on such an effluent. This was not, however, found to be the case, and up to the end of the experiment these coal filters remained in an unsatisfactory state, causing the effluent to be acid even when the filter was fed with an alkaline tank effluent.

After testing for some months the possibility of the recovery of the filters, the material in them was thoroughly examined and found to be still clogged with fermenting, yeasty sludge. It was then determined to remove the whole of the filtering medium from the filter beds of one side and to replace it with ashes arranged as follows: The first filter was underdrained with channels formed of loose bricks laid upon the concrete bottom of the bed, and the bed was then filled with four layers of riddled ashes, the bottom layer consisting of 6 in. of clinker sized from 1½ in. to 1 in., then 12 in. from 1 in. to ¾ in., 12 in. from ¾ in. to ½ in., and the top 9 in. from ⅜ in. to ⅛ in.; 3 ft. in all. The second bed, underdrained in the same way, had 12 in. of riddled ashes in 1 in. size, 12 in. ¾ in., 9 in. from ⅜ in. to ⅛ in. 3 in. of fine limestone chippings, and again, 3 in. of fine ashes, free from dust; 3 ft. 3 in. in all. In order, however, to catch the fine suspended matter carried forward from the settling tank by the flushes of liquid, the first bed was covered at the inlet end with an extra layer of fine ashes 3 in. deep. These filters were brought into operation on September 8, and were used regularly after that date, the effluents being always neutral at the time of discharge, although occasionally they have become acid on keeping.

While these experiments were being carried out with the large filters, smaller experimental filter beds were constructed and brought into use. At the end of June, two 36-gallon casks were filled, the first with coke varying in size from pieces of 1 in. at the bottom to pieces between ⅜ in. and ⅛ in. in the top layer, and 2 ft. 8 in. in depth altogether; the second of the same depth, with the same coke in the bottom, but with the top 6 in. filled with Trent sand. The water capacity of each of these filters was 22½ gallons at first, but rapidly fell to 18 gallons, and remained at that figure. On October 12 a percolating or trickling filter was constructed in a similar cask of coke-breeze in pieces about

1 in. in size, partly new and partly taken from some Dibdin contact beds, which had been in use for a long time at adjoining sewage works.

At first the brewery refuse was diluted to the extent of 30 per cent. by mixing with it river water along with a little sludge from the septic tank of adjoining sewage works, and this mixture was supplied to these filters and given two hours' contact in each. After a few days a fairly good effluent was obtained, but before any reliable test could be made the sand in the second filter became choked, and the filter became useless. By turning the sand over, the filter was again brought into use, but choked up again, and finally the sand was removed, and in each filter a layer of fine stone chippings was placed on the surface of the coke.

These three cask filters were used in the first place for dealing with the effluent which was produced by the settlement of the refuse precipitated in the cask which has already been mentioned, but after December 21 were fed with the effluent from the ash filter, and after this the third cask filter was provided with a tap and used as a contact bed. The brewery refuse could thus be subjected to chemical precipitation by lime and other precipitants and double contact in the large ash filters, followed by triple contact in the cask filters of coke. Even this did not produce a satisfactory result, and on no occasion did any nitrates appear in the effluent. It was therefore decided to experiment further with the effluent from the ash filters. A larger sprinkler was therefore constructed and brought into operation on November 9. This filter was constructed on a concrete foundation which sloped from the center to the circumference, the filter being circular in shape, 6 ft. in diameter and 6 ft. deep. On the concrete floor a layer of stones was laid for drainage purposes, on which the filtering material was built up. The material was coke-breeze, about a quarter of which had been obtained from some first contact beds at sewage works, and the remainder fresh from the gas works. The pieces were about the size of apples, and were held in position by upright boards placed at intervals and supported by iron bands. For the supply of this filter, a storage tank having a capacity of 225 gallons was fixed at a sufficient height. This tank was fed by a pump from the valve chamber of the second ash contact-bed, and from the tank the liquid was supplied to the filter by means of a rotating sprinkler. The tank was filled twice a day and discharged each time on to the trickling filter in the course of one hour, giving a quantity of some 75 gallons per square yard, treated upon the filter twice a day, the filter being allowed to rest for the remainder of the day.

The result of this extra treatment was at once apparent, the effluent being free from smell, clear and not frothy, and these improved results have been steadily maintained. The analyses show, however, that even by this treatment of lime precipitation, double contact and percolation, no nitrates were produced in the effluent, and the rate of filtration was therefore greatly reduced, the ash filter effluent being supplied in intermittent doses every five minutes for eight hours a day to the amount of about 140 gallons per square yard per day. By this reduction in the rate, and this method of application, the results obtained were greatly improved, and nitrates appeared in the effluent; and when the filter effluent had been strained through sand to remove from it the suspended solids which are invariably found in the effluent from a percolating filter, the resulting filtrate was one which could be said to be very satisfactory.

A further experiment was made with a view of ascertaining the effect of filtration through natural soil upon such an effluent, and for this purpose an earthen bed was constructed and brought into use on January 11. This bed was 11 ft. by 5 ft. by 5 ft. 6 in. deep. It was constructed on a bricked and grouted floor of gravelly and loamy soil taken at a depth of 4 ft. from some neighboring excavations, with a covering of 1 ft. 6 in. of good garden soil and grass turf. An underdrain lying on the brick floor was provided for the purpose of collecting samples. On to this bed the effluent from the ash filter could be pumped, and was supplied to the earth bed in quantities of some 100 gallons, which was found to be the quantity the filter would take without overflowing, the bed being used on the principle of intermittent downward filtration.

The results of this treatment have been very similar to those obtained by the use of the sprinkler filter, and the effluent produced has generally been very satisfactory, having a low oxygen-absorbed figure and showing nearly always the presence of nitrates in appreciable quantities. These results show that although brewery refuse is more refractory than domestic sewage, it is quite practicable to purify it by ordinary bacterial means, aided by a preliminary treatment with lime.

Taking the average results, the precipitation with lime produces a tank effluent in which as compared with the crude refuse the suspended solids have been reduced from 24.8 to 13 parts per 100,000, and the albuminoid ammonia from 3.8 to 1.8, while the oxygen-absorbed figure is increased to 32.7; it produces, moreover, a liquid which no longer has an acid reaction, although in such a condition that the acidity soon returns. The alkalinity, however, persists long enough to permit of bacterial purification taking place. The double-contact treatment of this neutral or alkaline tank effluent further reduces the albuminoid ammonia from 1.8 to 0.7, and brings the oxygen absorbed figure from 32.7 to 7.9—quantities which are still much too high to be satisfactory. The percolating filter fed with the effluent from the contact beds produces an effluent which, when strained through sand, may be considered very satisfactory, the albuminoid ammonia being reduced to 0.15 parts per 100,000, the oxygen absorbed to 1.8, while nitrates have made their appearance, and the earth filter yields nearly the same result. The purification thus effected by chemical precipitation, double contact, percolation and sand straining, when judged by the amount of albuminoid ammonia, amounts to 96 per cent., and when reckoned on the oxygen-absorbed figure to 93 per cent.

It will be seen that the course taken by the experiments was to a great extent determined by the nature of the existing works. In constructing works anew for the purification of such refuse, the best course to take would probably be to provide tanks for chemical treatment, a first percolating filter, and another at lower level, and finally a shallow strainer of sand for the removal of suspended matters. The tanks should not be too large, for fear of including acid fermentation in their contents, and the filters should be of sufficient area to allow of only a moderate quantity per yard being passed through them. With such an apparatus there should be no difficulty in producing an effluent quite fit to be discharged into a stream.

Tests of Asphalt for Paving Purposes.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Following are the methods of testing asphalt which we recommend to cities for which we draw paving specifications. They do not cover all the tests called for under some of the more recent specifications, but are sufficiently comprehensive for the purpose intended.

DOW AND SMITH,
Chemical Engineers, New York City.

PENETRATION.—The penetration of an asphalt, asphalt cement or bitumen at 32 F., shall be determined by ascertaining the distance, expressed in hundredths of a centimeter, that a No. 2 needle will penetrate into the material under a weight of 200 grams operating for one minute.

The penetration at 77 F., shall be determined by ascertaining the distance, expressed in hundredths of a centimeter, that a No. 2 needle will penetrate into the material under a weight of 100 grams operating for five seconds.

The penetration at 115 F., shall be determined by ascertaining the distance, expressed in hundredths of a centimeter, that a No. 2 needle will penetrate into the material under a weight of 50 grams operating for five seconds.

These penetrations shall be ascertained by the use of the Dow Penetration Machine and shall be made in the following manner:

The sample to be tested shall be immersed in water at the desired temperature and kept at such temperature at least thirty minutes before being tested. It shall then be placed in a glass dish and covered with water at the desired temperature. The glass dish containing the sample shall then be immediately placed on the shelf of the penetration machine and the penetration of the sample determined in the standard manner prescribed for the use of this machine. The temperature of the water surrounding the sample in the glass dish shall be taken immediately after each test, and no determination shall be considered if the temperature varies more than one-half of a degree from that at which the test was to have been taken.

DUCTILITY.—The ductility of an asphalt, asphalt cement or bitumen shall be determined by ascertaining the distance in centimeters that a standard briquette of the material will draw out before breaking under the conditions hereinafter specified. The test shall be made either upon the commercially pure homogeneous asphalt cement or on the pure bitumen cement obtained by extracting the asphalt with a solvent or the purified bitumen from the non-homogeneous asphalt cement obtained by straining it through sieves.

If the asphalt, asphalt cement or bitumen to be tested contains over 96 per cent. of bitumen soluble in carbon di-sulphide, and is free from lumps of inert bitumen, it shall be considered as sufficiently pure to test.

If the asphalt, asphalt cement or bitumen contains less than 96 per cent. of bitumen, and the bitumen is homogeneous, or nearly so, that is, contains no lumps of inert bitumen, the ductility test shall be made upon the pure bitumen obtained from it by the following method:

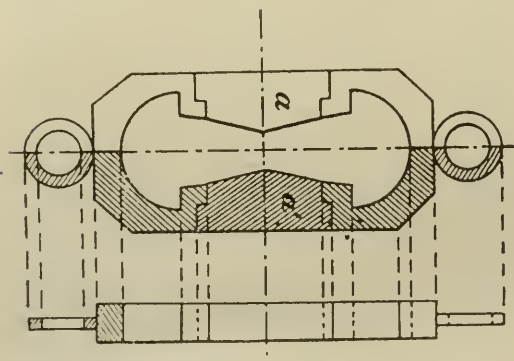
Preparation of pure bitumen. Sufficient quantity of the refined hard asphalt, before having been fluxed, to yield 150 grams of pure bitumen, is treated with carbon di-sulphide in an Erlenmeyer flask. After standing for two or three hours, the flask is shaken until none of the asphalt is seen adhering to the sides or bottom of the flask, after which it is set aside and allowed to stand twenty-four hours. The solvent is then carefully decanted off from the residue into a second flask. The residue is again treated with the solvent, shaken, allowed to subside and decanted as before. This is continued until the solvent is practically colorless or of a light straw color. The combined solutions, after standing at least twenty-four hours after the last addition of solution, shall then be carefully decanted off and the solvent distilled off until only sufficient remains to keep the extracted bitumen liquid. The residue is then poured into a large evaporating dish and as much of the remaining solvent as possible evaporated off on a steam bath. To facilitate the removal of the last particles of carbon di-sulphide from the bitumen while on the steam bath, it should be stirred from time to time. After this treatment on the steam bath, one-half to one cubic centimeter of water should be incorporated into the bitumen and the heating continued over a burner until all foaming ceases, after which the dish containing the bitumen should be placed in a hot air oven and kept at 300 F. for thirty minutes. While heating the extracted bitumen over the burner, it should be stirred constantly with a thermometer and care exercised that the temperature never exceeds 300 F.

If the bitumen of the asphalt, asphalt cement or bitumen to be tested is not homogeneous, that is, when it contains lumps of hard bitumen which can not be brought into solution in the softer bitumen, even when in a molten condition, it is impossible to obtain a pure bitumen that will have the same relative physical properties as the active bitumen of the cement. Such an asphalt, asphalt cement or bitumen shall be refined by passing it, while in a molten condition, through sieves, thus removing the coarser lumps of inert bitumen.

Preliminary Treatment of non-homogeneous bitumens. The asphalt, asphalt cement or bitumen shall be heated in an air bath at a temperature between 300 F. and 350 F., together with a 20-mesh sieve and a 50-mesh sieve. When the material is in a thoroughly molten condition, it is first strained through the heated 20-mesh sieve and afterwards through the heated 50-mesh sieve. The molten cement must not be forced through the sieves, but must run through by gravity alone.

The asphalt, asphalt cement or bitumen to be tested for ductility and prepared in accordance with the foregoing, must then be brought to a consistency of 50 penetration at 77 F. by softening it with a flux similar to that which it is proposed to use in the practical work and the test for ductility shall be made on this prepared asphalt cement or bitumen.

The briquette of the asphalt cement upon which the test is made shall be shaped as shown in the accompanying diagram.



Its dimensions shall be as follows: One centimeter in thickness throughout; distance between clips, 3 centimeters; width at mouth of clips, 2 centimeters; width at minimum cross section half way between clips, 1 centimenter. The molding of this briquette shall be done as follows. The mold, as shown in the diagram, shall be placed on a brass plate. To prevent the asphalt cement from adhering to this plate and the inner sides of the two removable pieces of the mould, a and a′, they shall be well amalgamated. The material to be tested is poured into the mold while in a molten state, a slight excess being added to allow for shrinking on cooling. After the cement is nearly cooled the briquette is smoothed off level by means of a heated palette knife or trowel wet with water to prevent its sticking. It should then be thoroughly cooled to the temperature at which it is desired to make the test, after which the clamp and the two side pieces, a and a′, should be removed, leaving the briquette of asphalt cement held at each end by the ends of the mold, which now play the part of clips. The briquette shall then be immersed in water maintained at 77 F. for at least thirty minutes before testing and the test shall be performed while the briquette is so immersed in the water at the above temperature, and at no time shall the temperature of the water vary more than one-half a degree from the standard temperature. The test is made by pulling the two clips apart at a uniform rate of speed by means of hooks inserted in the eyes. The clips shall be pulled apart at the rate of 5 centimeters a minute until the thread of asphalt cement has parted. The distance between the clips shall then be measured in centimeters, and this distance, less the 3 centimeters originally separating the clips, shall constitute the ductility of the material examined.

Heat Test.—The loss on heating an asphalt, asphalt cement or bitumen shall be determined in the following manner: Fifty grams of the material shall be weighed into a circular tin box, with vertical sides, measuring 2 centimeters deep by 6 centimeters in diameter, internal measurement. The penetration at 77 F. of the material to be examined shall then be determined in the manner heretofore described. The sample in the tin box shall then be placed in a hot air oven heated to 325 F., and shall be kept at this temperature for 15 hours. During the last two hours of this time the sample shall be stirred each hour with a small stirring rod. At no time shall the temperature of the hot air oven vary more than 15 degrees F. from 325 F. When the sample has been heated for the full five hours, it shall be removed from the oven and well stirred with the iron stirring rod and put on one side to cool. The material adhering to the stirring rod must be carefully scraped off and added to the tin containing the sample, or the rod may be weighed with the sample and the box in the first place. When the sample has cooled to normal temperature it shall be weighed, and the per cent. loss by volatilization calculated. After this the penetration of the residue shall be determined at 77 F., in the manner heretofore described, and the loss in penetration determined by subtracting this penetration from the penetration before heating.

Action of Water on Asphalt Cements.—The commercial asphalt cement, as it will be used in practical work, shall be tested as follows to determine the extent to which it is acted upon by water: It shall be coated on a piece of glass and immersed in distilled water maintained at a temperature between 70 and 90 F. If the surface of the asphalt cement remains bright and shows no corrosion or discoloration from an immersion of seven days, it shall be considered as not being readily affected by the action of water.

Formula for Asphalt Floors.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In further answer to the question on p. 217 of the March number of MUNICIPAL ENGINEERING, we suggest the subjoined specifications for asphalt mastic floors, prepared particularly for use with our own materials.

AMERICAN ASPHALTUM AND RUBBER CO.,
Chicago, Ill.

ASPHALT MASTIC FLOOR SPECIFICATION.

Mastic and Flux.—The asphalt mastic and asphaltic flux to be used shall be produced by the American Asphaltum and Rubber Co., of Chicago. The flux must not be less than 99 per cent. bitumen; shall be absolutely waterproof and unaffected by extremes of temperature.

Mix.—The mix shall consist of about 480 pounds mastic (or 6 blocks), to which shall be added about 6 per cent. of the flux. The mastic shall be broken up into small pieces. After the mastic and flux have been brought to 400 to 430 deg. F., 80 to 85 per cent. clean, dry, torpedo sand or coarse grit shall be added and the same thoroughly mixed by means of mastic spuds.

Process of Laying Floors.—Floor 1 inch thick shall be laid in one layer. Floor 1½ inch thick shall be laid in two layers, each ¾ inch; the bottom layer, however, must not be rubbed smooth, but evenly spread—great care should be taken that no dust be allowed to accumulate on this layer before second layer is laid. The mixture shall be laid evenly in strips 6 feet wide, using a strip of hard wood or steel ¾ inch thick by 1 inch wide, laid parallel with the wall as a guide.

After two strips of the bottom have been laid, second layer ¾ inch thick shall be placed over same. The first strip of this second layer shall be only 5 feet wide, so that each joint in this layer shall overlap joint in first layer about one foot; all remaining strips shall be 6 feet wide. This layer must be rubbed smooth as fast as it is laid, using limestone dust or cement on the surface while rubbing.

When laid on wooden floors, they should be made as clean and dry as possible, then covered with two thicknesses of building paper, or one layer of waterproof felt, before applying the mastic.

When laid on concrete floors they should be swept clean of all dirt and dust, then painted with a heavy coat of "Amarco" asphaltum paint, before applying the mastic.

Joints.—In making joints in both the bottom and top layers, hot mastic should overlap preceding strips laid about 4 inches, so that the edge of the cold strip will become soft, thus allowing the rubber to make a perfect joint after surplus material has been cut away, all joints being first thoroughly painted with hot asphaltic flux.

Waterproofing of Walls and Posts.—All walls and posts should be painted with two coats of "Amarco" asphaltum paint, from 3 to 6 inches above the floor line.

Fillet.—After floors have been finished, put 3-inch fillet around all walls and posts.

Workmanship.—All work to be done in a thoroughly workmanlike manner.

Guarantee.—Should any defects develop during a period of 5 years from the date of completion, due to either faulty material or workmanship, the contractor shall repair same at his own expense, provided, however, such defects are not due to faulty foundation or other conditions not controlled by the contractor.

Difficult Sewer Construction in St. Louis.

In the construction of the $4,000,000 River des Peres sewer in St. Louis, almost all of the difficulties known to sewer engineers will be encountered. The sewer, when completed, will be the longest underground drainage canal in the United States. It will be 12 miles in length, 9 feet in diameter and will drain the largest watershed of any sewer in the country—110 square miles, or 70,000 acres.

Work already has begun on the sewer, R. E. Cooney, active superintendent, is the engineer for Burke & Joseph, contractors. Walter T. Gray, engineer of the Sewer Department, is supervisor. Work on the rock tunnel is rapidly progressing, and the engineers will begin the quicksand tunnel soon.

In cutting the 9-foot tunnel section through the rock formation, about 36,000 cubic feet of excavation will be necessary. In this rock work in which the work is progressing at present a headway of 9 or 10 feet is a good day's work for the crew. The holes in which the explosives are placed are drilled 11 feet. For each day's work 200 pounds of nitroglycerin dynamite are used in each "head." The total length of rock tunnel is about 2,200 feet.

In the quicksand tunnel work, of which there is approximately 1,000 lineal feet, the shield process will be used, a 9-foot shield being necessary. It is estimated that the quicksand tunneling will progress at the rate of about 20 feet per day. An air compressing plant is being erected at present to furnish compressed air for the quicksand tunneling.

At the mouth of the sewer, a difficult proposition awaits the constructors. After drilling the rock tunnel to within 100 feet of the river, the engineers will come to the surface and begin an open trench to connect river and rock tunnel.

To do this they must dig down nearly 100 feet, or 20 feet below low water stage. Necessarily something will have to be done to keep the water from rushing in.

The engineers will surmount this difficulty by going out into the Mississippi and building a dam around the proposed mouth of the sewer. After having made the dam water-tight, they will pump the water out of it, further strengthen their dyke and begin work on dry ground.

The building of the inside of the tunnel, after the hole in the ground has been made, presents several methods. From the river to the beginning of rock tunnel for 100 feet the sewer tube will be made of four rims of brick, re-inforced over the top and sides with 8 inches of concrete.

In the rock tunnel the walls will be bricked, while in the quicksand tunnel the hole will first be lined with segments of 8-inch timber, sawed so as to fit perfectly in the 9-foot aperture, after which a layer of brick will be laid. In the open trench bricks, re-inforced by concrete, will be the method. The four layers of brick in the first 100 feet will be placed there on account of the heavy hydrostatic pressure the sewer will have to withstand, owing to its location beneath the river.

MUNICIPAL MATTERS IN COURT

Decisions of the Higher Courts of Interest to Municipalities.

Water Franchise as Property—Under the law of Wisconsin, a franchise granted to a water company by a city to build and operate a water works system therein is regarded as the principal thing to which the other property acquired by the company, real or personal, is an incident; the whole being personalty so long as owned by the company. Trust Co. of America vs. City of Rhinelander, Wis. 128 F. 64.

Damages Due to Water Pressure or Corrosive Effect—Plaintiff, having a contract with defendant water company for water supply, alleged that defendant was bound to furnish water under reasonable pressure, but that it negligently supplied water of a harmful character and of such a high and abnormal pressure as to corrode plaintiff's pipes so that one of them burst and caused damage, etc. *Held*, that the complaint stated a single cause of action; the corrosive nature of the water and the abnormal pressure being stated as co-operative causes in producing the injury. Miles vs. Charleston Light & Water Co. (S. C.) 69 S. E. 292.

Liability of Contractor for Error in Bid—Where a bidder on a municipal contract inadvertently made an error in footing up items, so that the amount of his bid was one-tenth of the amount intended, which error was patent upon the face of the bid itself, the bidder will be relieved from liability for damages for breach of an agreement contained in the bid to carry out a contract upon the terms stated in the bid. City of New York vs. Doud Lumber Co. et al. (N. Y.). 125 N. Y. S. 394.

Failure to Fix Water Rates—Injunction—Where water rates have not been fixed by the board of aldermen, as provided by Greater New York charter, an owner of an apartment house is entitled to an injunction restraining the municipal authorities from cutting off his water supply, on condition that he permits the meter to be installed to measure the water actually used while the injunction continues. Johnson-Kahn Co. vs. Thompson et al. (N. Y.). 125 N. Y. S. 443.

The Right to Extend Water Mains.—Where a municipal water company sought to justify laying enormous pipes through the city's streets upon the ground that they were going to extend their mains without the corporate limits to supply people on adjoining roads, a thing the company could do under the direct provisions of the statutes, upon condition that the consent of the owners on the road be secured, the consent of such owners is a condition precedent to compelling the city to allow the extension, and, until that be shown, the company is not entitled to a preliminary injunction to restrain the city from preventing the laying of the pipes.—Somerville Water Co. v. Borough of Somerville (N. J.), 78 A. R. 793.

The Right of a Municipality to Furnish Light.—A municipality cannot furnish lights for private use, unless specially authorized.—Rand, Collector v. Marshall (Vt.), 78 A. R. 790.

Gratuitous Services to a Municipality May Be Terminated at Will.—If one agrees to perform a certain service for a village gratuitously, he may withdraw such promise at any time before the same is performed, and notice of such action is sufficient, if duly given to one member of a committee of the village board in charge of the improvement upon which the services are performed, and if the committee then continues his employment, the village will be liable for the value of the services thereafter rendered.—Launt v. Village of Oakdale (Neb.), 129 N. W. 258.

Water Department Expenses Payable from Current Expense Fund.—In the absence of a showing of apportionment by the city council of the current expense fund created by the statutes among the several departments of the city, it is *held* that the expenses of the city water department are payable from the current expense fund.—State ex rel. Briggs et al v. McIlraith, city treasurer (Minn.), 129 N. W. 377.

The Signing of a Paving Petition Does not Prevent Action for Damages in Case of Injury.—Where, when a petition for paving a street was presented to the trustees of a village, the plans therefor had not been made, and one signing the petition was told by the trustees that the construction of the pavement would cause no appreciable change in the grade of the street that would damage his property, and signed in reliance on such statement, and it did not appear that the paving could not be done without making so great a change, petitioner was not estopped from claiming damages for changing the grade.—Stillman v. Village of North Olean (N. Y.), 126 N. Y. S. 728.

Water Company's Liability for Damages Due to Fire.—Where the contract between a city and a water company provided that the company should supply sufficient water for protection against fire, and that it should supply private fire plugs as well as the ordinary private demands, the company was not liable to one who did not have a private fire plug, for destruction of property owing to its failure to supply sufficient water for fire protection, but such person could recover under the contract between the company and the city, on showing that the water pressure in the general mains was wholly insufficient for general fire protection.—Kenton Water Co. v. Glenn et al (Ky.), 133 S. W. 573.

The Right of a City to Make a Charge for Sewer Connections.—A city ordinance which reserves to the city the exclusive privilege of building lateral sewers from the property line to the public sewer, and which makes a uniform charge of $20 therefor, is not so unreasonable as to be void, merely because the expense to the city is not the same in every case, because some lots are nearer to the sewer than others.—Harter v. Barkley et al (Cal.), 112 P. R. 556.

Engineer's Certificate Required before Assessment for Improvements Can be Levied.—The certificate of the city engineer that the work has been completed in accordance with the contract is essential before the city officers can properly levy assessments against individual property for the payment of the cost of a sewer.—Baker v. City Council of City of La Moure et al (N. D.), 129 N. W. 764.

Operating Expense of Purification Plant May Not be Capitalized.—The contract between a water supply company and a city under which waterworks were constructed by the former for supplying water to the city, provided that the operation of sewage disposal works constructed by the company shall not be an expense to the city, and further provided that if the waterworks were purchased by the city under its option to purchase, they should be delivered to it "as a completed, operating plant, free from pollution as aforesaid." The city claimed, in a suit to compel the transfer of the waterworks under its option to purchase, that the annual cost of operating a device for removing germs should be capitalized, and, as capitalized, be deducted from the contract price. *Held,* that the company's contract was to deliver a plant, and not the money with which to operate it, and the cost of operating such device should be borne by the city; such cost not being a part of the completed plant.—Mayor, etc., of Jersey City v. Flinn et al (N. J.), 78 A. R. 391.

Liability of a City for the Character of Its Water Supply.—A complaint charged that defendant city negligently allowed the supply in its waterworks system to become polluted with poisonous substances, and large quantities of filth and sewage to escape into and saturate its water supply, by reason whereof plaintiffs' intestates contracted typhoid fever and died as a consequence. On demurrer it is *held,* (1) The municipality was liable for its negligence in its private or corporate capacity, and was not exempt because it was carrying out a governmental function. (2) An administrator of a person whose death was due to the wrongful act of a municipality may maintain an action for damages conseqnent thereon.—Keever v. City of Mankato. Flanagan v. Same (Minn.), 129 N. W. 158.

Liability of a City under Franchises of a Purchased Water Company.—The city of Mobile was authorized to build or buy a waterworks system to furnish water at usual rates, etc. Under this act the waterworks was built, and later the plant of a private company was purchased, and water was supplied through the purchased company's mains, etc. The franchise of the purchased company provided that it should furnish water to the municipal buildings and hospitals, and to the courthouse and jail, free of charge. *Held* that, as the act above refrred to did not authorize the inference that the power conferred was to be burdened with the duty of furnishing water to the public buildings of the county, the purchase of the private company's property did not burden the city with its franchises, for the duty was not upon the property, but upon the franchises of the water company.—City of Mobile v. Mobile County (Ala.), 53 S. R. 793.

Water Supply May be Shut off in Case of Willful Waste.—For failure to pay a valid claim for willful or unreasonable waste or for fraudulent use of water, the supply may be cut off until the waste is stopped and all arrears paid.—J. N. Mathews Co. v. City of Buffalo et al (N. Y.), 126 N. Y. S. 596.

The Definition of "Channel."—The "channel" of a stream, in its larger sense, is its bed from bank to bank; the hollow or course in which the water flows.—Village of Prairie Du Rocher v. Schoening-Koenigsmark Milling Co. (Ill.), 93 N. E. 425.

One Contractor not Liable for the Incomplete Work of Another on the Same Job.—Plaintiff contracted with a city to pave certain streets, the contractor to excavate the subsoil to a specified depth, and if rock should be encountered, it was to be removed for at least three inches deeper. Several years before, the city had let contracts for grading the streets in question under which all rock was to be excavated to a depth of two feet below the curb line and the excavation then refilled with soft filling to the street level. Under such previous contracts, the contractors had received payment in full upon proper certificates that the work had been fully performed. Such contracts were on file as public records with the certificate showing the full performance of the work and payments therefor. When plaintiff undertook to excavate the streets, he found that the rock had, in fact, been removed to a depth of only about a foot below the curb instead of two feet and was required, over his protest, to remove the rock which should have been removed under the former contracts. *Held,* that the parties to the contract did not contemplate that the contractor would have to remove the rock which was supposedly removed under the former contracts, and the contractor, being compelled to make such excavation to perform his contract, there could be a recovery therefor as for additional work.—Dunn v. City of New York (N. Y.), 126 N. Y. S. 61.

A Court Will Not Interfere in the Management of a City So Long as the Officers Are Within the Limits of the Statute.—Courts will not interfere with the management of the municipal affairs of a city by its chosen officers, so long as they are within the limits of the power conferred by the statute, and it is not shown that in the enactment of ordinances they were influenced by malice, or fraud, or actuated by an unreasonable or capricious spirit.—Town of Lagrange v. Overstreet (Ky.), 132 S. W. 169.

Time Limit of Contract May Not Be Extended after Time of Performance Has Expired.—A contract for public improvements which provides for a certain time of completion cannot be extended by an ordinance of the common council passed after the time of performance has expired. —Paul v. Burress (Mo.), 132 S. W. 330.

Meter Readings Are Not a Record of Quantity of Water Delivered.—Where books of a city water department purporting to show delivery of water to defendant were not in fact a record of the sale and delivery of water, but of conclusions drawn by the water department from readings of various meters and conduits leading to defendants premises, the books were not evidence of a sale and delivery of water to defendant.—Mayor and Council of City of Bayonne v. Standard Oil Co. (N. J.), 78 A. R. 146.

Open Ditch May Not be Substituted for Drainage Pipes without Legal Right.—The attempt to make and use the open waterway in place of the drainage pipes without obtaining the consent of the grantor or the legal right to do so may be restrained by injunction.—Boleno et al v. City of Hutchinson (Kan.), 112 P. R. 129.

Los Angeles Municipal Water System.

The municipally owned water system of Los Angeles, Cal., seems to be a decided financial success according to the figures from the annual report.

Last year, that is, for the year ended June 30, 1910, according to the city's books, the water department earned $1,107,199. Its operating expenses were $239,792, and its profits, therefore, were $867,407. This profit makes it possible to put a capitalized value on the plant. The amount represents 6 per cent. interest on a capitalization of nearly $15,000,000. The rate is probably too high. With conditions as they are 5 per cent. return on the investment would be considered adequate by private capital, and at this rate the capitalized value of the property would exceed $17,000,000.

When the city bought the plant it paid $2,000,000 for it. Later it paid $337,500 for the West Side Water company's plant, adding it to the system. Every year, under municipal ownership and control, the department has shown big profits. In 1902 it made $408,000 in round figures above expenses; in 1903, $537,000; in 1904, $664,000; in 1905, $758,000; in 1906, $819,000; in 1907, $866,000; in 1908, $902,000, and in the period from November 30, 1908, to June 30, 1909, when a charter amendment changed the fiscal year so that it ends in June instead of November, it earned $474,000.

These annual profits have been used for the benefit of the whole people, not alone the taxpayers, for water rates have been kept down and the efficiency of the service has been kept up. In addition, the department has relieved the taxpayers at large of the payment on the water works bonds and has even taken care of a part of the interest and sinking fund on aqueduct bonds. The remainder has been used in extensions and other betterments to the system, so that the property is becoming more and more valuable every year.

The actual physical value of the plant

today, figuring what the property would bring if sold at a forced sale, is nearly $6,000,000. In addition to the amount shown on the books as profit there is a further profit to be considered. The city itself is one of the heaviest consumers of water. Millions of gallons are used annually in the parks, on the streets, for flushing sewers and a score of other public uses.

No charge is made the other departments, but the amount estimated to be used this year if charged for at ordinary rates would cost $216,519, and it is fair to figure this, too, as profit to the taxpayers.

CURRENT INFORMATION

Cheap Gas in Oklahoma—Conduits of Lincoln Park Electric System—Pittsburg Transportation Problem—Suggested Garbage Receptcle Ordinance for St. Louis—Automatic Sewage Pumping Stations—Beautifying Fifth Avenue—Providence Playgrounds Popular

Cheap Gas in Oklahoma.

A company has recently been organized and incorporated for furnishing gas for the city of Claremore, Okla. The company is capitalized for $50,000, the control being held by local capital. The gas is to be secured from fields near Collinsville and piped a distance of ten miles to the city limits. It is proposed to furnish the gas to local factory concerns at a rate of 3 cents per thousand cubic feet.

Conduits of the Lincoln Park Electrical System.

The extension of the boulevard lighting system of the north portion of Chicago, to include Lincoln park and the boulevards leading to it, has been productive of some very excellent construction details as relates to this class of work. Chief among these are the various improved methods adopted in conduit construction.

It was necessary, for a number of reasons, that not only the lighting wires, but those for the telephone system, should be placed beneath the ground. Economy demanded that, if possible, both the wire lines should be placed within the same trench, and within the same condiut if possible. Telephone engineers were doubtful of the practicability of the latter, by reason of troubles arising from induced currents, leakage, etc.; but the success of the plan adopted has proved these fears to have been wasted. The system has been in use since June, and not the slightest difficulty has been experienced. This fact is remarkable when it is considered that the telephone ducts adjoin up to eight to twelve ducts of 6,700-volt, single-phase lighting circuits and 4,000-volt, three-phase power circuits. The telephone lines are metallic circuits placed in paper-insulated and lead-covered cables.

All the conduits laid were of bituminized fiber duct, manufactured by the American Conduit Co., East Chicago, Ind. The method of laying this conduit was very simple and relatively low in cost. The trench was prepared to the desired depth, and in it was placed a layer of concrete which was tamped down. Upon this base the duct was laid, only three men being required to handle it. One of these dipped the ends of the duct into hot bitumen, and the other two placed them in the trench; the one fitting the counterbored ends together, and the others pushing the duct into place to make a tight joint. Where the conduit comprised several layers of ducts, concrete was placed between each course, filling the space between the adjacent ducts. Concrete was then placed over the top layer of ducts and the whole was thus made an integral mass. A portable concrete mixing plant was used, and the work was carried on with considerable speed.

The bituminized fiber conduit has proved to be low in first cost, cheap and easy to lay, and under the severe conditions just described has demonstrated its properties of insulation.

The Pittsburg Transportation Problem.

The monumental report of Bion J. Arnold on the Pittsburg transportation problem is published in a book with a portfolio of drawings, and will serve as a model for this kind of work. While Pittsburg's problem is more difficut than that of most cities, it contains practically all the elements which might present themselves for consideration in any city, so that the principles of some part of the report, at least, can be applied in any other city.

Automatic Sewage Pumping Stations.

A number of plans have been under consideration in New York City involving the use of automatic pumping stations for small areas where the elevations are too low to permit of gravity sewers. The report of the chief engineer of the board of estimate and apportionment contains a reference to the investigation of the subject. This reference is briefly abstracted in the following:

In 1908, the board authorized the installation of a temporary plant on the St. Nicholas avenue sewer, to provide an outlet for the dry-weather flow into an existing sewer. The pump chamber of this station has a depth of about 40 feet. Inspection after the station had been in operation for some time showed that the surface drainage had been admitted in large volumes to the sewer, much overtaxing the capacity of the station. This excess flow was in part removed by a high-level overflow, while the remainder was temporarily stored in the trunk sewer, converting it for the time into a septic tank, leading, of course, to disagreeable odors and complaints from those residing near the station.

Notwithstanding the fact that the operation of the station was limited to the day periods and that an attendant was assigned to its constant supervision, the plant was very frequently out of commission. It is believed that the troubles experienced arose from an overtaxing of the capacity of the plant, though part of the blame is ascribed to the dampness of the chamber and its effect on the machinery, and to faults in the design of the machinery.

The experience with the St. Nicholas avenue station and the possibility of the city being confronted with large damage claims as a result of the failure of future plants that should be installed, led to the investigation of conditions in New Orleans, where entire reliance is placed upon such pumping stations. Assistant Engineer John E. Hill was assigned to the investigation, and his report is partially transcribed in the report of the chief engineer.

New Orleans being built on very flat ground, with the highest elevations at the points of outfall, it is impracticable to install any sewerage system which will deliver the sewage flow of all sections of the city to the necessary points of outfall by uninterrupted gravity. Consequently automatic pumping stations, electrically connected with central stations, have been designed along the lines of the main intercepters and their principal tributaries. Of the thirteen designed automatic sewage-pumping stations, but six are at present built. The pumps are all centrifugal pumps, directly and vertically connected to induction motors; and all friction bearings and working parts are smothered in oil. Each inlet sewer discharges into a shallow suction pit having extended vertical walls.

All these six sub-stations are built of reinforced concrete and have their pumps set in a dry well, with the center of the pump casing below the level of the center line of the inlet sewer. They are provided with automatic regulating devices connected with float chambers and so arranged that the pumps will go into operation at their full rated capacity when the inlet sewer is seven-tenths full, and will cease when that sewer has been pumped dry at the suction pit end. They are also provided with secondary float chambers and cable devices used for automatically sounding signal alarms at the central station. Each chamber is connected with the primary duct, and when the water in the sewer rises above the seven-tenths full level, lugs on the cable throw a connecting arm into the circuit, and a continuous alarm is rung and an annunciator falls at the central station. An emergency by-pass leading from the suction pit to the discharge sewer is also provided; and this comes into operation when a sudden breakage occurs in machinery or in cable, or when a prolonged suspension of power renders the plant, for a time, inoperative.

Besides these installations, each station is provided with a set of incandescent lights, a ventilating fan, an automatic gauge for recording sewage height, a transformer, a switchboard, a hydraulic-siphon sump pump and a compound inlet-outlet ventilating stack with hooded cowl. The lights, the ventilating fans and the pressure pumps operate to keep the stations dry, warm and fit for electrical apparatus. They have been found necessary, even though such apparatus is well encased and protected.

Each station is visited once each day and receives a careful inspection and attention, lasting, normally, about fifteen minutes in each station. The intelligence devoted to the general superintendence and to the daily inspections was strictly high grade, and has resulted, apparently, in maintaining absolute reliability in the automatism of the starting devices and in the precision of the operating machinery; and it is claimed that, except during floods and two isolated occasions, this perfect automatism and precise operation had continued without interruption, damage or significant cost of repairs, twenty-four hours a day, every day of the last three years.

The factors which have led to the success of the New Orleans station are briefly noted by Mr. Hill as follows:

(a) Broad and generous design, fortified by splendid construction and hair-line inspections.

(b) Intelligent and methodic watchfulness over both daily routine and working machinery.

(c) Shallow suction pits instead of receiving wells and the combined alternating and supplementary character of all pumping units.

(d) Short runs and small lifts, with the avoidance of the necessity for screening.

Suggested Garbage Receptacle Ordinance for St. Louis.

The Civic League of St. Louis has caused to be introduced in the Municipal Assembly a new draft of the garbage receptacle ordinance about which there hsa been considerable discussion in the past. The ordinance passed in 1909 has proven to be unenforcible on account of a division of responsibility between owner, lessee and tenant as to the purchase and maintenance of the receptacles.

The new draft has been drawn with great care by the league's attorney, Chas. P. Williams, under practical provisions decided upon by the Housing and Sanitation Committee, J. Hal Lynch, chairman.

The bill provides:

1st. That it shall be unlawful to deposit garbage in or upon any place in the city of St. Louis except as provided in the ordinance.

2nd. The ordinance provides that all garbage shall be placed in water-tight metal pails or cans provided with tight-fitting covers and handles.

3rd. The ordinance defines garbage as waste or refuse matter, animal and vegetable, derived from the preparation or use of meat, fruits, vegetables, etc., including also small dead animals. Ashes, crockery and glass may not be placed in garbage receptacles.

4th. The provisions of the present ordinance regarding the placing of these cans are repeated in clearer terms.

5th. The duties of the Street Commissioner and Police Department in the matter of collections and notices of hours of collection are the same as under the present ordinance.

6th. The duty to maintain the receptacles required devolves primarily upon the tenants or occupants of a single dwelling or apartment and any building containing not more than four apartments. The same duty devolves upon the person or firm conducting any restaurant, hotel, etc. In all of the cases it rests upon the landlord immediately above the tenant and upon the landlord's agent where the premises are let out or rented.

7th. A penalty is provided for the willful removal or overturning of any garbage receptacle.

The health authorities and persons conversant with conditions in the poorer sections of the city have found that the evil of loose garbage has not been settled by the passage of the ordinance in 1909. The danger to health from the exposure of garbage is great not only on account of the decaying waste, but particularly from the fact that it is a breeding place for flies. This garbage receptacle bill is a health measure of the first importance, and it is expected it will not meet opposition.

Beautifying Fifth Avenue.

A recent issue of the *Municipal Facts* of the City of New York contains mention of the movement being made for the beautifying and improving of Fifth avenue. A meeting of the Architectural League of New York recently took up the question in its various phases. This discussion was materially aided by a report of a committee of the New York Chapter of the Institute of Architects, recently appointed to devise plans for the betterment of Fifth avenue. This committee consisted of John M. Carrere, of Carrere & Hastings, who are building the new Public Library on Fifth avenue; Albert Brunner and William M. Kendall, the latter of McKim, Mead & White.

Those advocating architectural changes on the avenue desire, for one thing, that there be some sort of regulation as to height of buildings. It has been shown, they say, that buildings over ten stories high along Fifth avenue are not only unsightly but unprofitable.

Second, they hope to see in time uniformity in the treatment of the facades of Fifth avenue s buildings, and—equally important—proper architectural treatment of side walls, which nowadays are often shockingly bare and ugly. Already those about to build along the thoroughfare have been approached, and in some cases, after conferences with the friends of "Fifth Avenue Beautiful," they have materially altered their designs in such a way as to benefit the avenue as a whole.

The side-wall question arouses the ire of architects most readily. Anyone walking along the avenue can understand this. Over and over again low buildings are dwarfed and "uglified" by great adjacent side walls, entirely unadorned—nothing more nor less than huge heaps of bricks. This is because those who built the adjacent building thought their duty done when they provided an ornamental and often pretentious facade.

One scheme to beautify these blank walls is to install window boxes along the avenue; there is another for getting Fifth avenue merchants to keep their windows lighted well into the night, and arrange beautiful window displays, thus attracting thousands of out-of-town people to the street at the hours when now it is "dead."

Those advocating the planting of trees on Fifth avenue are fully aware that the cost will be great, but, as one of them points out, the city can have rows of trees along the avenue if it is willing to pay for them.

"Probably the best kind would be Norway maples or Oriental planes," said a landscape architect. "They would have to be in huge flower-pots, with some sort of reservoirs or vaults under the sidewalk to keep them alive. There are trees from Fifty-ninth street north on one side of the street—why not all the way on both sides?"

"Wealth is so great along Fifth avenue that the cost of tree planting would be, relatively, a small outlay. It might be done by combination among those whose property fronts the thoroughfare. Each property owner might put in two trees, let us say, at cost of about $200 or $300."

Prominent in the practical betterment of the street is the Fifth Avenue Association, founded four years ago. Then it was a mere group of people; now its membership is over 300, recruited chiefly among property owners, business men and residents in the Fifth avenue section.

MUNICIPAL AND TECHNICAL LITERATURE

Engineering Data—Books for Engineers

Engineering Data.

The little collection of facts called "Data," which has been coming monthly for about half a year at the price of $1 a year is rapidly demonstrating its value to the engineers. Ten cents will get a sample copy if sent to "Data," at 92 La Salle St., Chicago, Ill., and will show that it is supplying a field that needs help.

Books for Engineers.

Conversations on Electricity. By Joseph G. Branch, B. S., M. E. An elementary work written expressly for engineers and students. First part. Cloth, 282 pp., 105 illustrations, $2. Rand, McNally & Co., Chicago, Ill.

The author has chosen the dialogue form for this work, which indicates the type of student for which it has been prepared. The large number of sample diagrams used as illustrations adds to the effectiveness of the treatment. The twenty-eight sections cover the field of the elementary theory of electricity and electrical machinery, and the author is unusually clear in his forms of statement and in his development of the subject. The book should be of much value to the young student who wants to get an elementary knowledge of the subject of electricity from a book.

Cost Keeping and Management Engineering. A treatise for engineers, contractors and superintendents engaged in the management of engineering construction. By Halbert P. Gillette and Richard T. Dana. Cloth, 339 pp., $3.50 net. The Myron C. Clark Publishing Co., Chicago, Ill.

The discussion of cost keeping and cost analysis in such organizations as the American Society of Engineering Contractors revives interest in this book, which compiles in a single volume material which is scattered through many papers, books and periodicals. In addition to the authors, who are responsible for the general discussions in the first five chapters or so and for the compilation of the rest, contributions to data, forms and discussions thereof are drawn from Gilbreth, Taylor, Moore, Worden, McCullough, Emerson, Hall, Guthrie, Steffens, Wason, Fisher, Lockwood, Keating, Hallihan, Cummings, Humphrey, Falk, Hammalt, Low, Newell, Hill, and numerous railroads, contractors and others.

The science of cost keeping and management engineering is not yet old enough to have received its full development. The rather hasty consideration of the subject by the authors of this book adds much to the material and the data they have collected add much more, so that, while one cannot accept as gospel anything given in the book and may be confused by the mass of not very well correlated material, if he will stick to his study and experiment, he can find help in almost any line in which he may be engaged.

Modern Methods of Street Cleaning. By George A. Soper, Ph. D., M. Am. Soc. C. E. Cloth, 201 pp., $3 net. Engineering News Publishing Co., New York.

This book is the result mainly of a trip to Europe and much of it is taken up with general descriptions of machinery and methods used for cleaning streets and disposing of the refuse in London, Westminster, Manchester, Paris, Berlin, Hamburg, Cologne, Amsterdam and New York.

The opening chapters treat in a theoretical way the sanitation of cities, particularly of the city streets, of methods of preserving the cleanliness of streets, of making and enforcing ordinances therefor; of methods of cleaning streets by the use of brooms, by water flushing and with the use of rubber scrapers and sprinkling; of disposal of refuse, including garbage and refuse. These chapters are all very brief, occupying less than 40 pages in all. A summary of European methods precedes the descriptions of the various cities. It includes the methods of organization, the character of labor, the plant and equipment, disposal of sweepings, removal of snow, collection and disposal of house refuse.

The figures showing cost are mainly totals, and there are but few cost details which can be applied in other cities. Nor are the details of methods any more thoroughly presented. From this point of view the book is rather disappointing. On the whole, however, it is of much interest and presents the general subject in a readable and logical form.

Backbone of Perspective. By T. U. Taylor, C. E., M. Am. Soc. C. E. Cloth, 56 pp. The Myron C. Clark Publishing Co., Chicago, Ill.

The author publishes these notes to save the time of his students in note-taking, and they will be of interest to anyone desiring to obtain a simple working knowledge of perspective, shades and shadows. Apparently no previous knowledge of descriptive geometry is necessary, as the necessary principles of that subject are all presented. A chapter on axometric projections requires much more mathematical knowledge than any other part of the book.

Elements of Water Bacteriology, with special reference to sanitary water analysis. By Samuel Cate Prescott, assistant professor of industrial biology and Charles Edward Amory Winslow, assistant professor of sanitary biology in the Massachusetts Institute of Technology. Cloth, 270 pp. $1.50 net. John Wiley & Sons, New York City.

The practical work of testing the sanitary condition of a water supply by biological methods is well described in this little volume by men who are familiar with every step of the process and with the history of the development of the modern methods.

The nature of bacteria, their occurrence in natural waters and the significance of their occurrence are well stated in the first chapter, and the methods of making quantitative bacteriological determinations are described in detail in the second chapter. The third chapter gives the discussion of the interpretation to be made of the quantitative analysis. The interpretation is restricted in the fourth chapter to the bacteria which develop at the body temperature.

The most important bacteriological study begins in the fifth chapter, which gives in detail the methods of isolating specific pathogenic bacteria, and continues in the sixth with methods for the isolation of the colon bacillus, and in the seventh with a discussion of the significance of the presence of that bacillus in water. The eighth chapter gives shorter tests for the colon bacillus, which are more practical in application, though not quite so exact in their indications.

Methods of testing the presence of other intestinal bacteria are outlined in the ninth chapter, and the tenth shows clearly the significance and applicability of the bacteriological examination of potable waters. The bacteriology of sewage and sewage effluents receives a brief treatment in the eleventh chapter.

The appendix gives full specifications for preparing the various media for the cultivation of bacteria of various kinds, the apparatus, formulae, etc. The book closes with a full bibliography of books, reports and articles referred to or used in the preparation of this book, which occupies a field not so well covered by any other book, and which is at the same time valuable to the technical bacteriologist and to the water engineer who wishes to obtain a clear idea of the subject.

There have been considerable advances in some directions during the four years between this second edition and the first edition, which was reviewed in MUNICIPAL ENGINEERING, vol xxviii, p. 410. These have been well covered by the 65 pages or more added to the first ten chapters and the eleventh chapter, which is entirely new.

The standard methods adopted by the committee on Standard Methods of Water Analysis are included in full. The activity in the study of details is suggested by the increase of about 80 per cent in the number of articles referred to in the bibliography.

Concrete Bridges and Culverts for Both Railroads and Highways. By H. Grattan Tyrrell, C. E. Flexible leather, 272 pp., 66 illustrations, $3. The Myron C. Clark Publishing Co., Chicago and New York.

The author has attempted in this book "as far as possible to eliminate mathematical formulae" and to present only what "is directly required in the design and construction of ordinary concrete or masonry arches, so it will be unnecessary for the busy engineer to spend valuable time and thought in the perusal and study of abstruse mathematical treatises." Within this restricted field he has succeeded in making a practical book which may serve as a convenience in gettng together the data and compiling a design for an ordinary arch or flat topped bridge or culvert. It is manifestly impossible for such a book to provide the material for the design of every problem which may arise in its field.

The first part, 95 pages, is devoted to plain concrete arch bridges. After a general discussion of the principles of arch design and the various forms of arches and their loadings, working unit stresses are assumed and methods of determining the line of resistance, point of rupture, thickness of arch ring, etc., are briefly outlined, designs for abutments, foundations, piers, etc., are suggested, and some data for approximate estimates of cost are given, followed by some of the details of a number of stone and concrete arch bridges, and a tabular statement of the principal dimensions of 56 concrete bridges varying in span of principal arch from 20 to 320 feet constructed and 703 feet proposed.

The second part takes up reinforced concrete arch bridges in a brief way, with a historical outline, a statement of the advantages of reinforced concrete, a discussion of adhesion, bond, and two or three methods of reinforcement with steel. Units of stress are assumed and the theory of the arch is again briefly stated, with an unexplainable exchange of the names of Greene and Cain as exponents of the graphical and analytical methods of analyzing the stresses in arches. Then follow some observations on the general design of an arch as regards each of its principal components and some data for estimating cost, including a table of approximate estimating prices upon various materials and operations, and a table of approximate quantities for arches of various spans. Some brief illustrated descriptions of existing arches are given and a table of the principal dimensions of 122 reinforced concrete bridges varying in span from 33½ to 259 feet.

Highway beam bridges and methods of design are briefly considered in the 8 pages of the third part.

Concrete culverts and trestles receive some attention in the fourth part, the large structures being briefly mentioned and the smaller structures and slabs being treated in tabular and diagram form and shown in dimensioned drawings, accompanied with itemized statements of the cost.

The Design of Highway Bridges and the Calculation of Stresses in Bridge Trusses. By Milo S. Ketchum, C. E., consulting engineer, dean and professor of civil engineering, University of Colorado. Cloth, 558 pp., 77 tables, 300 text illustrations, 8 plates, $4 net. Engineering News Publishing Co., New York.

Professor Ketchum has given us another of his practical books, covering a field which has been neglected for some years, and he has done his work thoroughly and well. The first part, occupying 190 pages, is devoted to the determination of the stresses in street bridges. It shows all the standard designs of trusses, gives the detail of estimates of weights of bridges of various designs, for both highways and railways and for loadings, gives clear statements of the algebraic and graphical methods of analyzing trusses and determining the stresses in their members, with examples of their application to both highway and railroad bridges with most of the forms of truss that are in use.

The second part goes into the detail of the design of highway bridges, short span, beam, plate girder, low truss, through and deck girders, riveted and pin connections, showing the advantages and disadvantages of each detail devised or described, and giving the standard specifications for loads, allowable stresses, qualities of material and workmanship, and the standard designs and arrangements of details adopted by the most prominent bridge manufacturers and designers. It also gives the principles governing the design of foundations, piers and abutments and such specifications for stone and concrete masonry as are necessary, with tables of standard dimensions, weights, materials, etc. One chapter in this part discusses the analysis of stresses in solid masonry arches, as a basis for the design of masonry bridges and culverts, and another gives a brief discussion of the applications of reinforced concrete to the same work, with numerous examples, which are fully described and illustrated, wth detailed statements of cost. The selection of areas and shapes of waterways is also well considered. The discussion covers everything from the great concrete arch to a vitrified or concrete pipe culvert. One brief chapter gives the essentials of the design of timber bridges. Another takes up the erection, the estimates of weights and the costs of highway bridges in detail and manner never before attempted. This part closes with a consideration of the general principles of economic design, with a form of contract and bond.

The third part takes up the critical study of an existing truss, going through all the steps described in the preceding pages and calculating weights, cost, efficiency of each member and each connection.

An appendix gives the author's full set of general specifications for steel highway bridges, in which he avails himself of the standards for various classes of highway and electric railway bridges adopted by Cooper, Schneider, the American Bridge Company and the American Railway Engineering and Maintenance of Way Association, with such modifications as are necessary to weld them all into a homogeneous and concordant document.

The relations of the bridge owner, the designing engineer, the consulting engineer, and the contractor, and of the preliminary plans on which contracts are let to the shop details, which are best left to the successful contractor under the supervision of the engineer, are clearly set forth, with statement of the common troubles which arise when the principles laid down are departed from.

ORGANIZATIONS AND INDIVIDUALS

Paving Specifications—Congress of Technology—Mechanical Engineers—Technical Meetings—Calendar—Technical Schools—Civil Service—Fred J. Cassidy—Personal Notes

The Association for Standarizing Paving Specifications.

The above name is the new title of the organization of city officials which has held two conventions for the purpose of producing standard paving specifications. The last convention was held in New York in January and the proceedings have been issued quite promptly and are now ready for distribution. They have been copyrighted and can be obtained in full only from the secretary of the association, John B. Hittell, 5917 Winthorp Ave., Chicago, Ill., at $5 a copy. The legitimate use of the specifications will be granted without charge to those who make written application to the executive committee, stating exactly what part or parts of he proceedings it is the desire to use and for what purpose. Thus any city desiring to use specifications for its paving construction work can avail itself of the work of the large number of experts in this line, who have produced after a full year of deliberation the standard specifications contained in this volume.

The two conventions held in 1910 and 1911 have reduced all the specifications almost to standard form but a third convention will be held in New Orleans January 20 to 26, 1912, according to the notice on one page and January 15 to 20, according to the notice on another page of the volume under consideration. Mr. Hittell will clear up this discrepancy and give full information about the terms of membership in the organization upon application. At this third convention some unsettled details will be further discussed and settled. But with the exception of these rather unimportant items, the specifications given in this volume are the completed standards recommended by the association.

The Congress of Technology.

The Congress of Technology which met in Boston on April 10 and 11 in celebration of the semi-centennial of the signing of the charter of the Massachusetts Institute of Technology was a pronounced success on the two main lines laid out by its projectors. The Congress opened on the afternoon of April 10 with an address by Pres. Maclaurin of the Institute on "Some Factors in the Institute's Success." The greatest of these, he said, was the method of teaching due to William Barton Rogers, the founder of the Institute, and now phrased as "the learning by doing."

The second day of the Congress was given over to the presentation of papers on various aspects of applied science. These papers were grouped in six divisions so arranged that the large numbers of the outside public which attended all the sessions were able to hear papers on the topics in which they were especially interested.

A banquet was held in Symphony Hall on the evening of April 11th when the enthusiasm of the thousand of Institute Alumni and their guests who filled the floor of the hall was a sort of summary of the impressions made by the two days' proceedings. The papers presented at the public session gave to the audiences an extraordinarily adequate idea of how completely applied science shapes and controls the living conditions of the present. And as all the papers were by alumni or members of the faculty of the Institute, it was also made clear how large a part the Institute had played in creating the applied science of today.

Among the papers which were presented were the following: "The New Profession of Economic Engineering," by Roger W. Babson, '98, President, Babson's Statistical Organization, Wellesley Hills, Mass.; "Reliability of Materials," by Walter C. Fish, '87, Manager, Lynn Works, General Electric Co., Lynn, Mass.; "The Function of Technical School Laboratories," by H. W. Hayward, '96, Ass't Prof. App. Mech., Mass. Inst. Tech., Boston; "Profitable Ethics," by David Van Alstyne, '86, Vice-President, Allis-Chalmers Co., Milwaukee, Wis.; "Technical Education and the Contracting Engineer," by Sumner B. Ely, '92, Vice-President, Chester B. Albree Iron Works Co., Allegheny, Pa.; "Sewage Disposal with Respect to Offensive Odors," by George W. Fuller, '90, Consulting Hydraulic Engineer and Sanitary Expert, New York City; "The Pollution of Streams by Manufacturing Wastes," by William S. Johnson, '89, Sanitary and Hydraulic Engineer, Boston; "Profitable and Fruitless Lines of Endeavor in Public Health Work," by Edwin O. Jordan, '88, Professor of Bacteriology, University of Chicago,

Chicago, Ill.; "Present Status of Water Purification in the United States and the Part that the Massachusetts Institute of Technology Has Played," by George C. Whipple, '89, Consulting Engineer, New York City. A number of other papers on industrial subjects were presented.

American Society of Mechanical Engineers.

The local Pittsburg committee of the American Society of Mechanical Engineers: E. M. Herr, chairman, and Elmer K. Hiles, secretary, in charge of the convention of the society which will be held May 30th to June 2nd, inclusive, has selected the Hotel Schenley as the society headquarters. In the evening of May 30 there will be an informal reception for the members and ladies.

Professional sessions will be held in the Lecture Hall of the Carnegie Institue, Wednesday morning and evening, Thursday and Friday morning. In the meantime there will be a number of inspection trips to various industrial plants in the vicinity; a boat excursion for the members and ladies up the Monongahela river, a reecption and ball at the Hotel Schenley on Thursday evening, and, finally, on Friday evening a smoker and entertainment, given by the Engineers' Society of Western Pennsylvania, in their rooms, in the Oliver Building.

Technical Meetings.

The second annual Inter-State Cement, Building and Clay Products Show is to be held in the Coliseum at St. Louis on May 8th to 12th inclusive. The exhibit section will include lumber and mill work, building materials and cement and concrete in addition to the realty show.

The opening dinner of the Greater Engineers' Club of Toronto was held March 16. Capt. Kilally Gamble presided. Speeches were made by Mr. H. E. Haultain, Dean Galbraith, Dr. Ellis, Mr. C. M. Canniff, City Engineer Charles H. Rust and Mr. A. D. Macallum, city engineer of Hamilton.

The sixteenth annual convention of the National Association of Manufacturers, of which John Kirby, Jr., is president, will be held at the Waldorf-Astoria Hotel, New York, on May 15th, 16th and 17th.

The Organization of City Officials for Standarizing Paving Specifications has changed its name to Association for Standardizing Paving Specifications. Copyightred proceeding of the recent meeting held in New York in January, 1911, are now published. Information relative to membership, use of copyrighted matter and cost of proceedings will be furnished upon application to the secretary, John B. Hittell, chief engineer of streets, City Hall, Chicago.

At a regular meeting of the Municipal Engineers of the City of New York, held in the Engineering Societies Building on April 2*th, Andrew J. Provost, Jr., sanitary expert, Board of Water Supply, read a paper on the "Sanitary Problems of the Board of Water Supply."

At a regular meeting of the Brooklyn Engineers' Club held on April 13, Clyde D. Gray presented a paper entitled: "The Design, Construction and Operation of High Tension Electrical Transmission Systems." An exhibition of engineering supplies and materials was held at the club house, 117 Remsen street, during the week of April 17th.

The Third Conference on City Planning will meet this year at Philadelphia, May 15, 16, 17 and concurrently with the sessions of the conference will be held the first municipal exhibit on City Planning in the United States, for which councils have appropriated $10,000.

A meeting of the Indiana Municipal League will be held in the Masonic Temple at Crawfordsville, Ind., on June 20, 21 and 22. Among the speakers on the program as planned are the following: Professor Mason B. Thomas, dean of the Wabash college faculty; Mayor John O. Wilson, of Marion; Paul Jameson, of Newcastle; Mayor Samuel B. Spohn, of Goshen; Mayor Thomas C. Knotts, of Gary; A. E. Veneman, recent speaker of the Indiana house of representatives; Judge Timothy E. Howard, of South Bend; E. B. Stotsenburg, of Evansville; Councilman Jonas G. Howard, of Jeffersonville; Judge Lawrence Becker, of Hammond; Mayor Foster, of Anderson; Henry C. Hogan, of Ft. Wayne; Senator Robert E. Proctor, of Elkhart; Dr. E. C. Loehr, mayor of Noblesville; Mayor John Harris, of Bloomington; Mayor W. W. Zimmerman, of Richmond; Councilman Frank A. McCauley, of Huntington; Mayor Rogers, of Lebanon; Mayor Herzog, of Mishawaka; Mayor Davidson, of Princeton; Mayor Joseph D. McDowell, of Vincennes; Mayor Albert J. Field, of Bedford; J. B. Cooper, city attorney of Columbus; Finley P. Mount, city attorney of Crawsfordsville; and A. D. Cunningham, city attorney of Lafayette.

At a meeting of the New England Water Works Association held in Boston, Mass., on April 12, Mr. E. V. French, vice-president and engineer of the Arkwright Mutual Fire Insurance Company of Boston, Mass., presented a paper on "Desirable Pressure at Hydrants."

At the annual meeting of the American Society of Engineering Contractors, held in the United Engineering Society Bldg., New York City, Jan. 10, 1911, the following officers of the society were elected: W. R. Harris, president; T. Rhys Smith, 1st vice-president; V. M. Roberts, 2nd vice-president. J. R. Wemlinger and Edward Wegmann were elected respectively, secretary and treasurer.

Calendar of Technical Meetings.

National Conference on City Planning—Philadelphia, Pa., May 15-17. W. Templeton Johnson, Asst. Secy., Room 395, City Hall, Philadelphia.

Ohio Society of Mechanical Steam and Electrical Engineers.—Annual Convention, Youngstown, May 18-19. F. E. Sanborn, Secy, Ohio State University, Columbus.

National Fire Protection Association.—Annual Meeting, New York City, May 23-25. F. H. Wentworth, Secy., 87 Milk St., Boston.

National Good Roads Association.—Fourth National Good Roads Congress, Birmingham, Ala., May 23-26. J. A. Rountree, Secy., Birmingham, Ala.

National Electric Light Association.—Annual convention at New York City, May 29-June 2. T. C. Martin, Secy., 29 West 29th St., New York City.

American Society of Mechanical Engineers.—Annual convention at Pittsburg, Pa., May 30-June 2. Calvin W. Rice, Secy., 29 West 39th St., New York City.

American Water Works Association.—Annual convention at Rochester, N. Y., June 6-10. J. M. Diven, Secy., 14 George St., Charleston, S. C.

International Association of Chiefs of Police.—Eighteenth annual convention, Rochester, N. Y., June 11-16. Major Richard Sylvester, Superintendent of Police, Washington, D. C., president.

New York State Association of Chiefs of Police.—Annual convention, Rochester, N. Y., June 13-18.

American Society of Civil Engineers.—Annual convention at Chattanooga, Tenn., June 13-16. Charles W. Hunt, Secy., 220 West 57th St., New York City.

Firemen's Association of the State of New York.—Watertown, N. Y., Aug. 15-18. A. H. Otto, Secy.

American Hospital Association.—New York City, Sept. 19-22. J. N. E. Brown, M. D., Secy., Toronto General Hospital, Can.

American Society of Municipal Improvements.—Grand Rapids, Mich., Sept. 26-29. A. Prescott Folwell, Secy., 239 West Thirty-ninth St., New York City.

League of American Municipalities.—Annual convention, Atlanta, Ga., Oct. 4-6. John MacVicar, Secy., Des Moines, Ia.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

May 24—Drainage engineer in drainage investigations, office of experiment stations Department of Agriculture, at salaries of $1,000 to $2,000 a year, with promotions up to $2,500 a year.

May 24-25—Topographic draftsman at $1,000 to $1,500 a year and copyist topographic draftsman at $900 to $1,500 a year, in the various departments at Washington. Also highway engineer in the office of public roads, Department of Agriculture, at $1,440 to $1,980 a year.

June 7-8—Assistant superintendent and superintendent in the lighthouse service at $1,600 to $2,400 a year.

Fred J. Cassidy.

Fred J. Cassidy is the latest addition to the sales force of the Chicago Portland Cement Co., Chicago, Ill.

FRED J. CASSIDY.

Mr. Cassidy is 24 years of age and a native of LaSalle, adjacent to which city the mills of the Chicago Portland Cement Co. are located. His connection with his present employers dates back to early in 1907 and his training has been varied, passing through the purchasing, traffic and sales departments in turn.

The Technical Schools.

"The Strength of Oxyacetylene Welds in Steel," by Herbert L. Whittemore, has just been issued as Bulletin No. 45 of the Engineering Experiment Station of the University of Illinois. This bulletin gives the results of an extensive series of tests to determine the strength which may be developed in welded joints made by fusing thin steel plates together by means of the flames of an oxyacetylene blowpipe. Considerable information as to methods of manipulation of the oxyacetylene blowpipe and the proper regulation of the gases is also given in the bulletin.

The January issue of the Clarkson Bulletin of the Thomas S. Clarkson School of Technology contains among other articles of interest, the following: "Some Problems of the Electrical Engineer," by Henry G. Reist, engineer, General Electric Co., Schenectady, N. Y.; "The Venturi Meter as a Steam Meter," by Clarence H. Sanford, professor mechanical engineering and "Graphics in Engineering Design and Construction," by Ralph W. Rogers, professor of mechanics and drawing.

At the University of Illinois on April 7 and 8 there was held a conference of central station men, including a series of lectures. The formal part of the program included the following: "The College of Engineering and the Engineering Experiment Station," by Dean W. F. M. Goss; "Choice of Prime Movers for Central Stations," by Ernst J. Berg; "Central Station Photometry," by J. M. Bryant; "Resuscitation from Electrical Shocks, a Demonstration with and without Instruments," by R. Y. Williams; "Effect of Vacuum, Superheat and Steam Pressure on Station Economy," by Ernst J. Berg; "Cost of Street Lighting," by J. F. Bryant.

Personal Notes.

W. B. Kester has been appointed assistant engineer of the Vandalia Railroad Company at Terre Haute, Ind., to succeed H. T. Simpson, promoted.

E. W. Johnson, 2214 Rockwell St., Chicago, Ill., has succeeded K. R. Ricketts in the sales department of the Barrett Manufacturing Co. of that city.

E. C. Crum, of the firm of Crum & Davidson, engineers, Frederick, Md., has been appointed city engineer of that city. Mr. Crum is engineer for the county. He will also continue his interest in the firm.

James L. Tighe, for nineteen years city engineer and engineer of the municipal water works in Holyoke, Mass., has opened an office in the Caledonian Bldg., Holyoke, Mass., for the practice of hydraulic and municipal engineering.

Mr. Godfrey Sperling, following his absence the past season, has taken up anew his civil engineering and surveying practice at 401 Overland Bldg., Boise, Idaho.

W. P. Bushnell was elected city engineer of Quincy, Ill., by 1,500 majority over F. L. Hancock.

Mayor Emil Seidel, of Milwaukee, recently made the following appointment: Harry E. Briggs, salary $5,000 as city engineer to succeed Charles J. Poetsch, whose term expired; Joseph A. Mesiroff, salary $4,000 as water registrar to succeed John Lemanski.

J. G. Rossman, of New York, has been appointed manager of the Winnipeg municipal power business at a salary of $6,000 a year. Power from the plant will be ready for delivery next July and this will undoubtedly do much to increase the industrial growth of the city.

Maughmer & Nickerson, civil and Hydraulic engineers, have opened an office at Sacramento, California, for the practice of engineering, giving special attention to water works systems, irrigation works, hydro-electric power plants, sewer systems, reclamation work and serving as consulting engineers.

Walter C. Parmley, member American Society Civil Engineers, Everett Bldg., E. 17th street, New York City, and Edgar S. Nethercut, member American Society Civil Engineers, Monadnock Bldg., Chicago, Ill., have formed a consulting firm to be known as Parmley & Nethercut. Both members will retain their present offices. The firm will handle reinforced concrete sewers and other structures.

Frank M. Blaisdell, architect and landscape engineer, First National Bank Bldg., Fort Smith, Ark., has established branch offices at 917 and 918 Southern Trust Bldg., Little Rock, Ark. Mr. Blaisdell is prepared to act as architect and engineer for private municipal and corporation building and grounds of all descriptions and invites manufacturers and others to send him catalogs and other literature of interest, addressing the Little Rock office.

A. B. Alderson and A. S. Brainard have established an office for the practice of civil engineering and surveying in the Phoenix Mutual Building, 49 Pearl St., Hartford, Conn. Special attention will be given to town engineering, including resurveys of town boundaries, highway surveys and maps, establishment of street and building lines, real estate surveys, maps and sub-divisions, the development and installation of sewer systems and sewage disposal plants, together with plans, estimates and specifications for general construction work.

M. D. Burke and W. M. Venable, members American Society of Civil Engineers, have entered into a partnership under the firm name of Burke & Venable, as consulting engineers, with office at Room 706, Second National Bank Bldg., S. E. Corner Ninth and Main streets, Cincinnati, Ohio. In addition to the surveying and development of real estate, planning and supervising the construction of streets, sewers, water supplies, drainage and similar engineering work commonly executed in connection with the improvement of property and of public works, the firm will give special attention to sewage and refuse disposal, hydraulics and reinforced concrete construction.

Portland Cement Manufacturers.

The little annual list of the companies manufacturing Portland cement, published by the Cement Era, Chicago, has been issued for 1911. It includes names of principal officers, capitalization, capacity, process, number of kilns, names of brands, etc., for plants in operation, under construction and in the promotion stage. There are 158 companies in the list. The book also contains alphabetical lists of the superintendents and chemists of the cement companies, the brands of cement on the market, companies manufacturing gypsum, in the same form as the Portland cement list; and a list of companies manufacturing lime, arranged alphabetically under the states in which they are located. The list is in convenient leather-bound pocketbook form, and is sold for $1.

MACHINERY AND TRADE

An Effective Weed Destroyer.

There has been on the market for a number of years, a chemical known as the Atlas Preservative A. This chemical has been extensively used for the purpose of impregnating wood to insure it against decay and the attack of insects. Its value for other purposes has recently been demonstrated. In nearly all the municipalities of the country, there has been considerable work involved in keeping the streets of the outlying districts free from weeds. These streets upon which the travel is not heavy are a source of a great deal of expense, under the usual method of removing the growth of weeds by hand. It has been found that the Atlas Preservative A can be used to much better advantage and a great saving for this purpose. Some of the leading real estate firms of New York City have been making use of the chemical to prevent weed growths on the streets of new additions. tI has been found to be from 50 to 90 per cent cheaper than the methods formerly employed. One application of the chemical has usually been found sufficient to hinder growth for one season. This one application can be made at a cost of about 75 cents per thousand square feet of area. If the chemical is used for two or three seasons in succession the soil is rendered entirely sterile and no further trouble is experienced.

The application of the chemical is made with the ordinary sprinkling cart by means of which material after being diluted is sprayed upon the surface to be treated under the same conditions as in ordinary sprinkling. The preservative is supplied in a concentrated form in six gallon drums, and three or four of these drums are sufficient to make about 600 gallons of solution depending upon the strength of solution deemed necessary. By reason of the simplicity of its application, the preservative may be used by the laborers ordinarily employed in street department workk.

In one of the largest municipalities in the state of New York several miles were treated last season at a cost of ¾ cents per yard including all items and labor of application. Previous to this time, the work had been accomplished by hand-labor (scrapers being used) at an average cost of 2¼ cents per square yard. In some places where a second scraping had been found necessary, the cost of weed prevention for one season was 4½ cents per square yard as compared to ¾ cents per square yard for Atlas Preservative A. In addition to this fact, the chemical not only killed the upper growth of weeds, but destroyed the roots and after a time rendered the soil entirely sterile. It is used by many railroads in removing the growth of weeds from their tracks, acting without the loss of ballast and other bad features attendant upon the usual method of pulling the weeds.

It is also used extensively, particularly on the railroads of India as a wood preservative. The method of treating is extremely simple, the wood being immersed in proper solution which is usually heated to about 150 degrees. This heating is not necessary in all cases, though better results are obtained by this process. The preservative hardens and strengthens the wood fibers, permeating their structure and driving out the green sap. It seasons without staining and renders the wood less inflammable and secure against the attacks of insects. Used in conjunction with coal tar it is an efficient substitute for creosoting.

The principal use which recommends it to the attention of municipalities is that property which makes it of value in the destruction of weeds. One drum of the concentrated solution is sufficient for one application over an area of 400 square yards. The strength of the solution is varied according to the absorptive power of the surface; the minimum being one gallon to fifteen gallons of water. Hard gravel may require a proportion of one gallon of solution to five gallons of water. Where the eradication of existing weeds is desired the application of a strong solution directly on them is recommended. Periodical use will result in the entire sterilization of the soil.

The chemical is manufactured by the Atlas Preservative Co. of America, 97 Liberty Street, New York City.

The Case Road Machinery.

Six years ago the J. I. Case Threshing Machine Co. put on the market their power steered 10-ton steam road roller which was then the only power steered roller on the market. Since then it has grown into favor throughout the country.

This year the company decided to put forth a line of machinery for road uuilding almost complete. In addition to the road roller and road sprinkling wagons they have been selling, they have added drags; rock crushers; rotary stone screens; rooters; road scrapers; railroad and township plows; the Troy line of bottom dump wagons and boxes; the Troy reversible bottom dump wagons, and the Case municipal tractors.

The latter are especially constructed for use on any kind of paved streets; and Case contractors' hauling engines, which complete the line. It can be readily seen that it is "almost complete" for road building

Data on Decorative Street Lighting.

"The Illumination of the Streets" is the title of a publication just issued by the Holophane Company. While intended for popular distribution rather than for engineers, the booklet contains some valuable data on the subject and should be appreciated by all who are interested in the so-called "boulevard lighting" installations.

The Holophane Company's street lighting units have several definite advantages, according to the data given. The units are the result of a long series of investigations and experiments by the Holophane engineers, and are designed to give the maximum of even illumination upon the streets and sidewalks with the minimum of objectionable glare. The comparative ,photometric curves published would indicate that the units are successful in both directions.

Artistic appearance, however, has not in this case been sacrificed to engineering considerations. The Holophane units are attractive and the various designs have a wide range of adaptability. A sketch of a lantern for residential districts strikes a new note in street lighting equipment.

A description of the Holophane installation in Cincinnati, Ohio, appeared in the March issue of MUNICIPAL ENGINEERING.

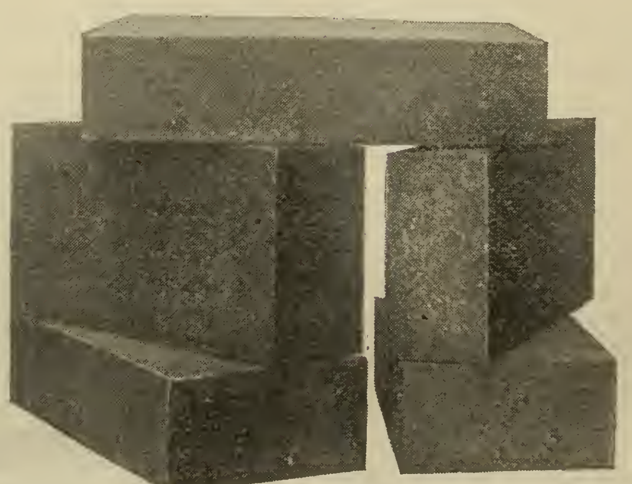
Cork Brick.

A material especially adapted for use in floors of fire stations, approach driveways, etc., has recently been patented by the Armstrong Cork Co., of Pittsburg, Pa. This material known as Cork Brick consists of finely granulated cork and an especial grade of tough asphalt, heated and thoroughly mixed and pressed into the form of bricks. These bricks, shown in the accompanying photograph, measure 9 inches by 4 inches by 2 inches and laid flat. A number of experiments were carried on to determine the proper grade and proportion of asphalt necessary in making the brick, and the product as now manufactured fully meets the expectations of the manufacturers.

The material gives a thoroughly sanitary, non-absorbent floor, especially adapted to use in fire department buildings, both in stables and engine rooms. As is shown by the fact that the brick will absorb less than 1½ per cent. when immersed in water, they are well adapted to the flooring of stables. The property of non-slipperiness makes them desirable in the engine room. It has been found that regardless of whether they are wet or dry, the friction property remains the same.

The brick have been tested in actual service and found to outlast most of the flooring materials. The special grade of asphalt used seems to add to this property of toughness or durability. The brick will not crack nor splinter.

They may be laid on any sort of smooth, sound foundation, concrete, broken stone or wood. If laid on concrete, the brick may be laid in three ways, viz; in Portland cement mortar, in a thin layer of hot asphalt or pitch, or in a bed of sand. When laid in asphalt or pitch, the surface of the concrete should first be given a light coat of asphalt paint. Over a broken stone base, the brick are put down on



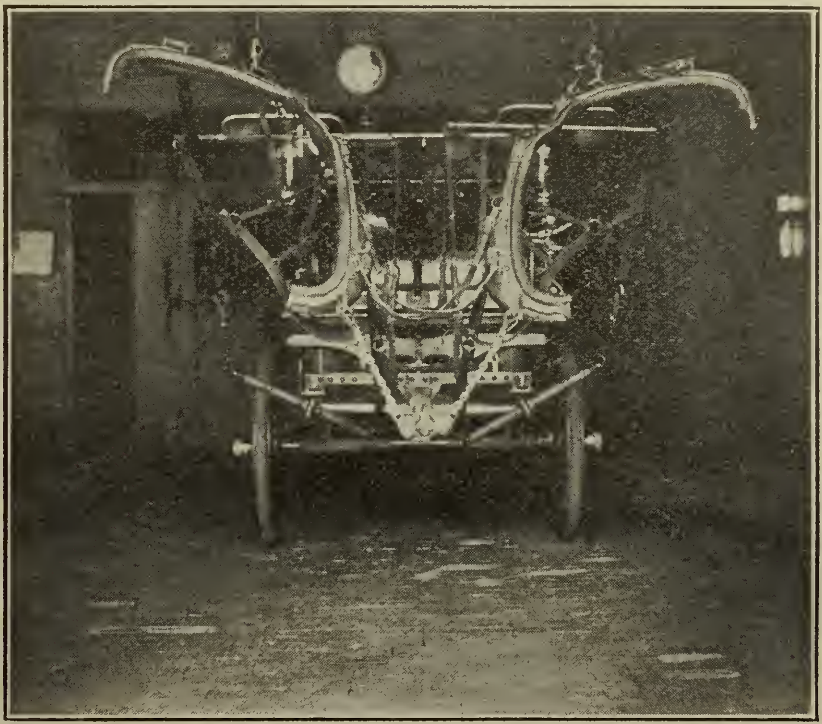
CORK BRICK.

a bed of sand; over wood, in hot asphalt or pitch.

The accompanying photograph shows a floor of a fire station which has been in service for about a year.

Confidential Trade Notes.

Amos Stouffer, of Wayneboro, Pa., has recently copyrighted a book known as "Confidential Trade Notes" which is devoted to a description of the best practice in the use of concrete. Mr. Stouffer is a man who has used cement in almost all of its forms throughout a lifetime. His work has been principally along the line of experiment and research; the results of this work being included in the book above mentioned.



CORK BRICK FLOOR IN FIRE STATION.

In speaking of the use of concrete, Mr. Stouffer states that it has been remarkable in the growth and volume of manufactured products in blocks and other forms which have been made; and also for the very meager profit accruing to those who manufacture such products. He accounts for this fact by the statement that the method of manufacturing has not been of the best; and the keen local competition has been made in the form of cheap brick, stone and monolithic concrete.

It has been the purpose of the book to set forth the methods to be followed in bringing concrete blocks to a superiority over these building materials. Under the new methods, a wheelbarrow load of concrete in its higher form carries an increased profit over the older and cruder methods. The new field offers a wide market and uses for concrete art products and provides for their disposal at profitabel prices. The uses of concrete in interior decoration and other ornamental purposes is given as the solution of the problem of the future of concrete. It is stated that no other material offers itself so readily to tasteful design and artistic results.

Among the subjects treated in "Confidential Trade Notes" are the following: prevention of crazing or map cracks; new methods of water proofing; improvements in rock face blocks; artistic art methods in rock face blocks; new matrix method in rock face blocks; sand finishes, stucco, etc.; pebble dash and wall plaster, etc.; concrete marble, art marble; a concrete plant in itself—entirely new; white Portland cement—new possibilities; cement letters, figures, signs, etc.; highway advertising signs, etc.; polished concrete marble, without friction; steam vapor curing of concrete; steam under pressure for concrete; polishing of concrete; marbleized concrete; and a number of other valuable uses.

Full information regarding the book may be obtained upon application to the Art Stone Co., postoffice, box 333, Waynesboro, Pa.

Reinforced Concrete Automobile Factory.

The Lozier Motor Company of Detroit, Mich., have recently completed one of the most complete automobile factories in the world. The buildings are of the Turner steel and concrete flat slab type with mushroom columns. Buildings were designed by Albert Kahn and constructed under his supervision. They are absolutely fireproof and the contents protected by automatic sprinkler, fire doors, and other devices of this nature. Fenestra glass is used for lighting. The ventilatinging, heating and blower systems are of the latest type. Special features in sanitation contained in this plant, are to be found in no other. The power plant is most complete, comprising boilers with automatic stokers, large Allis Chalmers generator, Laidlaw Dunn-Gordon air compressors, and other machinery of this character.

In 1906 in Somerville, Massachusetts, the experiment was tried of bonding the top layer of 1¼ inch stone in a macadam road with Tarvia. The Tarvia was sprayed onto the road hot from a tank wagon, in a single coat of 1½ gallons to the square yard. The Tarvia was covered with pea stone and the road rolled until solid. This first and now classic experiment was a forerunnner of what is now known as the penetration method of bituminous macadam road construction.

The form of construction and the method of applying the materials must necessarily be varied to suit local conditions. In striving to meet the exacting require-

SPRAYING TARVIA X ON THE BROKEN STONE AS A BINDER.

ments of the broad radiating thoroughfares extending out from the metropolitan centers a new form of construction has been developed during the past two years to which the name of "The Tarvia Modern Pavement" has been given.

The Tarvia Modern Pavement.

The experience of the last few years has demonstrated to road engineers that a turning point has been reached in the problem of maintaining macadam roads against the disintegrating forces of modern traffic.

When the destructive action of the automobile tires was first observed, surface applications of bituminous binder were believed to be all that was necessary. Experience has shown, however, while surface treatments, cost considered, give good results, it is more satisfactory and economical to construct the road throughout with a bituminous binder.

In Tarvia, a prepared coal tar of great tenacity and viscosity, engineers have found a bituminous binder which has given good results.

This material has been in use in various places on this continent for about six years. The only questions now discussed are the details involved in the reduction of the cost of Tarvia treatments.

In this construction Tarvia enters not only into the top surface of the road, but is carried down beneath the top course. Coupled with the use of Tarvia throughout the road is the use of larger stone in the second course. Experiments with this form of construction through the past two years have shown its superiority over other forms where a considerable amount of traffic of all descriptions is to be carried on the road.

The foundation of The Tarvia Modern Pavement is prepared as for ordinary macadam, but care should be taken to see that this foundation is properly drained and properly consolidated, for the best of surfaces can be destroyed by softness and movement below. Upon the foundation the base course is laid using run of crusher stone 3 inches to 1 inch in size. Usually a thickness of four inches, measured after rolling, will be sufficient. This course is filled, rolled as for ordinary macadam and then has spread upon it ½ inch of clean sharp sand or good gravel. Over this without further rolling is sprayed Tarvia A to the amount of one gallon to a square yard. Another layer of crusher stone (3 to 1 inch) is spread over the Tarvia A to such a depth that when rolled this course will be two and one-half inches thick. It is then rolled thoroughly with a steam roller until the Tarvia and sand are drawn up between the stone and until this layer of stone is bedded firmly into the stone below. The layer of Tarvia and sand holds this course firmly in place and cements the top course of the road thoroughly to the bottom course. A spraying of Tarvia X, a denser grade of Tarvia, is then given to the road, using one and one-quarter gallons to a square yard, and a thin layer of ¾ inch stone is spread over the surface. Enough stone must be used to fill in all the chinks of the surface, making it smooth, but not enough should be used to leave any loose material on the top. The road is rolled again until perfectly smooth and a final coat of Tarvia A amounting to one-half gallon to the square yard is sprayed on and the road finished by adding pea stone or screenings and given a final rolling.

The thorough incorporation of the Tarvia throughout the road insures the binding of every part and the elimination of the internal friction which is so destructive to macadam roads.

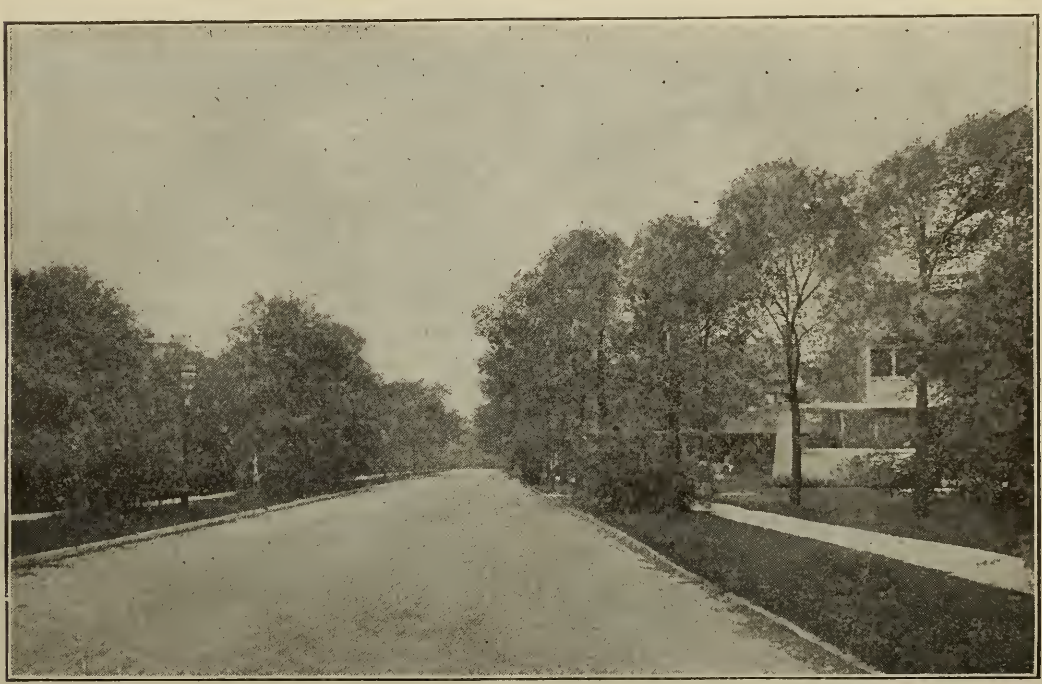
The first of the accompanying photographs shows the method of applying the binder.

The use of large stone throughout the road and in the surface layer insures a structural strength not obtainable with smaller sizes of stone. This strength-giving principle has long been recognized abroad, but with a water bound macadam it was not possible to use this form of construction satisfactorily. The anchoring-in of the stone in the wearing course by the sand Tarvia matrix, now makes the use of the larger stone feasible.

The increased strength and wearing qualities of the larger stone are presented to the best advantage since the stones are held firmly in place with no chance of movement and with the wear taken alone on the upper surface.

The Tarvia Modern Pavement, like other forms of Tarvia construction, is inexpensive compared with the other forms of bituminous construction. An engineer, by properly designing the road can often save enough in stone, in watering, in screenings, and in rolling, to offset much of the cost of the Tarvia.

The second photograph shows a finished roadway laid on Hazel avenue, Chicago, Tarvia being used as a binder.



HAZEL AVENUE, CHICAGO, MADE DUSTLESS WITH TARVIA.

The Russell Road Building Machines.

The Russell Grader Manufacturing Co., of 2233 University Ave., South East, Minneapolis, Minn., have a catalogue descriptive of a complete line of road machinery which they manufacture. Among the machines shown, there is a "township size" elevating grader operated by six horses.

The feature of this machine is the carrier or elevator (a belt 36 inches wide) which conveys the dirt from the plow to the place desired. This elevator is operated by gasoline engine. As the machine does not depend on drive wheels for its tractive power there is no danger from slipping, and it may be used in loose or very wet dirt. This feature is also of value in using the machine in sand or gumbo soil. The grader is capable of moving from 1,000 to 1,200 cubic yards of earth per ten hours of actual work; and in some cases 2,000 yards have been handled in this interval. The operating expense is comparatively low as only two men are employed in loading wagons, two to handle the plow and another the carrier.

This is only one of the many types of machines shown in this catalogue. There are other graders some power driven; and in addition to this, there are shown ditching machines and the ordinary type of road graders.

In addition to these there are road drags of various types; slips; wheelers; tongued scrapers, and plows.

The catalogue is worthy of attention from those interested in road construction, as almost all apparatus required in road work is shown.

North Yakima Adopts Bitulithic.

The following is from a report of the council committee from North Yakima, Wash., who investigated paving in some of the northwestern cities a few weeks ago:

We find that the pavement required for city streets should have the following essential qualities: durability, noiselessness, cleanliness, non-slipperiness, cheapness, which must be figured by the rule, the ultimate cost of a pavement is first cost plus maintenance.

Being quite familiar with brick and asphalt, having laid 48,000 square yards of asphalt, and 71,200 square yards of brick in our own city, we devoted a major portion of our time to other materials in use.

After spending three days looking over the pavements in Seattle and Tacoma, which are paved with brick, asphalt, wood block and stone block, we visited the city of Puyallup where bitulithic pavements are being laid exclusively. Here about five miles of bitulithic pavements are laid, and the contractors were in process of constructing other streets with the same material. Upon being invited to procure a sample, we selected a place and a sample was cut out in our presence which was replaced to our satisfaction, the idea being to demonstrate to us the ease and perfection with which it can be repaired, and when finished the place could not be found again where the patch was made. As these pacements were but recently completed, and the oldest street laid was only one year old, we could not draw a definite conclusion as to its durability. We therefore proceeded to Portland, Oregon, where there are 54 miles of bitulithic pavement laid, the oldest being laid in 1903. The streets of Portland are exceedingly narrow. On some of the principal streets there is but room enough between the car track and the curb for one vehicle, thus subjecting the pavement to the severest test possible. Bitulithic pavements which were laid in 1903 are still in good condition. Mr. Morris, city engineer of Portland, informed us that there is not a crack in the bitulithic pavement in Portland, and we can corroborate the statement as far as we were abel to ascertain.

Bitulithic is easily maintained, it being at a nominal cost, to resurface or build up a depression with a perfect bond between the original surface and the portion added—thus demonstrating that the remaining portion of pavement, after wearing for a period of time has inherent binding qualities, thus proving that the old portion is of value in making repairs and that it is not necessary to remove the old pavement should it become necessary to resurface, while to resurface asphalt it is necessary to remove top and binder. Some of Portland's steeper grades are paved with bitulithic.

A Portable Machine for Making Compression Tests.

Compression tests on such building materials as concrete, rock, and brick, in fact any material used for resisting compressive stresses only are obviously far more important to the designing engineer than a knowledge of the results of their tensile strength. Cement specifications at present require only that tensile tests be made on briquettes of neat cement, a mixture of one part cement and three parts sand.

Compression tests are not required in specifications because of the great weight and cost of the common type of compression testing machines and the difficulties connected with carrying such a machine around from place to place. Tension testing machines are comparatively light and can be made so because cement is weak in tension and no great force is necessary to rupture a briquette. Heretofore there has been no simple, satisfactory compression testing machine on the market.

Concrete is a material that cannot be tested too frequently in compression. Being constantly proportioned and mixed by men who have no knowledge of the properties of the mix, very close supervision is necessary. To know positively that concrete has the necessary strength to stand up under its load and not collapse before the building, chimney or foundation wall is complete, as has so frequently happened and is still happening daily, should be a great load off the minds of the designing and constructing engineers. It was this condition of affairs that suggested to The Watson-Stillman Co., N. Y., the building of a hydraulic compression machine that would comply with the demands of men on the job as well as the demands of laboratories.

This new machine, which we illustrate, is of a common type of hydraulic press and weighs only 425 lbs. as compared with 3,400 lbs., the weight of material necessary to build the common beam type of machines of equal capacity. The base measures 12 inches by 16 inches and the press is 27 inches high. The cylinder is a steel forging machined to fit down into the reservoir, and the pump cylinder is of bronze. This type of testing machine can be carted from place to place on a truck and is also superior to the ordinary compression machines in that all observations can be made by the operator of the pump. He can watch the compression specimen, the pressure gauge, and handle the pump simultaneously. This permits rapid work and no waste of time. The operator can also apply the load as rapidly or as slowly as he wishes by corresponding manipulation of the lever. The gauge is graduated to give both the fluid pressure in pounds per square inch and the pressure of the ram on the specimen in tons. A feature of the machine is the ease and quickness with which the ram can be moved to and from the work by means of the lever and connecting links at the left. The small handle at the right furnishes sufficient power where only light pressures are required, while the extension lever applied to this same arm, develops pressures up to 30 tons. The platen face is 8 inches square; the platens are 8 inches apart at maximum opening and the ram movement is 4 inches. The machine will, therefore, accommodate compression cubes or cylinders varying from 4 inches to 8 inches. The size to be tested must be left to the discretion of the testing engineer as it depends upon his estimate of the strength of the mix. A 4-inch cube would have to hold 3,750 lbs. per sq. in. under a load of 30 tons, but as that figure is higher than most mixes will hold, 3 in. cube might be a satisfactory size for all mixes.

Fireproof Roofing.

Over a million times during the past ten years we have witnessed the thrilling sight of burning buildings. Last year $204,000,000.00 worth of property was destroyed by fire. In the search for practical methods of lessening the danger of ignition and spread of flames, tile, vitrified facings, terra cotta, concrete construction and numerous other fire-resisting materials have been developed for use in all parts of buildings except the roof, while but few important improvements have been made in roofing materials, notwithstanding the fact that authorities claim that from 27 per cent. to 50 per cent. of the conflagrations are the result of flames being communicated to adjoining buildings by burning sparks and embers falling on an inflammable roof.

Factories, barns, etc., are probably more at the mercy of burning sparks and embers than other types of buildings, because they are usually covered with so-called ready roofings, and nearly all roofings of this type are made of wool felt, rag stock, paper, coal tar and other highly inflammable materials. There is one roofing of this type, known as J-M Asbestos Roofing, which is being largely used on factories and large buildings, which seems to overcome the objections to all others of this type. It is said to be so fireproof that it will withstand the flame of a blow-torch for an hour without being injured. This roofing is made by the H. W. Johns-Manville Co., of New York, well known as manufacturers of asbestos products.

This roofing is made of asbestos (a stone) and Trinidad Lake Asphalt (a mineral).

The asbestos rock, when scientifically crushed, produces long, tough fibres which are woven into cloth for asbestos theater curtains, made into sheets of felt for roofing, and treated in various ways for making hundreds of different fireproofing materials.

In making this roofing, several sheets of this asbestos felt are thoroughly saturated with Trinidad Lake asphalt, a waterproofing material. These sheets are then cemented firmly together with this asphalt, making one homogenous mass. This, then, constitutes an actual covering of stone, which, because of its all-mineral nature, not only offers to a building protection against fire, water, wind and weather, but which also naturally cannot rot, rust, melt, run or crack, and requires no painting to preserve it.

A copy of the very handsomely illustrated catalog, which we received from the manufacturers, will, no doubt, gladly be sent to any of our readers inquiring for it.

The Heltzel Steel Sidewalk Forms.

The development of methods in connection with concrete sidewalk work has ben noticeably slow. The old, original processes and methods have been unchanged since concrete walks were first built. This has been particularly true in the case of forms, which have been of the old wood and stake system from the start. The Heltzel forms manufactured by the Jones & Heltzel Co., 115 South Sterling St., Streator, Ill., are a notable advancement over the old methods of construction. They consist of adjustable steel sections so made as to be readily adapted to almost any line desired. The side rails, which correspond to the wooden strips used in the old method, are of annealed steel, provided with division plates set at intervals of one foot. These rails are joined by adjustable sleeves made larger in section to provide a free slipping engagement with the side rails. These sleeves are made of varying lengths as needed.

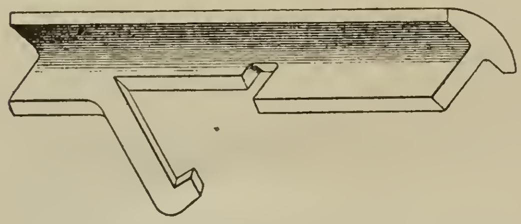
The forms are held in place by division plates of high carbon steel, which slot into the side rails, holding them rigidly into position. These division plates are removed by means of small hooks which pry them loose from the side plates and allow them to be easily lifted.

The forms may be easily adapted to any angle, and suitable curves are provided according to specific conditions desired. The method of joining these grooves and angles admits of an even surface along the entire edge of the walk.

In addition to these forms, the Jones-Heltzel Co., manufacture a steel curb and gutter form which is distinctive in its method of operation, requiring no clamps, stakes, nor wedges. Their forms and concrete tools are shown in their catalogues which will be sent upon application.

Imperial Curb Bar Reinforcing.

It has been acknowledge for some time that some reinforcing on the wearing surface of concrete curb is necessary. The ordinary forms of reinforcement have been on the market for a number of years and have been giving very good satisfaction. There has, however, been recently invented a form of curb bar which possesses features of superiority over previous forms as regards method of attaching it to the curb.



The accompanying photograph shows the Imperial Curb Reinforcing Bar, manufactured by Edward E. Buhler Co., 103 Park Ave., New York Ciay. The distinctive feature as may be noted is the fact that the center web is sheared in such a manner as to give a hook or lug which may be firmly imbedded in the concrete. This factor gives additional security against loosening of the bar and the chipping of the curb surface.

The bars are manufactured in seven foot lengths, it being deemed advisable to adopt this length, although ten foot bars were formely supplied. There are, at present, two sizes manufactured, but differing specifications demanded by engineer's of various cities have made it necessary to manufacture four sizes. The bar is galvanized by a new process which gives a surface to which the cement adheres firmly. About 12,000 feet of the bar make a car load.

Other metal accessories used in cement work, such as ditch protectors for railroad platforms, cross walks, and columns; separators, to be used between sections of curb; and benders for reinforcing bars are manufactured by this company.

Test of Decarie Garbage and Refuse Incinerator.

The official test of the Decarie incinerator reecntly built at Wheeling, W. Va., to determine the ability of the furnace to consume 60 tons of garbage—its rated capacity—in 24 hours, was begun at 10 o'clock on Jan. 6, 1911. The last ounce of the 60 tons accumulated for the test had been reduced to ashes on Friday morning at 3:45, a period of 15 hours and 45 minutes. The furnace thus had 8 hours and 15 minutes to spare. The furnace was in charge of F. W. Cappelen, chief engineer for the Decarie company, and the test was witnessed throughout by the city health commissioner.

Basic Bitulithic Patent Sustained by U. S. Circuit Court of Appeals.

The decision of Judge A. C. Coxe, of the U. S. Circuit Court of the Southern District of New York, which was reported on p. 64 of the January number of MUNICIPAL ENGINEERING, has been fully sustained by the U. S. Circuit Court of Appeals of the Second Circuit. The validity of the basic patents on bitulithic pavement was attacked in the suit, but was affirmed by Judge Coxe and his decision is now sustained upon appeal.

Calcium Chloride as a Dust Layer.

Calcium chloride is used for dust laying purposes in two ways: First, by dissolving in water and applying with an ordinary sprinkling cart; second, by spreading it directly on the road in its dry granular form, containing 75 per cent. calcium chloride, and allowing it to dissolve by absorbing water from the air. Both methods have proven successful.

Where the expense of water is not an essential element, and there is already a sprinkling plant, the first method may be used successfully and economically. All that is necessary is to first dissolve the calcium chloride in the watering cart at the rate of 1 lb. to 1½ lbs. of calcium chloride for a gallon of water, and, as the material itself is the only additional expense, and as a treatment will last two or three weeks, the reduced cost of application more than makes up for the cost of the calcium chloride. This method of application has been used for some years by such communities as Brookline, Mass., Pittsfield, Mass., Albany, N. Y., etc., and has been found to lay the dust effectually.

This method has also been used with complete success on race courses and driveways. The New York State Fair Commission have for the last three years treated their track at Syracuse with a solution of calcium chloride, and have not only rendered it dustless, but have thereby made it one of the fastest tracks in the country. At the race meet at this fair in 1910, three world's records were broken; two automobile records by Ralph De

Palma, and one by the horse "Harvester."

The second method, which is applying the calcium chloride in its dry granular form direct to the road, and allowing it to dissolve by absorption of water from the air, is more satisfactory in all cases except in the immediate vicinity of towns or cities, where water is easily available. Even in many of these cases, it has been found more satisfactory. One pound of the 75 per cent. granulated calcium chloride applied in this manner will attract and retain from the atmosphere 1 to 1¼ lbs. of water. This keeps the road in a firm, moist condition, but without the formation of mud.

The city of Duluth, Minn., found last year that one application of 1 lb. to the square yard lasted nearly the whole season, thoroughly laying the dust and preserving the road surfaces.

The best results are obtained by applying at the rate of 1½ lbs. to the square yard, though in some cases a smaller application is sufficient. Generally, three applications per season are required, though this will depend somewhat on weather and traffic conditions. As mentioned above, the first application should be 1½ lbs. to the square yard, but the succeeding applications may be lighter, there always being a certain per cent. of the calcium chloride retained by the soil, though in itself it may not be sufficient to lay the dust.

The New York State Highway Commission have also used granulated calcium chloride to a large extent during the last year in the maintenance department, with most satisfactory results. By the dry method, the medium of application is an ordinary land lime spreader, and four men with one of these machines will readily cover five miles of a 16-foot road a day, thus reducing the cost of application to a minimum. The state officials figure a cost of about $150.00 to a mile of 12-ft. road per season, this varying slightly with the location.

The Solvay Process Co. of Syracuse, N. Y., supply calcium chloride in its granulated form, suitable for applying by the second method. The accompanying photograph shows a road in Detroit, Mich., treated by this process.

"CALCIDE" ROAD, DETROIT, MICH.

Charter Gas and Gasoline Engines.

An improved type of gasoline engine manufactured by Charter Gas Engine Co., 911 Wallace St., Sterling, Ill., recommends itself to contractors' use by reason of its simplicity of design, and small number of working parts which are exposed to wear and the destructive effects of heavy service.

The principle of operation in the development of power in this engine differs but little from the ordinary type of gas or gasoline engine. On the first stroke of the engine a mixture of gas and air is drawn through a check-valve into the cylinder; this check-valve opens during the second stroke and is closed again during the in-stroke and is ignited in mixture is compressed into the space between the cylinder head and the piston during the in-stroke; and is ignited in the ordinary way by means of a spark from the battery or magneto. The mixture is expanded, giving an impulse to the piston. When the piston has reached its second out-stroke, an exhaust valve is opened, remaining open during the second in-stroke of the piston, and the products of combustion are expelled into the muffler.

The engine uses gasoline direct from the tank, taking it into the air suction pipe without any other complication and never coming into contact with the air except in the suction pipe and cylinder of the engine. The supply of gasoline is automatically regulated and varies with the speed of the engine.

Various types of enginees are furnished depending upon the substance used to furnish power, that is to say, gas, kerosene, petrol, distillate, naphtha or alcohol. The type of engine which recommends itself to the contractors' use is the gasoline engine.

Various pumping equipments and hoists are furnished as desired, some portable outfits being included in the types manufactured.

CORINTHIAN STANDARDS IN MINNEAPOLIS FIRE.

The economy of the engine is one feature which will recommend it to the contractors' use. The gasoline engine uses about one pint of gasoline per hour to each actual horse power. All of the gasoline is utilized. The horse power stated is in all cases the actual horse power which may be obtained, as it is the policy of the company not to overrate their engines. The material and workmanship are guaranteed throughout, the best of metal and the most careful construction being insisted upon. A catalogue and full information will be furnished upon application to the manufacturers.

Fire Test of Corinthian Standards.

On the night of March 5th there appeared in Minneapolis, a fire which in its intensity and destructive effect far exceeded anything which that city has known, not excepting the recent explosion and fire in the Power Plant which was so crippling in its destruction. The fire devastated the south of Nicollet avenue for one block, and wrought a total property damage estimated by insurance men and Nicollet avenue business men at from $1,100,000 to $1,300,000. The entire Syndicate building was ruined and adjacent buildings were attacked by the flames, which were driven by a high south wind in such a manner that at times they extended entirely across the street. Sparks and embers were carried across, destroying the awnings and frames of adjacent buildings and except for the fact that most of them were of fireproof construction, there is no doubt but that the entire business section of the city would have been destroyed.

One remarkable fact in connection with this fire is that the ornamental lighting standards which stand along the street in front of the Syndicate building, although exposed to most intense heat, and in fact surrounded by flames at times during the fire, were not in any way damaged. The accompanying photograph indicates the position of these standards with reference to the burning building. The light effect coming from the building represents the flames, which were so intense that the firemen were unable to approach closer than thirty feet distant. As shown, streams of water were kept playing in close proximity to the standards, which were red hot from the intense heat. In spite of this fact, there was no evidence of cracking or warping, such as would be expected under the conditions. These facts evidence the superiority in the casting of the posts and the high quality of metal used in their construction. A better test could not have been planned than that which the Syndicate fire afforded. The standards were the "Corinthian" type, manufactured by the Flour City Ornamental Iron Works, Minneapolis, Minn.

An Unusual Booklet.

One of the most unique publications issued during the past month is that known as "An Important Trial," which is being distributed by the Dunn Wire-Cut-Lug Brick Company, of Conneaut, Ohio. The question is stated as a matter before a jury, and the purport of it is:

"Shall we continue to require manufacturers to re-form wire-cut bricks by puting them through a stamping machine and call them repressed brick, or shall we permit them to cut lugs while cutting the original brick and thus preserve the original formation?"

The points in favor of wire cut brick are offered as testimony in the case. A list of cities which have admitted the wire cut brick to their specification is given in the back part of the publication.

Commendation for Sieben Sewer Cleaner.

Letters over the signatures of the mayor of Kansas City, Mo., J. E. Porter, and Wm. M. Clancy, supt. of sewer cleaning and repairs, testify to the efficiency of the Sieben system of sanitation sewer cleaning device.

In speaking of the operation of the machine, Mr. Clancy says

On Ashland avenue sewer we operated the machine, cleaning a distance of 380 feet after the machine was set in the sewer in twenty-four (24) minutes. This sewer was about 1-3 full, a 15 inch pipe sewer.

The test given the machine on 2nd street, in an 18-inch pipe sewer was full within 6 inches of the top. We cleaned 280 feet in forty-four (44) minutes. On 2nd street, in a 15-inch pipe sewer we cleaned 300 feet in thirty-six (36) minutes. This sewer was very badly congested, only about 4 inches of an opening in the top of the sewer.

Mr. Porter in his letter, tells of the cleaning of 400 feet of sewer at a cost of $9.00, including the time of three laborers and one man with a wagon. Both officials agree in their opinion of the efficiency of the machine.

A complete account of the tests may be had from the Sieben System of Sanitation Co., Kansas City, Mo.

Trade Publications.

The Atlas Dryer Co., of Cleveland, O., have a catalog called "A Thesis on the Use of Drying." Photographs and sections of their machines are shown.

The Chicago Portland Cement Co., 108 La Salle St., Chicago, have issued a handsome illustrated book descriptive of structures erected with their product, the "Chicago AA" Portland Cement. Almost every form of construction involving cement is shown.

The April issue of the Bulletin of the Universal Portland Cement Co., 72 West Adams St., Chicago, contains among other articles of interest, photographs of slab bridge construction of New York state roads, concrete mine timbering, slab and beam construction, and description of their wire-tied cement sacks.

The Eclipse concrete mixer described at length in the March issue of MUNICIPAL ENGINEERING is fully illustrated and described in a thirty page booklet issued by the Standard Scale & Supply Co., 1345 Wabash Ave., Chicago, Ill.

A leaflet issued by the Stedman Johnson Manufacturing Co., 1007 Schofield Bldg., Cleveland, Ohio, describes the Stedman "Estimeter" which is used in scaling maps and measuring lines thereon.

The Allis-Chalmers Company, Milwaukee, Wis., have two very valuable booklets describing new types of machines which they are manufacturing. The first of these is devoted to centrifugal pumps and gives a full description of the general features of design, and points of value in their use. The second devoted to steam turbines and generators, is also exceptionally clear in the description of the machines in question; full illustration being given to show all points mentioned.

The May number of the publication of the Lehigh Portland Cement Co. is given entirely to the use of cement in chimney construction.

The lamp standard department of the Flour City Ornamental Iron Works, Minneapolis, Minn., is about to issue a new and handsome catalog which will contain a fully detailed account of the various "Corinthian," "Egyptian," "Capitol," and "Boulevard" designs, with half-tones on an actual scale of ½ inch to the foot. All that will be necessary is for the engineer or architect to take a ruler and apply same to the pictures, then he will have full details at his command. Specifications are included in the text.

The Geo. V. Cresson Co., Philadelphia, Pa., issue an interesting discussion of the comparative merits of jaw and gyratory crushers, with particular reference to their Buchanan all-steel rock and ore jaw crushers for mines, cement and stone-crushing plants.

The little "Monthly Pipe Parley" of the McWane Pipe Works, Lynchburg, Va., is a convenient memorandum book, which gives each month some valuable information about water and gas pipe, and it can probably be induced to make its monthly visits to any one interested by application to the company.

Trade Notes.

BRICK.

Louisville, Ky.—The contract for furnishing 200,000 vitrified blocks was let to the Peebles Paving Brick Co., Portsmouth, O.

CEMENT.

Golconda, Ill.—Special—A 3,000 barrel modern cement mill is to be constructed by Omaha, Neb., capital. H. G. Calkins, City National Bank Building, Omaha, is interested in the plant.

Bedford, Ind.—Special—The property of the United States Cement Co. was sold at public auction to E. W. Shirk, representing the creditors of the company. The purchase price was $115,000.

Lynn, Mass.—The contract for furnishing 10,000 barrels of cement was let to Smith-Green Co., Boston, $16,500.

Kansas City, Mo.—Special—Due to the increase in business west of the Mississippi River, the McCormick Waterproof Portland Cement Co., of St. Louis, Mo., have opened another office in Kansas City, Mo., Reserve Bank Building, Room 332. Wm. H. K. Bennewitz has been appointed special representative of the company in that territory. The McCormick Waterproof Portland Cement Co., now has seven offices located in the following cities, viz: St. Louis, Mo., Chicago, Ill., New York City, Boston, Mass., Pittsburg, Pa., Toledo, Ohio, and Kansas City, Mo.

PURCHASE OF MACHINERY.

Palo Alto, Cal.—Special—A bond issue of $50,500 for the purpose of building an auxiliary pumping station, garbage destroyer, concrete water works building and purchasing an automobile fire engine, and steam condenser and water cooling tower, has been voted.

Washington, D. C.—Special—An American consular officer in Mexico desires names and addresses of American manufacturers of cast iron and iron pipe. Address the Bureau of Manufacturers, No. 6568.

Chicago, Ill.—Special—To handle more efficiently its increasing business in the middle west, the Iroquois Iron Works, of Buffalo, New York, have established a warehouse in Chicago, where a complete line of macadam and tandem rollers, asphalt tools, kettles, etc., is now carried for immediate shipment. The new shipping depot is in charge of T. H. Morris, the Chicago representative of the Iroquois Works, with offices in the Tribune Building.

Richmond, Ind.—The municipal electric plant is contemplating the installation of automatic stokers to cost about $6,000.

Duluth, Minn.—The board of public works is contemplating the purchase of an automobile truck.

Duluth, Minn.—The contract for laying Solvay calcium chloride in 8 sprinkling districts was let to the Board of Trade Livery Co., Duluth, Minn., at $18 per ten.

Rahway, N. J.—May 3, 8 p. m. Bids will be reecived for furnishing one 5,000,000 horizontal high duty cross compound crank and fly-wheel pumping engine, by Francis W. Langstroth, chairman committee on pumping.

Rochester, N. Y.—The contract for furnishing 2,300 tons cast iron pipe and special castings was let to the United States Cast Iron Pipe & Foundry Co., Rochester, N. Y., $53,270.

Galveston, Tex.—Bids will be received May 3, 12 m., for furnishing two centrifugal pumping units; piping, valves, etc., necessary to complete installation; each unit to consist of two single stage, 8-inch centrifugal pumps for direct connection to 107 kw. steam turbine, 3,600 rpm.; to be operated in parallel against a head of 55 pounds. Certified check $200. Address John D. Kelly, city secretary.

MISCELLANEOUS.

Chicago, Ill.—Special—R. Seelig & Son, manufacturers of engineering and surveying instruments, have removed to 231 North Fifth Ave., Chicago, Ill.

Moline, Ill.—L. O. Johns, commissioner of public property, Moline, Ill., desires catalogues of firms manufacturing equipment, materials and supplies used in municipal work.

Akron, Ohio.—Special—The Northern Ohio Traction and Light Co. have decided to develop their water power on the Cuyahoga river near this city. H. von Schon, consulting engineer of Detroit, Mich., is preparing plans and specifications.

Patents Concerning Cement Manufacture.

920,784. Cement Burning Apparatus. Henry S. Spackman, Ardmore, Pa.

926,561. Burner for Cement Kilns, etc. Wm. H. Harding, Philadelphia, Pa.

927,054. Tube Mill for Cement, Stone and the Like. Ira A. Knecht, Nazareth, Pa.

927,516. Tube Mill. Geo. S. Emerick, Nazareth, Pa.

928,512, 928,513. Processes of and Apparatus for Burning Cement and Like Materials. Byron E. Eldred, Bronxville, N. Y.

929,144, 929,145. Apparatus and Process for Making Cement. Robert W. Lesley, Haverford, and Henry S. Spackman, Ardmore, Pa.

929,167. Rotary Kiln for Burning Cement. Friedrich J. Poths, Hamburg, Germany.

930,697. Waterproof Cement and Method of Making the Same. Jacob F. Schoellkopf, Buffalo, N. Y.

930,946, 930,948, 930,949. Apparatus for Burning Portland Cement. Thos. A. Edison, Llewellyn Park, Orange, N. J.

932,374. Method of Making Portland Cement. Joseph M. Carrere, Allentown, Pa.

934,056. Process of Making Cement Clinker and Apparatus Therefor. Carleton Ellis, White Plains, N. Y.

935,617. Process for Manufacturing Cement. Maxmilian Trembour, Hartzburg, Germany.

936,555. Process and Apparatus for the Manufacture of Portland Cement. Chas. F. McKenna, New York, N. Y.

937,255. Drier. Richard K. Meade, Nazareth, Pa.

937,826. Ball Mill. Pool T. Lindhard, New York, N. Y.

938,176. Tube Mill Cement Feeder. Arthur E. Sparrow, Chicago, Ill.

939,044. Tube Mill, etc. Pool T. Lindhard, New York, N. Y.

939,049. Kiln. Chas. A. Matcham, Allentown, Pa.

939,078. Process of Making Cement and Other Products. Sam'l Peacock, Chicago, Ill.

939,817. Cement Kiln. Thos. A. Edison, Llewellyn Park, Orange, N. J.

941,630. Process and Apparatus for Artificially Aging or Seasoning Portland Cement. Thos. A. Edison, Llewellyn Park, Orange, N. J.

942,509. Cement Kiln. Thos. M. Morgan, Long Point, Quebec, Canada.

944,996, 944,997. Pebble Mills. Max F. Abbe, New York, N. Y.

945,307. Process and Apparatus for Burning Cement. Henry L. Doherty, New York, N. Y.

945,498. Multitubular Cement Kiln. Henry L. Doherty, Madison, Wis.

953,092. Combined Ball and Tube Mill. Joseph E. Kennedy, New York, N. Y.

953,258. Process of Making Hydraulic Cement. Joseph M. Carrere, Allentown, Pa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Tuscaloosa, Ala.—The city is contemplating building about 4,000 sq. yds. concrete sidewalk and 12,000 lin. ft. concrete curb and gutter. W. H. Nicol, cy. engr.

Clarksville, Ark.—W. A. Reams, of Ft. Smith, Ark., has been retained to make plans for road improvement.

Little Rock, Ark.—Wood block pavement to the amount of $45,000 is contemplated. E. A. Kingsley, cy. engr.

Washington, D. C.—An appropriation for $79,000 for paving will be available July 3rd. T. B. Hunt, engr. of highways.

Americus, Ga.—A bond issue of $105,000 has been passed for street improvements.

Newnan, Ga.—A bond issue of $150,000 has been passed for paving work.

Summerville, Ga.—A bond issue of $75,000 has been passed for the purpose of making street, sewer and water works improvements.

Harrisburg, Ill.—A $35,000 bond issue has been voted for hard surface roads.

Angola, Ind.—Plans are being prepared for paving of about 8 blocks of business district. Thomas Owens, mayor.

Huntington, Ind.—Construction of various stone and gravel roads is contemplated. John Weaver, audt. J. B. Vernon, engr.

Indianapolis, Ind.—The park commission has ordered the improvement of 39th st. known as Maple road by the construction of curbs and gutters and a macadam roadway. Henry Jameson, president board of park commissioners.

Michigan City, Ind.—The paving of Baltimore, Wabash and Willard streets is contemplated. M. R. Miles, cy. engr.

Peru, Ind.—The paving of Second street is contemplated. Michael Horan, cy. engr.

Valparaiso, Ind.—Pleasant township has voted $77,000 bonds for sixteen miles of gravel road.

Cedar Rapids, Ia.—City council has voted to construtc a wood block pavement on 16th ave., W., to cost $1,200.

Wichita, Kan.—The paving of Main st. to cost $79,000 is contemplated. City engineer Bert Wells.

Marblehead, Mass.—A bond issue of $50,000 for macadamized roads and sidewalks has been voted. John G. Stevens, selectman.

Carthage, Mo.—The city is contemplating the paving of Maple st., with asphalt macadam. F. B. Newton, cy. engr.

Kalispell, Mont.—City is contemplating the paving of the entire business area of the city with bitulithic. A. L. Jaqueth, cy. engr.

Boro of Queens, N. Y.—The paving of Church ave. with asphalt block on concrete fofundation, to cost $18,900, is contemplated.

Plattsburg, N. Y.—This city is contemplating $8,000 brick, asphalt or concrete paving. R. H. Rogers, cy. engr.

Whitesboro, N. Y.—A bond issue of $19,400 has been voted for the purpose of paving various streets.

Bellaire, O.—South Belmont street will be paved at a cost of $18,000.

Hammondsville, O.—The construction of eight miles of pike road is contemplated.

Marion, O.—Bids will be received soon of seven miles of macadam road. B. L. Alles, co. audt.

Toledo, O.—The paving of St. Clair st. with asphalt, bitulithic or wood block is contemplated. Estimated cost about $60,000. City engineer Tonson.

Ashland, Ore.—A $35,000 bond issue for street paving has been passed.

Forest Grove, Ore.—About 19 blocks will be paved with bitulithic.

Portland, Ore.—Skidmore hard surface paving district has been formed to lay bitulithic pavements to the amount of $321,770.

Newport, Pa.—Bids are being asked for repaving of Fifth ave., Sixth st. and further street improvements are contemplated.

Pittsburg, Pa.—Street improvement to the amount of $450,000 is contemplated. Director of public service, Joseph G. Armstrong.

Springdale, Pa.—A $10,000 bond issue for grading and paving streets and alleys has been passed.

Maryville, Tenn.—A $300,000 bond issue has been passed for the purpose of building pike roads.

Memphis, Tenn.—State road precinct No. 1 which includes Memphis, has voted $25,000 for road construction.

Aransas Pass. Tex.—Bonds to the amount of $100,000 for road improveemnt has been voted.

Crockett, Tex.—Bonds to the amount of $150,000 have been voted by Houston county for road construction.

Granger, Tex.—A $100,000 bond issue has been voted for the purpose of constructing roads.

Tacoma, Wash.—Cement sidewalks to cost about $12,000 are contemplated. W. C. Raleigh, cy. engr.

Madison, Wis.—Street paving to the amount of $278,126 is planned by the board of public works.

Winnipeg, Man., Can.—This city contemplates the spending of $5,000,000 on improvements to water mains, sewers, sidewalks and improvements.

CONTRACTS TO BE LET.

Bedford, Ind.—May 2, 1 p. m. Construction of two gravel roads. Ezra W. Edwards, audt.

Bloomfield, Ind.—May 2, 2 p. m. Construction of macadamized roads in Taylor township. P. H. Jennings, audt.

Bluffton, Ind.—May 4, 1 p. m. Construction of stone roads in Jackson township. C. D. Garrett, audt.

Brazil, Ind.—May 5, 11:30 a. m. Construction of gravel road in Van Buren. Griggs, Johnson and Posey townships. W. A. Staggs, audt.

Brookville, Ind.—May 9, 1 p. m. Construction of roads in Bath and Springfield townships. Chas. A. Miller audt.

Crown Point, Ind.—May 5. Construction of eight gravel roads. Charles A. Johnson, audt.

Decatur, Ind.—May 1, 10 a. m. Furnishing crushed stone and supplies for repair of roads. H. S. Michaud, audt.

English, Ind.—May 1, 2 p. m. Construction of pike road in Liberty township. J. Egan, audt.

Fowler, Ind.—May 1, 1 p. m. Construction of free stone road in Oak Grove township. Lemuel Shipman, audt.

Greencastle, Ind.—May 1. Constructing 13,000 feet macadam road in Madison township. D. B. Moffitt, audt.

Greenfield, Ind.—May 1, 10 a. m. Construction of retaining wall. Chas. H. Troy, audt.

Logansport, Ind.—May 2, 10 a. m. Construction of gravel road in Jefferson township. J. E. Wallace, audt.

Monticello, Ind.—June 7, 12 m. Construction of stone road on county line. A. G. Fisher, audt, Pike county.

Rockport, Ind.—May 2, 10 a. m. Construction two highways in Ohio township. John T. White, audt.

Rockville, Ind.—May 3, 1:30 p. m. Construction of gravel road in Pollard township. James G. Elder, audt.

Rushville, Ind.—May 1, 1 p. m. Construction of gravel roads in Rush, Shelby and Hancock counties. Jesse M. Stone, audt.

Salem, Ind.—May 1, 1:30 p. m. Construction of road in Gibson county. Frank S. Munket, audt.

Vernon, Ind.—May 1, 11 a. m. Construction of pike roads as noted in Bulletin of April 15. M. W. Brogan, audt.

Versailles, Ind.—May 1, 1 p. m. Constructing gravel roads. David H. Moffitt, audt.

Wabash, Ind.—May 2, 1 p. m. Construction of two gravel roads in Center township. J. P. Noftzger, audt. May 2, 1:30 p. m. Construction of two roads in Noble township.

Williamsport, Ind.—May 1, 1 p. m. Construction of gravel road in Clinton township. David H. Moffit, audt.

Iowa City, Ia.—May 5, 2 p. m. Constructing cement walks and crossings throughout the city. Certified check $25. George P. Redvick, cy. clk.

Newhampton, Ia.—May 3, 7:30 p. m. Constructing 12,000 sq. yds. of cement paving; and 1,600 ft. cement curbing. F. B. Strike, cy. clk.

Pittsburg, Kan.—May 3, 4 p. m. Constructing about 4,500 sq. yds. vitrified brick pavement, with asphalt filler. L. E. Burtman, cy. engr.

Boston, Mass.—May 2, 12 m. Paving Geneva ave. with brick paving. Certified check $5,000. Louis K. Rourke, com. of public works.

Charlevoix, Mich.—May 2. Paving 4,600 ft. on Michigan ave. with Tarvia, macadam, Sarco, bitulithic, asphalt, creosote block, brick, cement or concrete or other material. E. J. Hiller, cy. clk.

St. Louis, Mo.—May 5, 12 m. Bids will be received on the following paving work: Paving Clay ave. with asphalt, certified check $650; Ashland ave. with bituminous concrete, certified check $549; Greer ave. with sheet asphalt, certified check $653; Howard st. with bituminous concrete, certified check $975; 21st st. with bituminous concrete, certified check $1,133; Michigan ave. with vitrified brick, certified check $521; Linton ave. with vitrified brick, certified check $709; California ave. with vitrified brick, certified check $563; Idaho ave. with vitrified brick; certified check $479; Clara ave. with vitrified brick certified check $704; 15th st. with vitrified brick, certified check $630; Osceola st. with bitulithic, certified check $665; Wyoming st. with bitulithic, certified check $700; Spalding ave. with bitulithic, certified check $567; reconstructing 25th st. with bitulithic, certified check $1,136; reconstructing 7th st. and surfacing with yellow pine block, certified check $647; reconstructing Pine st. and surfacing with yellow pine block, certified check $735; reconstructing Benton st. and surfacing with yellow pine block, certified check $1,450. Maxime Raber, president board of local improvements. Wm. B. Finley, secy.

Hudson, N. Y.—May 2, 10:30 a. m. Paving Warren st. with vitrified brick. Commissioners of public works.

Lackawanna, N. Y.—May 15, 8 p. m. Paving Ridge road with vitrified brick. Certified check 10 per cent. Bond 50 per cent. John J. Monaghan, cy. clk.

Seneca Falls, N. Y.—May 4, 2 p. m. Paving State and Bayard sts. 25,000 sq. yds. brick or macadam. John M. Guin, cy. clk.

Barnesville, O.—May 15, 12 m. Paving North Lincoln ave. with brick. certified check $250. F. Waldo Hilles, clk.

Cincinnati, O.—May 2, 12 m. Paving Sumter ave. with brick, certified check $2,000; paving Whiteman ave. with wood block, certified check $700. John J. Wenner, clk, director of public service.

Cincinnati, O.—May 5, 12 m. Paving of Carthage ave. Certified check $1,000. Fred Dreihs, clk. Hamilton county.

Cleveland, O.—May 3, 11 a. m. Improving Hargitt road. Certified check $100. John F. Goldenbogen, clk. of Cuyahoga county.

Greenville, O.—May 6, 10 a. m. Constructing the following roads: Detrick, four sections, three of which are 2,640 and one 2,415 ft.; M. J. L. and Livingston roads in two sections, each about 2,640 ft.; Ross road in four sections, three of which are 2,640 and one 2,697 ft.; Baughman road in three sections, two of which are 2,640 and one 1,882 ft. Certified check $100 on each section. Frank Snyder, co. audt. Darke county ,O. Carl F. Frade, co. sur.

Minerva, O.—May 10, 12 m. Paving portions of Market, Valley, Wood and Lincoln sts. Certified check $500. Austin Freed, clk.

New Philadelphia, O.—May 22, 1 p. m. Paving 1,000 ft. of road in Warren township with brick. Certified check $100. W. C. Shott, audt. of Tuscarawas county.

Rockport, O.—May 12, 12 m. Constructing Settlement and Linndale roads. Certified check $200. Fred Feuchter, clk., Rockport, O.

Memphis, Tenn.—May 26. Constructing five miles gravel roadway, 3.9 miles tar macadam, 1.4 miles of vitrified brick, 2.9 miles wood block or bitulithic. George T. Lodge, st. com.

Ft. William, Ont., Can.—May 4, 5 p. m. Paving 14,000 sq. yds. with asphalt block sheet asphalt or bitulithic. John Wilson, cy. engr.

CONTRACTS AWARDED.

Covina, Cal.—Paving Piplus ave., to L. H. McGowan, Higgins blvd., Los Angeles, Cal., $37,693.

Long Beach, Cal.—Construction of 30 ft. cement blvd., to J. D. Kneen Concrete Co., Santa Monica, $110,985.

Los Angeles, Cal.—Street improvement awarded as follows: paving Selma ave., to A. W. Bessemyer, $18,627; Kenwood st., to Fairchild, Gilmore, Wilton Co., Pacific Electric Bldg., $9,429; Frees st., to L. N. Davies, $4,162; cement sidewalks, to Arthur Sikes, 959 W. 43rd st., $4,539; all firms in Los Angeles, Cal.

Redondo, Cal.—Contract for petrolithic paving to W. C. Henderson, 3030 N. Main st., Los Angeles, $26,100; petrolithic paving, to Venable & Morrell, of Redondo, $19,600.

San Francisco, Cal.—The following contracts have been let: Paving Cook st. to Reisph Improvement Co.; curbing S. Brazil ave. to Flinn & Tracy; paving 25th ave., 17th ave., and others to City Street Improvement Co.

Denver, Colo.—Paving in north side improvements district No. 14, to Municipal Construction Co., Denver, $15,723.

Canton, Ill.—Construction of pavements on South Park st., to Roller and Savill, Canton, Ill.

Chicago, Ill.—Paving work awarded as follows: Wood block, $2,316, to Central Paving Co., 172 Washington st.; wood block, $3,570, to McGarry, 188 Madison st.; $1,880, to Central Paving Co.; $1,951, to Alexander Todd, 197 N. Hamlin ave.; $2,555, asphalt work, to American Asphalt Paving Co., 138 Washington st.; $17,003, to Standard Paving Co., 1101 S. 48th st.; $7,436, to L. M. Conway Co., 138 Washington st.; $484, to Calumet Coal and Feed Co., 2926 95th st.; $101,107, to Parker-Washington Co., 138 Washington st.; $13,181, to Farr Bros., all firms in Chicago.

Murphysboro, Ill.—Contract for $21,000 paving, to Meyer-Thomas Co., of East St. Louis, Ill.

Bluffton, Ind.—Construction of twelve gravel roads, as follows: J. M. Fryback, gravel, $3,760; W. Clahoun, stone, $6,160; Turner & Sours, gravel, $6,060; J. M. Harris, gravel, $2,860; L. Sfl Walser, stone, $3,400; C. Stogdill, gravel, $4,160; S. Risley, macadam, $6,000; Isaac Jacobs, gravel, $3,400; Peter Wiesbrodt, macadam, $5,480.

Indianapolis, Ind.—The following contracts for cement walks have been let: Tremont st., to Henry Maag; Raymond st., to J. V. Baxter; Defrees st., to William H. Lackey; all of Indianapolis.

Kentland, Ind.—Constructing macadam road, to Alva D. Herriman, Brook, Ind., $5,982.

Knox, Ind.—Construction of two roadways, to James Sticker, Knox, Ind., $3,200.

Lafayette, Ind.—Construction of roads in Wabash township, $3,225, to B. H. Fatout, Indianapolis, Ind.; $6,000 road work, to Mahoney & Allen, Greencastle, Ind.

Logansport, Ind.—Construction of roads in Cass county to Fred Grover, Frank Justice and Beal & Beal, all of Logansport.

Monroe, Ind.—Construction of macadamized road in Wabash and St. Marys township, to Eli Entle & Sons, Monroe, Ind., $6,198 and $6,370.

Sullivan, Ind.—The following contracts have been let: 2 stone roads in Pike township, to D. E. Uzerhart, Sullivan, Ind.; and Keegan Bros., Brazil, Ind., $9,464 and $8,465 respectively; stone and oil road in Hamilton township, to Bageby & Cunningham, Linton, Ind., $3,430.

Ackley, Ia.—Constructing concrete and brick pavement, to John A. Beebe, Omaha, Neb.

Colfax, Ia.—Contract for paving to Turner Improvement Co., Des Moines, $50,000.

Des Moines, Ia.—Contract for street paving to Meyer Bros. Construction Co., of Erie, Pa., includes 18,000 yds. of asphalt.

Red Oak, Ia.—Construction of 30 blocks brick pavement to Hamilton & Schwartz, of Shenandoah, Ia.

Detroit, Mich.—The following paving contracts were awarded: Cedar block, $15,565 and $7,245, to Thomas G. Currie, 29 McGraw Bldg.; cedar block, two contracts, $24,642 and $11,841, to J. A. Mercier, 211 Hammond Bldg.; brick paving, $17,642, to Porath & Sons, 301 Penobscot Bldg.

Duluth, Minn.—Contract for cement walk to W. H. Kilpin, Duluth, $12,653; contract for cement walks to D. H. Clough, $14,297; cement walks on Park Point to D. H. Clough, $3,987; contract for laying solvay calcium chloride in 8 sprinkling districts to Board of Trade Livery Co., Duluth, Minn., at $18 per ton.

Meridian, Miss.—Constructing 20 miles paved highway to Healy Construction Co., McAlester, Okla.

Kansas City, Mo.—Construction of municipal wharf, to A. N. Blodgett Construction Co., Kansas City, $22,760.

Bloomfield, N. J.—Contracts for paving and road work were let as follows: Concrete work to Shire & Woods, Lyndhurst, N. J. and De Amato & Steffenalli, of 74 Sumner ave., Newark; Telford stone work, to Telford Construction Co., 22 Clinton street, Newark, and Fusco Construction Co., 671 Broad street, Newark N. J.

Albany, N. Y.—The following contracts have been let for road work: $55,847, to De Drass and Hozeboom, Kingston, N. Y.; $36,186, to same; $50,000, to Huckness Construction Ca., Albion, N. Y.; $49,670, to Breezcn & Biton, 27 Williams st., New York City; $33,220, to Newport Construction Co., Newport; $80,550, to Joseph Walker, New Paltz, N. Y.; $49,950, to same; $7,800, to Fred W. Berger, Newport, N. Y.; $55,270, to Kennedy Roofing & Paving Co., Utica, N. Y.; $11,920, to John Hyde, Rome, N. Y.; $32,000, to Central City Paving Co., Syracuse, N. Y.; $65,458, to Thomas Meehan & Sons, Philadelphia, Pa.; $33,975, to Paddock & Williams, Memphis, N. Y.; $43,990, to Joseph H. Conners, Fulton, N. Y.; $66,999, to Folk & Menzies, Buffalo, N. Y.; $47,990, to Chas. O. McComb, Syracuse, N. Y.; $88,900, to James Stewart & Co., 30 Church st., New York City; $69,889, to John E. Johnson, Buffalo, N. Y.; $45,593, to Thomas Meehan & Sons, Philadelphia, Pa.; $69,800, to A. J. Rockwood, Rochester, N. Y.; $38,892, to Herrihy Contracting Co., Glens Falls, N. Y.; $60,000, to Catskill Construction Co., Catskill, N. Y.; $33,700, to Sphroezer-Hicks Contracting Co., Rochester, N. Y.; $22,500, to Sontononi Construction Co., Newcomb, N. Y.; $63,300, to Thomas Grazy & Co., Rochester, N. Y.; $44,740, to John H. Weidman, Syracuse, N. Y.

New York, N. Y.—The following contracts were awarded; Granite block pavement, $28,875, to John E. Donovan, Port Richmond, N. Y.

Port Niagara, N. Y.—Constructing roads, walks, etc., to Lake Shore Construction & Supply Co., Dunkirk, N. Y., $12,988.

Rochester, N. Y.—Paving Genesee st., to Whitmore, Rauber & Vicinus, $25,041; brick pavement on Oak, to same, $42,912; asphalt pavement on Oak st., to Rochester Vulcanite Co., $20,610; asphalt pavement on Bloss st., to Rochester Vulcanite Co., $11,763.

Utica, N. Y.—Paving Wurz ave., to James W. Johnston, Utica, $17,770.

Fayetteville, N. C.—Constructing 10,000 feet paving, to Bowe & Page, Charleston, S. C.

Belle Valley, O.—Road construction, to

Juniper & Nixon, of Nelsonville, O., $10,-332.

Findlay, O.—Construction of pike road in Huron county, to Taylor & Biggs, $42,-000.

Lowellville, O.—Constructing sidewalks for a period of one year, to Kimbrough-Elder, Newcastle, O.

Lawton, Okla.—Paving 45 blocks, to C. H. Shaw, Lawton, Okla., $150,000.

Ingram, Pa.—Paving Stanley st., to Thomas Cronin Co., Pittsburg, $11,032.

Philadelphia, Pa.—Spring Garden st. resurfacing, to Barber Asphalt Paving Co., $15,000.

Knoxville, Tenn.—Constructing 10 miles of pike road, to Mann Construction Co., Knoxville.

Montesano, Wash.—Paving Spruce st., to Anderson Construction Co., Tacoma, $16,266.

Seattle, Wash.—Paving Sixth ave. with asphalt, to Barber Asphalt Co., Henry Bldg., Seattle, $30,990.

Tacoma, Wash.—Paving and laying cement sidewalks on various streets, to Keasal Construction Co., Providence Bldg., Tacoma, $23,894; asphalt paving, to Ollar-Robinson Co., 1322 South Yakima ave., Tacoma.

Racine, Wis.—Paving Eire and Dodd street, to McCugo-McCullock Co., of Waukegan, Ill., $14,626.

SEWERS.

CONTEMPLATED WORK.

Denver, Colo.—Sewers to cost $122,320 are to be constructed in sewer district No. 3. J. B. Hunter, cy. engr.

Summerville, Ga.—A $75,000 bond issue for street, sewer and water works improvements has been voted.

Waycross, Ga.—An extension to the sewer system to cost from $15,000 to $20,-000 is contemplated.

Aurora, Ill.—Bids will be asked soon for about $105,000 of concrete and pipe sewers. M. J. Barble, cy. engr.

Anderson, Ind.—An 8 ft. sewer. 1¼ miles long, to cost $100,000, is contemplated.

Mount Vernon, Ind.—Bids will be asked soon for construction of storm sewer to cost $5,000. D. W. Farlls, cy. engr.

Newcastle, Ind.—City council will advertise for bids for building arch sewer over open stream. Estimated cost $50,000.

Clinton, Ia.—Receiving of bids for sewer district No. 4 has been postponed from April 4 to about May 2. I. P. Hart, cy. engr.

Bowling Green, Ky.—Plans are being prepared by state sanitary engineer, Paul Hansen, for the construction of a complete sewerage system for the city of Bowling Green.

Spencer, Mass.—A $1,000 sewage disposal plant will be constructed.

Austin, Minn.—City will construct 6,600 feet sanitary sewers. Martin Clausen, cy. engr.

Ely, Minn.—A $30,000 bond issue has been voted for the purpose of a sewer system.

Madison, Mo.—A $200,000 sewer system is contemplated. B. H. Colby, St. Louis, engr.

Newark, N. J.—Sewers on Gardner and Dickerson sts. are contemplated. Alfred L. Swain, clk. bd. of street and water comrs.

Albany, N. Y.—Rudolph Hering, of New York City, has been retained to plan intercepting sewers.

Buffalo, N. Y.—Bids will soon be requested for the construction of sewers in various streets. Comr. pub. wks. F. G. Wood.

Boro of Queens, N. Y.—A sewer system in the Wave Crest section of Far Rockaway, estimated cost $24,850, is contemplated. The improvement will provide for 10-in. cast iron force main in Cedar ave. and an electric pumping station.

Mariana, O.—A $20,000 bond issue for the purchase of complete sewerage system from private company has been voted.

Marysville, O.—E. A. Kemmler, of Columbus, O., has been retained to furnish plans and specifications for a $100,000 sanitary sewerage system, which will be constructed immediately.

Toledo, O.—The sum of $3,000 has been appropriated to retain an engineer to make plans for removal of sewage in the Swan creek district. Sewer dir. Cowell.

Youngstown, O.—Sewers on State and Liberty sts. to cost $10,000 are contemplated. Cy. Engr. Wilson.

Britton, Okla.—A $20,000 bond issue for sewer improvements has been voted.

Eugene, Ore.—A $28,000 bond issue for sewer improvements has been voted.

Altoona, Pa.—Sewer extensions and a disposal plant to cost $260,000 are contemplated. Cy. Engr. Engstrom.

Beaver Falls, Pa.—Leo Hudson, of Haverstraw, N. Y., is preparing plans for a complete sewerage system and disposal plant for Beaver Falls.

Ligonier, Pa.—State board of health has ordered the village to build the sewage disposal plant.

Parker, Pa.—The city has been directed by state board of health to construct sewage disposal system and water filtration plant.

Springdale, Pa.—A $12,000 bond issue for a sewer system has been voted.

Clinton, S. C.—A $45,000 bond issue for sewer improvements has been voted.

Columbia, S. C.—The street department is authorized to advertise for bids on storm sewers on Dervais st.

Cuero, Tex.—A $30,000 sewer system, with disposal plant, is contemplated. Capt. S. R. Perkins, engr.

Milwaukee, Wis.—No bids were received on March 27 for the construction of a sewer on 25th ave. The work will be advertised again. John J. McGucken, dept. comr. pub. wks.

Winnipeg, Man., Can.—This city contemplates the spending of $5,000,000 on improvements to water mains, sewers, sidewalks and pavements.

CONTRACTS TO BE LET.

Pensacola, Fla.—May 2, 12 m. Constructing 15,060 lin. ft. of storm sewers, 10-in. to 60-in. in diameter; 23,880 lin. ft. sanitary sewer, 6 to 24-in. in diameter. Certified check, $2,000. John M. Merritt, chr. bd. of bond trus. George Rommel, Jr., engr.

Kokomo, Ind.—May 1, 12 m. Constructing sewers 10 to 48-in. in diameter, about 12,900 ft. in length. Certified check, $500. Bond, $25,000. John Havens, cy, clk.

Cloquet, Minn.—May 3. Constructing 1,300 lin. ft., 8 to 10-in. sewers. Cy. clk.

East Las Vegas, N. Mex.—May 17, 4 p. m. Constructing 23,000 ft. 8 to 15-in. vitrified pipe sewers. Certified check, $500. Chas. Tamme, clk.

Cleveland, O.—May 5, 12 m. Construction of sewers on Bessemer ave., southeast; East Eighty-eighth st.; Harris ave.; Marshall ave.; Pensacola ave.; east branch of Dugway brook intercepter, and part of Lorain ave. Separate bids required. A. B. Lea, comr. of pub. serv. Ira Hoffman, sec.

Elyria, O.—May 8, 12 m. Constructing sanitary sewers to cost about $27,000. Certified check, $1,000. Rose Moriarity, clk. D. S. Butts, engr.

Hubbard, O.—May 2, 12 m. Constructing sanitary sewers. Certified check, $1,500. J. Edward Schofield, vl. clk. Wm. Wilson, Youngstown, O., engr.

Xenia, O.—May 3, 11:30 a. m. Construction of sanitary sewer in Green county, Ohio, infirmary, and for the preparatory sewage treatment device. 10 per cent. certified check. Walter L. Dean, co. audt.

The Dalles, Ore.—May 15. Constructing sewer in District No. 1. L. T. Boyle, cy. engr.

Doylestown, Pa.—Construction of sewage disposal bed. Certified check, $200. Harrison & Sthreider, 2215-17 Land Title Bldg., Philadelphia, Pa., engrs. William Bishop, supt. of the Doylestown Sewage Co.

Williamsport, Pa.—May 24, 12 m. Construction of storm water sewer in Hepburn st. Certified check, 10 per cent. Robert J. White, chrmn. of com. on highway and sewer imp. J. J. Galbraith, cy. clk.

Reedsburg, Wis.—May 17, 5 p. m. Constructing trunk sewer on Franklin st., including 1,650 ft. of 30-in. pipe, 1,200 ft. 27-in. pipe, 1,410 ft. 16-in. pipe, 10 manholes, 22 catchbasins, etc. Certified check, 5 per cent. A. H. Hueding, cy. clk.

Ft. D. A. Russell, Wyo.—May 8, 9:30 a. m. Constructing 2,125 lin. ft. 8-in. vitrified pipe sewers; 2,900 lin. ft. 6-in. vitrified pipe; 9 manholes. F. S. Armstrong, const. q. m.

Toronto, Ont., Can.—May 9, 12 m. Constructing sewers as noted in Bulletin of April 15. D. R. Geary, mayor.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing storm sewers in the Eighth paving district, to Sullivan & Lang, Bessemer, Ala., for $26,019.

San Francisco, Cal.—The following contracts have been let: Grade and sewer on 25th ave., to Frank L. Sheerin; sewer on 32d ave., to E. E. Gallagher.

Winters, Cal.—Plans for a sewer system to cost $28,000 have been adopted by the city council. Haviland & Tibbets, engrs., Oakland, Cal.

Colorado Springs, Colo.—Constructing sewers, to Westcott-Doan Investment Co., Gas and Electric Bldg., Denver, Colo., for $4,208.

Ft. Morgan, Colo.—Constructing sewers to Meeker & Gobson, of McCook, Neb., for $5,146.

Stamford, Conn.—Sewer construction, to Frank Palmer, Stamford, for $45,543.

Moline, Ill.—Construction of sewer system to E. R. Harding & Co., Racine, Wis., $50,995.

Peoria, Ill.—Resurfacing Perry ave. with asphalt, to J. W. Bushell, Peoria, Ill., for $25,713.

Tampico, Ill.—Constructing open ditch, to A. O'Mara, Cullom, Ill., 85,000 cu. yds. excavation.

Indianapolis, Ind. — Construction of brick sewer, to American Construction Co., 1201 E. Georgia st., Indianapolis, Ind., for $72,152.58.

Kokomo, Ind.—Contract for construction of Tudor drain, to Indiana Drain Tile Co., of Brooklyn, Ind., for $27,393.

Michigan City, Ind.—Contract for construction of 12 miles of Porter ditch, to Yoder & Swartz, Nappanee, Ind., for $10,000.

Indianola, Ia.—Sewer construction, to Lydle Construction Co., Sioux City.

Nappanee, Ind.—Contract for drainage work to Nappanee Drainage Co., of Nappanee, Ind., $63,000.

Easton, Md.—Construction of sewer system, to Hines & Hayman, Baltimore, Md., for $37,001.

Albert Lea, Minn.—Constructing lateral sewers, to J. J. Connolly, St. Paul, Minn., for $3,143.

St. Cloud, Minn.—Sewer construction in East Side, to Ilstrup & Olsen, Minneapolis, Minn., for $8,826; West Side to Carl Krapp, St. Cloud, Minn., for $20,103.

South Orange Township, N. J.—Construction of sewers in Milton district, consisting of 8 to 12-in. vitrified pipe sewers, manholes, flush tanks, all appurtenances, to J. J. Fusco, of Montclair, N. J., for $18,246. Alexander Potter, 146 Liberty st., New York City, con. engr.

Watertown, N. Y.—Constructing a 20-in. sewer in 2d ward, to Burns Bros. & Healy, Watertown, N. Y., for $17,343.

Cincinnati, O.—Construction of sewers to the amount of $3,500, to James McLane & Sons, Cincinnati, O.

Dayton, O.—The contracts for sewer work were awarded to the following contractors, all of Dayton: Hucker & Kirschner, John F. Cooke, Shafor & Dill, A. J. Kanner.

Girard, O.—Constructing sewers, to Dan Mercer Construction Co.

Millersburg, O.—Contract for sewer in northern part of the city, to Lee & Griggs, Millersburg, O.

New Salem, O.—Constructing sewers on South Union, Evans, Garfield and other streets, to John Devine, Alliance.

Russell, O.—Constructing various sewers, to Scherer & Mountain, Ironton, O., for $10,891.

Salem, O.—Construction of sewers on South Union and Evans sts., Garfield ave., Wilton, Newgarden, Liberty and Fair sts., to John Devine, of Alliance, for about $9,000.

Zanesville, O.—The contract for sewer in Marble alley, to John Tooper, Zanesville, O.

Newburg, Ore. — Constructing sewer system, to T. S. Sheppard, Portland, Ore., for $75,940.

Silverton, Ore.—Constructing water and sewer systems, to Mars Construction Co., Seattle, Wash., for $63,940.

Carnegie, Pa.—Contract for sewer on Orchard ave., to William Donnelly, Carnegie, Pa.

Glassport, Pa.—Constructing about 3,915 ft. of 6 to 18-in. terra cotta pipe sewers, to McLaughlin Construction Co., Pittsburg, Pa.

Grove City, Pa.—Sewer construction, to Thomas & Saull, Grove City, approximately, $2,000; Dunn Leader Construction Co., Steubenville, O., approximately, $13,000.

Williamsport, Pa.—Construction of East End sewer, to George W. Rockwell, Sunbury, Pa., for $20,631.

Columbia, S. C.—Construction of sewers on Gervais st., to R. E. and E. N. Beaty, Georgetown, S. C., for $10,192.

Cameron, Tex.—Constructing sewer system, to Hamilton Bros. Construction Co., Chicago, Ill.

Galveston, Tex.—Dredging of Galveston's channel, to L. B. Gaylord, Houston, for $281,400.

Honey Grove, Tex.—The Honey Grove Sewer Co. has been incorporated, with a capital stock of $10,000, by J. W. Hadley and S. M. Kemp.

Seattle, Wash.—Sewer construction to Hayden & Sons, Seattle, Wash., for $18,889.

Milwaukee, Wis.—Contract for sewer construction in South district, to George Zimmerman, for $15,000; contract for sewer work in same district to T. J. Fzukalfki.

Racine, Wis.—Constructing sewer in Spring st., to P. C. Johnson, Racine, Wis.

Stoughton, Wis.—Constructing sewers, to E. R. Harding, Racine, Wis., for $20,411.

WATER WORKS.

CONTEMPLATED WORK.

Mena, Ark.—$60,000 waterworks plant will be constructed. John Thompson, chr. bd. of imps.

Palo Alto, Cal.—A bond issue of $50,500 for the purpose of building an auxiliary pumping station, garbage destroyer, concrete waterworks building, an automobile fire engine, and steam condenser and water cooling tower, has been voted.

Sisson, Cal.—Voted $40,000 bonds for improving waterworks system.

Gunnison, Colo.—A $90,000 bond issue for waterworks has been voted. Burns & McDonnell, Kansas City, Mo., engrs.

Flowery Branch, Ga.—This village is contemplating the installation of a $6,000 waterworks system. P. R. Parson, mayor.

Summerville, Ga.—A bond issue of $75,000 has been passed for the purpose of making street, sewer and waterworks improvements.

Mountain Home, Ida.—A $35,000 bond issue has been voted for the purpose of constructing a city water system. P. M. Blake, Boise, Ida., engr.

Troy, Ida.—Voted $12,000 bonds for the construction of a waterworks system.

Bloomington, Ill.—The extension of water mains on Mason st. is contemplated.

Rockdale, Ill.—The village has decided to erect a municipal water plant and build a distributing system to cost $25,000.

Rushville, Ill.—The Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., has been retained to prepare plans for complete pumping station and waterworks system, to cost $30,000.

Shelbyville, Ill.—Shelbyville Water Co. will construct a 2,000,000-gal. reservoir Charles Chester, supt.

Des Moines, Ia.—The city is contemplating the purchase of a municipal water plant owned by private corporation.

Burton, Kan.—A $15,000 waterworks system is contemplated. Rollings & Westover, Beals Bldg., Kansas City, Mo., engrs.

Emporia, Kan.—In connection with changing pumping system from steam to electricity, city will purchase 3½ miles transmission line, two 3,000,000-gal. pumps and booster pump. Bids asked early in May. Fred H. Smith, cy. clk. Matthew Brown, cy. engr.

Kansas City, Kan.—A bond issue of $350,000 for the constructing of a municipal lighting system has been voted.

Sedgwick, Kan.—A waterworks system to cost $20,000 is contemplated. R. R. Hobbe, cy. clk.

Dawson Springs, Ky.—Plans will soon be prepared for the construction of waterworks system to cost about $15,000. J. W. Holmes.

Dexter, Minn.—Voted bonds for the construction of a waterworks system.

Mankato, Minn.—A $20,000 bond issue has been voted for the purpose of constructing waterworks system.

Power, Minn.—A $16,000 bond issue for construction of waterworks plant has been voted.

Waseca, Minn.—A waterworks system to cost $15,000 is contemplated.

Bassfield, Miss.—Bonds have been voted for the purpose of installing a waterworks plant.

Princeton, Mo.—This city is contemplating the construction of a waterworks system. Rollins & Westover, engrs., Beals Bldg., Kansas City, Mo.

Shelby, Mont.—Contemplating the construction of a waterworks system to cost about $35,000.

Bridgeport, Neb.—A $17,500 bond issue for waterworks has been voted.

Newark, N. Y.—This city has voted $8,000 for the extension of waterworks mains and installation of additional equipment.

Newport, N. Y.—This city has issued $15,000 bonds for improvement of waterworks system.

Tarrytown, N. Y.—Voted $70,000 bonds to enlarge water supply.

Kenton, O.—A $40,000 bond issue for waterworks plant has been voted.

Urbana, O.—The city is contemplating the erection of a municipal water plant.

Boswell, Okla.—A bond issue of $27,000 for new waterworks system has been passed.

Helena, Okla.—A $10,000 bond issue for waterworks has been voted. L. A. Ruley, cy. clk.

Oklahoma City, Okla.—Bids will be requested soon for waterworks improvement, including $12,000 sedimentation basin, new boilers, 200,000-gal. equalizing tower, and about 28 miles of mains.

Madras, Ore.—A bond issue of $10,000 has been voted for a complete city water system, including 13,000 feet of mains.

Oil City, Pa.—Waterworks improvements to cost $18,000 are contemplated.

Pittsburg, Pa.—The construction of a reservoir on Cabbage Hill is contemplated. Director of pub. wks., Joseph G. Armstrong.

South Sharon, Pa.—A $160,000 waterworks system is contemplated.

Springdale, Pa.—A $50,000 bond issue for building a municipal water plant has been passed.

Alvin, Tex.—Franchise for waterworks system in this city was granted to a company of which T. P. Magaois and W. P. Hunt, of Alvin, Tex., are interested.

Lott, Tex.—Bonds to the amount of $14,000 have been voted for construction of waterworks.

Victoria, Tex.—Extensions to the waterworks system are planned.

White Salmon, Wash.—Contemplating the construction of waterworks. C. H. Estes, town clk.

Milton, W. Va.—The Milton Water Co. has been incorporated to build a waterworks system for city.

Wheeling, W. Va.—A bond issue of $300,000 for the erection of filtration plant has been ordered.

Antigo, Wis. — Waterworks improvements to the amount of $10,000 are contemplated. Improvement includes 425,000-gal. reservoir.

CONTRACTS TO BE LET.

Cloquet, Minn.—May 1. Constructing 12,000 lin. ft. 6 and 4-in. water main. Cy. clk.

Buffalo, N. Y.—May 4, 11 a. m. Construction of two brick tunnels on east side of Front ave. pumping station. Certified check, 50 per cent. Francis G. Ward, comr., 5 Municipal Bldg.

Lakewood, O.—May 9, 12 m. Constructing steel water tower as noted in Bulletin of April 15. E. R. Lieblion, clk.

CONTRACTS AWARDED.

Kingsbury, Cal.—Constructing a municipal waterworks, to Braun, Williams & Russell, of Redondo Beach, Cal., for $25,000.

Terra Bella, Cal.—Constructing waterworks and sewer system, to Western Engineering and Water Supply Co., Oakland, Cal., for $6,034.

Sparta, Ga.—Construction of complete waterworks system, to Walton & Wagner, Atlanta, Ga., for $34,000.

Canton, Ill.—Contract for waterworks extension and deep well improvement, to Cook Construction Co., Des Moines, Ia., for $6,801.

East Mobile, Ill.—Constructing waterworks system complete, to E. R. Harding, Racine, Wis., for $13,500.

Coldwater, Kan.—Construction waterworks and electric light systems, to Fred M. Clark, Havana, Mo., $29,180.

Hornell, N. Y.—Construction of closed reservoir, to Fahy & Prentice, of Hornell, for $37,000. Laying 15 miles of pipe, to Gray & Miller, of Hornell, for $10,000.

Ogdensburg, N. Y.—Construction pumping station, filter intake and mains, to L. B. Cleveland, Watertown, N. Y., for $29,849.

Lakeside, O.—Contract for a filtration plant, to Pettibone & Dankleson, Lakeside, O.

Lexington, O.—Contract for complete waterworks system to National Co., South Bend, Ind., for $62,165.

Checotah, Okla.—Installing waterworks station, laying pipe, etc., to C. R. Nichols, of Checotah, Okla., $13,160.

Indiana, Pa.—Constructing filtration plant for refuse of Indian Brewery, to P. J. McGovern, Indiana.

Columbia, S. C.—Constructing water mains, to Weston & Brooker, $2,268; pipe and supplies, to Lynchburg Foundry Co., Lynchburg, Va., for $3,780.

Gettysburg, S. D.—Construction of complete water system, to Cook Construction Co., of Des Moines, Ia., for $14,000. F. M. Wright, cy, audt.

Dawson, Tex.—Contract for $15,000 water system to J. S. Williams, Dawson.

Galveston, Tex.—Construction of duplicate mains across Galveston Causeway, to Isaac Heffron, Galveston, for $66,389.

Prescott, Wis. — Construction waterworks system to Des Moines Bridge and Iron Co., Des Moines, Ia., $19,419.

BRIDGES.

CONTEMPLATED WORK.

San Bernardino, Cal.—Contemplating the construction of a wooden bridge to span Mojave river near Victorville, to cost $12,000.

Santa Barbara, Cal.—Plans will be prepared for a concrete bridge to span the Santa Ynez river, to cost $40,000. Frank F. Flournay, co, sur.

Thomasville, Ga.—The commissioners of Thomas county have decided to replace all wooden bridges by steel bridges.

Plymouth, Ind.—The construction of two 60-foot concrete bridges is contemplated. County commissioners of Marshall and Fulton counties.

Wichita, Kan.—The construction of a $20,000 steel bridge on 13th st. is contemplated. Co. comrs.

Barbourville, Ky.—Six steel bridges will be constructed in Knox county.

Foxcroft, Me.—Bonds to the amount of $25,000 have been appropriated for construction of concrete bridge.

Kalamazoo, Mich. — Construction of bridge on Alcott st. is contemplated.

Oklahoma City, Okla.—A charter was granted to the Lexington Auto Bridge Co., of Lexington, Ky., with $25,000 capital, the purpose of the company being to build a bridge between Lexington and Purcell. The directors are J. A. Brownell, L. J. Brownell and A. Brownell, all of Lexington.

Shawnee, Okla.—Contemplating the construction of three bridges. Bd. co. comrs.

Gettysburg, Pa.—The construction of a 98-foot reinforced concrete bridge over Possum creek at Aspers is contemplated.

Pittsburg, Pa.—County will build 16 bridges, to cost $281,250.

Angleton, Tex.—Bonds to the amount of $100,000 have been voted for the purpose of building two bridges across the Brazos river.

Dallas, Tex.—Contemplating the construction of three modern drawbridges, to cost about $75,000.

Lampasas, Tex.—Bonds have been voted for the erection of a bridge to cross the Lampasas river.

Smithville, Tex.—A concrete bridge over Gosly creek is contemplated.

Wichita Falls, Tex.—Bonds to the amount of $151,000 have been voted to build bridges across the Wichita river.

CONTRACTS TO BE LET.

Bloomfield, Ind.—May 3, 2 p. m. Construction of three bridges of 70, 60 and 40-ft. spans, respectively. Caswell H. Jennings, audt.

Bluffton, Ind.—May 4. Construction and repair of fifteen bridges. O. D. Redd, audt.

Brazil, Ind.—May 2, 10 a. m. Constructing four concrete steel culverts. D. B. Huntington, audt.

Decatur, Ind.—May 2, 10 a. m. Constructing a number of bridges and arches. H. S. Michaud, audt.

Lebanon, Ind.—May 2, 1 p. m. Construction and repair of thirty-two bridges. B. S. Herdrich, audt.

Newport, Ind.—May 15, 1 p. m. Repairing Perryville bridge. H. E. Payne, audt.

Plymouth, Ind.—May 2. Construction of two bridges on county line road. Chas. M. Walker, audt., Plymouth.

Princeton, Ind.—May 3, 11 a. m. Construction of twelve steel bridges. W. D. Roberts, audt.

Rockville, Ind.—May 3, 1:30 p. m. Repairs to several bridges. James G. Elder, audt.

Shelbyville, Ind.—May 2, 10 a. m. Construction four concrete-steel culverts. G. B. Huntington, audt.

Shelbyville, Ind.—May 8. Construction of concrete abutments and repair work on St. Paul bridge. G. B. Huntington, audt.

Washington, Ind.—May 3, 2 p. m. Construction of seven bridges. Thomas Nugent, audt.

Columbus, O.—May 16, 12 m. Building substructure and approaches to Wilson bridge. Certified check, $500. F. M. Sayre, county auditor, Franklin County.

Hamilton, O.—May 9, 10 a. m. Constructing small culvert and bridges in Madison township. Certified check, 10 per cent. J. E. Brate, co. audt.

CONTRACTS AWARDED.

De Witt, Ark.—Contract for construction of steel bridge, to Memphis Bridge Co., Memphis, Tenn., for $2,500.

Fillmore, Cal.—Piru bridge awarded to the Missouri Valley Bridge and Iron Co., Denver, Colo., for $19,210; Sheicoy bridge awarded to Merry-Elwell Co., Oakland, Cal., for $53,800.

Los Angeles, Cal.—The contract for Arroyo steel bridge, to Memphis Bridge Co., Memphis, Tenn., for $2,500.

Champaign, Ill.—Constructing a bridge 75 ft. long and 20 ft. wide, to J. M. Breese, Mattoon, Ill., for $14,000.

Lake Bluff, Ill.—Construction of $10,000 bridge, to James Corse, Racine, Wis.

Tremont, Ill.—Constructing two reinforced concrete bridges in Elm Grove township, to Porter-McCulla Contracting Co., Mackinaw, Ill.

Clay City, Ind.—Construction of a bridge, to L. W. Gibens & Sons, Saline City, Ind.

Greenfield, Ind. — Constructing three bridges to Greenfield Bridge and Sewer Co., Greenfield, Ind.

Huntington, Ind.—Constructing ten arch bridges, to I. J. Walker, Pennville, Ind.

Newcastle, Ind.—Construction of steel and concrete bridges in Adams county, to E. J. & H. S. Burke, at Newcastle, Ind., $4,448.

Rockport, Ind.—Contract for 25 bridges in Spencer county awarded to following contractors: Vincennes Bridge Co., Vincennes, Ind.; A. L. Greenburg Co., Greensburg, Ind.; Haines & Kinman, Evansville, Ind.

Cedar Rapids, Ia.—Constructing a 6 span concrete bridge on 3d ave., over Cedar river, and reconstructing the present 3d ave. bridge on 8th ave., to B. J. Sweatt, Boone, Ia.

Louisville, Ky.—Construction of steel viaduct, to Grainger & Co., of Louisville, for $800,000; concrete work, to B. D. Milner & Sons, Louisville, Ky.

Kansas City, Mo.—Construction of Fifth st. bridge, to Western Bridge Co., Harrisonville, Mo., for $9,400.

Bronxville, N. Y.—Construction of 2-arch bridge, to O'Rourke Construction Co., Yonkers, N. Y., for $9,227; construction of bridge, to E. J. Boyle & Co., N. Y., $7,742.

Falconer, N. Y.—Contract for 2 bridges on S. Wood st., to F. P. Benson & Co., of Falconer, $7,886; contract for E. Main st. bridge, to G. P. Holcomb, of Kennedy, $6,500.

Petersburg, N. Y.—Constructing 85-ft. span reinforced concrete arch bridge across Little Hoosick river, to Cole-Mortland Co., White Creek, N. Y., for $2,700.

Canton, O. — Construction of small bridges, to Peter Hahn & Son, of Canton.

Findlay, O. — Contract for county bridges, to Ebbington & Burnett, Findlay.

Hamilton, O.—Construction of small bridges, to the following-named contractors: P. F. Brace, J. P. Guillaume, B. E. Snider, all of Hamilton.

Youngstown, O.—Construction of bridge over reservoir, to Hunter Construction Co., Youngstown, O.

Pittsburg, Pa.—Contract for Larimer ave. bridge to Booth & Flynn, for $139,-922.

Reading, Pa.—Mohnton bridge No. 1, to Carl R. Camp, Montrose, $5,461; Borgners bridge No. 1, to Willauer & Co., of Pottstown, Pa., for $7,399; Borgners bridge No. 2, to Nelson, Meredyth & Co., of Chambersburg, Pa., for $6,560.

Reading, Pa.—Repairing various bridges, to Harry A. Gernert and James M. Smith, and L. H. Fothe & Sons, of Reading, Pa.

Yardley, Pa.—Construction of concrete bridge across Delaware river, to S. M. Talbot Co., New York City.

Yankton, S. D.—Constructing a steel bridge over Rhine creek at Walnut st., to Ellerman & McLain, Yankton, S. D., for $4,295.

Bristol, Tenn.—Construction of steel bridge over Sinking creek, to Morris Gope, of Chattanooga, Tenn.

Memphis, Tenn.—Constructing a steel bridge to Memphis Bridge Co., Memphis, Tenn., for $2,500.

Fredericksburg, Va.—Constructing a steel bridge 35 ft. long, with 12-ft. roadway, superstructure to be of concrete, to Roanoke Bridge Co., Roanoke, Va.

Richmond, Va.—Construction of new bridge, to I. J. Smith & Co., Richmond, Va., for $232,061.

Roanoke, Va.—Constructing a steel bridge, 35 ft. long, with 12-ft. roadway, to E. C. Woodward, Richmond, Va.

Seattle, Wash.—Constructing a steel bridge over 5th ave. at Yesler Way, to American Bridge Co., Seattle, Wash.

Superior, Wis.—Constructing a bridge over Nemody river, to Hennepin Bridge Co., Minneapolis, Minn., for $4,940.

STREET LIGHTING.

CONTEMPLATED WORK.

Decatur, Ala.—Contemplating the construction of an electric light plant. Cy. coun.

Gurdon, Ark.—City has granted a 30-year franchise to J. G. & J. E. Graham to erect an electric light and water plant.

Newport Beach, Cal.—Contemplating the construction of an electric light plant. L. S. Wilkinson, cy. clk.

Atlanta, Ga.—The installation of ornamental lights on Pryor st. is contemplated.

Colquitt, Ga.—A $22,000 bond issue for erection of electric light plant has been voted.

Fairburn, Ga.—A $10,000 bond issue for the construction of electric light plant has been voted.

Pelham, Ga.—This city has voted $25,-000 bonds for the extension of the water and light plants.

Garrett, Ind.—Contemplating enlarging the municipal electric light plant. Cy. coun.

Kendallville, Ind.—This city is contemplating the installation of a boulevard, with lighting system. George Hess, chr. light com.

Shoals, Ind.—Construction of electric light and power plant is contemplated. S. W. Bateman, cy. engr.

Quincy, Ill.—The installation of 64 ornamental lighting standards is contemplated. Robert Halbath, chr. of commerce com.

Redfield, Ia.—Contemplating the construction of an electric light plant.

Red Oak, Ia.—The city is contemplating the installation of ornamental street lights.

Escanaba, Mich.—A $40,000 bond issue for construction of a municipal light plant has been voted.

Duluth, Minn.—The city engineer has been instructed to prepare estimate of cost of electric light and power plant.

Newton, Miss.—Voted $11,000 bonds for the construction of an electric light plant. W. A. Gilmore, cy. clk.

Hastings, Neb.—A $120,000 bond issue for municipal lighting plant has been voted.

Rochester, N. Y.—The Rochester Railway and Light Co. has been directed to lay underground conduits on a number of streets.

Barberton, O.—Bids will be requested soon for lighting streets for term of years. Present contract expires on June 1st.

Sandusky, O.—The director of public service has been directed to advertise for bids for lighting the streets for a period beginning January 1, 1912, and ending December 31, 1913. Joseph Loth, Jr., clk. coun.

Zanesville, O.—This city is contemplating the erection of thirty electric lighting arches.

Helena, Okla.—A $10,000 bond issue for electric lighting plant has been voted. L. A. Ruley, town clk.

Eugene, Ore.—A $25,000 bond issue for installing pumping and lighting system has been voted.

Lock Haven, Pa.—The city is contemplating the installation of about 49 five lamp ornamental lighting standards. Henry Hipple, chairman, board of trade committee.

Newcastle, Pa.—City is considering the construction of $100,000 municipal electric light plant.

Bayfield, Wis.—Extensive improvements on the light plant are contemplated.

CONTRACTS TO BE LET.

Benicia, Cal.—May 3. Furnishing electric supplies for one year from June 30, 1911. Lieut-Col. J. W. Benett.

Winnipeg, Man., Can.—May 1, 11 a. m. Furnishing ornamental lighting standards. Magnus Robertson, secy. board of public works.

CONTRACTS AWARDED.

Escondido, Cal.—Contract for lighting city streets with 60 arc lamp for a period of five years, to Escondido Utilities Co.

Jacksonville, Fla.—The following contracts have been let for machinery in electric light power station; boilers to Babcock & Wilcox Co., New York, $39,384; two 1600 kw. turbo generators and two 100 kw. turbo exciters, to General Electric Co., of Schenectady, $54,650.

Key West, Fla.—Furnishing and maintaining tungsten lights for a term of three years, to Key West Electric Co.

Chicago, Ill.—High power generator and high tension transformer to Crocker-Wheeler Co., $24,900, and the W. A. Jackson Co., $17,492, respectively.

Columbia City, Ind.—Installing complete electric system, to Ft. Wayne Electric Co., Ft. Wayne, Ind.

Shreveport, Ill.—Lighting system for a term of five years to Shreveport Railway & Light Co., arc light, $67 per year; boulevard lights, $36 per pole.

Richmond, Ind.—Engines and generator equipment for municipal electric light plant, Hooven, Owens, Rentschler Co., Hamilton, O., $8,260.

Adair, Ia.—Constructing a combined electric light and water works plant, to Des Moines Bridge and Iron Co., Des Moines, Ia., $23,460.

W. Sioux City, Ia.—Contract for a municipal electric light and power plant, to C. E. Hekinson, Sioux City, $9,900.

Webster City, Ia.—Erecting new city electric light and power plant, to C. E. Atkinson, Webster City, Ia., $9,897.

Carlisle, Ky.—The Carlisle Electric Light and Power Co., has been given contract for lighting streets for a term of years.

Frankfort, Ky.—The city has contracted with the Capitol Gas and Electric Light Co. for street lighting for a term of twelve years.

Salem, Mass.—Lighting streets for a term of years to Salem Lighting Co.

Eveleth, Minn.—Furnishing and installing ornamental street lights, to John S. Swanson, Duluth, Minn., $4,796.

Auburn, N. Y.—Furnishing and maintaining 35 ornamental lamps for a period of ten years, to Auburn Light, Heat & Power Co.

Auburn, N. Y.—Construction of fibre conduit on E. Genesee street, to Brayer Bros., Auburn, N. Y., $26,285.

Cincinnati, O.—Contract for street lighting for a period of ten years, to Union Gas and Electric Co.

Franklin, Pa.—Contract for lighting city streets for a term of 9 years to Franklin Electric Co.

Seattle, Wash.—Constructing cluster lights on 3rd ave., etc., to R. E. Downie, Seattle, Wash.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Palo Alto, Cal.—A bond issue of $50,500 for the purpose of building auxiliary pumping station, garbage destroyer, concrete water works building, an automobile fire engine, and steam condensor and water cooling tower, has been voted.

Wilmington, Del.—A new crematory will be built to replace the one that was burned recently. Wilmington Sanitary Co. E. H. Woodward, secy.

Rochester, N. Y.—Construction of an incinerator to Decarie Incinerator Co., Minneapolis, $82,950.

Lorain, O.—The director of public service has been authorized to advertise for bids for collecting and disposing of city garbage.

Salem, O.—L. E. Chapin, of Canton, O., has been retained to prepare plans for new garbage disposal plant to cost about $50,000.

McKees Rocks, Pa.—A special committee has been named by the council to inspect garbage disposal plants and report to the council.

CONTRACTS TO BE LET.

Washington, D. C.—Furnishing 30 one horse two wheel carts for street cleaning department. Property clerk, 320 District Bldg.

Batavia, N. Y.—May 16, 10 a. m. Constructing Imhoff settling tank, sprinkling filters, and pludge drying beds. Certified check 5 per cent. Hering & Fuller, 170 Broadway, New York, engrs. John H. Wood, clk. bd. of sewer com.

Buffalo, N. Y.—May 6, 11 a. m. Building foundations for 40-ton Heenen-Froude, 3-grade destructor; boiler, hot air duct, flue and blower; removing present Morse-Boulger destructor; placing 125 h. p. Geary water tube boiler and building setting. Certified check 50 per cent. Sanford G. Ward, com., 5 Municipal Bldg.

Toledo, O.—May 3, 12 m. Furnishing two flushing wagons for street cleaning purposes. Certified check, $100. Fred Shane, secy., director of public service.

Erie, Pa.—May 8, 8 p. m. Construction of an incinerator plant. Certified check 10 per cent. B. E. Briggs, cy. engr. Chas. C. Brown, consult. engr. Indianapolis, Ind.

CONTRACTS AWARDED.

Troy, N. Y.—Disposal of city garbage for two years, to Zeph. F. Magill, Troy, N. Y., $1,000 per month.

Tiffin, O.—Collecting city garbage for one year, to Albert Shultz, Tiffin, O., $1,090.

Carnegie, Pa.—Garbage collection to W. H. Proffer, for 3 years, $4,200.

Lancaster, Pa.—Contract for the garbage disposal for one year with the privilege of 4, to the Conestoga Garbage Co., Lancaster, Pa., $8,888.

FIRE APPARATUS.

CONTEMPLATED WORK.

Lodi, Cal.—City is contemplating the purchase of automobile wagon and other equipment.

Los Angeles, Cal.—Council has been asked to appropriate money for 6 new ladder trucks, 6 auto pumping engines and 6 chassis for hose work. In addition $165,000 will be expended in fire alarm and police telegraph systems.

Palo Alto, Cal.—A bond issue of $50,500 for the purpose of building an auxiliary pumping station, garbage destroyer, concrete water works building, an automobile fire engine and steam condenser and water cooling tower, has been voted.

San Francisco, Cal.—Contemplating the purchase of 6 auto chemical engines, 1,000 ft. 3½-in. fire hose for fireboats, and 3 auto trucks.

Denver, Colo.—One horse drawn steam fire engine and two auto fire trucks will be purchased. B. F. Owens.

Havana, Ga.—A fire alarm system is being extended to Ballantyne.

Murphysboro, Ill.—This city is contemplating the purchase of 40 gallon chemical engine. J. L. Schmidvall, mayor.

Mishawaka, Ind.—City will purchase an American La France auto combination chemical truck.

Lewiston, Me.—The purchase of an auto truck is contemplated.

Milford, Mass.—The city is contemplating the purchase of an automobile fire truck. Fire chief Crockett.

Palmer, Mass.—The city will buy an auto fire truck. W. H. Holbrook, Palmer, Mass.

South Farmingham, Mass.—The purchase of an auto chemical engine and an auto combination chemical wagon is contemplated.

Springfield, Mass.—The city is contemplating the purchase of auto apparatus.

Whately, Mass.—Contemplating the purchase of a fire engine.

Iron River, Mich.—The purchase of a combination hose and chemical wagon is contemplated. Chas. McFarland.

Pewamo, Mich.—The purchase of a chemical engine is contemplated.

Saginaw, Mich.—The city is contemplating auto fire engine. B. G. Appleby, secy. real estate board.

Springfield, Mo.—Contemplating the purchase of an auto combination chemical wagon.

Columbus, Neb.—The purchase of an auto is contemplated.

Hollis, N. H.—Contemplating the purchase of a chemical engine.

Hempstead, N. H.—Contemplating the purchase of a chemical engine.

Succasunna, N. J.—This city is contemplating the purchase of chemical engine. E. C. Harvey.

Delmar, N. Y.—The purchase of two chemical enginees is contemplated.

Port Chester, N. Y.—A $100,000 sewage disposal plant is contemplated. B. O. Frederick, pres. bd. of trus.

Tarboro, N. C.—The purchase of fire equipment is contemplated. M. W. Haynes.

Cincinnati, O.—Extension of fire limits will require purchase of two hose wagns and one auto chemical wagon enginee. Archibald.

Lorain, O.—The city is contemplating the purchase of auto apparatus.

Beggs, Okla.—City is considering the purchase of a gasoline fire engine and 500 ft. of hose.

Medford, Ore.—City is contemplating purchase of automobile equipment. F. H. Cowles.

Easton, Pa.—City is contemplating the purchase of motor chemical and hose wagon, scaling ladder, 500 feet of hose, etc. Chief Ricker.

Lewiston, Pa.—Contemplating the purchase of fire hose and equipment.

Millersville, Pa.—City will purchase automobile engine and other apparatus. H. T. Short, chairman council committee.

Washington, Pa.—The purchase of an auto hose truck is contemplated. Patrick Curran, fire chief.

Camden, S. C.—The purchase of an auto hose wagon is contemplated.

St. Albans, Vt.—The city is contemplating the purchase of a combination chemical truck, auto propelled.

Moundsville, W. Va.—The city is contemplating the purchase of an auto fire truck.

CONTRACTS TO BE LET.

Washington, D. C.—May 1, 2 p. m. Furnishing motor car for fire department as noted in Bulletin of April 15. Property clerk, 320 District Bldg.

Princeton, N. J.—July 5. Furnishing automobile propelled pumping engine. E. M. Updike.

CONTRACTS AWARDED.

Los Angeles, Cal.—The city has purchased 5 pieces of auto propelled apparatus from the Seagrave Co., Columbus, O.

Lexington, Ky.—Furnishing triple combination hose wagon, to Knox Automobile Co., Springfield, Mass., $8,600; combination chemical and hose wagon, to Knox Automobile Co., $5,600.

Long Branch, N. J.—Furnishing auto propelled fire engine, to American La France Fire Engien Co., Elmira, N. Y., $4,700.

Mt. Vernon, N. Y.—Furnishing two heavy fire engine tenders, to Combination Ladder Co., Mt. Vernon, N. Y., $1,800.

Chester, Pa.—Installing fire alarm system, to Gamewell Co., 19 Barclay St., New York, N. Y., $14,860.

Nashville, Tenn.—Installing fire alarm system, to Gamewell Fire Alarm Telegraph Co., New York; hose wagon, to Seagrave Co., Columbus, O.

Tacoma, Wash.—Contract for furnishing 25 electric fire alarm boxes to Gamewell Fire Alarm Telegraph Co., 19 Barclay St., New York City.

TOO LATE FOR CLASSIFICATION

Concord, Cal.—A bond issue of $29,000 for sewer construction has been voted. Sloan & Robson. San Francisco, Cal., engrs.

Charles City, Ia.—Contract for Fifth ave. sewer to R. C. de la Hunt, Cedar Rapids, Ia.

Municipal Engineering

VOLUME XL — JUNE, NINETEEN HUNDRED ELEVEN — NUMBER SIX

Contracting Practice

By DeWitt V. Moore, M. Am. Soc. Eng. Contr., Indianapolis, Ind.

Discussion of Classification

THERE may be other ways or methods as good or, better than those suggested by the writer; but any such system is good only so far as it recognizes the close relationship existing between estimating, construction and final analysis.

A carefully prepared estimate on work not secured is not valueless but instead should be preserved and indexed to form a part of the contractor's or estimator's personal files. In addition such estimates should be summarized and compared with each other and with those estimates where the job has been actually constructed. Such a comparison cannot help but be of benefit; first, in emphasizing the fact that the characteristics and individuality of every job require special consideration, thereby disabusing the mind of the idea that any fixed or lumped sum unit prices can be used indiscriminately; second, by the development of a greater estimating ability and by the correction of preconceived ideas of estimating, which are modified by experience in those estimates which have gone through actual construction. A comparison of this kind is just as properly a part of analysis as the cost records of any particular job, and, in addition, the tendency, if this plan is carried out, is to build up the cost analysis turn of mind, so that the same becomes almost instinctive.

Suppose the job is secured, then this estimate, if it had been made in detail, is of still more value, for future comparison, in as much as the opportunity is afforded of checking the detail items during the progress of the construction. The resulting final cost analysis is truly an analysis, rather than a mere collection of cost records. In other words, the estimate may be more properly designated as a preliminary plan of attack, to be followed later by the filling in of details secured during construction, until we have the final completed picture framed and brought out by the final analysis.

Before entering upon the discussion under the divisions suggested in the first installment in the May issue, it is probably well to set forth in a condensed form, the logical steps by which the work advances from the time of the estimate until the time of the final analysis.

These steps of course, are included in the primary divisions of estimating, construction and analysis, and cover a wide field of work. Their ramifications through these divisions and subdivisions, sidelights and related subjects will be considered consecutively in their proper order, but so that the reader may have before him in the beginning, in a general way, this idea of a systematic sequence of thought and operation, we submit the following schedule:

(In the subject matter following the designations given the operations in this schedule will be used, perhaps sometimes at the sacrifice of an apparently connective thought, but as we are writing for a definite purpose, we will adopt this form as it will serve to emphasize this system.)

Estimating—

First—"Outline of work."
Second—"Scheme of operation."
Third—"Itemized quantity estimate."
Fourth—"Itemized cost estimate."

Construction—

Fifth—"Labor cost distribution."
Sixth—"Progress by sections."
Seventh—"Labor Cost Bookkeeping."
Eighth—"Material Cost Bookkeeping."

Analysis—

Ninth—"Analytical Progress Estimates."

Tenth—"Analytical Progress Estimates."

Eleventh—"Progressive Comparative Charts."

Twelfth—"Final Cost Analysis."

It will be noted that by this schedule the work proceeds in natural sequence from beginning to end. The outline covered by this schedule should be carried out by proper forms of printed blanks. It may be necessary, in large work to have a different form printed for each, but in the case of smaller work, or where the contractor is confining his operations to a special definite line, the schedule can be reduced by the combination of a number of the necessary forms in one general blank, although the order of thought or use of these blanks should not be disturbed. In the succeeding subject-matter illustrations will be given of the preparation of forms for each item and also for combinations.

In outlining the above schedule and attempting to follow the same as "sign posts" on our way we are really emphasizing at this time that part of the subject which was given minor consideration in our preface in the May issue, but in order that we may have order in our thought and have in our mind at all times the route by which we expect to reach our objective point, this schedule is first offered.

In order that we may impress the idea of the connection of our principal divisions with their secondaries and tertiaries, attention is called to the accompanying chart Plate I showing the relations existing. It might be said that the principles cover the whole line of thought and naturally this is true to a certain extent, but the thought is too broad to be given proper consideration without further division.

The divisions to be made are evident. On the one hand we have the physical forces to overcome and be controlled and on the other hand we have the forces wherewith this is to be accomplished. These secondary or physical forces and tertiary or operative forces, are again subdivided into all the operations, methods, forms of blanks used, reports made and all that goes to make up a complete contracting organization.

The line of thought connecting the original estimate, the construction and the final analysis is so intimate that we are prompted to again and again call attention to the same. In the writer's opinion there has not yet been suggested a proper definition as to what analysis really is, that is with reference to the use of the word in connection with contracting operations. The Century Dictionary and March's Thesaurus give us the following definitions of analysis:

"1. Resolution (a) Meaning the separation into component parts.

(b) Dissections, that is, the cutting to pieces for examination.

(c) Dissolution, meaning the process of breaking into parts.

2. Digest. That which is worked over, classified and arranged.

3. Investigation.

4. Numbering.

5. Organization. The constitution into parts having a special relation.

(a) Reason, or the Art of Reasoning; or the Process of drawing conclusions from the premises stated.

6. Ratiocination (b) Consectary reasoning, as opposed to instinct, which is to judge by intuition.

(c) The necessity of reasoning, or probable reasoning, or the great principle of order thinking, cataloguing the accumulation of knowledge, putting us in shape to correct our own mistakes (Century)."

This latter definition or synonym for analysis as given by the "Century" is a beautiful thought, and will bear reading more than once. Unless we have a clean cut definition of just what we mean in contracting practice for the world analysis, we cannot all be working to the same end. This definition must be in a very concise form. It is for this reason that we now propose the following definitions which after much thought and mature deliberation seem to best qualify this idea, viz.:

First—Estimate: "The Original Analysis."

Second—Construction: "The Actual Experience."

Third—Analysis: "The Final Estimate."

What is an estimate? It cannot properly be said to be any more than an analysis of the conditions considered with reference to past training and experience. Therefore an estimate is an analysis. The actual construction is a verification or modification of previous ideas. The final analysis is a final estimate for the purpose of obtaining a better, more extended, more experienced, better balanced consideration of future propositions.

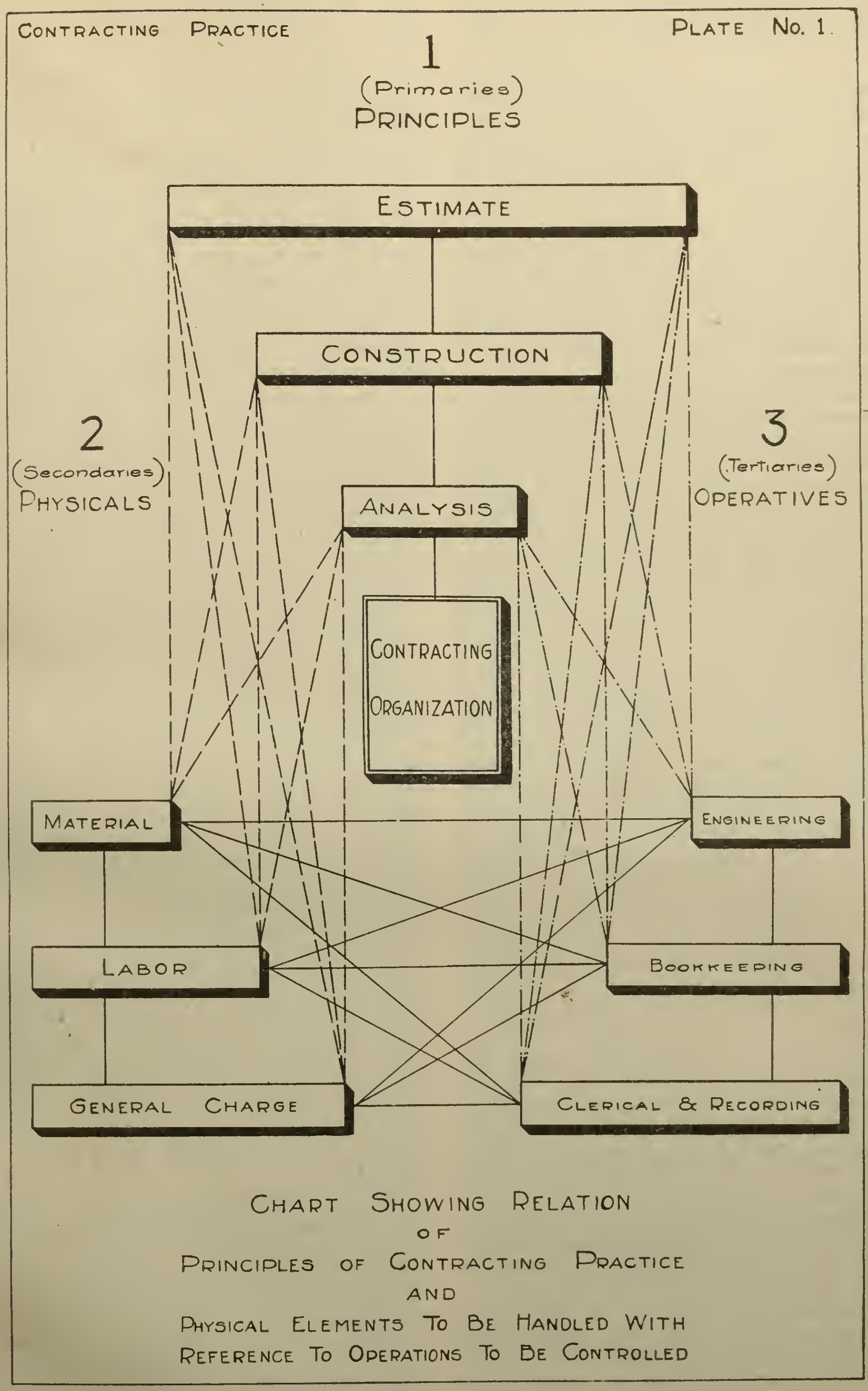


PLATE I. CONTRACTING PRACTICE.

In our final analysis we must go back to our first estimate analysis and follow the same general line of procedure or we lose the benefit of consectary reasoning. In the next estimate we prepare, we base our conclusions upon past experience and anticipate a more perfect preliminary analysis, just so far as we have profited by the deficiencies in our past estimates and experiences.

Construction is therefore an intermediate process or period of educational value during which we reap benefits, not alone in dollars, but in the building up of experience as a connecting link between the past and the future.

Cost analysis is not a question of any particular style of form used for collection of cost data, and those forms suggested in succeeding articles are not to be so taken. Analysis is an intelligent systematic order of thought, followed by an executive as he plans his work, dictates how reports shall be made and compares results. It is not to be confused with merely the preparation or use of blank forms, which is purely a clerical operation. Forms for reports and bookkeeping which have been prompted by analysis are of value, but the danger is in the suggestion of such forms for indiscriminate use. Some will copy such forms for use on their own work, when in reality they may not be at all proper, and where the originator of such forms, being a man of analysis, would have prepared something entirely different.

We again desire to say that this series of articles deals with principles and throughout we shall attempt to caution against the use by *copying* of any forms, tables, charts or costs given.

We hope to encourage initiative, imagination and originality, and discourage imitation and transcription.

The principals or primaries of contracting practice are three in number: the estimate, the construction and the analysis. These primary divisions are influenced and directly connected with two main subsidiary divisions of three each, viz.: the physicals or secondaries and the operatives or tertiaries.

The first division, or the primaries, pertains strictly to the organization of contracting practice. The second division, or secondaries, pertains to the actual materials and labor on the work, together with the items of general charge for fuel and oil, fittings and repairs, petty tools, bond and insurance and general expense. These latter items are as true a part of the cost of the work as the actual material entering into the job, although they may be considered in the nature of supplies or accessories to the actual construction. The material charge carries with it a certain amount of what we may term indirect labor necessary for the delivery of the material f. o. b. the job. The third division, or tertiaries, consists of the contractor's own work or the work of his office force along the line of engineering or planning, bookkeeping and clerical work to secure analysis. Let it be understood that in order to carry out our suggestion it is not necessary that any office be departmentalized and conducted on an elaborate scale. Each and every one of the operative divisions in minor practice can be actually conducted and performed by the contractor himself and the same resulting system will be accomplished. Such a contractor will be his own engineer in the planning and estimating of the work, he may also be his own superintendent and foreman during construction, and he is certainly going to be his own analysis man, when the work is completed.

By proper consideration of the intimate association of the principals and operatives shown graphically in our chart, Plate I, a proper idea will be gained of the efficiency of organization. Each and every one of the principals is directly concerned with each and every one of the three divisions under physicals and operatives, and in addition the physicals and operatives are dependent one upon the other.

It only requires a moment's thought to realize that each and every line connecting these various divisions represents a distinct systematic line of thought, and that in the aggregate these principal connectives amount to fifty-four different view points, which we may term mental analysis. To this must be added the many divisions of different classes under each main division.

This is not complicated or complex and in reality is no more than the ordinary unconscious working of the mind of any successful contractor, but when it comes to the securing of uniformity, that can only be obtained by setting forth a definite condensed chart or picture, which, if studied and memorized, will be always in mind, and constitutes a safeguard.

The Estimate, Construction and the Analysis must each consider Material, Labor and General Charges, but each from a different association, viz.: Future, Present and Past. The same is true of Engineering, Bookkeeping and Clerical work. Take the last division of the Operatives viz: Clerical. If properly conducted this division must consider the original estimate, the actual construction and the final analysis and must compare the same; it must consider material, labor and general charges with reference to what was estimated and what was actually used, and analyze the differences; it is also directly dependent upon the engineering and bookkeeping records in its own operative class for a consistent harmonious, co-operative working. This thought contemplates that engineering for the purpose of this article refers to any method whereby are obtained reports as to the quantity of work done or estimated, and bookkeeping, for the purpose of this article, is the distribution of money actually expended. The clerical organization, is therefore, for the purpose of this article, the analysis man, although in actual practice he may be the engineer, the bookkeeper, or the contractor himself.

The physicals would appear easy of separation and directly dependent upon the work to be estimated, but it is only by the closest possible unification of action of the operatives that this result is actually accomplished. Materials sometimes include labor, inasmuch as the material charge against the work is the cost as delivered on the job. It would be wrong to include such a labor charge in the labor cost distribution of handling this material at the job. Two jobs exactly similar, where the labor distribution should vary but slightly, may be so located that the labor cost of delivery of materials to the one job located on a railroad siding, is nothing, whereas the other job, located at a long distance requiring hauling, may double the labor cost. Labor sometimes includes material or general charge items, as for instance, where a subcontract is made for the furnishing of labor, but where the subcontractor furnishes the minor materials or supplies necessary for the manipulation for his class of work.

It therefore rests with the contracting organization so to train the operatives that they will have constantly in mind the principal divisions of contracting practice, with a view of so carefully watching and separating and distributing the cost of material and labor and general charges that analysis may be facilitated. When this is done, and the carefulness that is required is engendered, then, the every day work is more satisfactory and profits are increased during the construction period and future estimates are more reliable.

In opening this discussion twelve different operations in the way of a schedule are proposed, these being divided into four each, under the principal divisions of contracting practice as shown by Plate I. We must have this chart thoroughly in mind before we can proceed to the practical application in the way of forms and methods as outlined in our schedule, we must also keep in mind that in this schedule each of the twelve steps under-laps and forms a foundation for the next succeeding step. This schedule does not list all of the forms which are in every day use during construction period, such as are required for pay rolls, discharge checks, requisitions, delivery invoices, etc., etc., all of which are necessary to the proper development of the schedule, but which are really subordinate, inasmuch as they constitute only methods in the development of the system.

The next article will take up the "Outline of Work," and also possibly the "Scheme of Operation" inasmuch as these two steps are so closely connected. This line of thought will be carried through the principal divisions, Estimate, Construction and Analysis, showing the practical value during construction of the detail work of the estimate and also showing its necessity in the analysis. This program will demand numerous illustrations of blank forms and layout plans adaptable for various kinds of construction.

In order that some attempt may be made to keep this matter in its general arrangement in a definite order, a general description will be given in the nature of a preface and the blank forms and layout plans will be grouped and arranged in their proper relation for different classes of work without any intervening text, other than explanatory notes.

One of the most important considerations in the making of any estimate and conducting of construction with the idea of future analysis in prospect is to divide the job into sections, and, inasmuch this thought is really the key to the whole subject of analysis, this additional idea must be carried in mind throughout the entire series of articles. Any job of any size possesses a certain individuality of the various sections within its own limits, and general averages applied to the job as a whole are misleading.

The "Outline of Work" and "Scheme of Operation" will provide for just such sectional divisions, and actual conditions will be given to prove that such sections are the first requisite in the estimate analysis and the analysis estimate.

The Water Works of Danville, Ill.

THE present water works system of Danville, Illinois, is the result of a gradual evolution to meet the growth and needs of the city. The original plant was constructed in 1883 when Danville was a town of about 9,000. In 1902, improvements and additions were added under the supervision of D. W. Mead, consulting engineer. Further improvements are at present nearing completion, a portion of which were made under specifications of Mr. Mead. The changes have in both cases, been merely the enlarging and developing of the system with no essential change in the plan of collection or distribution.

The water supply is derived from the north branch of the Vermillion river at a point about two miles above the city; a dam being constructed across the river to form an impounding reservoir. This dam has been twice rebuilt as need for a larger capacity of reservoir or other conditions have required. The original dam was a low timber structure, but as it was found possible to use water impounded as a source of power, a concrete dam with a spillway extending the full width of the river was constructed. This dam had a height of eight feet as compared to four feet in the case of the timber dam.

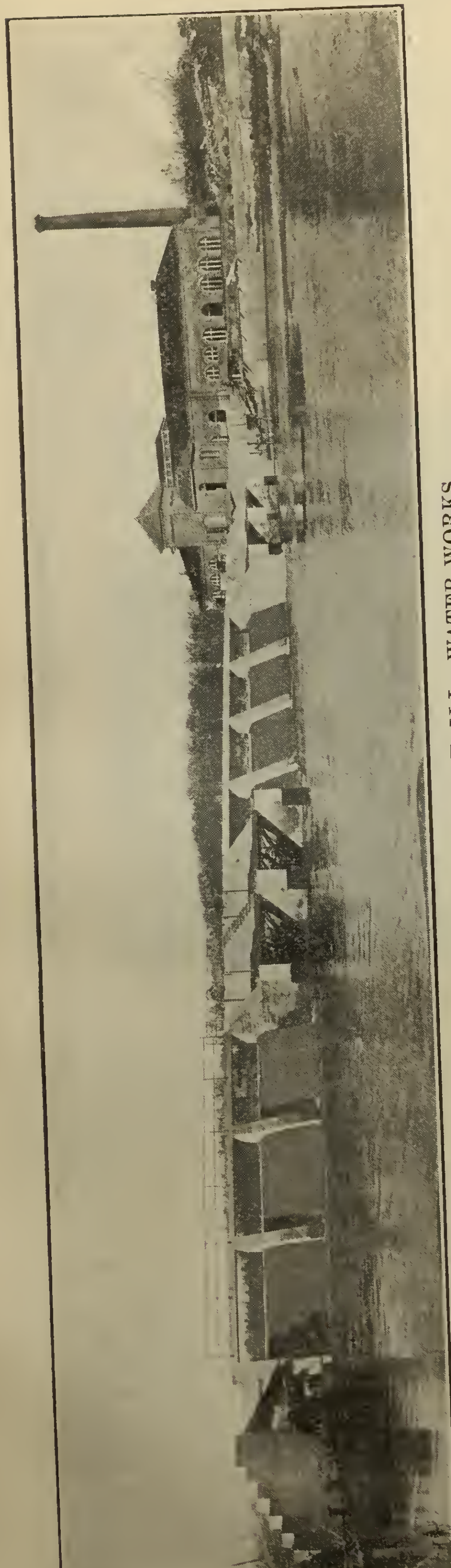
Improvements to this concrete dam have just been completed, so that the completed structure is as shown in the accompanying photograph. The length over all is 236 feet between wing walls. The old dam was removed at the points shown to allow the placing of the Tainter gates. At all other points along the dam, the new portion was built on the original concrete in the manner shown in the accompanying cross section. As will be noted, buttresses were provided and a walk built along the entire length of the dam. This walk serves a double purpose, for in addition to allowing easy access to all portions of the structure, the height of the dam may be raised by placing flash boards against it. This is accomplished by placing oak needles in the notch provided for them in the up stream side of the dam and resting at their upper ends against the walk. The design is such as to allow of this, should it be desired to obtain additional head for the hydraulic turbines or additional storage capacity.

The fact that considerable trouble had been experienced due to ice forming above the dam made it necessary to provide the Tainter gates shown in the drawing. These gates, of which there are four, are constructed of steel shapes. They are pivoted at the down stream side and are raised and lowered by means of chains. A tight joint is provided between the gate and the concrete sidewalks, by means of strips of rubber packing bolted on the face of the gate in such a manner as to give an L-shaped section with the concave surface upstream. During the time when the ice is "breaking up" the Tainter gates are operated to relieve the pressure against the face of the dam.

As is required by the state law of Illinois, a fishway is provided as is shown at the extreme left of the photograph. A series of vertical baffles regulate the flow of the water so that it is possible for fish to pass upstream through the dam.

When the plant was rebuilt in 1902, it was found possible to utilize the surplus flow of the stream to operate the low lift pumps. At that time one Victor 33-horse power vertical turbine was installed in a penstock at the side of the dam nearest the station. Now that the dam has been raised and because of the proven efficiency of the original plan, an additional unit has been installed.

The new turbine is a 34-inch New American turbine delivering 78 horse power under a head of 10 feet. Vertical shafting connecting by gears to horizontal shafting and thence by rope drive to the shaft driving the low lift pumps, transmits the power from the turbines. Suitable gears are provided so that each turbine develops 300 r. p. m. on the same horizontal shaft. The rope drive, which is about 125 feet in length, delivers at the shaft in the pump room 85 horse power of the 110 combined turbine horse power. The



CONCRETE DAM OF DANVILLE, ILL., WATER WORKS.

low lift and filter-washing pumps are operated by this power or by steam power at such times as there is not a surplus of water.

The water is drawn from the river by either of two centrifugal pumps located in the filter room of the pumping station, and is pumped into two coagulating basins, whence it flows to the filters by gravity.

The water of the North Vermillion is of very good quality as regards purity, but it possesses a turbidity which is greater than the water of the Mississippi river. The drainage basin includes about 267 square miles, and in this area there are only two small towns; the nearest being a town of about 2,000 population situated twenty-five miles above the pumping station. There was therefore no urgent need for filtering or purifying the water on account of sewage pollution. But with a view to reducing the turbidity a rapid sand filter was installed.

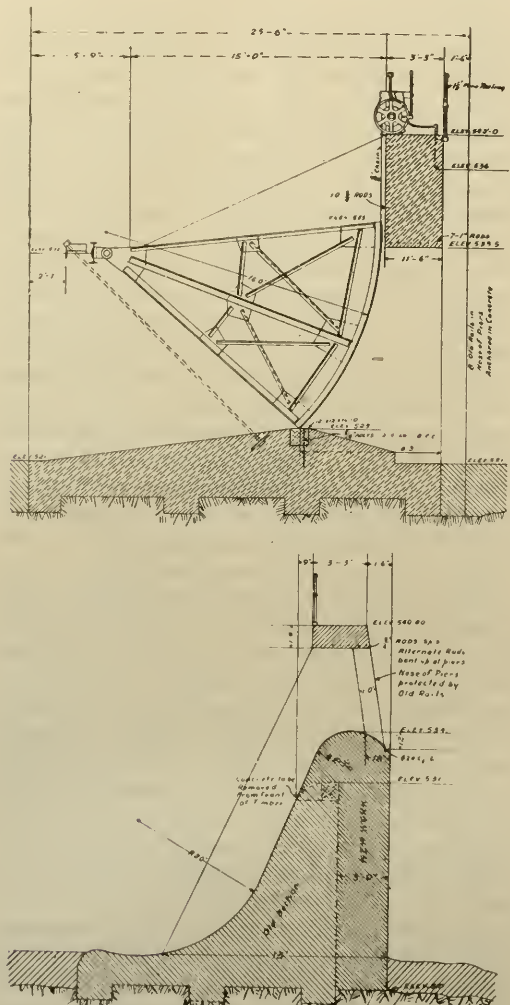
As originally built in 1902, eight basins were built, though only six were in operation. The increase in pumpage has made necessary the equipping of one other unit so that seven are now in operation. Sulphate of iron and lime are used as a coagulant.

The method of using the lime and iron is unique and admirably adapted to the purposes of a water plant of this size. The chemicals are mixed separately in concrete tanks beneath the floor of the filter room. From these mixing tanks they are elevated by pumps attached to the shaft, which is operated either by the hydraulic turbines or by a steam engine, to tanks placed about twenty feet above the level of the floor. Overflow pipes from these tanks maintain a constant level so that a uniform head is maintained. The quantity of discharge from the tanks is regulated by a device consisting of a plate with a number of circular openings of different diameters. By turning these plates an area of discharge may be obtained which is suited to the needs, depending on the degree of turbidity. The iron solution is added on the discharge side of low lift pumps and the lime solution is forced into the water at the point where the discharge pipe passes out of the station to the coagulation basin.

The coagulation basins, two in number, are circular, 35 feet in diameter and 20 feet deep. They are provided with baffle boards and are so designed as to allow about two hours for the passage of the water through them.

From these basins the water passes by gravity to the filter beds.

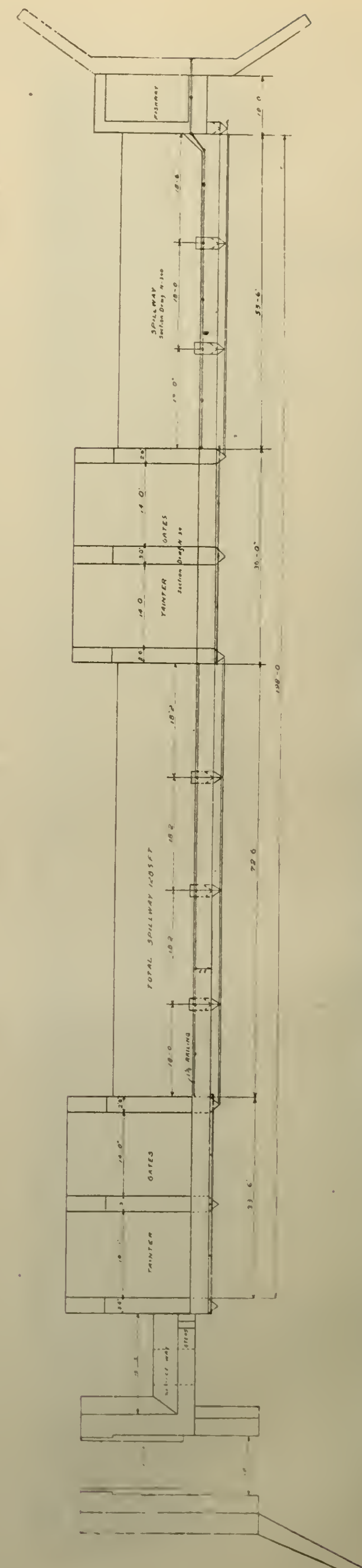
The sand filter beds are each 25 feet by 10 feet by 8 feet in depth. Extending entirely around them are iron troughs 12 inches wide by 18 inches deep, through which the water is supplied in such a manner as to prevent stirring the sand. They also allow of the wash water being removed without losing any of the sand in the beds.



DANVILLE, ILL., WATER WORKS.

Upper—Section of Tainter Dam.
Lower—Section of Dam, Showing Old Section; Addition to form New Section; Walk, and Flash Boards.

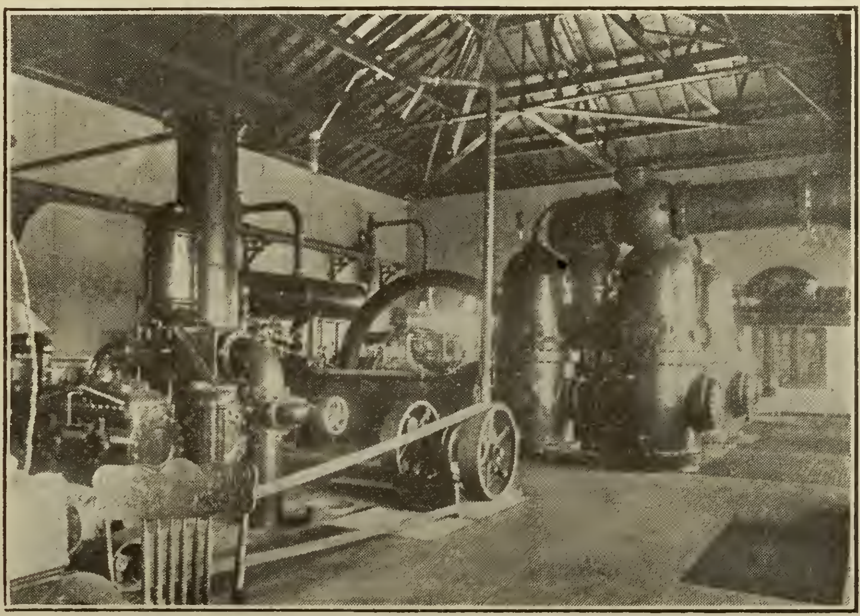
The sand is about 4 feet in depth, allowing about 3 feet depth of water over the entire surface. The water enters through the trough around the edge of the tank and passes down through the sand to the bottom. The system for collection and removal consists of an 8-inch manifold drain pipe running the length of the bed, from which 2-inch pipes branch out at intervals of 6 inches. Along these pipes are placed small circular brass strainers set at intervals of 6 inches. From



PLAN OF DAM, DANVILLE, ILL., WATER WORKS.

the main pipe or header, the water passes through the clear water pipe into a clear well which is connected with a smaller suction well.

The level of the water in the filter is controlled by means of a butterfly valve and float, and the outlet is controlled by a Weston regulator, which throttles the outlet so as to maintain a uniform rate of filtration. Gauges which record the loss of head in the filters, due to their clogging with sediment, and indicating when washing is needed, are attached to the discharge pipes leading from each of the filter beds. In making these tests, the number of bacteria in the raw water were counted, and then after it had been filtered another count was made; the difference between the number of bacteria in the raw water and that in the water as it came from the controllers, divided by the number of bacteria in the raw water, gives the percentage of efficiency of the filter. The average of efficiencies of the filter is about 98.1 per cent. The comparison of the rate at Danville with that in other cities of about the same size indicates that this is an exceptionally efficient system.



PUMPING STATION, DANVILLE, ILL., WATER WORKS.

The filters are washed from one to two or three times each twenty-four hours, depending on the degree of turbidity of the raw water. The process of washing consists merely in reversing the filter process. That is, water is pumped through the strainers and up through the sand bed, whence it overflows into the troughs along the side and is carried out into the river below the dam. During the washing the sand is agitated by air, which is introduced from a blower through an air pipe, from which it is distributed to the strainer pipes. The washing pumps and blower are operated from the same shaft as the low lift pumps, by power from the hydraulic turbines or steam engine.

The capacity of the filter plant is about 31,000 gallons per hour for each of the filter beds. Tests of filters to determine their efficiency have been made on several different occasions.

From the filters, the water flows by gravity into a pure water basin of 750,000 gallons capacity. This basin is circular, 110 feet in diameter and about 22 feet deep. The force pumps take suction from a suction well which is about 33 feet in diameter and 30 feet deep, being located about 5 feet below the level of the clear water basin. This suction well has an inlet direct from the filters, so that, if desired, water may be drawn direct from the filters without passing through the clear water basin.

The development of the plant has had a greater influence on the pumping equipment than on any other feature. The original plant consisted of two high-pressure Blake pumps of 1½ and 2½ million gallons capacity. Later a compound direct-acting, duplex Dean pump of 3,000,000 gallons capacity was added. In 1902, a 5,000,000-gallon horizontal, high-duty, cross-compound Snow pump was added. This pump is designed for fire pressure of 125 pounds and a domestic pressure of 100 pounds operating under a 125-pound steam pressure. The water pressure is controlled by means of a device which operates on the cut off of the high pressure cylinder, so as to maintain a constant water pressure. By means of a small valve this control may be regulated for either fire or domestic pressure as may be desired, and is provided with a safety device which acts automatically to prevent the speed exceeding a safe limit. An 8,000,000-gallon Snow pump similar to the 5,000,000-gallon pump was installed in 1908 and the two Snow pumps, used alternately, do the entire pumping service. They pump direct into the mains, of which there are two leading from the pumping station to the distributing system. The pumpage averages about 3,500,000 gallons per day, though at times, it reaches 4,300,000 gallons, and occasionally the pumpage is at the rate of 6 to 7 million gallons per 24 hours.

In the boiler rooms, units have been added as needed to keep pace with the development of the plant. One dutch-oven stoking device, a Hawley down-draft furnace, has been added, which provides for smoke consumption. As will be noted from the accompanying photograph, though operating under a full load no smoke is visible from the stack. Coal and ashes are handled by hand at the present time, though it is probable that improved coal-handling devices will be installed in the near future. There is now in process of erection a new 110-ton coal bunker to provide for storage. In addition to this storage house there is under construction a building to provide for storage of iron and lime, in which building a work shop, office and laboratory for the control of the filters will be included. The local conditions make this plan easy of execution, as there is a hill situated so that the coal may be hauled into the bunker at a level much above where it will be taken to be conveyed to the boilers.

Sewage Disposal With Respect to Offensive Odors

By George W. Fuller, M. Am. Soc. C. E., New York City

Putrefaction of Sewage

As has been indicated in connection with the oxidization of sewage it may be here stated that theoretically speaking organic matter may be reduced in several ways, as follows:

1. By direct chemical means.
2. By indirect chemical means.
3. By direct biological means.
4. By indirect biological means, such as through the aid of enzymes.

Brief reference will here be made to the manner in which putrefaction is accomplished, and special attention will be given to the products of putrefaction and the means of avoiding them.

DIRECT CHEMICAL REDUCTION.

The organic matter in sewage according to practical observation does not respond appreciably to chemical reducing agents. Thus hydrogen, for instance, released automatically as in the case of certain reducing fermentations, does not seem to affect measurably the organic matter in the liquid undergoing such fermentation.

INDIRECT CHEMICAL REDUCTION.

From the practical viewpoint, so far as now known, indirect chemical reduction cuts very little figure in sewage disposal operations. It may be that some chemical products of reducing decompositions may influence further decomposition of sewage, but it is believed that these relate to certain mineral salts rather than to compounds of an organic nature.

DIRECT BIOLOGICAL REDUCTION.

This is a large and important field which is full of significance in the operation of sewage disposal works. Our understanding of the subject has progressed quite slowly on account of its very complicated nature. It deals, of course, with the broad field of putrefaction, such as studied years ago by Pasteur in such a brilliant fashion in other fields of research.

We know that as soon as bacteria practically exhaust the oxygen in a sewage, there are plenty of kinds of bacteria that will proceed upon an anaerobic basis to reduce the organic matter to simpler compounds. The result of this represents a complex situation because, in addition to certain products of putrefaction that are quite well known, there are also left in the sewage other residual products about which our understanding is at present quite meagre.

Investigations made by the writer at the Lawrence Experiment Station and given in the report of the Massachusetts State Board of Health for 1894, page 461, indicate that the direct biological reduction of organic matter in sewage relates to dissolved organic matter more particularly than to suspended organic matter. Whether or not these Lawrence tests are representative of a wide range of conditions can scarcely be told from the available evidence. It is a point worth further study.

Cleavage products are characteristic of putrefaction through bacterial decomposition. Marsh gas or methane is, of course, a conspicuous product of the decomposition of vegetable matters as found in the ordinary mill pond, and, is likewise conspicuous in the decomposition of sewage. Some forms of carbonaceous matter, notably the carbo-hydrates, allow carbon-dioxide to appear as a cleavage product and so far as this end-product is concerned there is a similarity between oxidizing and reducing fermentations of organic matter. It is not this product, however, or such decomposition gases as marsh gas, nitrogen or hydrogen that is related to objectionable odors.

Hydrogen sulphite has the reputation of being the most malodorous product arising from the putrefaction of sewage. It is certainly the best known of the malodorous products and no doubt it deserves for the most part the reputation which it has received. While this product seems to separate as a cleavage product from the organic compounds containing sulphur, it likewise appears, as already indicated, to be characteristic both of oxidizing and reducing fermentations. Its appearance is obscured, however, in an oxidizing fermentation, on account of its being promptly oxidized.

Sulphureted hydrogen appears to come for the most part as a cleavage product from organic matter, yet in some of the most conspicuous instances of its development it appears to come in part as a result of the reduction of mineral sulphates. In other words, desulphurization through bacterial agencies may be a most important factor to be reckoned with. In some measure it is similar to the denitrification process as affected by bacterial agencies, although it is believed to be of much less frequent occurrence. It is not, however, these bacteria generally spoken of as sulphur bacteria which desulphurize the mineral sulphates. The true sulphur bacteria will live upon sulphureted hydrogen and oxidize it to metallic sulphur. On the other hand, there are several species of bacteria which are capable of reducing mineral sulphates to sulphites and some species which carry the bacteria to the sulphureted hydrogen stage. These are a class of bacteria about which more information is urgently needed.

It is not to be inferred that sulphureted hydrogen is the only objectionable product as to bad smells which arise from sewage decomposition. Although our knowledge is very meager as to other products they undoubtedly exist. Among such a list may be included mercaptan, indol, skatol, cadaverin, etc. It is highly desirable to have more definite information about these last-named products from the standpoint of their relation to objectionable smells.

Ordinarily, these products appear in the soluble rather than the gaseous state but this does not mean that they will not volatilize so as to make noticeable smells in the immediate neighborhood of disposal plants.

INDIRECT BIOLOGICAL REDUCTION.

There is no doubt that enzymes or the soluble ferments secreted by bacteria are an important factor in the reducing decomposition or putrefaction of organic matter in sewage. This is a wide field for laboratory men to investigate under the conditions found in practice. It relates, in fact, most intimately to the question of utilizing to best advantage the so-called septic process. It would appear, according to the writer's observations, that the time interval necessary to establish the septicization may be largely accounted for by the period required by the bacteria to produce the enzymes in sufficient quantity to effect a substantial decomposition of suspended organic matter. When these products become established, however, they proceed in a most active manner and accomplish the liquefaction of organic matter. It seems that these soluble ferments will do their work over and over again for some time without material exhaustion provided they can work in an environment where toxins or other antagonistic products do not arise through their own activities.

PRODUCTS OF PUTREFACTION IN THEIR RELATION TO OBJECTIONABLE SMELLS.

Of the soluble but easily volatile products of decomposition, such as mercaptan, indol and other compounds mentioned above, there is too little information now available to allow anything specific to be said on that score. But as regards the gaseous products of decomposition and especially sulphureted hydrogen there is considerable information that ought to be applied to sewage disposal plants in a somewhat more scientific and reliable manner than is frequently the case under present conditions of practice.

Brief mention will be made of some of these features in order to accentuate to the engineers their importance in practical undertakings as well as to suggest to the laboratory men that there is considerable important work for them to do in securing needed data for crystallizing our views as to the proper handling of these subjects.

In the first place, it will be well to point out some of the physical characteristics of those gases which are related to sewage decomposition, although sulphureted hydrogen is the only malodorous one of the group. A comparison of the characteristics of this gas, however, with others found in the decomposition of sewage will tend to accentuate the characteristics of the gases. Particularly, it is important to note the density and relative diffusive power of the gases and the volume and weight of the gases necessary for saturation under the different conditions of temperature and pressure. These features are brought out in the three following tables with respect to pure water, but without the influence of the several gases upon each other or of the impurities which are dissolved in the sewage, all of which are factors of importance and about which our knowledge is meager at present. Rapid strides, however, in physical chemistry in recent years ought to permit these questions to be solved without great difficulty, so as to facilitate the proper consideration of these features.

TABLE I.

TABULATION OF SOME PHYSICAL FEATURES OF THE GASES OF SEWAGE DECOMPOSITION.

Gas	Weight of One Liter (Grams).	Density.		Relative Diffusion (Air=1).	Note*
		Air=1.	Hydr.=1.		
Hydrogen	0.090	0.0626	1.00	3.83	...
Methane	0.716	0.554	7.97	1.34	...
Ammonia	0.762	0.762	8.59	1.29	7.13
Nitrogen	1.254	0.967	13.92	1.01	...
Oxygen	1.429	1.105	15.90	0.95	...
Hydrogen Sulphide	1.523	1.189	17.10	0.95	16.4
Carbon Dioxide	1.965	1.529	22.00	0.81	52.1

Note.—(*)=Vapor Tension in Atmosphere at 15° C. (Water Vapor= 0.017.)

TABLE II.

TABULATION SHOWING THE APPROXIMATE VOLUMES OF DIFFERENT GASES (PURE) OF SEWAGE DECOMPOSITION WHICH ARE REQUIRED TO SATURATE ONE VOLUME OF PURE WATER AT DIFFERENT TEMPERATURES AND PRESSURES.

Gas,	Atmospheric Pressure.		Pressure of 30 Feet of Water.	
	4° C.	15° C.	4° C.	15° C.
Hydrogen	.02064	.01883	.0405	.0365
Methane	.04985	.03874	.09065	.0751
Ammonia	941.9 (2)	727.2 (2)	......	.....
Nitrogen	.02130	.01682	.0413	.0326
Oxygen (1)	.04397	.03415	.0852	.0664
Hydrogen Sulphide	4.044	3.233	7.830	6.272
Carbon Dioxide	1.513	1.002	2.943	1.942

Notes.—(1) This is for pure oxygen, not atmospheric oxygen.
(2) Due to formation of NH_4OH.

TABLE III.

TABULATION SHOWING THE APPROXIMATE WEIGHT IN PARTS PER MILLION OF DIFFERENT GASES OF SEWAGE DECOMPOSITION WHICH ARE REQUIRED TO SATURATE PURE WATER AT DIFFERENT TEMPERATURES AND PRESSURES.

Gas.	Atmospheric Pressure.		Pressure of 30 Feet of Water.	
	4° C.	15° C.	4° C.	15° C.
Hydrogen	1.86	1.69	3.61	3.27
Methane	35.65	27.7	69.15	53.7
Ammonia	792,000. (2)	611,000. (2)	....	....
Nitrogen	26.70	21.1	51.8	40.9
Oxygen (1)	62.8	48.8	121.8	94.5
Hydrogen Sulphide	6,160.	4,930.	11,950.	9,560.
Carbon Dioxide	2,975.	1,965.	5,760.	3,810.

Notes.—(1) This is for pure oxygen, not atmospheric oxygen.
(2) Due to formation of NH_4OH.

Returning to the question of sulphureted hydrogen it is important to ascertain the conditions under which this very soluble gas may perhaps make its escape so as to produce offensive odors at some distance removed from the sewage disposal plant. In this connection, there are several features to be borne in mind, amongst which are to be mentioned that liquids containing gases in amounts forming only a small percentage of that required for saturation are capable of releasing some of the gas at the surface when the liquid is surrounded with an atmosphere free or comparatively free of the gases in question.

Another feature of importance is that such gases as sulphureted hydrogen may accumulate at some particular place, such as within the sludge at the bottom of a settling tank, and mass together into bubbles of such size as to create a buoyancy sufficient to cause the bubble to rise quickly to the surface of the over-lying liquid. Sulphureted hydrogen or other gases can thus make an escape into the atmosphere without allowing much opportunity for the gases to be held back either through saturation of the liquid or by combination of the gases with other products in the liquid sewage.

Precipitation of hydrogen sulphide by iron compounds which form a black insoluble product, is apparently an important factor in tracing the history of the sulphur compounds in sewage decomposition. It explains the black appearance of old sewages.

Still another point is that there is apt to be quite an irregular dispersion of organic sulphur compounds in the compound matter of the sewage, particularly deposits in the sedimentation tank. This feature may perhaps be quite important and explain irregularities in the release of objectionable smells from certain sewage disposal devices, such as septic tanks.

While there is good reason to believe that sulphureted hydrogen is characteristic of all decomposition products, and that certain bacteria never decompose sewage with the formation of marsh gas and no hydrogen sulphide, while other bacteria ferment sewage to produce sulphureted hydrogen and no marsh gas, it will be readily gathered from the tables above given and the comments made upon them, that there may be certain conditions under which objectionable quantities of offensive gases may be released from certain operations of a disposal plant at certain times.

The above remarks are made, having in particular view the observation that some disposal plants produce noticeably objectionable odors on half a dozen days or nights in the course of a year, and are practically free from such odors during the balance of the time. It is, therefore, necessary to increase our energies in the study of the special conditions which occasionally prove bothersome.

Associated with the above mentioned factor is the condition of the atmosphere at times when the odors are most noticeable as to intensity and distance from the disposal plant. Aerial nuisances as to odor vary much with the barometric conditions and wind velocity, as they affect the dispersion and oxidation of gases in the atmosphere. Thus, at many disposal plants it is found that objectionable odors are most noticeable as to intensity and distance from the plant on what are ordinarily spoken of as "muggy" days. The barometric pressure of such occasions no doubt prevents the gases, particularly a heavy one like sulphureted hydrogen, from rising as high in the atmosphere as ordinarily is the case. Furthermore, the dispersion of the decomposition gases in the atmosphere is much less rapid than usual and this perhaps prevents aerial oxidation at normal speed. Associated with this are no doubt a variety of other factors about which information is quite meager at present. It is perhaps worth mentioning that some of the malodorous products may not be present in a chemical state such as to promote oxidation. They may be combined with other compounds which retard the reaction with the oxygen of the air.

Before dismissing this subject it will perhaps be well to speak briefly of the fact that at some disposal plants there are characteristic odors other than of putrefaction. These odors are sometimes spoken of as being similar to laundry odors or odors resembling a raw turnip. The odor of cooking of certain vegetables is, of course, a conspicuous one under some circumstances. It is mentioned here to accentuate the thought that there are a good many decomposition products which have an individuality which is not specifically offensive, although it is noticeable and objected to by some. At the same time, such products suggest that hydrogen sulphide is not the whole story, and that it is important to study other compounds in connection with the question of objectionable odors.

The Parks and Boulevards of Oklahoma City.

By S. T. Bisbee, Oklahoma City, Oklahoma.

TEN years ago Everett I. Leach, alderman of the Fifth Ward of Oklahoma City, stood on the floor of the council chamber and begged the city council to appropriate fifty dollars to improve a one-acre park that had been donated to the city. The council absolutely refused to appropriate one penny. Seven days later the same Leach pleaded with the council, for sanitary reasons, to allot the sum of twenty-five dollars to remove the rubbish, tin cans, filth and debris from the one-acre tract. The council begrudgingly granted the request for this pitiful sum, and for sanitary reasons the one-acre tract was cleared, grass was planted by the neighbors, and the magnificent park system of Oklahoma City was born.

Today, ten years from the date when the intrepid Leach fought for the interests of the public, the park system of Oklahoma City embraces an uncompleted group of parks connected by a twenty-eight-mile boulevard which encircles the city. The ground that the boulevard occupies is now worth probably $1,000,000. At intervals on that great speedway parks are located which represent at this time a land value of $910,000 for the 1,700 acres contained therein. In addition to the land actually in use and being platted for parks, the park board controls (the title being held by Oklahoma City) 770 acres which can be sold at the present time for $500,000. However, this land is not for sale. The park board bought the land adjoining the parks, as the park property was acquired, simply as an investment, that town lots might be sold for many years to come, the revenue to be used to improve the parks which comprise the system.

Planning with the idea that Oklahoma City would have a population of 200,000 in 1920, the members of the present board, Will H. Clark, Whit M. Grant, and Paul M. Pope, built on broad lines. Opposed at times for extravagance, the commissioners did what they believed was best. When they bought land for the park system they also bought adjoining farms, knowing that the creation of the parks would enhance the value of the abutting property, and they wanted the park system to get the profits.

No one man has put Oklahoma City on the map as the "Park City;" no one man can receive all the credit for looking ahead. Yet there does rise before the gaze of the people of Oklahoma City a figure, unique, original and peculiar, a figure that has been passive in public affairs in Oklahoma City for many years, and never reached full development until parks came to mean to him "recretation for the people." This man was Will H. Clark.

Leading the simple life, Mr. Clark acquired wealth in a quiet way, and while not a rich man, has been able to retire from active life, only to re-enter the arena as the champion of the park system. For years he was of such a retiring disposition that in a rapidly growing city only the old timers knew him. New comers were too busy to pay much attention to men who were not busy making money and busy making themselves heard.

A lover of nature, Mr. Clark was offered the position of park commissioner in 1907 by a personal friend who happened to be mayor and who knew that Clark knew more about flowers and trees than the rest of the town put together.

William H. Clark woke up, Oklahoma City woke up, the great park system commenced to assume form, and to this Clark more than to any other one person is Oklahoma City, "Queen City of the Last Frontier," indebted for that splendid avenue which girdles the metropolis of the State, dotted at irregular intervals with groves of giant oaks and stately elms, graced with flower gardens which are the pride of the State, and offering to the children of the former frontier town a place to play all day in the sun or in the shade.

The history of the building of this park system has been widely different from those of other American cities. Oklahoma City is not yet twenty-one years of age, yet it has a population of 70,000, and of this number 60,000 has become permanent within ten years.

In the early days of Oklahoma City Daniel F. Stiles, a captain of the U. S. Army, who was in charge of a company of infantry at this point, acquired a tract of land adjoining the city limits. He deeded to the city an acre for a children's playground, which is the tract mentioned in the first paragraph.

Since that date other citizens have, from time to time, donated tracts to the city for park purposes, but the real development, the carefully planned, wisely outlined methods date from December, 1908, little more than two years ago.

Park Commissioner Clark tramped over many miles of rough country to familiarize himself with the physical conditions and the park and boulevard possibilities. He had hunted wild birds and wild animals over the same ground when the suburbs of Oklahoma City were a wilderness, but this time his trips were for business, that posterity might have wide areas in which to spend their pleasure hours.

Then the active Clark, not the timid Clark of the early days, went before the city council with his plans, urged, requested, demanded that an election be called to authorize the issue of $400,000 of bonds for park purposes. The aldermen held their breath. People stood aghast. What! Spend that enormous sum of money for dirt and rocks and trees when that much money would build giant skyscrapers?

OKLAHOMA CITY PARK.

Showing Character of Park Area, Road, Bridge, Dam and Lake Bed not yet Filled.

It did look like a wild scheme. But the election was held, a spirited campaign took place, and the bonds were voted.

Options had previously been secured on the land which was desired, and the work began.

The largest park is the Northeast Park, comprising 741 acres; the next largest is Trosper Park, 620 acres in extent. Not all of the land in these two parks will be used for park purposes, for about one-half of each will be held and sold for residence lots. That is what it was bought for, and the gain in value of the excess land is such that it can be sold at the present time for more than enough to extinguish the total bond issue of $400,000, presenting the unusual municipal condition of a city owning a system of parks worth more than $1,000,000 without a penny of investment, but the result of a few small donations of land and the far-seeing ability of a wise board of park commissioners.

The southern sun and the balmy air of the Southland are here, and the parks of Oklahoma City are glorious in their mantle of green. Yet these parks are not all in a finished state. Two years will not build a park system. Some of the smaller parks are completed, have grass, flowerbeds, electric lights and cement walks, with entrances of great architectural beauty. But the larger ones are in process of formation. Men and teams are at work constantly, the summer season in this section is long, and work can progress during ten months of the year. The man who has furnished the technical knowledge, the landscape skill is R. E. Brownell, for many years connected with the park system of Chicago. His work is a monument to him and is just beginning to be appreciated by a people that love the out-of-doors.

The excess lands in possession of the city will be held for some years. The members of the park board are gratified at the demand that exists for such land. Rich men are eager to purchase building tracts in the vicinity of the parks that they may build great mansions fronting on the twenty-eight mile boulevard. The land would bring more than enough to pay the bonded park debt. Yet the park commissioners turn deaf ears to the entreaties of the would-be purchasers. The homes of rich men are desired along the boulevard, but not now. The park board is determined that men with money shall pay more and still more. The land will be worth it. As the parks and the boulevards take on their finishing touches the demand for the abutting acre tracts cannot but be keener. It is the most beautiful collection of building sites of the capital of the State, but is not on the market yet.

The park commissioners are stubborn. Eighty per cent. of the people of this city approve of the stubbornness, for it means that Oklahoma City will have a park system without cost which will be worth millions to the next generation.

A European Abattoir*

By S. M. Dodington, London, Eng.

LET us imagine ourselves in a large German city of 500,000 inhabitants. We alight at the main railway station and ask for the public slaughter house; we board the tram and are soon out in the suburbs, and see laid out before us a set of buildings surrounded by allotment gardens, and frequently by parks and open fields, though in some cases the abattoir is surrounded by residential property, it being an exploded idea that an abattoir must needs be isolated, for modern science and hygiene have made such progress that a modern abattoir is no more a nuisance than an ordinary lavatory. We alight at the main entrance gate, having on one side the director's residence and garden, and on the other side offices, hotel, restaurant, and sometimes a postoffice, and the ordinary caretaker's residence. We pass through the gates, enter one of the offices, and obtain a ticket of admission for a few pence.

Having purchased a ticket, we pass inside the grounds; the first thing noticeable is the amount of space and the handsome grass plots and trees between the buildings. The cattle market adjoins the abattoir, is invariably under cover, and is quite a different affair from the average cattle market in England. Whitewash is not generally seen, but glazed or smooth bricks are used. The writer has seen cattle markets in Germany which would take away the breath of the average Englishman; huge covered glazed brick halls fitted with marble slabbed pens, etc., glass offices occupied by officials taking charge of every detail of the organization; a truly wonderful sight. The animals arrive by train or in special conveyances to the arrival platform, and from thence they pass into the mar-

*From a paper before the Society of Engineers.

ket and are sold; from the market they pass into the lairage to await slaughter. Every living animal that is brought on the premises is inspected alive by a qualified veterinary surgeon, then again after killing, and finally the carcass is examined when it is ready to leave the building.

In practically every civilized country in the world except England and the rest of the United Kingdom, veterinary surgeons, duly qualified and trained, are the only men allowed to take charge of a public slaughter house. In England the meat inspection is a sheer farce, carried out by people who are not experts, and the English butchers, not to mention the public, suffer in consequence. In North America the meat inspection is indifferent, and when North America sends meat to Germany in tins with "passed U. S. A." stamped on the tins, all the respect these tins receive is a prompt order from the chief veterinary surgeon for the covers to be at once removed, the German veterinary surgeons rightly trusting to no one but themselves.

Near the slaughtering halls are the gut washing rooms and triperies lined with glazed brick, lighted by electricity like all the rest of the buildings, and fitted with hot and cold water. Then comes the destructor for destroying condemned meat, a sterlizing apparatus for sterilizing doubtful meat, which, after being dealt with in this apparatus, is sold at a nominal price in a special shop on the premises and open to the public. Then there is a horse slaughter house, and baths and changing rooms for the slaughtermen and staff. The smallest continental abattoirs possess a horse slaughter house, and a sanitary slaughter house for unhealthy animals whose carcasses will be destroyed. The writer has seen in Holland an abattoir fitted with a billiard room for the slaughtermen, and has known of others where a gymnasium is fitted up for their use; a large abattoir nearly always contains a pathological laboratory for examination of trichinosis.

Certain parts of condemned animals and also bones are treated in the "Powderville" apparatus. This consists of a large rotating iron cylinder containing rollers inside; the organs and bones to be destroyed are put into this apparatus and crushed and at the same time subjected to high pressure steam; when the process is finished the result is excellent manure, which is sold at a profit. Blood is sometimes converted on the premises into manure and food for animals, and many large abattoirs contain a water-softening plant.

Every abattoir, large and small, is now beginning to have a cold storage room and to make its own ice, electricity, etc.; frequently they make ice for sale as well. Yet with all these luxuries the Continental abattoir not only pays, but helps to relieve the rates. Why? Because everyone must slaughter in them, no private slaughter houses are allowed, and all meat inspection and traffic in live stock and dead meat are centralized and properly organized, and the by-products turned to profitable use on the spot; fat and tallow rendering, blood-converting, and the manufacture of manure being dealt with on the premises. There being a good supply of water on the premises it is not unusual for some towns to combine the public baths with the abattoir.

A great deal of horse meat is eaten on the continent, there being no objection to eating healthy horses; it is purely and simply an English prejudice. The horses are inspected just the same as the other animals, the healthy ones killed and sold, and the unhealthy ones killed and the carcasses burnt. There are usually two horse-killing rooms, one for healthy horses, and another for unhealthy horses. Sausages are frequently made in the abattoir in special rooms; these rooms and the sausage machines being models of cleanliness, and under the charge of a veterinary surgeon.

Nearly all modern abattoirs on the continent are fitted with cold storage plant, make their own electric light, and besides this process a destructor for bad meat, and a sterilizer for doubtful meat. In a large abattoir, as seen at Berlin, Leipzig, or Dresden, the engine room will be centrally situated and possess several water tube boilers and two horizontal compound steam engines direct coupled to alternators; these engines are generally worked with either the "trip" or "Corliss" gear, and are condensing. Several engines are used for driving the ammonia refrigerating plants as well as the water-softening apparatus.

In Germany the water softening is carried out by means of a large tower, engines being used to pump the water to the top of the tower, from whence it descends through a softening apparatus. This tower frequently has more than one function; it is used for water softening, acts as a smoke shaft for the boilers, and at the very highest point of the tower is a large cistern for high pressure water service. The tower frequently contains an illuminated clock and bells, and is sometimes highly ornamented. Steam engines are preferred to gas or oil engines in an abattoir, as hot water and steam have always to be in use for cleansing the carcasses of animals, therefore it is not worth while to have two separate plants. The boilers that supply steam and hot water are also used for driving the engines. The large abattoirs and now even the smaller ones have their own engineers. At Leipzig abattoir there were three or four trained engineers in charge of the engine room, which was as large as a London generating station; it would seem as if modern public abattoirs go in for the best of everything, for the abattoirs the writer has seen in Germany and Holland contained the finest plants of engines and boilers that could possibly be imagined, the highest workmanship being noticeable in every detail, the engine room being lined with glazed bricks and having tessellated floors. It is usual to place the engine room adjoining the cold storage, so that the brine pipes come straight through the cold storage to the ammonia machines in the engine room. The destructor is so constructed that while it is in use for destroying bad meat no gases can escape without first passing through the fire, so that no smell can reach the outer air. The destructors are made in various types, one of which resembles an oven. The sterilizing plant is very simple, and consists of a large cylinder into which doubtful meat is put and subjected to very high pressure steam.

In the slaughtering halls the overhead tracking is interesting as it allows, by means of movable switches and points, for any carcass in any part of the hall to be run into any other part of the hall or into the cold storage direct without leaving the hooks. All the drain traps are fitted with special intercepting grids to prevent large substances passing, as well as with grease intercepters. All large abattoirs have a small workshop for repairs. Electric motors for hoisting carcasses of beasts are now coming into vogue. At Islington (London) they have been installed not only for beasts, but for sheep and calves. They are certainly useful for hoisting up the carcasses of beasts, but they have been abandoned in general practice for the smaller animals. These fads are beginning to make the modern abattoir much more complicated than is really necessary. A destructor, and perhaps a sterilizer, is a necessity, while cold storage is now considered a sine qua non, though it adds greatly to the cost. In England many butchers have their own cold storage room, so that the value of a huge cold storage room at the local abattoir is open to question.

Every part of the abattoir, and also the market, both inside and out, should be fitted with hydrants, with a set of hose pipe to each hydrant, so that every part of the building can be kept in a state of most scrupulous cleanliness; and in summer the whole place can be kept cooler and free from flies. The slaughtering halls of the modern abattoir are lighted at night by electric arc lamps, incandescent lamps being used in the offices and outhouses. The ventilation of the slaughtering halls and lairages can be regulated. At Vienna and Budapest abattoirs a most complicated system is used for changing the air in the lairages, fans and large flap valves being used, so that the ventilation can be regulated at will.

Water Works Management*

By C. H. Hurd, Chief Engineer of Water Company, Indianapolis, Ind.

THE successful administration of a water works plant means, in its strictest sense, economy; economy not only in the operation affecting the cost of production, but economy of the highest order in the exercise of judgment and foresight, both in the character of construction and design, and its financial operations with a view to future growth. The plant or enterprise can well be divided into two parts—the physical and the financial plant. The physical plant is represented by the equipment and properties necessary for its operation; the financial plant or institution is represented by the investment and the returns upon such investment. The efficiency of administration, which depends almost entirely upon the relation of the operating and financial supervision, is measured by the character of service and net earnings.

If those in charge of the financial affairs are not conversant with the physical conditions and requirements, the corporation or department is likely to be a failure; on the other hand, if those in charge of the design and construction are not familiar with the financial conditions and policies, the plant cannot be a success as an operating and financial concern. In this connection, the designing and constructing engineer must not only so plan and carry out his work that there shall be no waste of energy and material, but he should make a careful study of the problem at hand and avail himself of a complete knowledge of the financial conditions and possibilities. The financial head or board should also have a complete and thorough knowledge of the ultimate effects which may be produced on account of improvements before he can intelligently pass upon, or authorize, such expenditures, as an unwarranted investment or error in judgment in design or construction is bound to become a tax on the business until the investment is wiped out.

Economical Equipment. Water works men are confronted almost daily with the problem of the selection of equipment. In considering such investments, it is always necessary to weigh carefully the indivdual items which go to make up the total annual cost. These items should include not only the operating and maintenance expense but also the fixed charges, that is, the depreciation and interest. It frequently happens that the plant which shows a low operating cost carries with it a high capital charge, and as a rule a high operating cost will mean a smaller investment, and the most efficient plant from the standpoint of engineering and invested capital will be the one which will show a minimum sum total when all these various items are considered.

In the selection of equipment for pumping stations, it is necessary to give considerable weight to the conditions of service as well as individual efficiencies. For example, large triple expansion pumping engines, on account of their high duty, may show a good return, providing they are in continuous service and always operating at their full load; but if they are to stand idle for any considerable portion of the time, or if they are operated at lower capacities, it is obvious that the fixed charges, which are going on continuously, will very much increase the unit cost for the year's output, and it is probable that a less expensive installation under these conditions would show a better over-all economy.

The cost of fuel will also have a decided influence upon the character of equipment. If the cost is high, more expensive and higher duty machines may be warranted, but if the cost is low, the saving in fuel will be a lesser consideration. It should be remembered, in making improvements, that a change in one part of the plant will have a more or less direct influence upon another. For instance, if it should be considered desirable to install low duty engines at a lesser cost, it will be necessary to have larger boiler capacity and greater cost of boiler-room labor and coal handling, and it does not always follow that a saving in one department will mean a net saving in the entire plant. What is true in connection with pumping equipment is also true in reference to filtration plants; the conditions of service and the character of water to be treated, govern. It has been shown repeatedly that each plant presents individual problems, and a system which is advantageous for one will not necessarily give good results in another.

*A paper before the Indiana Sanitary and Water Supply Association.

The pipe system, which is often neglected from the standpoint of engineering, is not always thought of as being a part of the working plant, but when we take into account that the size of the pipe, and inversely the friction head, is a direct charge against pumping, it is necessary to make a balance between the capital and operating costs.

Efficiency of Operation. The efficiency and cost of operation, which may be considered independently from the fixed charges, will fluctuate and depend to a large measure upon the efficiency of the superintendence or management. This cost will be affected by the selection of materials, the efficiency and the cost of labor and the operating methods. Fuel and labor are usually the two principal items of cost. As a rule, the average plant is wasteful in the use of fuel, not only by the loss of steam, but the loss of fuel and heat in the boilers themselves. When we consider that the efficiency of the average boiler plant is less than 40 per cent and that it is possible to obtain from 70 to 72 per cent, we can conceive of the enormous loss of fuel and energy even in water works plants. The saving in labor is also an item which must not be overlooked. While it is not always advisable to employ cheap labor, particularly to operate plants representing enormous sums of capital, it should be kept in mind that the saving of a single man is equivalent to a capital investment of approximately $12,000, and eight men to an investment of nearly $100,000.

The comparison of one plant with another is always valuable as a measure of economy, but proper allowance should always be made for different classes of service. The plant pumping directly into the mains, the unit cost should be more than one pumping into a reservoir of a sufficient capacity that the rate of pumping can be governed or distributed. A plant which is required to put up fire pressure, particularly in the larger cities, is always at a considerable disadvantage on account of large expenditure in equipment and the necessity of working against different heads. In other words, the unit cost per foot of head does not give comparative figures unless proper allowance is made for the difference in requirements.

Capital Expenditure and Depreciation. While most water works engineers and managers give considerable attention to operating and maintenance costs, sufficient attention is not given in the average plant to interest on invested capital and depreciation. Many industrial enterprises have been failures because the management has lost sight of the fact that the physical plant depreciates and, while the investment apparently is paying substantial dividends, sooner or later they find that the plant is worn out or obsolete, and that their investment is wiped out. Annual contributions into a renewal reserve fund are as important as the payment of taxes or for fuel. For unless such contributions and deductions are made, it is not possible to determine the net earnings nor is it possible to carry a representative physical value of the plant.

Among the more important features connected with the accounting of any corporation or department of this character is to have available at all times reliable data in the form of records showing the net physical value, the deduction for depreciation, and the additions on account of capital expenditures. To obtain the true amount of the annual depreciation in the value of any property, it is necessary to estimate a sum of money which represents the yearly depreciation of each of the component parts of the plant, and the aggregate of these sums will give the annual depreciation. Any method of arriving at this amount that does not take into account the individual depreciations of the various parts, must be an approximate at best, although it may be based upon results obtained in a correct manner for other similar plants. This depreciation should be considered in three parts and is usually classed as physical, functional and contingent. The physical depreciation is that due to natural causes or ordinary wear and tear of equipment. In order to estimate the amount of this depreciation it is necessary to have a knowledge of the nature of service and a general acquaintance and broad experience with this character of plant. The functional depreciation, or that due to obsolescence, can only be estimated approximately by an intelligent forecast. Contingent depreciation, or special insurance, is also difficult to estimate, but it is intended to cover unforeseen accidents and destruction of property. The accumulation of funds for this purpose should be used only for this specific purpose, and when property must be replaced on account of its depreciation either from wear, obsolescence or accident, the cost should be defrayed out of this renewal fund.

Revenue and Character of Service.

The careful supervision of expenses is always desirable and necessary, but the plant cannot be a financial success without a sufficient income. One of the first essentials toward a satisfactory income is that the water shall be of a high character; the second, that the rates shall be fair and equitable. If the water is not pure and is dangerous and a menace to public health, the plant should not be expected to give a reasonable return. If the water is turbid or otherwise objectionable for domestic or manufacturing purposes, it is not expected that it will be used in large quantities or by the large consumers. If the rates are excessive, the volume of business will be small and the plant cannot be expected to be a success.

The plant which will show the best economy is not the one which is especially proficient in any single department, but is the one which is established on a sound financial basis and is so operated in all its departments that the community will be supplied with a water unquestionable in character and at rates which are reasonable. To this end, eternal vigilance and activity in directing operations and carefully considered expenditures are the price of success and the prime factors in the economical administration of a water works plant.

The Existing Los Angeles Water Works

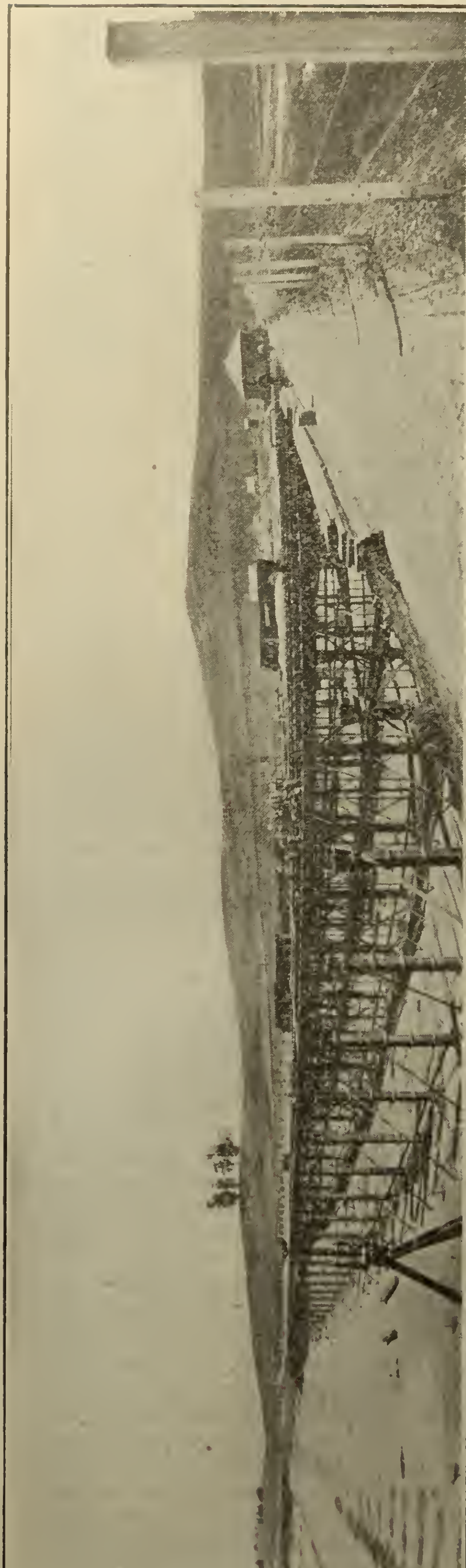
By Burt A. Heinly, Los Angeles, Cal.

SUPPOSE that throughout the Atlantic, the Southern and the Middle Western States, for the year extending from May 1, 1908, to May 1, 1909, the precipitation had been decreased suddenly below the minimum of 35 inches to one of 19 inches. Sup-again, that in this broad area the month of May, 1909, brought no rainfall, that the entire month of June was cloudless, that July brought no moisture, that this drouth continued into August, then into and through September and finally until the 23d. day of October, when there was begun the musical tinkle of rain drops on the roof. I am not giving you the opening of one of Wells's novels. The frightening suggestions, with their terrible import, if true, to the territory named, were the actual climatic conditions as they existed in and about Los Angeles for the period named. In the deserts stretching away to the northward and eastward, this situation was highly intensified. And yet, for Los Angeles, 1907-'08 was set down in the meteorological records as a wet year. The average annual rainfall in the vicinity of Los Angeles is only 15.64 inches, but there are lean years which are as certain to come as are the seasons. For instance, in 1897-98 the total rainfall was 7.13 inches; in 1898-99 it was 5.53 inches; in 1899-1900 it was 7.90 inches. In other words, the total of the three years was 20.56 inches or a little over half of the minimum rainfall of a single year in the Atlantic States.

Under these conditions the task of furnishing Los Angeles, a city of 318,000 people, with an adequate supply of the precious fluid carries with it features of unusual interest not only to the engineer but to the layman as well. Likewise the measures adopted to cut down the waste, for here it is as important to prevent extravagance in the use of water as it is to find a supply adequate for the City's needs. In truth, when the supply had been developed to the utmost and was still found to be lacking, the day was saved and a famine was averted by the enforcement of rigid economies at the ends of the service pipes.

In 1902 when the corporate Water Works had shown itself powerless to cope with the situation, the City took over the property and began the purveying of its own water. It did this through a clause in the Company's franchise, which was given in 1868 when Los Angeles had a population of 5,000, and which provided that the City should have the privilege of purchase at the actual cost of the works at the expiration of thirty years. It required four years to settle the legal squabbles and to come to an agreement as to terms, so that it was not until February, 1902, that the city took possession. The distribution system at this time was in a worn-out condition, hundreds of miles of new mains were needed, new pumping stations, more reservoirs and the development of an additional water supply.

Today, the Los Angeles City Water Department, with all improvements made entirely out of its own revenues and with a low water rate, is one of the mcst successful in the United States. As such, even without con-



THE LOS ANGELES WATER WORKS.
The Ivanhoe Reservoir. Erecting Concrete Pillars to Support Roofing.

sideration of the severe climatic conditions which must be overcome and the scarcity of water, it is well worth careful study.

At first sight Nature appears to have treated Los Angeles very shabbily in her water supply, but on closer inspection it will be found that the kind Mother of us all has here worked beneficently, as she always does. She has only to be understood. To the north and west of Los Angeles lies the San Fernando Valley, a depression having an area of 200 square miles and a drainage of 450 square miles from the mountains and hills which surround it on all sides excepting the comparatively narrow opening to the southwest through which the Los Angeles River escapes. Through the ages this valley has been filled to its present level with granitic debris swept down from the mountains. The whole forms a great subterranean reservoir which performs not only the office of impounding but of clarification and purification as well. Now again we discover the kind thoughtfulness of Nature. Most California rivers run upside down, that is, the subterranean flow is very often in excess of the surface flow for more than half the year. In this case Nature has provided against the drainage of the San Fernando subterranean reservoir by a dyke of rocks extending almost to the surface of the river bed, at a point within two miles of the center of the city. And from this natural impounding basin Los Angeles procures the most of her supply from the surface and subteranean flow of the Los Angeles River. In the East this stream would little deserve the name of river. At times during the winter season, freshets give it considerable volume for periods of from 36 to 72 hours, but in summer the surface flow hardly merits calling it a brook. From July until November, due to the city's withdrawals, the river bed is nothing more than dry, yellow sand for a distance of 25 miles from its mouth.

The first intake is eleven miles northeast of the city on the Pomeroy-Hooker ranch. Here the surface waters are drawn upon as well as the underground flow. The latter is interesting because it shows how Nature has been made to filter the water without expense. Beneath the river bed and extending at right angles to the flow plane for a distance of 2,500 feet, a horse-shoe-shaped concrete gallery has been constructed. It is buried to a depth of from 25 to 30 feet, is loosely paved on the bottom with concrete slabs, and through the interstices between these the water percolates and is delivered into the main conduit at the rate of 5,000,000 gallons daily. This is further augmented during the summer months by a compressor plant which is capable of delivering 8,725,000 gallons daily from six casing wells driven 300 feet into the river gravel. The supply from this source is carried through the main conduit for a distance of 5.5 miles in tunnel, conduit and 52-inch riveted sheet-steel siphons over canyons, to be delivered into the Elysian, Bellevue, Silver Lake and Ivanhoe Reservoirs, of which more will be said.

Four miles below the Pomeroy-Hooker plant, both subterranean and surface flow is again tapped. At this point there is a dependable total supply of approximately 23,000,000 gallons daily, of which 12,000,000 gallons is surface flow. The underground sources consist of two lines of vitrified sewer pipe, from 12 to 14 inches in diameter and extending a total length of 3,600 feet across the river's flood plane. In addition, an infiltration gallery similar to that on the Pomeroy-Hooker ranch extends 2,475 feet under the river channel and delivers a daily supply of 6,500,000 gallons; also, a compressor plant with five wells operated by compressed air gives an additional 5,000,000 gallons. The water derived at this point is carried through a recently completed concrete conduit 8 feet wide and 5 feet high to a settling basin, which also serves as a diversion chamber. A mile from Crystal Springs this conduit is connected with the main conduit by a 24-inch main. From the settling basin are mains leading to the Buena Vista and Bellevue reservoirs with a cut-off line delivering a gravity flow into Hazard reservoir.

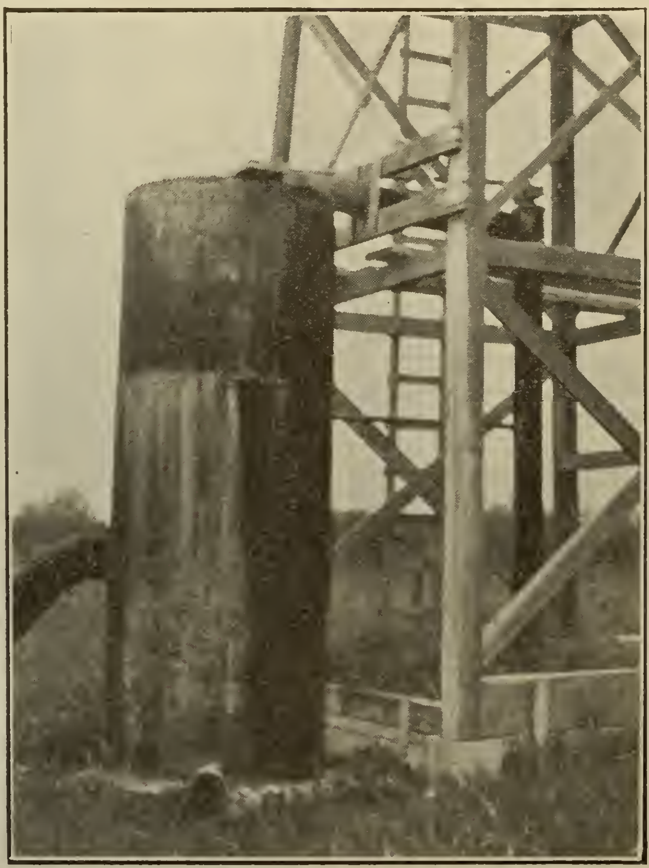
Three miles below the Crystal Springs intake is a third plant. This is a reserve station which supplies 3,000,000 gallons daily from wells driven into the bed of the river. The plant consists of a standard gasoline engine driving a Byron-Jackson horizontal centrifugal pump.

Five miles below Crystal Springs and 2 miles from the center of the city, the subterranean flow of the river is again intercepted at the Buena Vista pumping station. Here a concrete lined shaft 14 feet in diameter was sunk to bed rock, a distance of 125 feet. A gallery was then driven 2,500 feet across the river channel obliquely to the river's flow. The tunnel lies from 75 to 100 feet below the surface of the

THE LOS ANGELES WATER WORKS.
Ivanhoe Reservoir Roofed. Showing Typical Form of Roofing.

river in bed rock, determined by sinking eight wells from 150 to 300 feet apart, and which pierce the roof of the tunnel. From this source is produced a daily supply of 4,500,000 gallons, raised by a deep-well pump designed to meet the unusual conditions.

In 1905 the City began the preliminary work on the Owens River project, designed to deliver a daily supply of 258,000,000 gallons from the Sierra Nevada Mountains, 250 miles distant, which has been described in a previous issue of MUNICIPAL ENGINEERING. The aqueduct is scheduled for completion late in 1912, or early in 1913, but at the time the enterprise was inaugurated, Mr. William Mulholland, Superintendent of the Water Department and Chief Engineer of the Los Angeles Aqueduct, foresaw that even with years of plenteous rainfall, the total flow of the Los Angeles River would be insufficient for the City's needs, and that other sources must be provided to tide over the period until the aqueduct could be completed. On the old southern city limits, therefore, wells were driven 300 feet to the water-bearing gravels and two pumping stations, two miles apart, were erected. These plants are similar in construction and equipment, the water being lifted by compressor plants into sumps, thence pumped into the mains by modern cross-compound crank and fly-wheel pumping engines. Each plant has a capacity of 4,000,000 gallons per day and, ready for operation, cost $75,000. Throughout the Southern California Coastal Plain the water level has been sinking steadily for a number of years, due to the heavy draughts made upon it by the withdrawals from the Los Angeles and San Gabriel Rivers for both domestic consumption and irrigation. In the first place the plants were a necessity, and in the second it was figured that even if they became practically useless at the end of seven years, by that time they would have more than paid for themselves and their cost of operation from their own revenues by their additions to the water supply.



THE LOS ANGELES WATER WORKS.
One of the Wells at the Slauson Avenue Station.

At first these plants were operated only a few hours each day during periods of stress in the summer season.

Last year, however, the pumps were placed in operation the first of May, and were run almost continuously until the first of October.

Two other small stations designed to furnish a supply to the high sections of the city which can not be reached with a gravity flow, complete the pumping equipment. Approximately 77 per cent. of the supply is by gravity, the remainder being pumped.

To show the necessity for the Owens River Aqueduct it may be stated that the maximum supply from all sources is 65,000,000 gallons, which would be very materially reduced should there be a cycle of two or three dry years. The average daily consumption is 40,000,000 gallons, but during the present summer the demand on several occasions exceeded 54,000,000 gallons per day. This does not represent the total consumption of the entire city.

Within the past four years the city's area has been largely increased by annexation and in each case the annexed district has been inadequately served with water. Preceding each annexation the Water Board has issued a public statement that no water would or could be furnished to the new territory until the aqueduct is completed. Despite this stand the Board is constantly importuned to enter the new districts. The city system now supplies about 24,000 acres with an estimated population of 280,000, leaving an acreage of 38,000 acres and a population of 38,000 to be supplied as soon as an additional source is available. Nearly a dozen private water companies supply these districts from wells at the present time.

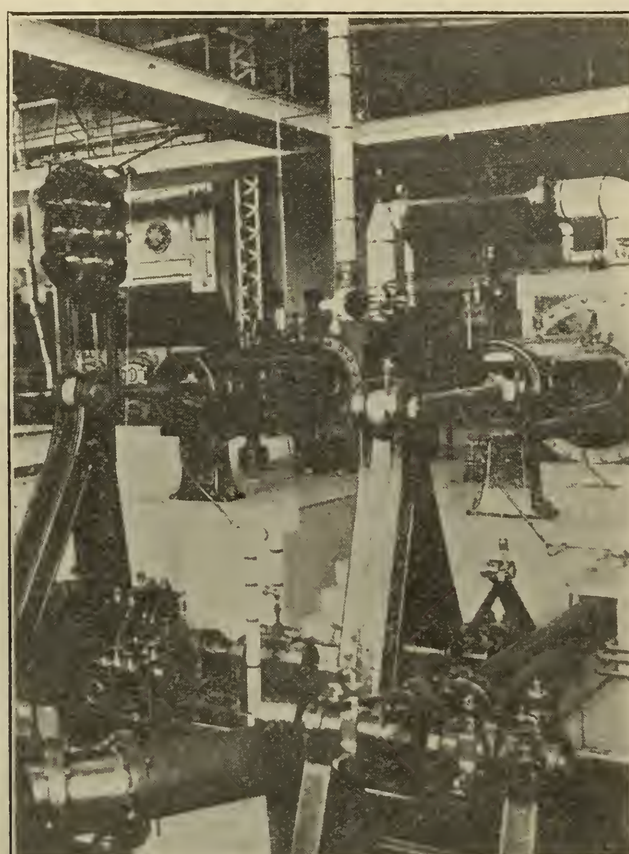
To guard against famine, recourse is had to storage reservoirs, of which the city has a system of thirteen, capable of storing 943,521,000 gallons, the latest acquisition being the Ivanhoe No. 2, having a capacity of 31,000,000 gallons and completed October 10. The system is well described by the accompanying table.

Name and Character	Area Square Feet	System	Capacity Gallons	Elevation. Top	Bottom
Buena Vista, rubble masonry sides, rock botton	86,151	Low gravity	13,000,000	374	349
Bellevue, concrete, roofed	207,000	Low gravity	39,000,000	380	340
Slauson, concrete, roofed	11,491	Low gravity	586,729	174	162
Elysian, concrete, roofed	81,900	High gravity	10,526,200	438	407
Hazard, concrete, roofed	23,674	High gravity	2,730,800	438	418
Ivanhoe, oiled slopes, roofed	419,000	High gravity	46,552,827	447	423
Silver Lake, earth	4,110,500	High gravity	772,959,324	447	400
Highland, earth, roofed, oiled slopes	194,154	High service	19,979,255	611	595
Solano, concrete, roofed	44,400	High service	5,723,442	613	593
Garvanza, concrete, roofed	8,281	Hill service	757,528	730	715
Edendale, steel, roofed, depth 25 ft., diameter 60 ft.	2,827	Hill service	528,731	761	736
Ivanhoe No. 2, oiled slopes, roofed	217,800		31,000,000	448	427
Figueroa, small pumping sump.					
		Total	912,344,816		

In a country semi-tropical in its climate, it will be surmised that algae, a troublesome pest wherever storage is resorted to, even in the temperate zone, become a serious problem in Los Angeles with its long summer season of dryness and month after month of dazzling sunshine. After much experimenting it was found that the only solution to the problem was to build the reservoirs so that a maximum of circulation is provided and then to shade the water by roofing. This has been done in every case with the exception of the Silver Lake, which is too large to make a covering practical. The total area of roofing amounts to 27.92 acres. The algae evil has cost the Los Angeles Water Department a large amount of money, but the problem has been satisfactorily solved.

The danger of a water famine has been frequently referred to in the foregoing. That it has not been experienced by the city is due undoubtedly as much to the metering system as to the extensive water development and the cycle of wet years since 1905, in which the average rainfall has been considerably in excess of the 31-year average.

When the city began the purveying of its own water, one of the first recommendations of the superintendent was that meters should be installed. In no other city in the United States could a more unpopular suggestion have been made. Los Angeles is essentially a city of homes and gardens—a tourist city where the beauties of a semi-tropical vegetation form one of the main attractions. It was argued that if water was to be paid for by the gallon, a tax was being imposed upon those who had the city's interests most at heart by having green lawns and flowering gardens. Despite the imprecations of the press and even against the opposition of a strong minority of the Water Board, the Department began the reduction of waste by the installation of meters. It has, without question, saved the city. When metering was begun, the average per capita consumption was 300 gallons; today the average is under 140 gallons.



THE LOS ANGELES WATER WORKS.
The Deep Well Pump at the Buena Vista Station.

The city began by metering the larger consumers and those whom inspectors reported as extravagant. When this had been completed, metering was undertaken by districts and within the past year, in addition, a meter is installed at the same time a new service is placed. The antipathy to meters has been entirely overcome. The change in public opinion can be shown in no better way than by the fact that if the department meters an old service outside the district in which metering is in progress, no charge is made for the meter, but a uniform rate of $3.50 is made for the work of installation. Meter and flat rates are as nearly equal as it is possible to make them, but the Angeleno of today prefers to pay only for what he gets. Meter installations under the $3.50 rate range from 50 to 150 a month by those who prefer not to wait until the city can reach their district with the free installation.

Of the 55,000 paid services in use July 1, 1910, 35,955 were metered and the work is progressing at the rate of from 800 to 100 per month. Ultimately every service in the city will be metered.

This department, under the meter superintendent, Mr. George Read, has devised what is called the Los Angeles meter, manufactured under its own specifications, in which a number of new features for long wear and better service have been evolved, and experimentation to better the type is continually going on in what is perhaps the most thoroughly equipped meter department shop of any water works in the country. Each meter it tested for accuracy before being installed, and a complete history is kept of the instrument until it shall have become worn beyond repair. The shop is prepared practically to rebuild a meter throughout, and keeps in repair all the meters in service besides conducting investigations along new lines.

The meter rate for water is 7 cents per 100 cubic feet, or approximately 9 2-3 cents per 1,000 gallons, with a minimum charge of 75 cents, with all bills payable monthly. It is rather a remarkable fact that with water to be had in such limited quantities and under such difficulties, the price per 1,000 gallons is shown by statistics on the subject to be equal to the minimum meter rate of the United States.

The issues of water works bonds total $2,517,500, of which was expended in the purchase of the properties of the Los Angeles City Water Company, $2,000,000 in 1902; also, $337,500 for the purchase of the works of the West Side Company in 1904, and in the same year, $150,000 for the construction of new reservoirs. Since the water works became municipal, water rates have been reduced 40 per cent; all the interest and sinking fund payments on the bonds have been taken care of out of the water revenues, with payments of $78,000 on the first Owens River Bond issue, and in addition, in the past 8 years the system has been almost entirely rebuilt and widely extended. Moreover water is furnished without charge to the city for the usual municipal purposes of fire protection, parks, play grounds, sewer flushing, street sprinkling, etc., the estimated value of which, if paid for, is placed at $216,000 per annum.

The rebuilding of the system in the past 8 years, as has been said, entirely from water revenues, with the one exception mentioned in the foregoing, is better shown by a comparison of the features in 1902 and in 1910.

	In System Nov. 15, 1902 Feet	In System July 1, 1910 Feet
Cast iron pipe	672,544	2,045,316
Standard screw and casing	6,319	23,257
R. S. iron and steel	81,708	210,064
Supply conduits	40,947	72,651
Gate valves	873	3,799
Fire hydrants	660	2,773
Meters	1,008	35,995
Pumping plants	3	8
Reservoirs	*7	**13

* 65,750,000 gallons.
** 943,521,000 gallons.

THE LOS ANGELES WATER WORKS.
Trenching for the New Eight-Foot Conduit.

This building and extension has been made necessary from two causes: first, when Los Angeles took over the works it found them worn out and incapable of supplying the then population of 118,000; secondly, the city has trebled its size in 10 years and the population of 318,000 in 1910 is shown by the Government Census to be the most remarkable in the history of the first-class cities—so remarkable, indeed, that the Government Census experts for several months doubted the figures.

What then is the explanation of the success of Los Angeles in her municipal water works? Obviously, first its efficient management on the part of the Water Board and its superintendent and chief engineer; secondly, its unparalleled opportunities for growth, thirdly, its freedom from politics.

Upon the purchase of the works in 1902, politicians and the gang looked for rich pickings. They were grievously disappointed. The people succeeded in procuring a Water Board whose members were without political connections. They were business men of high caliber, of good moral quality and with the civic sense well developed. There has been no change in the character of the appointments since that date. The president of the Board, who is chosen by four confreres, receives a salary of $3,000 per year, the others serve without pay. Membership on the Board is through appointment by the Mayor and confirmation by the Council with a term of service of four years.

The first Board retained the efficient employees of the private companies and lopped off the hangers-on who always form a certain percentage of the staff of a private utility corporation. The Civil Service then filled by competitive examinations the positions made vacant. The position of an employee in the Department is just what his efficiency and capabilities show him to be—no more and no less. This has resulted in a highly trained organization in which the men are well satisfied, and by whom the work is carried on with efficiency and with a minimum of numbers.

The department has its offices some distance from the city hall, pays far less attention to politics than does the organization of a public service corporation, and is not at all affected by any change of administration. The Water Board collects its own revenues and by the charter is given power over their expenditure, so that money is placed in the work that is most necessary, irrespective of wards or districts.

All the rebuilding and renovations have been done by the water works construction department under day labor force account, the only contracts being for stock for the excavation of reservoirs and the hauling of materials. This has resulted in the saving of the "contractor's percentage," no small item on two or three millions of dollars worth of work.

Of the total bonded indebtedness of $2,517,500 there remains outstanding $1,959,500. Exclusive of the value of the city's water rights in the Los Angeles River, the works, after figuring the depreciation at $924,197, have a net cash estimated value of $5,654,270, and capitalized at 5 per cent. pay interest on a valuation of $15,000,000.

Leaving out of consideration the infinitely better service that has been given, Los Angeles in her 8 years of water works operation is very firmly of the opinion that public ownership pays.

It is this experience which has given the city courage to enter upon the construction of the Owens River Aqueduct, involving an expenditure of $28,000,000 and providing in addition to an inexhaustible supply for domestic use, the irrigation of more than 100,000 acres of land and the development of 120,000 horsepower of electrical energy.

The completion of this project will in no way work a change in the water works system as at present constructed; future construction will keep the new supply in mind, but with the aqueduct in use, the water will be drawn from the San Fernando Reservoirs, 20 miles distant, carried to a junction with the present supply system and from there will be conveyed into the distribution mains.

Determination of Water Rates for Madison, Wis.

IN a recent decision the Railroad Commission of Wisconsin made a thorough discussion of the water rates in the municipal water department of Madison, Wis., and developed the various parts of the rates finally prescribed, showing the reasons for each, the final rates resulting from their combination and the probable effects thereof upon the revenues of the department. The following is partly abstracted and partly extracted from the opinion accompanying the decision, because on the whole the opinion gives the most satisfactory practical example of a scientific method of fixing water rates by meter which has yet been published.

The first step was to determine the value of the plant. This was done first by means of an inventory made by the commission's engineer, which was checked by the books and annual reports of the department and finally fixed at $576,188. Upon the lack of sufficient accounts and the charging of operation and construction expenses incorrectly, errors being made both ways, is based the first order, viz: "That the board of water commissioners of the city of Madison hereafter keep full and complete records of the operation of the water system under its control as required by law and in the forms prescribed by this commission."

As to the interest to be allowed, the commission believes that it should be allowed upon the whole investment, as it would then be to the city's interest to retire the bonds as rapidly as possible and earn the interest itself, holding it in reserve for future extensions or other proper purposes. In fixing the rate of interest a distinction should be made between public and private plants, giving the advantage consequent on possible lower rate to the consumer. The commission does not mention the desirability of giving this advantage as an offset to the higher cost of operating a municipal plant, although it shows in several places that the present administration, though honest and efficient, is not always as economical as one under private ownership would probably be. A rate of 4 per cent. is allowed, as against 6 per cent. probable in a private plant, making a saving of about $12,000 a year.

The allowance for depreciation is $3,500 a year on the sinking fund plan. That for taxes is $5,000.

In determining the proper allowances to make for operating expenses, careful studies were made of the expenditures for the various items for a series of years, to determine the normal expenditure. Thus the coal bills paid during the past five years varied from $3,696 in 1907 to $10,633 in 1908, and the price per ton from $4.15 in 1906 to $7.10 in 1909. The normal expenditure for 1909 is developed by diagram to be $11,900, as compared with the actual expenditure of $7,891.

Maintenance of buildings, fixtures and grounds was averaged for the five years as $467, and $500 was assumed as the normal for 1909 as compared with $850 actually paid. Maintenance of reservoirs, tanks and standpipes varied from 0 to $605 and averaged $165, which is assumed as the normal.

Other items are worked out in the same manner, and the total cost of service is determined to be as follows:

Operating expenses	$31,184.33
Interest	23,047.52
Taxes, as above	5,000.00
Depreciation, as above	3,500.00
Total cost of service	$62,731.85

The commission has long made a sharp distinction between the class of expenses of operation due to the necessary capacity of the plant, and that due to the output of the plant. The first class is nearly constant, and the second class varies with the output. Some items partake in part of the nature of each. Each account in the operating and maintenance cost is tabulated and distributed between the two classes, and the totals show that 49.93 per cent. of the expenses are chargeable to the capacity of the plant and 50.07 per cent. of the capacity of the plant, or say, half to each. The output cost is higher in Madison because of direct pumping, and general expenses are small because rent of office, treasurer, bookkeeper, etc., cost almost nothing, being added to duties of other city employes, thus reducing the percentage of capacity expenses from the usual 60 or 70 per cent. Interest, depreciation and taxes are distributed in the same ratio.

A study is then made of the distribution of the capacity expenses between public service and private service. The various items of original cost of the plant are divided between these two classes, according to the judgment of the engineers. Thus reservoirs and standpipes, necessary for ample supply for fires are assigned $18,769 to public and $6,256 to private service, while the distribution system is assigned $144,189 to public and $187,452 to private service. Each of the thirteen items is similarly distributed according to the values of hypothetical plants required to supply public and private demands. The result is that 49.6 per cent. of the value of the plant is chargeable to public service and 50.4 per cent. to private service, or half of the output expenses would be charged to private consumers and half to the city at large.

Output expenses are distributed in like manner. It is shown by measurements and estimates that the total consumption in private service is 254,795,608 gallons and in public service is 183,523,000 gallons, or 58.2 per cent. in private and 41.6 per cent. in public service. This does not include the 178,998,392 gallons "consumed in operation," viz: slippage and double pumpage not actually consumed, flushing mains, and the balance lost and unaccounted for. This amount is not put into the account but the cost of supplying water is computed for the amounts consumed in the public and private service above given. This gives the average output cost of furnishing water as between 5 and 6 cents per 100 cubic feet.

Adding the capacity and output charges together, the city should pay per year $16,052.34 on the former account and $12,854.62 on the latter, or a total of $28,906.96. Private consumers should pay $15,454.62 on the former account and $17,898.05 on the latter, or a total of $33,352.67. This is a total for both classes of consumers of $31,506.96 on capacity account and $30,752.67 on output account, and a grand total of proper payments of $62,259.63.

The present total payments are $52,396.82, of which the city pays but $11,675, being $1,675 interest on bonds and an allowance of $10,000 for taxes on the value of the plant, not paid. Private consumers pay $40,721.82 or $7,369.15 more than their just share on the basis of the investigation. On the same basis it seems that the payments to the company should be increased $9,862.81 to make the plant strictly self-sustaining, although much of this sum would be interest on the excess of value of plant over indebtedness and would be going into a fund for future extensions and betterments.

These figures give a basis for modifications of the present rates to bring the income from private consumers down to the amount above derived as their proper share. The rates are divided into two parts, the service charge, based on the capacity account, and the output charge based on the output account.

The capacity charge is made up of a meter charge and a charge for readiness to serve. The meter charge is made up of a charge for maintenance of meter and one for reading the meter. The charge for maintenance of meter is made up of one for interest and depreciation on the investment and one for maintaining meters, being the capacity account part of the total cost of maintaining meters.

The amount of interest and depreciation is taken as $4,000, being 8 per cent. on an investment in meters of $50,000. The capacity share of the expense of maintaining meters is $490, being 70 per cent. of the total expense of maintaining meters for a year. The cost of reading meters for the year was $508.75. This makes the total charge for maintenance of meters $4,998.75. Subtracting this from the $15,454.62 given above as the amount private consumers should pay on capacity account, leaves $10,455.87 as the sum which should be charged directly to consumers without reference to the amount of water used.

The meter charge of $4,998.75 is divided among the meters in the following manner: The $508.75 cost of reading 4,418 meters amounts to 11.5 cents per meter per year. The balance, $4,490, is distributed according to cost of meters, the unit charge for one ⅝-inch meter being computed to be 94.5 cents, and the other sizes increasing in proportion to the cost. Adding the meter-reading cost, dividing by 2 and taking the nearest even quarter, the meter charges for a half year result. There being 5,723 customers, the charge to private consumers of $10,455.87 on capacity account amounts to about $1.82. This is made an even $1 for the half year. The meter rate schedule per half year thus becomes the following, being made up of the meter charges, varying according to the size of meter and the consumer's charge:

For ⅝-inch meter..............	$ 1.50
For ¾-inch meter..............	1.75
For 1- inch meter..............	2.00
For 1½-inch meter..............	2.75
For 2- inch meter..............	3.75
For 3- inch meter..............	6.00
For 4- inch meter..............	10.00

If there is more than one consumer taking water through a single meter the consumer's charge of $1 is added to the schedule rate for the size of meter in use for each such additional consumer.

The output charge of $17,898.05 chargeable to private consumers, distributed over the 254,795,608 gallons of private consumption makes the cost of water 5¼ cents per 100 cubic feet on this account. The schedule is made so that consumers using less than 75,000 cubic feet per half year pay 6 cents per 100 cubic feet, and those using more than this amount pay 5 cents per 100 cubic feet for the excess.

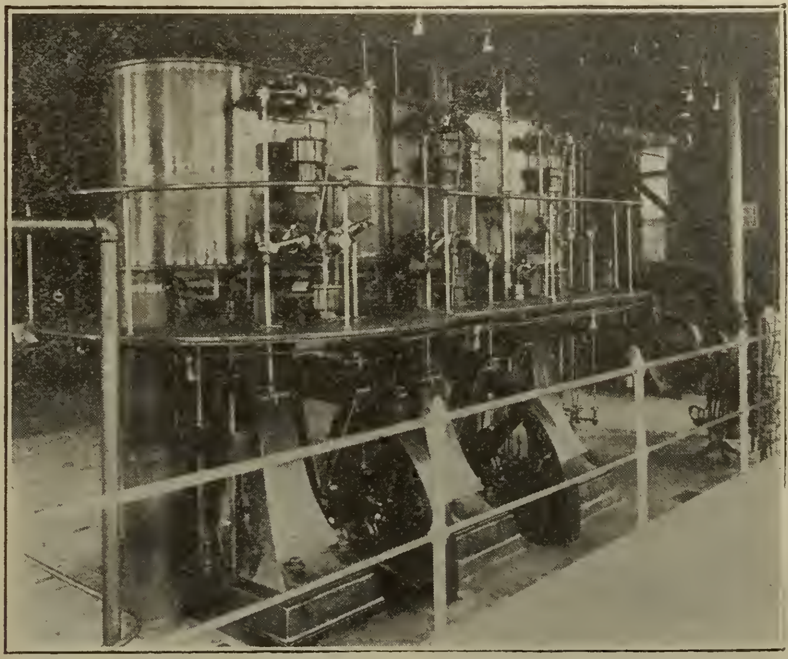
Detailed calculations show that under the new rates every class of consumers receives slight reductions, though some 1,260 customers have their bills increased from 1 to 40 cents per year. The total reduction in income from private consumers for a year is about $3,000. It is stated above that they have been paying $7,369.15 more than their share, so that the reduction is conservative.

The city should pay, as stated above, $28,906.96 a year toward the maintenance of the water plant. Schools and other public buildings are put on a meter rate of 5 cents per 100 cubic feet, and it is recommended that they be required to pay this to the water department. The total is estimated at $1,062.73 per year for the 27 metered connections. The street sprinkling fund should also pay 5 cents per 100 cubic feet or some $2,500 a year. Crediting the city with $5,000 taxes on the plant, this leaves $20,344.23 to be paid out of the general fund.

A study of the interest and depreciation on the cost of the plant shows that it approximates very closely the proper payments by the city. This study shows that the city should have paid in 1909 $29,830.54, as compared with the $28,906.96 computed as above. Actual payments have been as low as $800 and even $450 in recent years, not including allowance for taxes, and the total for the life of the plant has been $311,524.99, as compared with a computed total interest and depreciation charge of $418,439.87.

This study is one of the most complete and scientific which has been made, and may serve as a model for others. The resulting rates should not be assumed as correct for another case, since conditions will undoubtedly be found to be different, but the modifications will be slight for the ordinary case.

Unfortunately, not all cities have records as complete as those of Madison, so that assumptions must be made or, better, tests must be made to determine the actual conditions. When they are ascertained the method prescribed in this opinion may be followed almost verbatim.



WATER WORKS PUMPING STATION, MADISON, WIS.

EDITORIAL COMMENT

Terms of Bond Issues for Street Pavements—City Government by Commission

TERMS OF BOND ISSUES FOR STREET PAVEMENT.

The question of the period of time to be selected for bond issues for payment for paving improvements is one on which there is considerable difference of opinion, as evidenced by the difference in practice. This is probably due to the fact that the principles upon which the decision should be based are seldom discussed and are only understood in a general sort of way. The inquiry for information upon this subject, answer to which will be found in the Question Department, suggests a discussion of these principles, and it is hoped that this will elicit further discussion, especially from those who differ from the positions taken.

It is an undoubted principle that the best service from a structure at the lowest cost is obtained when the expenditure is such as to keep the structure always at or near its maximum efficiency. This is attained, if the first cost of the structure is paid in cash when built, by providing a depreciation fund from which repairs and renewals shall be made as they are required. The amount of allowance to be made annually for this fund, that the payments to it may be as nearly uniform each year as possible, must be computed from the lives of the various parts of the structure, assumed from knowledge of the life of similar structures under like conditions. If the structure brings in a revenue, this depreciation fund should be built up by annual contributions from the income of the plant. If, as in the case of a pavement, there is no income, a similar fund should be provided through annual appropriations, that excessive demands in any one year may not be refused on account of lack of funds.

If the cash investment is not made when the structure is built, but bonds are issued to pay for it, the statement of the theory must be modified. If the structure could be assumed to last like the "one hoss shay" in good condition until the end of its life, then the sinking fund for the retirement of the bonds should just equal the amount of the bonds at the time the structure ceases to exist. Practically, the depreciation fund must still be provided, and if it is kept up in the manner above described, the structure continues indefinitely at its condition of economical efficiency. In such case the money represented by the bonds is the capital invested in the concern, and they may be of indefinite life, the interest on the bonds taking the place of equivalent dividends on capital invested by the stockholders, in the ordinary commercial corporation. In the case of a pavement laid by a municipal corporation, the question is different in that the capital invested gets no return in the form of dividends and the choice is not that in the commercial corporation between investment of the stockholders' money or borrowing of money with which to build the structure. It is rather the choice between paying for the pavement at once or distributing the cost over a period of years. Assuming that the pavement is kept in its best condition through the action of the depreciation fund, the term of the bonds may be anything which is decided upon as equitable and convenient, without reference to the assumed life of the pavement.

Actually, under ordinary municipal conditions, particularly for a pavement, no depreciation fund is sufficient to make all the renewals necessary to keep the pavement continuously in good condition, although this is the most economical mode of procedure. Ordinarily the depreciation fund is kept small, or rather is represented by fluctuating annual appropriations or expenditures for repairs, and the pavement is not kept always in its best condition, but is allowed to deteriorate until it requires complete renewal, at least of the wearing surface. For some paving materials periodical renewal of the wearing surface is inevitable. Taking a lesson from this actual method of treating pavements, it is necessary to substitute for the lack of sufficient appropriations to the depreciation fund a sinking fund provision, which shall extinguish the indebtedness by the time a general renewal is necessary. Theoretically, this sinking fund need be only large enough to provide for the cost of the wearing surface, if the foundation is a proper one. Practically no distinction is made along this line and all the bonds are given the same term. From this point of view the term of the bonds should not be longer than the life of the pavement.

There is another element which comes into an equitable settlement of the case; the effect of the improvement upon the value of the property benefited, and upon the valuations for taxation, and consequently upon the revenues of the city.

If the cost of the pavement is assessed directly upon the property affected thereby, the term of the bonds should be affected by the estimated increase in the value of the property assessed. When there is such increase it is but fair that this increase in value of property should offset the assessment, and only time enough to demonstrate this increase is required. This reasoning is the basis of the various customs of paying for pavements in three, five, seven, ten, or even twenty annual payments. The writer has known of developments of urban districts as well as of such neglect of pavements as required new pavements, often of better quality, before the ten-year period for the payment of the bonds on the first pavement had passed. This simply shows the impossibility of making a general law fixing the same period for all improvements which will be equitable in its application under all conditions.

Theoretical considerations would therefore seem to require that the term of the bond issue should be determined, in the case of a pavement which can be kept indefinitely in good condition by a depreciation fund to cover repairs and renewals, after considering the comparative economy of paying interest indefinitely and extinguishing the principal by increasing the annual payments; and modifying the result by adding to the points to be considered the effect of the pavement in increasing the value of the property, in case the bonds are paid by assessments on the property directly, or in increasing the taxable value in case the bonds are paid by the municipality.

And practical considerations would seem to require, in the ordinary case, that the term of the bonds should not be greater than the life of the pavement, otherwise two sets of bonds may be in process of payment at the same time. The only exceptions noted above are in regard to the position of the bonds representing the foundation, where the renewal of the wearing surface only is required, and where the life of the pavement can be made indefinite by proper attention to repairs and renewals, and complete renewal or reconstruction of wearing surface is therefore not necessary at any time.

CITY GOVERNMENT BY COMMISSION.

The University of Wisconsin has just issued Bulletin No. 423, which is on the subject of "City Government by Commission," and is by Ford H. MacGregor, who is in charge of the municipal reference bureau of the University Extension Division. The bulletin is preliminary to a more exhaustive treatment of the subject, and gives much information regarding the features of the various forms of municipal administration which are loosely and often incorrectly grouped under the general term, government by commission.

Mr. MacGregor makes the same objections to the use of the term "commission" that have been made by MUNICIPAL ENGINEERING, and calls special attention to the fact that the ordinary use of the term is to denote an appointive body, removed as far as possible from the vote of the people. This term was properly applied to the first Galveston commission, because at least part of its membership was appointed by the governor of the state and was thus properly a commission. When this method of establishing the governing body of the city was declared unconstitutional and election by the people was substituted, the designation of the governing body was continued, and thus the present inaccurate use of the term was inaugurated.

As Mr. MacGregor states, this elected body is upon an entirely different basis from the true "commission" and is as complete an example of direct responsibility to the voters as the true commission is of removal of control from the direct action of the voters. The author recognizes that the so-called commission form of government is largely a modification of the council form. In its most complex form the city government is made up of a mayor and two legislative bodies elected from differently formed districts or for different terms of office or otherwise so that they shall be in some sense at least subject to different influences. Perhaps a few other city officials are elected by the people also, but most of them are selected by the councils or under regulations adopted by them. A simpler form, and one equally popular, especially in the smaller cities, is that of one councilmanic body and a mayor, otherwise the general form and procedure being similar to the above. In each of these cases the councilmen or aldermen are usually elected by their respective wards or districts, though in some cases the members of one body are elected by wards and those of the other are elected by the city at large. Still a third form is that of selectmen, elected by the municipality at large quite probably at the town meeting. The new commission differs only in detail in this respect from the board of selectmen and only in the direct source of its responsibility from the two forms of councilmanic government.

The only real departure from the letter of the older forms of city government is in the assignment of each councilman to the administration of a certain department of the city's activities, thus making him directly responsibility for the administration of this department as well as jointly responsible with his fellow councilmen or commissioners for the exercise of the legislative functions of the city government. And this is little, if any, departure from the actual practice in many boards of selectmen.

In other words, the commission form of city government is simply a development of the old form of government by council with some of its failures of true representation of the people corrected and its faults of administration eliminated, but with the checks on its legislative functions removed, and its lack of definiteness in fixing responsibility continued.

The tendency of the American people to ascribe difficulties to the form of government rather than to defects in the machinery of operation of the existing form is clearly shown by the author as well as the consequent slow progress in the improvement of municipal government. Each newly established form continues most of the defective machinery in use, because of the actual ignorance of all the new (as well as the old) officials of the details of administration, and the consequent necessity of continuing the old forms of doing the city's business. As a consequence the new form, when the first enthusiasm dies out and the "practical politician" has an opportunity to get back into his briefly interrupted control, develops the same administrative defects and gives rise to the same complaints of defective form of organization. The fact is that the only necessities are direct responsibility of each individual in the city government for his own department, the elimination of all influences except those having to do only with the policy of the people in governing their municipality, publicity, especially regarding financial transactions, and retention in office of the competent technical employes of the various city departments without reference to the vicissitudes of voting for their elected superiors. These things can be provided for in any form of municipal government to some extent at least, and can be applied to most of the existing forms of American municipal government quite as easily as they have been applied to the commission form. Such safeguards as non-partisan nominations, the double election, the initiative and referendum, civil service, the short ballot, the finance commission, are applicable, and most of them have been applied somewhere with success, to other forms. For some of them we are indebted to the attempts of various legislatures to supply the safeguards which are imperatively demanded by the original commission form.

That form has not yet been long enough in operation for the original enthusiasm to have abated, so that we can not yet state from direct observation that it will follow the usual course, though there are some indications from the cities making the earlier applications that this is the case. The lesson can be drawn from parallels in history.

Mr. MacGregor states that there are four essential features of the commission form, (1) complete centralization of power in a small commission, which is (2) elected at large and not by wards, includes (3) all the elective officers of the city except perhaps one or two and appoints all other officials and (4) removes all appointees at will. These are the features of the Galveston plan and none of the other so-called commission cities possess them all.

Perhaps the most complete departure from them is in the charter of St. Joseph, Mo., which has been called a commission city since its city council was reduced to five members elected at large, thus conforming with the above formula only in the second item.

The charter of the city of Indianapolis centralizes all power except that of making appropriations and fixing tax rates in one commissioner, the mayor, elects its councilmen at large, gives the mayor through the boards appointed by him full power to appoint and remove all officials and employes, except as to park and school boards. It therefore differs from the commission form of government only in the fact that it has a single commissioner who is responsible for everything except the levying of taxes and making appropriations and the passing of such legislation as may be necessary for the exercise of his powers and duties. In but this one respect is his power less or his responsibility less than it would be under the commission form. Yet Indianapolis is distinctly not a commission city. The form of government of the city has been called the "federal" form, but it is really in this form only by accident. It is more nearly the business form than is the commission form. It differs in but two essentials from the true business form, viz: The mayor, the president of the corporation, is elected directly by the people instead of by the council or board of directors; voters, or stockholders in the corporation, do not have the opportunity to select their own candidates for president and board of directors, the machinery of nomination being neatly devised to give the political manipulators the power to make the nominations of candidates and to make it difficult effectively to present any other candidates. In other words, if Indianapolis, and with it other Indiana cities of the higher classes, were given the non-partisan nominations and perhaps the double election, provisions which are not included in the above given commission formula and on which it has no copyright, they would have a form of government which is nearer the business form than is the much vaunted commission form, one which has demonstrated its efficiency in every way except the one failure to eliminate partisan politics from city government. Will it not be safer, more economical, more progressive, to give to this tried and tested form the provisions which will make it possible for public spirited citizens to secure good administration of their city affairs and remove the temptations to political manipulation of purely business matters, rather than to overthrow the entire system and try to start a new one, which is only old enough to demonstrate that it needs an increasing number of safeguarding provisions to keep it from becoming a still more objectionable political machine?

THE QUESTION DEPARTMENT

Casing for Deep Well.

I would like to ask a good place to get casing for a deep well proposition where we can rent the case and return what we do not need. I am one of a committee to let these contracts and want information. We are going to let a contract for deep well to 2,000 feet.

Y., ———, Mo.

Can our readers give any information on this subject?

Perhaps information can be obtained from firms listed in the "Business Directory" printed in each number of Municipal Engineering under the headings "Well Drilling Machinery," "Pipe Manufacturers," "Contractors' Tools and Machinery," "Contractors."

Terms of Water Works Franchise.

Will you please tell me if under Sec. 11 of the enclosed franchise the city can deduct the interest which the Water Company pays on first mortgage bonds, as a part of the operative expenses, to be deducted for finding the franchise value of the water plant?

In case the city should refuse to purchase this plant as provided herein, does not this franchise extend itself for another twenty years?

D., ———, S. D.

Sec. 11 reads as follows:

Should said city purchase the water plant herein mentioned as herein provided for, the amount to be paid by said city therefor shall be determined in the following manner, viz: One year before the expiration of twenty years from the date of the commencement of the operation of said plant the common council shall pass and adopt a resolution declaring an intention to purchase said plant and appropriating, setting aside or otherwise providing for the funds necessary for said purchase and directing the city auditor to serve upon the said ———, his associates, successors or assigns a certified copy of such resolution and commencing on the day following the date of service of such copy of such resolution, the said ———, his associates, successors or assigns shall keep in a set of books to be kept for that purpose, and for no other, an accurate account of the receipts and disbursements of said plant and of the business connected therewith, which accounts shall be open to the inspection of the city treasurer of said city at the end of each quarter year and at the expiration of one year the said city shall pay to the said ———, his associates, successors or assigns as the value of said plant, such a sum of money in cash, as the net earnings of said plant so determined shall be five per centum of. The term "net earnings" as here used being hereby construed to mean the difference between the total receipts and the actual operating expenses of said plant, and upon such payment the said ———, his associates, successors or assigns shall surrender to the said city all their property, rights and franchises choses in action, contracts, and things of value of every name and description appertaining thereto or connected therewith.

The answer to the first question depends upon the definition given to the term actual operating expenses. Since there is a difference of opinion upon this point, the court would probably decide the question with direct reference to the equity of the case.

Assumng good faith on both sides in making the contract, the intention seems to have been to make the net earnings of the plant the measure of its value. If the plant had no debts, whether funded or floating, this is approximately true, if the plant is considered merely as a revenue producer. In such case the net earnings would, under the franchise, be 5 per cent of the sum which the city should pay for the plant. If there is any indebtedness against the plant, it would evidently be necessary for the company to extinguish it before the transaction could be completed and the title could pass to the city, and unless the city should be willing to agree to accept the plant subject to such indebtedness, in which case it might be fair to compute the purchase price of the company's equity in the plant by deducting from the "net earnings" the interest on said indebtedness for the year of the computation, the city fulfilling the remainder of its contract by assuming such indebtedness. Whether this would be equivalent to the transfer of the plant free of all indebtedness for twenty times the "net earnings" is a question for the answer of which data are not supplied.

The only provision in the franchise governing the answer to the second question seems to be a proviso in the first section of the ordinance to the effect that

At the expiration of said twenty years should the said city refuse or neglect to grant to the said ————, his associates, successors and assigns the right to operate and maintain said system of water-works for another twenty years upon the same terms and conditions as may then exist between the said ————, his assigns and the said city or upon such conditions as may then be agreed upon, then and in such case the said City of ———— shall purchase from the said ————, his associates, successors and assigns said system of water-works and mains and all property appurtenant thereto or connected therewith in the manner and at a valuation to be determined as hereinafter provided.

This provision does not seem to extend the franchise for 20 years or any other period, but requires the city to purchase the plant at the valuation determined as in Sec. 11. Whether this is a contract which could be enforced against the city and under the present city council is a question which the courts only could decide with authority.

The writer does not wish to be considered as favoring the method of determining the value of the water plant which is prescribed in the franchise. The net earnings give information as to the value of the plant, but they do not give all the information and the real value may be greater or less than that determined under the terms of the franchise. This question has been discussed quite fully at various times in MUNICIPAL ENGINEERING and this is not the place to repeat any of these discussions.

The opinion of an attorney familiar with the laws and court decisions of South Dakota and with the local conditions should be sought as to the applicability of the general principles above stated to this particular case and in this particular state.

Sufficiency of Proposed Gas Franchise.

Enclosed find a proposed gas franchise together with the report of a meeting at which it was discussed by the public. If it is not asking too much I would like to know what you think of it in general and where the specific weak places are, assuming that there are some or the gas company would not propose to accept.

Do you think gas can be sold at a profit at 90 cents in this city, that is gas of the proper amount of heat units? Could a new plant be built here and do business profitably at that rate?

M., ————, Ind.

Following is a sketch of the provisions in each section of the proposed ordinance with comments upon such as might be improved:

The first section grants the company the right to manufacture gas and maintain and operate the existing plant and any additions that may be made thereto under the ordinance for a term of 25 years.

This is understood to be the limit of such grants under the statutes. With proper supervision of rates an indefinite franchise would be better, if it were possible, for it removes the disturbance of financial conditions which arises from the periodic expiration of franchise and consequent renewal of the company's financial obligations.

The second section provides that the acceptance of this ordinance and contract by the company shall act as a cancellation of all grants heretofore made to the company or its predecessors, and of all obligations thereunder on either side.

The third section places all responsibility for damage to any one incurred in the construction and maintenance of the plant upon the company, including defense of suits against the city on such accounts.

The fourth section provides for filing maps of the company's pipe system and of proposed extensions of pipe mains, not including service connections.

The fifth section provides for issue of permits for digging trenches before beginning work and for permits from contractors having pavements under guaranty to be filed with the city clerk; except that permits will not be required for emergency work. It also prescribes regulations for doing the work and penalty for company's neglect of them; also for keeping mains and services in repair and for rebuilding; and for services to property line at company's expense so located as to meet approval of property owner; also for notice to company of any new paving improvement and placing or renewing of main and services requiring same within 60 days; except that services will not be laid to unimproved property or without year's contract for gas unless the property owner pays $6 therefor, to be credited on his first bills for gas if he begins to use gas within 3 years. The company can lay its mains in alleys if property can be as well served thereby. The company is not required to lay mains unless the agreements provided in Sec. 10 are made.

The sixth section provides for laying

mains to present established grades and for changes to suit future establishment of grades at the expense of the company.

The seventh section fixes quality of service and materials as adequate and first class and provides that sewers or other public or private property shall not be damaged or interfered with by the construction.

The eighth section provides for an adequate supply of gas with at least 550 B. t. u. per cubic foot and of not less than 16 candle power, and provides for cancellation of contract and franchise for failure for causes not beyond the company's control; except as to defects in service pipes and fixtures on consumer's property.

This quality of gas is easy to obtain with any gas coal, by the ordinary coal gas process, and is easier to obtain by the carburetted water gas process than the gas usually prescribed. The reduction in requirements below those usually made reduces the cost per thousand cubic feet of making the gas, as explained below. Also it will be noted that gas with 550 B. t. u. at 90 cents is almost exactly equal in cost to the consumer to gas with 600 B. t. u. at $1 a thousand cubic feet for the same heating service. In other words, one must burn about 11 per cent more of the poorer gas to produce the same effect, and his bills will be no less for the poorer gas at 90 cents than for the better gas at $1. Still another way to put it is that the poorer gas can be supplied at 90 cents with more profit to the company than the better gas at $1, because more of it will be used, not to speak of the greater profit per cubic foot in selling the poorer gas. Gas deteriorates in its passage through the mains so that if this poorer gas is adopted the tests should be made at the consumer's tips anywhere in the city. See also the fourteenth section.

The ninth section provides that for ten years the price for gas shall be $1.10 with 10 cents discount for payment by the tenth of the month, or a net rate of $1 per thousand cubic feet, the minimum charge to be 40 cents a month for 400 cubic feet or less consumed in the month. It also provides for an agreement on a price within 60 days of the end of the 10 years, or, failing agreement, for the appointment by each party of an arbitrator and if they two cannot agree they to select a third arbitrator to fix the price for the ensuing 5-year period; this operation to be repeated each 5 years during the period of the franchise. It is also provided that if the state establishes a public service commission it shall take the place of the arbitrators after 5 years from its establishment.

It is not possible to say without careful study of the situation in all its details whether the rate prescribed is equitable or not. Conditions vary so much that no general statement can be made. It may be said, however, that a number of cities in the same state as the city under consideration and in adjoining states have rates of $1. There does not appear to be any reason why the arbitration feature of the franchise should not be applied to the rate to be adopted with the franchise. The city of Taylorville, Ill., recently passed two franchise ordinances, containing this provision in somewhat better form than that above stated, and they were accepted by the companies, except that one company, operating a gas plant as a part of its business, was not satisfied with the gas rate fixed in the ordinance and took advantage of the arbitration clause to have the rate fixed by the board provided for. The case has been presented to the board and is now under consideration by them. This would seem to be the equitable mode of procedure in the case under consideration. The city council probably knows no more about what the rates should be at this time than the council ten years from this time will know and is equally deserving of assistance from experts in determining them. The Taylorville ordinance has a more satisfactory provision for establishing the arbitration board, in that it provides that appointees on the board shall not be nor be considered to be representatives of either party. This was attained, on the second attempt, by both parties joining in the notice of appointment of the two nominated by the two parties respectively, and in the stipulation as to matters to be brought to the board and method of procedure. Thus, while the nominations are made by the interested parties they must be mutually satisfactory, which may eliminate excessive partisanship in such appointees at the same time that it insures each side the full consideration of its point of view. The selection of the third member by these two further tends to eliminate partisanship. The provision whereby the state public service commission if established, shall be substituted for the arbitration board is excellent, though why this substitution should be delayed until the commission is five years old does not appear. There is evidently much temptation for a public service corporation to indulge in political manipulations to secure a favorable council, city attorney and mayor at the time of revising rates and thus nullifying the provisions of the rate revision, at the same time that the ordinance is followed strictly to the letter. This tendency is eliminated by the reference of the matter to the state commission.

The tenth section provides for extensions of mains when the number of consumers contracting to take gas for a year from the time the mains are in readiness is four to each 350-foot square or block, except that the company cannot be required to lay more than two miles of main each year. Services for unoccupied or unimproved property are to be put in only under the provision of the fifth section.

If four consumers per block, approximately one for each 90 feet of main, are sufficient to give interest return on the money invested in the pipe, there seems to be no reason for limiting the length of mains that can be ordered to two miles, but this provision is not uncommon. Occasionally it is modified by requiring extensions under such provisions as the above and then giving the city the right to order extensions, whether having the required number of consumers or not, to a certain limited extent, the equivalent, say, of one or two miles in a city of 10,000 population.

The eleventh section provides that the company shall supply meters correct within two per cent and shall maintain an efficient meter prover, subject to the inspection by the city of the prover and of the tests of meters by it. If the meter shall be found fast the company must refund the excess for the last two months.

The twelfth section provides that the company may make reasonable rules and regulations for use of gas and making collections and may charge $1 for reconnecting meter shut off for non-payment of bill.

The reasonableness of these rules and regulations should really be subject to the decision of the city authorities or in case of difference of opinion of the arbitration board. The question of responsibility for unpaid bills of tenants who move away is not mentioned in the franchise. This may be sufficiently established by custom or by the regulations concerning collection of bills. These regulations often give the company the right to require a deposit of, say $5, to cover such delinquencies in ordinary cases, or of larger amount for larger consumers.

The thirteenth section provides for forfeiture of the franchise on failure of the company to comply with any or all of its provisions on 60 days' notice if the council passes an ordinance to that effect; except that unforeseen casualties for which the company is not responsible shall not be counted.

The fourteenth section provides for test of gas on petition of any consumer, by competent tester or chemist appointed by city, for heat units and candle power. If the gas is not equal to ordinance requirement the company pays cost of test, if it is equal to the standard the petitioner pays the cost. If the city were larger it should establish testing apparatus which could be used easily and at a minimum cost. The regulations of the Wisconsin State Commission provide for an average heating value of 600 B. t. u., and a minimum of 550 B. t. u. Such a provision requires regular testing of gas and if it were made the city, in order to keep proper watch of the gas, would be obliged to keep in operation the testing apparatus for periodical tests from which to derive the average and watch any drops below the minimum. It may be deemed inadvisable to do this in a city with but small consumption, and in that case a minimum should be fixed below which the gas should never drop. In fixing this minimum it should be remembered that normal coal gas can be manufactured from good gas coal without enriching with heat value of 585 to 600 B. t. u. with economy; and that gas of 550 B. t. u. is obtained by simply distilling over the subsequent poorer gas from the same coal and mixing it with the better gas. The only cost of this additional gas is the additional heat required for the additional time the coal is kept in the retort. Or cheaper coal may be used. This is evidently a paying proposition from the point of view of the manufacturer. The quality of the gas at the consumer's tip is what interests him and, particularly if a low minimum heat value is prescribed, the tests should be made there and not at the manufacturing plant, and if the place of testing is not at the tip farthest from the works, allowance should be made for this or the tests of the gas drawn at the city's laboratory should be checked by analyses of gas drawn at such farthest tips.

The fifteenth section provides that on acceptance by the company of the ordinance as passed by the council and signed by the mayor it shall become a contract to continue for twenty-five years.

Life of Cast Iron Gas Mains.

I am investigating the life of cast iron pipe when used as a gas main, and would appreciate it if you would inform me on the following points:

What is the average life of cast iron pipe when used as a gas main, conditions, such as soil, etc., being the average?

Is corrosion more marked on the inside or outside of such a pipe? I have heard that the nature of gas is such that it really acts as a preservative rather than otherwise. Is this the case?

Would it be advisable to build a 20-year pavement over a 3-inch gas main which has been in the ground 55 years even though an examination of the pipe shows it to be in good condition?

We are contemplating putting an expensive pavement on one of our streets where a 3-inch main has been laid 55 years, and the local company maintains that their pipe is good for over 30 years yet. D. F. McC., ———, Vt.

The average life of gas mains has not yet been determined. Good cast iron properly coated and laid in ordinary soil where there is no danger of electrolysis seems to have an indefinite life, those fifty years old or more seeming to be in as good condition as when laid, where they have been examined. This does not apply to all gas mains nor to all soils, nor to all conditions, for mains have failed within three or four years. For any particular case, therefore, actual inspection at points enough to give one a good idea of the whole line must be resorted to. As the deterioration can be observed from the outside, this inspection is not difficult to make. If this inspection shows the pipe to be in good condition, with little or no corrosion as compared with the condition of new pipe, it may be safe to cover it with a permanent pavement, for the 55-year old pipe may well be equal to 30 or more additional years of life. The writer would make no definite recommendation, however, without a personal examination of the pipe, the soil, the possibilities of corrosion and electrolysis.

Methods of Testing Oils.

I recently purchased through your magazine a copy of Standard Paving Specifications in which an editor's note states that Bulletin No. 65 of the American Railway Engineering and Maintenance of Way Association can be obtained from E. H. Fritch, secretary.

I have written Mr. Fritch and find the edition is exhausted and as I have used this Bulletin as referred to in my specifications, I would very much like to obtain a copy, especially that part that refers to the distillation of oils. I will thank you very much if you will advise me where or how I can obtain this Bulletin at an early date.

J. M., Columbia, S. C.

The method of distilling coal tar creosote for determining its qualities prescribed by the American Railway Engineering and Maintenance of Way Association is given in MUNICIPAL ENGINEERING, vol. xl, p. 422, second column, in an article on "Methods for Testing Coal Tar and Refined Tars, Oils and Pitches Derived Therefrom."

The method of obtaining samples is not there given and is here quoted from Bulletin No. 65 of the Association:

In view of the fact that everything depends upon the samples taken for analysis, too much care cannot be used to make sure that such samples are strictly average ones of the whole bulk of the oil.

To this end the oil should be completely liquefied and well mixed before any samples are taken. Wherever possible, a drip sample of not less than 2 gallons should be taken, commencing after the oil has started to run freely. Where this cannot be done, as, for instance, in large storage tanks, samples should be taken from various depths in the tanks, by means of a tube or bottle, the number of samples depending on local conditions.

For taking samples during the process of treatment, it is desirable to take a sample of oil from the storage tank about 1 foot from the bottom of the tank before the cylinder is filled, and, where possible, a sample directly from the cylinder during the process of treatment. For this purpose a thermometer well is recommended.

The sample to be analyzed should be thoroughly liquefied by heating until no crystals adhere to a glass stirring rod, and also well shaken, after which one-half shall be taken for analysis and the balance reserved for a check test.

The apparatus used is shown in Drawing No. 6 on p. 420 and is described as follows:

The apparatus for distilling the tar oil or creosote must consist of a stoppered glass retort similar to that shown in drawing (No. 6), having a capacity as nearly as can be obtained of 8 ounces up to the bend of the neck when the bottom of retort and the mouth of the off-take are in the same plane. A nitrogen-filled mercury thermometer of good standard make, divided into full degrees centigrade, must be used in connection therewith. The bulb of the retort and at least 2 inches of the neck must be and remain covered with a shield of heavy asbestos paper, shaped as shown in diagram, during the entire process of distillation, so as to prevent heat radiation, and between the bottom of the retort and the flame of the lamp or burner 2 sheets of wire gauze, each 20-mesh fine and at least 6 inches square must be placed.

It is also recommended that the flame be protected against air currents. An ordinary tin can, from which a portion of the bottom and all the top have been removed, placed on a support attached to the burner, as shown on the diagram, has been found to answer the purpose.

Design of Grade for Flat Street.

When a town is naturally "as flat as a flounder" will a profile map of a grade be necessary prior to paving the streets? In other words, is a town ever flat enough, however apparently so, to dispense with a preliminary grade? SOUTH FLORIDA.

The designs of the grade for a flat street is the most difficult problem in street construction, from an engineering point of view, although, of course, errors due to lack of preliminary grades are not so serious from the standpoint of cost as those made where there are various and appreciable changes in elevation, with the consequent necessity of fitting the grade of the street under improvement to the grades of intersecting and other neighboring streets, or to existing improvements on the abutting property.

The writer finds it necessary to make his most careful studies of the problem of getting the rain water off of flat streets. A sub-surface drain or sewer with connections from catch basins or inlets located at frequent intervals and gutters graded to give summits between the inlets and at the same time give crowns neither too flat at such summits in the gutters nor too sharp at the inlets, are the principal points to be considered and the designer needs all the help he can get regarding the location of all these points on the ground. Therefore the engineer needs even more detailed surveys, including elevations at frequent intervals along both center and gutter lines, cross-sections, etc., than for streets with steeper grades. If the street is to be constructed without such an engineering study, the surveys are not necessary but trouble in getting rid of water over the surface may be expected, both because proper provision is not made for it and because the surface channels will become clogged with sediment on slight provocation.

Remedy for Swelling of Wood Block Pavement on Bridge.

Three years ago we built here an iron bridge with wood block paving. This year we have had a number of thaws, quickly followed by freezing weather, etc. Most of the paving has been free from snow, but the gutters for a foot or two have been covered with ice, including the tar expansion joints. During the freezing weather the paving has humped up and split longitudinally, due we believe to absorption of water in the blocks and some water in the joints, and then freezing. Joints filled with Portland cement grout.

We understand this has happened in other places with wood, and would be glad to hear from you as to what methods have been used to overcome this. Have you any record of springs being used in both gutters to take care of the pressure due to the swelling?

C. H. S., ———, N. Y.

If the blocks have not been treated by the water-proofing methods which are adopted as standard by the Association for Standardizing Paving Specifications, or their equivalent, it is doubtless true that they have absorbed water and have swollen on that account, giving rise to the trouble described. The writer described some ten years ago in Municipal Engineering the observed contraction of block pavements under continued cold weather, with consequent opening of joints and even cracks across blocks where the rows of blocks ran diagonally across the roadway. These cracks were filled with dirt, snow and ice by the traffic and when the thaw came the absorption of water by the blocks caused the heaving of the pavement.

The only remedy for the troubles described which the writer can suggest for application to the pavement as it stands is prompt cleaning off of the snow when it falls, thus keeping the pavement continually as dry as possible. If the traffic on runners is so general that this method is not practicable, the drainage of the pavement should be improved so that there will not be a formation of ice in the gutters. This would seem to be a good place to use the curb conduit shown on p. 64 of the January number, or some modification of it, as it gives an opportunity for the water from the melting snow to drain off of the pavement immediately, and if the conduit has frequent points of discharge into the stream below the danger of stoppage of the conduit by filling it with ice is minimized.

The ordinary remedy applied to bulging wood block pavements is to relay the blocks, trimming them enough to let them into the space. Springs have been suggested to take up the swelling but, so far as the writer knows, have never been applied, and have evident defects which moke their success doubtful.

For the last ten or fifteen years the development in the treatment of wooden blocks for paving purposes has been in the line of making them waterproof, so much so that in the latest standard specifications above referred to, the provisions exclude the treatment with creosote oil formerly used, and reduce the permissible amount of the preservative creosote oil to a small percentage of the total material used.

The requirements of the perfect oil for treating blocks are preservative qualities; fluidity sufficient to enter the voids in the wood at treatment temperatures which are not so high as to be dangerous to the wood; viscidity enough to keep its place in the wood under the temperatures to be found in pavements; low evaporation rate, that heat and air may not remove the material from the blocks by evaporation; lack of solubility in water, that the water collecting on the street may not carry away the material in solution. Since it is practically impossible to meet all these requirements at the same time, the fashions regarding methods of treatment change with the change in opinions as to which is the most important characteristic to be developed in the treated blocks. Just now this seems to be the waterproof quality, with as much attention to the permanence of this quality under the conditions to be met in the street as is convenient.

But with the most approved method of waterproof treatment there is more or less trouble, sooner or later, with swelling of blocks, so that there must be close attention to drainage, particularly prompt removal of water from the surface of the street, whatever the treatment adopted.

Perhaps some of our readers may be willing to report their experiences and practice.

Maturity of Bonds and Life of Pavement.

I am interested in the subject of street paving, mainly in the question of bond issues for the payment thereof and the life of different pavements, my point being that the bond issues should not cover a longer period of time than the life of the street. Have you any published matter relating to this question?

Ralph E. Clark,
Cincinnati, O.

The argument on the term of bond as compared with life of pavement is the same as that on comparative length of life of any structure and term of bonds issued to pay for it. This has been discussed frequently from one point of view or another in numerous articles in Municipal Engineering. One of these, will be found in the department of "Editorial Comment" in this number. The following articles throw more or less light on the subject:

In vol. xxxix: "Depreciation and Sinking Fund Accounts," p. 26; "Indebtedness for Public Service Plant may not be a Municipal Burden," p. 198; "Information about Franchises for Public Utility Corporations," p. 473, giving references to previous articles, some of which will be of interest in this connection.

In vol. xxxviii: "Depreciation and Sinking Funds," p. 33; "Municipal Finances," p. 302; "Bonds and Guarantees for Pavements," p. 324; "Front Foot Rule in Assessments for Paving," p. 327.

In vol. xxxvi: "Terms of Water Works Franchise," p. 177; "An Outline of a Contract between a City and a Water Works Company," p. 247.

In vol. xxxv: "Methods of Paying for Public Improvements," p. 116; "Pavement Assessments and Collections," p. 367.

In vol. xxxiv: "Good Pavements and How to Secure Them," p. 151; "The Terms of a Water Works Franchise," p. 296.

In vol. xxxi: "The choice of Paving Materials," p. 16; "New Orleans Street and Sidewalk Paving Law," p. 464.

In vol. xxx: "Municipal Ownership of Gas Works," p. 49; "Benefits of Pavements," p. 435.

In vol. xxix: "Fixing Rates for Public Service," p. 422.

In vol. xxvii: "Methods of Making Assessments for Public Improvements in Toronto, Ont.," p. 355.

In vol. xxvi: "The Indiana Street Improvement Law," p. 235.

In vol. xxiv: "Hydrant Rental," p. 182; "Brick as a Paving Material," p. 338.

In vol. xxiii: "What are Paving, Repaving and Repair?," p. 425.

In vol. xxi: "Pavement Guarantees," p. 288.

In vol. xvii: "Methods of Paying for Street Improvements," p. 12; "The Life of Pavements," p. 272.

In vol. xvi: "Limitation of Paving Assessments," p. 312.

Vacuum Street Cleaner.

I have been instructed to make inquiry regarding street cleaning devices and am writing you as being likely to be able to give me the information desired.

What I wish to learn is whether there is now on the market any street cleaning device of the vacuum cleaner plan, either horse drawn or propelled by gasoline or steam power. If there is such a device, will you kindly give me the address of the manufacturer of same?

D., City Clerk, ———, Mich.

Several such machines are mentioned and described in MUNICIPAL ENGINEERING, vol. xxxix, pp. 115, 391, 473. So far as the writer knows, none of these are in the market in the sense that they are in stock ready for sale. The Furnas machine is understood to be now in practical working order as an automobile. It has been in operation in several cities for many years as a horse-drawn machine with steam-driven machinery. McMeans and Tripp, Majestic Building, Indianapolis, Ind., are the mechanical engineers having the design and construction of the new Furnas machine in hand.

Purification of Woolen Mill Waste.

Kindly advise if you can give me any information on the purification of waste from a woolen mills, can you furnish me the address of a company that makes a machine for this purpose?

T. P., Indiana, Pa.

Methods of purification of various kinds of trade wastes are discussed in the following articles in MUNICIPAL ENGINEERING:

"Purification of Brewery Refuse," vol. xl, p. 433.

"Purification of Dye Waste," vol. xxxix, p. 88.

"Treatment of Brewery Waste," vol. xxxix, p. 292.

"Purification of Slaughter-House Refuse at Zerbst, Germany," vol. xxxi, p. 86.

"Disposal of Dye and Wool Finishing Waste," vol. xxxi, p. 204; a detailed account of investigation made at Ravenna, O., filling about 7½ pages of space.

"Sewage and Dye Waste Disposal," vol. xxx, p. 276.

"Purification of Condensed Milk Factory Refuse," vol. xxvii, p. 190; mainly a list of references to articles and books.

A review of Naylor's "Trades Waste" in vol. xxv, p. 123, gives some of the conclusions reached by the author, including wool washing wastes.

"The Bacterial Purification of Trade Effluents," vol. xxiii, p. 55.

"The Bacterial Treatment of Trades Wastes," vol. xxii, p. 179.

In addition to Naylor's book above mentioned, reference may be made to the chapter on trades wastes in Rideal's "Sewage" ($3.50).

Progress in Use of Concrete for House Building.

I would refer to "A Concrete Bungalow," page 43, January, 1909, to inquire if there are reported any further developments in that line of building, or any experience from that which was built; also if such a house were now to be built, the latest experience as to water-proofing for that kind of thin work, whether to be mixed in or applied on the surface.

C. E. V., E. Palestine, O.

There have been material advances along both the lines mentioned. These advances have been recorded in the periodical press and, more particularly in the proceedings of societies and the publications of the Portland cement manufacturers. Among the latter are a number of bulletins of the Association of American Portland Cement Manufacturers, Philadelphia, Pa., on "Concrete Surface Finish," "Reinforced Concrete for Houses, with Special Reference to Architectural Details," etc. The Atlas Portland Cement Co., 30 Broad street, New York, publishes several books on the subject, one on "Concrete Country Residences," one on "Concrete Construction About the Home and on the Farm," etc. The Sandusky Portland Cement Co., Sandusky, O., publishes booklets on water-proofing and on the use of white Portland cement for ornamental purposes. The Universal Portland Cement Co., Chicago and Pittsburg, also publishes several booklets, particularly "Plans for Concrete Residences" and "Representative Cement Houses." The Lehigh Portland Cement Co., Chicago, Ill., publishes a monthly bulletin, many numbers of which will be of interest in this respect. These publications happen to be at hand. Other cement companies have similar booklets, most of which can be had for the asking, by those interested.

There has been improvement in water-proofing methods, both as regards mixing with the materials and surface applications, which are described in some of the publications referred to.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Bituminous and Cement Fillers for Brick Pavements.

To the Editor of MUNICIPAL ENGINEERING.

Sir—In your April number on page 375, there appeared reproductions of photographs of Main street, Akron, Ohio. On page 374 there was an unsigned article, evidently written in the interest of pitch filler, calling attention to the upper photo, showing the superior construction of the section of Main street wherein the brick were filled with pitch filler, twenty years old. The lower photo showing an extension of this same pavement, constructed some five years later and in which cement filler was used. The statement is made that the comparison is "more than fair to cement filler" as the pitch filled section is nearer the center of the city and receives more traffic than the grouted section.

Readers of your magazine who are thoroughly posted upon the respective merits of cement filled and pitch filled streets, concluded at once that the article was an unfair one, not to say a misrepresentation of the facts and as the writer is interestd only in the best possible construction of brick pavements and is not in any way prejudiced by reason of affilations in a financial or even in a friendly way with either cement or "elastic" filler manufacturers, he determined to visit the city in question and obtain, if possible, the facts in connection therewith.

The accompanying photos were taken on Main street, in Akron, Friday, May 19th, 1911. We walked over this street from Market street and inspected the pitch filled pavement as far as Thornton street and continued over the cement filled street from Thornton street some distance farther south.

The statement made in the article mentioned in regard to the age of the respective pavements is admitted to be true.

We inquired of a number of property owners in regard to the conditions of the construction and we learned that the foundation in both instances was of cinders, there being no concrete used. We were informed that the cinder foundation under the pitch filled pavement, was thoroughly compressed, rolled and smoothed, and was doubtless well filled with pitch filler, although evidences of the pitch were not apparent except at the gutters and occasionally a little bright bubble that sometimes appeared owing to the very hot day upon which we examined the street. We did not find twenty-five running feet of this pavement in what can be called good condition, the street, itself, being very rough and the bricks badly worn off at their edges.

There are depressions in the street from ½ inch to more than 3 inches in depth which would, of course, indicate that the foundation had settled and that the "elastic" filled brick must follow the foundation.

Photo number one is a typical view of this pitch filled street, taken opposite number 549.

Photo number two was taken opposite number 497 and actually shows breaks in the pitch filled pavement, a feature which the inexperienced are led to believe could not be found in this type of pavement.

Photo number three was taken opposite number 740 and from the same view point as the pitch filled photo shown in the article in your magazine referred to above, except that the camera was focused to show more detail of the individual bricks.

We admit that the photo of the cement filled section, fifteen years old, as shown in the article mentioned above, is a fair view of this pavement at this particular point, where an attempt was made to apply the cement filler, but an effort was certainly made to find the worst section of the cement filled pavement, as photographs 4 and 5 accompanying this article, were taken at the very same point, but on the opposite side of the street car tracks, where they were more successful in getting the cement into the interstices of the bricks. At this point the cement filled pavement is in almost perfect condition and a similar spot cannot be found on the pitch filled section.

Moreover, we found that absolutely no provision was made for expansion, there being no expansion joints along the curb on either side of the street, nor was there any attempt to provide for the vibrations of the street car track. We found brick removed from this pavement and they were so made that they laid close together, and while in some cases the cement filler showed in joints of not more than 1-16 of an inch, there were many places where the brick were so close together that the cement filler could not possibly penetrate unless a neat ce-

1. MAIN STREET, AKRON, O.
Opposite No. 549. Pitch Filler.

2. MAIN STREET, AKRON, O.
Opposite No. 497. Breaks in Pitch Filled Pavement.

3. MAIN STREET, AKRON, O.
Same view as shown on page 375 of April number, upper photograph. Pitch Filler.

4. MAIN STREET, AKRON, O.
Opposite side of street from view shown on page 375 of April number, lower photograph. Pitch Filler.

ment was used, and even in such case, there would be no positive assurance of the penetration of the cement filler.

This again, should be sufficient evidence of the actual necessity that the specifications require uniform lugs on every brick, which will positively avoid any failure to have the cement grout filler or bonding material properly penetrate the blocks.

Now we do not question the correct representation of the condition as shown in these photos, considering the manner in which the cameras were manipulated, but the misrepresentation lies in the fact that that portion of the street photographed never was filled, in truth and in fact, with a cement filler, but, as many citizens can testify, it was simply bridged over on top of the interstices and had a very poor foundation upon which to rest and, of course, when the travel and traffic came upon it, the slight bridge crushed and gave way, leaving the bricks on the street as if they were laid in loose without any filler, whatever. The only way in which the real truth can be determined and a fair comparison made is by inspecting conditions which result from a street which is really filled with cement, properly applied and with expansion cushion along the curb. In other words, built under modern and improved methods, properly filled with cement filler, one to one.

Compare such a street with a street filled with pitch filler, constructed in the best possible manner and from such a condition the public may learn what they really wish to know: the real merits of the cases respectively.

That the actual facts regarding the relative merits of cement filled and pitch or asphalt filled pavements may be truthfully considered, the writer has recently had photos taken of Harbor street, Conneaut, Ohio. The section from Main street to the L. S. & M. S. R. R. was laid on the natural soil, except where it was deemed advisable to put in gravel on account of the swampy condition of the soil, and in this work the cement filler was used as shown in photo number six. This photo was taken within a few feet of the L. S. & M. S. R. R. and shows the condition of a cheaply constructed street now 11 years old, having been laid in 1900. It is true that this pavement is

5. MAIN STREET, AKRON, O.
Same pavement as shown in No. 4. Pitch Filler.

6. HARBOR STREET, CONNEAUT, O.
Cement filled brick street laid in 1900 on natural soil, immediately south of L. S. & M. S. Ry.

badly cracked in places on account of improper drainage and no foundation.

Compare with this, photo number seven, which was taken immediately north of the L. S. & M. S. R. R. and shows an asphalt filler used over a good concrete foundation and only 3 years old, having been opened to the traffic in 1908. The actual condition of this pavement might not be noticed by one passing over it, except for its roughness, as the interstices are filled with filth and disease germs, there being no asphalt found near the surface of the bricks except quite close to the curbs on either side. In the natural path of the traffic along this street, which is a little more than a mile in length, the condition is exactly as shown in this photograph except that on this particular spot, the interstices were swept out with a small whisk broom before taking the photo.

We have made an effort to learn the cost price per yard of the pavement as shown in photo number six, but have

7. HARBOR STREET, CONNEAUT, O.

Asphalt filled brick street laid in 1908 on concrete foundation, immediately north of L. S. & M. S. Ry.

been unable to do so, although work under the same specifications has since been done here for $1.07 per square yard. The cost of the pavement as shown in photo number seven was $1.68 per square yard for concrete foundation, brick laid and the asphalt filler, it being divided as follows: cement foundation and brick laid, $1.48 per square yard and asphalt filler twenty cents per square yard. We believe, however, that this is somewhat misleading, as it was a fact that other bidders bidding on this work figured the same filler at thirty-five cents per square yard, the successful bidder placing his figure at twenty cents per square yard and increasing the price of other items.

8. BROAD STREET, CONNEAUT, O.

Pavement 45 feet wide. Cement filled brick street laid in 1902 on natural soil with half-inch pitch filled expansion joint every 25 or 30 feet.

We would call attention to the fact that the condition of the pavement in photo 7 cannot be attributed to poor quality of brick, as the same identical brick were used in photo number 6. The traffic conditions are the same in these photos as they were taken between the same intersections. We would call particular attention to the comparison of these photos numbers 6 and 7 as regards the age of the pavement, the cost and sanitary conditions and would further say that we have never seen a pitch or asphalt filled brick pavement, two years old, in as good condition as the cheap pavement shown in photo 6, which is as stated above, 11 years old. We would suggest that the advocates of pitch or asphalt filler, show photos of their ideal pavement by focusing the camera on the individual blocks at close range, as is freely done by the advocates of cement filler.

In conclusion we wish to call your attention to photos numbers 8 and 9. Number 8 is a photo of Broad street between Main and State street, 45 feet wide between curbs and was laid in 1903 on natural soil foundation and ½-inch joint was allowed for expansion, the theory of the necessity for which has since been exploded. One can easily see the weakness of this pavement at this point, as it has been the means of breaking loose the two adjoining courses of bricks. Note the condition of the surface of this pavement at the interstices filled with cement grout. Photo number 9 is State street between Harbor and Washington streets. In this it was sought to overcome the particular weakness in photo number 8 by not leaving any wide space for the "elastic" filler but by filling 6 joints with pitch filler at intervals of about 40 feet. Note the effect where, in this instance also, the adjoining courses have been broken loose until now it would appear that there were 8 or 9 pitch filled joints and in both cases the bricks are so loose and unprotected that they are actually broken up by the traffic and it is only reasonable to suppose that had similar filler been used over this entire pavement, the proper authorities would now be considering a means for resurfacing this street.

F. B. Dunn,
Conneaut, O.

9. STATE STREET, CONNEAUT, O.

Cement filled brick street laid in 1904 on gravel foundation, with six joints poured with pitch filler every 40 feet.

A Method for Keeping a Constant Temperature on Samples of Asphaltic Cements to Be Penetrated.

To the Editor of Municipal Engineering.

Sir—Any one, who has had to take penetration of asphaltic cement either in the laboratory or at the plant, knows the great loss of time and inconvenience in trying to keep these samples in water at a definite temperature. This is specially true of plant work and, therefore, I think the following method, which I adopted this season, and which is very effective and simple, and new only in the application to this kind of work, will be of interest to those working along this line. The method is as follows:

Take two papier-mache cylinders closed at one end, put one of these cylinders inside of the other, leaving an air space of about 1 inch between them. In the inner cylinder set on corks metallic container to hold the water and sample. Cover with a papier-mache cover with a hole in it for insertion of thermometer.

A somewhat cruder but very satisfactory method and one that can be made very easily at an asphalt plant is to take an ordinary tin pail, put waste in the bottom, and then on this set a smaller pail to hold water and sample; fill this space between the outer pail and the inner one with waste and cover with asbestos board containing a hole for insertion of thermometer.

By this method, it is possible to hold water at the correct temperature for ordinary penetration work easily for one-half hour without giving it further attention.

Henry M. Milburn,
Chief Chemist Testing Laboratory,
Omaha, Neb.

Machinery for Making Cement Tiles.

To the Editor of Municipal Engineering.

Sir—I note in your issue for May an inquiry in regard to a cement pipe machine. Enclosed find a short description of a machine that is just being put on the market, and which I believe to be the most up to date.

J. B. Marcellus,
Assistant City Engineer,
Boise, Idaho.

The same information has been received from F. P. VanHook, also of Boise.

Following are some of the principles that were sought after and obtained:

First. To turn out a machine that would not require an expert to operate; in fact, one that would be so simple that any layman could successfully operate and turn out a good pipe for every purpose, without thirty to sixty days' experimenting.

Second. To turn out a machine consistent with the best of engineering practice; one that would not require the attention, once or twice a week, of a repairman, causing a loss of the time of the crew, thereby detracting from the value of the machine to the extent of the number of pipe manufactured. No wood whatever is used in construction; instead, steel channels and angles are used, securely riveted together into a solid frame, on which is mounted the machinery, fully protected against every fault, bearings protected from grit, and everything done by power.

Third. To construct a machine every movement of which is under the control of the operator by means of levers, suitably placed, doing away with the handling of the bell ring, which, in the larger sizes, weighs a hundred pounds, seriously affecting the output of the machine. This is accomplished by the new system of making the pipe bell end down, the rings being fastened to the tables and never moved. This, with the control of the feed by operator, successfully produces a cement pipe far superior to any other.

Fourth. To construct a machine capable of producing more pipe per day than has been heretofore accomplished. To do this a number of tampers, or rams, are used, which are adjustable to any density of pipe required and to any speed. Four tampers are used on this machine, and the speed may be varied; and, as a result, the output over any other machine may be multiplied by four.

Fifth. To construct a machine in which both the core and jacket are stationary, but so that the core may be rotated at any time, to give the necessary inside finish without blistering. Also, that the core or inside form may be pulled from out the finished pipe in such a manner that no injury, such as minute cracks, may result. This is accomplished by pulling the core from beneath the pipe, instead of up, as in the other machines. This not only preserves the pipe against injury but tends to increase its density and strength.

The Standard Specifications for Treating Wood Blocks for Pavements.

To the Editor of MUNICIPAL ENGINEERING.

Sir—Your March issue contains a list of 22 questions on the specifications for wood block paving adopted by the Association for Standardizing Paving Specifications, and inviting comment thereon. This is still a very live subject and the questions asked bring forth many pertinent points. I recently had occasion to go into the matter of wood block preservatives quite extensively and in the light of my investigation would answer the questions as follows:

1. (a) The specifications do exclude ordinary distillate creosote oil.

(b) As to an "excess of free carbon" the specifications would be less monopolistic if they allowed more free carbon—practical creosoters seem to agree that they can, without undue difficulty, secure an injection of 20 lbs. of oil per cu. ft. of wood with 5 or 6 per cent. free carbon present in the oil, whereas the specifications allow only 3½ per cent. As to coke, it would be our belief that the coal tar product specified contains little coke as such—of course, if the distillation is carried to the end, coke will be formed due to the cracking of the high boiling constituents.

2. Evidence received in private correspondence seems to show that it does not (see 1-b above). At least the required amount (20 lbs. per cu. ft.) can be injected readily.

3. The oily portion of this coal tar product is the regular creosote oil.

4. The specifications probably are comparatively new and untried, but there seems to be no sound reason why they should not be successful—the ordinary American practice is to specify a 20-lb. treatment of the heavy coal tar product. Inasmuch as at least half of this is 'genuine creosote oil," this insures at least a 10-lb. treatment of creosote oil in addition to the heavy bituminous portion which should aid materially in waterproofing the blocks. The ordinary practice abroad is to use 10 lbs. of creosote alone.

5. The "heavy coal tar product" in question is a mixture of refined coal tar and coal tar creosote. Inasmuch as creosote oil strictly refers only to distillate oil from coal tar, it would be far preferable not to call the heavy product "creosote."

6. Most of the notable successes in wood block paving have been with the use of distillate creosote oils and there is the highest authority for its use; on the other hand, the heavy coal tar product has not been in use long enough to furnish any reliable experimental data. The main argument advanced for the use of "heavy coal tar product" is its better and more lasting waterproofing qualities, which seems reasonable.

7. This does not concern the merits or demerits of the product specified.

8. A low-carbon tar seems to be needed for this product. There are three principal manufacturers of by-product coke oven tar in this country (1) Otto Hoffman; (2) Semet-Solvay, and (3) Koppers ovens. I would personally gladly welcome any authoritative information as to how far their outputs are controlled by one concern.

In addition to the above I would like to know how difficult it is to secure this same product abroad and how much disadvantage in cost this would make for the importer.

Also there has been frequent mention of a process for removing free carbon from tar, stated to be practiced on a commercial scale. Considerable secrecy seems to have surrounded this, however. If it is commercically feasible at low cost this would go a long way toward removing this "heavy coal tar product" from a monopoly.

9-10. We should answer yes to both questions.

11. This is precisely what I should like to know. It is very difficult to secure evidence enough to show conclusively that a product so widely produced is a monopoly, but unless the company against whom so many charges of monopoly have been made comes to the front with proof to combat the statement, then it would seem that the claim has good foundation.

12. The heavy coal tar product was freely quoted to us at about 7½c per gallon f. o. b. producing plant.

The rest of the questions do not relate to the merits or demerits of the oil in question.

The above is submitted not with the idea of condemning or defending the "heavy coal tar product" specification, but with the hope of bringing forth discussion.

SUBSCRIBER.

MUNICIPAL MATTERS IN COURT

Higher Courts—Denver Water Case.

Decisions of the Higher Courts of Interest to Municipalities.

Water Company May Recover State Tax from City.—A water company contracted to furnish water to a town in consideration of "a sum equal to the annual taxes for the current year which shall be assessed upon the franchise and real and personal property of the company actually used in connection with the business of supplying water." *Held,* in the company's action to recover an amount equal to the amount of an annual tax assessed by the state against the company, that such tax was a part of the stipulated compensation for the water service, and that the company could recover.—Montclair Water Co. v. Town of Montclair (N. J.), 79 A. R. 258.

City Purchasing Water Plant is not Bound by Contract of Water Co.—A water company agreed to supply water to a consumer at a fixed annual price. Subsequently it conveyed a large part of its property, including its pipes and franchises, to the city, but retained some of its property, including real estate, with the reservoirs and pumping building thereon. The city then sought to recover the reasonable value of water furnished therafter. *Held,* that the city was not bound by the contract of the water company, and was entitled to recover the reasonable value of the water furnished by it.—City of Bordentown v. Anderson et. al. (N. J.), 79 A. R. 281.

Permission from City Necessary to Excavation of Streets.—A permit to lay water pipes in a public street can only be claimed by one legally entitled to use the street for such purpose, and if one, without such right, attempts to excavate a street for such purpose, a court of equity will not restrain a municipality having the power to regulate the use of streets from forcibly preventing the disturbance of the public easement.—Mayor and Council of Bayonne v. Mayor and Council of Arlington (N. J.), 79 A. R. 357.

Contract of City with Water Company Does Not Prevent City from Subsequently Furnishing Its Own Supply.—Where a water company, under power given by statute, entered on the streets of a borough and furnished water generally to the public, and thereafter the borough contracted with the company to furnish water for municipal purposes, and the company agreed, as a consideration for such privilege, not to charge the inhabitants any excess over the rates previously charged, the contract did not preclude the borough from subsequently furnishing its own supply of water to the inhabitants.—Tarentum Water Co. et al. v. Tarentum Borough (Pa.), 79 A. R. 402.

City May Require Electrical Inspection for Which Fees Are Paid.—An ordinance of a city regulating the installation of electrical appliances inside and outside all buildings subject to the city electrician, and requiring permits for such installation, and the payment of fees for the inspection of the work, is valid as a proper exercise of the police power of the city to adopt measures to protect life and property. License and inspection fees levied under the police power of a city are not an "occupation tax" within Const. art. 8, sec. 1, providing that persons engaged in mechanical and agricultural pursuits shall not be required to pay an occupation tax.—Ex parte Cramer (Tex.), 136 S. W. R. 61.

Municipality's Attempt to Evade Limit of Indebtedness in Connection with Water

Works.—Where a city with power to purchase, hold, and enjoy real estate, and to sell and dispose of the same for the common benefit, in order to obtain a water works system conveyed certain rights of way and other property to a private corporation in order that the corporation might issue bonds secured by a mortgage on the property for an amount required to build the works beyond the limit of the city's indebtedness as then fixed and after the city's debt limit was extended, the city regained control of the water works system in accordance with a vote of the people, it was estopped to claim that the bonds so issued by such private corporation, which the city assumed were invalid, as ultra vires, because the entire scheme was a mere device to evade the debt limit.—Wykes v. City Water Co. of Santa Cruz et al. (Cal.), 184 F. R. 752.

Grant of Water for Consideration of Right of Way Is Assignable.—A deed to a city for a right of way to construct and maintain a pipe line for its water system executed for a recited consideration of $1, which recites that the city covenanted that the grantors shall have the free use of a designated quantity of water from the pipe line on compliance with the covenants to permit the city to go over the land and perform acts necessary to carry into effect the purposes of the grant, and not to interfere with the pipe line or the operation thereof, and to be governed by the ordinances and regulations of the city for the operation of its water system, creates an assignable estate in the grantors in the quantity of water reserved, and, unless subsequent conveyances by the grantors otherwise provide, the purchaser of any fraction of the original quantity is entitled to such a proportional quantity of the water reserved as his fraction of the land bears to the whole tract.—Tone et ux. v. Tillamook City (Ore.), 114 P. R. 938.

Action to Set Aside Improvement Assessment Must Be Brought Within Time Limit.—St. 1898, sec. 925-197, provides that every action or proceeding to avoid any special assessment or tax levied pursuant to the same, or to restrain the levy of such taxes or a sale of land for the non-payment thereof, shall be brought within nine months from the end of the period of 30 days limited by the city improvement notice provided for by section 925-191, and not afterwards. *Held,* That where complainant failed to sue to set aside a street assessment because of alleged failure of a contractor to comply with the specifications until 17 months after the expiration of the 30-day period referred to, his action was barred.—Gaastra v. Kenosha County et al. (Wis.), 130 N. W. R. 870.

Taxable Value of Water Works Franchise Includes only Amount of Land Necessary for Operation.—As affecting the taxable value of a water works franchise, the amount of land necessary for proper operation and for preservation of the water supply is largely for the determination of the directors; but land purchased to prevent its acquisition by some one else should not be included.—People ex rel Queens County Water Co. v. Woodbury et al. State Board of Tax Com'rs (N. Y.), 128 N. Y. S. 22.

Municipality Liable for Damages Due to Discharge of Sewage into Natural Water Course, Regardless of Statutory Authority.—The owner of land injured from the discharge of sewage into a stream by a village may have such village restrained, though others contribute to the injury, and may recover from the village such damages as its acts have occasioned up to the time of trial; but such village should be given a reasonable time, before enforcing the injunction, in which to provide for a different disposal of its sewage, the village in the meantime to pay the injured land owner his damages suffered during such period of suspension. Statutes expressly authorizing the construction of sewer systems with the approval of the State Board of Health give no authority for maintenance of a nuisance involving consequent injuries to private property.—Fonda v. Village of Sharon Springs (N. Y.), 128 N. Y. S. 147.

Sewers Must Be Designed to Allow for Future Growth of Population.—A city undertaking to establish a system of sewers must provide for the increase that may naturally be expected in population, and that sewers, when first constructed, are adequate to meet the demands of conditions then existing does not relieve it from responsibility, if, by growth of population, they become inadequate. Where a sewer becomes increasingly inadequate by the increasing demands on its capacity, due to the growth of the city, each recurrence of injury attributable to the changed condition is a separate cause of action, and limitations do not begin to run until the accrual of such a cause of action.—City of Louisville v. Leezen (Ky.), 136 S. W. R. 223.

City Has No Right to Grant Exclusive Franchise—The city of Ennis, when it granted to a water works company the exclusive privilege of furnishing water to the city and its inhabitants for 30 years, owned the source of the water supply, consisting of lakes, but had no distributing plant, except some 8,000 feet of water mains; and the grantee of the franchise owned a distributing plant and supplied the water through it in connection with the city's mains and lakes, though the contract did not confine it to such lakes for its supply. *Held,* That the city had no express or implied power to grant an exclusive franchise.—Ennis Water Works v. City of Ennis (Tex.), 136 S. W. R. 513.

A Corporation Has the Rights of a

Riparian Owner in Using the Water of a Stream; but Must Not Interfere with Its Quality.—A corporation incorporated under the general corporation act has, as a riparian owner, the right to use the water of the stream so far as is reasonably necessary, subject to the obligation to leave the stream otherwise undiminished in quantity and unimpaired in quality; and it may not as riparian owner take water from the stream for the use of municipalities. A grant by the state to a municipality of the right to discharge its sewage into a stream of the state authorizes the municipality to construct an ordinary sewer system, and, by implication, authorizes it to discharge the sewage into the stream, and thereby interfere with the state's rights to have the waters flowing unimpaired in quality.—Wilson, Attorney General, v. East Jersey Water Co. (N. J.), 79 A. R. 440.

A Franchise Must Be Construed in Favor of the Public.—The public grant of a franchise, whether by a constitution, statute, or municipal ordinance, is to be strictly construed in favor of the public, and nothing passes by implication.—Madera Water Works v. City of Madera (S. D.), 185 F. R. 281.

A Gas Company Must Take Precautions Against Leakage.—A gas company must take every reasonable precaution to confine the gas furnished its customers within the channels where it may be employed with safety, and where a company has undertaken to repair service pipes, which it has established for its own profit, the measure of its liability to those affected by any negligence is equal to that of its duty and opportunity to keep the system in repair, without reference to the technical question of the ownership of the pipes.—Consolidated Gas Co., of Baltimore City, v. Conner (Ind.), 78 A. R. 725.

Franchise Does Not Prevent City From Constructing Municipal Lighting Plant.—The granting by a municipality of a franchise to operate a lighting system does not confer an exclusive privilege on the grantee, and does not prevent the municipality from subsequently erecting a system of its own.—Houma Lighting & Ice Co., Ltd., et al. v. Town of Houma et al. (La.), 53 S. R. 970.

Insufficiency of Water Supply Must Be Shown in Suit for Fire Damages.—Where an individual sues a water company for damages sustained by the destruction of his property by fire, consequent upon the alleged ground that such water company failed to supply water for the extinguishment of such fire in compliance with its contract with the municipality, the burden of proof is, at all times, on the plaintiff to show by a preponderance of the evidence: (1) That the water company failed to supply water in the quantity called for by its contract with the city; and (2) that, but for such failure, the plaintiff's property could have been saved from destruction.—Tampa Water Works Co. v. Mugge (Fla.), 53 S. R. 943.

Damages for Defective Bridge May Not Be Recovered After Bridge is Opened for Travel.—A contract with a township for the construction of a bridge did not expressly provide that the town should have an inspector on the work, nor that material or work should be accepted or rejected in the course of construction, but was susceptible of such construction, and was evidently so understood by the parties; the town board, as authorized by statute, appointing a person to superintend the work, who exercised the right to approve or reject material and workmanship as the work progressed. The contractor sublet the construction of the substructure, and accepted and paid for the same only after the material and workmanship had been approved by the town's representative. *Held,* That after the bridge had been completed and opened to public travel, the town could not refuse to accept and pay for it on the ground of alleged defects in the substructure, which, if they existed, were obvious to its superintendent when the work was being done; its remedy, if any, being the recovery of damages for breach of the contract.—Town of Pockwaukee v. American Bridge Co., 183 F. R. 359.

Location of Sewage Disposal Plant.—The act, which requires the consent of certain bodies before a sewage disposal plant can be located in a municipality other than the one desiring the same, applies to all municipalities; it also applies to all proceedings taken to construct such plants, save such proceedings as at the date of the approval of the statute had reached a stage where the work had proceeded so far that the municipality was irrevocably bound to complete the work, or else suffer serious pecuniary loss.—Borough of Florham Park v. Borough of Madison et al. (N. J.), 78 A. R. 753.

Restrictions of Use of Water.—A water company must supply water to a consumer for a purpose contemplated by the company's charter at reasonable rates, and subject to reasonable rules and regulations. A water company can require a consumer to so apply water as not to menace the safety, stability or usefulness of the system, nor injuriously affect other consumers.—Kimbal v. Northeast Harbor Water Co. et al. (Me.), 78 A. R. 865.

A Street Railway Franchise Held to Be Exclusive.—An ordinance of a municipal corporation, granting to a person or corporation authority to use the streets and highways of a city for the purpose of constructing and operating a street railway system, confers privileges which are exclusive in their nature against all persons upon whom similar rights have not been conferred; and any person or corporation attempting to exercise such rights, without legislative authority or sanction, invades the private property of the person or corporation to whom such franchise has been granted, and may be restrained at the instance of the owner of the franchise.—Tulsa Street Railway Co. v. Oklahoma Union Traction Co. (Okla.), 113 P. R. 180.

Damages May Be Collected for the Intercepting of Ground Water.—Where a city, to obtain a water supply, acquires lands and sinks wells, pumping up the water percolating below the surface, taking it from contiguous lands of other owners, such owners may recover for the injuries done them, and may have a continuance of the trespass enjoined.—Willis et al. v. City of New York (N. Y.), 127 N. Y. S. 699.

The Rights of Water Companies to Install Meters.—In discharging its legal duties to furnish water to the inhabitants of a village, a water supply company may make reasonable rules for the conduct of the business; and, if there is no other practical way of measuring the water, may install a meter, showing the amount consumed by each individual, to prevent waste or misuse of water.—Pond v. New Rochelle Water Co. (N. Y.), 127 N. Y. S. 582.

Denver Loses Water Suit.

The temporary injunction recently granted by the United States circuit court enjoining the city of Denver, Colo., from issuing $8,000,000 bonds and taking other steps for the installation of a city water system of its own is upheld in a decision handed down recently by Judge Hook in the United States Court of Appeals.

The New York Trust company, holder of the first mortgage bonds of the Denver Union Water company, filed a petition in the United States circuit court in Denver on August 22, 1910, asking that the city be enjoined from issuing these bonds for the purpose of building a municipal water plant.

The petition alleged that the building of a new plant would amount to a confiscation of property without process of law; that it would render their securities valueless and would be violative of the rights guaranteed by the constitution of the United States. They asserted that under ordinance 44 of the series of 1890 and ordinance 163 of the series of 1907 the city had failed to buy the water company's plant at the appraised valuation of $14,000,000, as its agreement permitted it to do, and that this failure gave the company in fact another franchise for twenty years.

A few days later the Denver Union Water Company filed its answer and cross bill. The documents were practically the same with the exception that the cross bill alleged that charter amendment 264A, under which it was intended to hold the election and vote the bond issue, was illegal and unconstitutional, in that it was in violation of the state laws and charter provisions governing charter amendments —giving sixty-five reasons why it was unconstitutional.

The water company asked the court to enjoin not only the holding of the bond election, but the issuance of the bonds as well. The New York Trust company, in its original petition, did not attack the validity of charter amendment 264A, asserting that for the purposes of the first hearing it was not necessary.

The water company alleged that the enactment of 264A was part of the conspiracy to deprive it of its property and that those guilty of the conspiracy were aware that a plant could not be built for $8,000,000 inasmuch as five of the most distinguished engineers and experts in the country selected by the city had placed a valuation of $14,400,000 on the plant.

The contract between the water company and the city provided that on either April 10, 1890, or April 10, 1910, the proposition of buying the water works should be submitted to vote. No action was taken either in 1890 or 1910, but in May, 1910, the water company prepared a franchise to be voted upon. Charter amendment 264A was submitted by initiative to be voted on at the same election creating a public utilities commission and naming the members and giving it power to build a water plant. It provided for the $8,000,000, indebtedness on vote of the taxpayers. It provided also that if the water company should place in escrow a deed of conveyance for all of its property with instructions to deliver to the commision all of its property in exchange for $7,000,000 in bonds at par, the water company to file its acceptance with the New York Trust Company, the same should constitute a binding contract of purchase.

This was to be followed by the special election for the first Tuesday in September, 1910, for the voting of the $8,000,000 bond issue, the additional million to be used for repairs on the old plant. If the company failed to agree to this the amendment authorized the election. The water company paid no attention to the offer and the election was ordered. The suit of the trust company followed.

Contention was made that the bonds, if voted, could not be used to construct and put in operation a complete water works system, could not be used to purchase the existing plant or be devoted to the appraised price of $14,000,000, but had to be used to build an independent plant, which was an impossibility. The city, it was alleged, could not buy a system already constructed and build another one. It claimed an appraisement should have been made under ordinance 44, but the city did not live up to its part of the contract to do so and that the water company is entitled to a renewal of franchise for twenty years.

The prayer for injunction also asked that if the court found that the city should have bought the plant and failed to do so and was compelled so to do under the ordinance that the court fix the purchase price separate and apart from that of the appraisers.

The city contended that, under the terms of ordinance 44, it did not enter into any contract not to build a water plant, nor did the two parties plaintiff claim that it had such an agreement. The city said that, under ordinance 44, it had the right to buy or extend the franchise for twenty years, or it had the right to refuse to do either and that under ordinance 163 it was expressly provided that, in the event the electors refused to grant a new franchise or purchase the plant, the status should be the some as though 163 never existed.

These propositions, said the city, were never submitted to an election, because the appraisers failed to fix the schedule, terms, conditions and rates, and the Denver Union Water Company failed to submit to the city and county any proposition for a contract or franchise based on any schedules, rates or terms fixed by the appraisers.

In the schedule initiated and submitted at that time also was a proposition to purchase the water company's plant for $9,000,000, which was also defeated. The proposition for "a business settlement of the water question" was defeated.

The city said that there had been no default on the part of the Denver Union Water Company in the performance of any of the terms or conditions of its deed of trust to the New York Trust Company, nor a violation of any of the covenants contained therein. The trust company, said the city, was neither in possession of the water works system of the water company nor entitled to possession, nor to any of the rents, revenues or income, nor had the New York Trust Company any interest in the contracts alleged to exist by virtue of ordinance 44 and ordinance 163, except such interest as accrued to it under its trust deed.

From the interlocutory orders of the injunction, which was issued on September 5, 1910, the day before the special election called to vote on the bond issue of $8,000,000, appeals were taken to the United States Circuit Court of Appeals.

Judge R. E. Lewis, in an oral decision, remarkable for the bitterness of the attack on the charter amendment features, the initiative and referendum, enjoined the issuance of the bonds; but, following his views as to non-interference with the affairs of the city, refused to stop the election of September 6, 1910. Neither did he attempt to pass on the issues raised as to the construction to be placed on ordinances 44 and 163, leaving that for consideration and determination of the higher court. The bond issue carried, September 6, 1910, by a big majority.

During the course of the arguments, however, he intimated many times that he believed that the city had not lived up to the terms of its agreement under ordinance 163 of 1907, in not submitting the question to the electors before the expiration of the ordinance of April 10, 1890, on April 10, 1910. He did not accept the view, that because the appraisers had not fixed the rates, that it could not have been done, and intimated that he was not sure but that the water company was entitled to another franchise of twenty years because the city had failed in the premises. He also said that the water company should have prepared a schedule in company with the city that would have proved satisfactory to the people or given them a chance to express their views without making any mistake.

Providence Playgrounds Popular.

A report of the committee on summer playgrounds in the city of Providence shows that the cost of maintenance for the season of 1910 was about four cents a day per child. The report shows that the average daily attendance at the playgrounds was 3,313, and the total for the season, 129,199. The total average cost per capita for the season was $1.72.

A total of fourteen playgrounds were conducted during the season, at which fourteen men and forty women instructors officiated. The playgrounds maintained in school yards were at America, Benefit, Candace, East and Elm streets, Elmwood avenue, and Greeley, Public, Putnam, Ring and Veazie streets. Three others were occupants of as many parks, namely: Davis, Franklin and Tocwotton parks.

The total of 129,199 was reached for the season's attendance, of which 48,646 were boys and 80,553 girls. The average daily attendance was 3,313, while the estimated daily average for the season of 1909 was 3,608. The total average cost per capita for the season was $1.72, or a little over four cents on an average per day for each child attending.

Baths were conducted under the direction of the committee as an adjunct to the playgrounds, the appropriation therefor being $700 this year, an increase of $100 over the amount available for this purpose in 1909. Five baths were operated, two being new ones, at Branch avenue and Veazie street, and ten attendants were on duty. Baths numbering 26,534 were taken, of which 13,221 were by boys and 13,313 by girls. The average daily number of baths was 564 and the daily per capita cost was about 2 3-5 cents. The number of baths greatly increased in comparison with the preceding year, nearly doubling in the case of the boys and showing an increase of [illegible] in the case of the girls.

While the plan of the work was similar to that of former years, the playgrounds curriculum underwent certain changes, generally in accordance with advanced methods of instruction and entertainment of the children. Dramatics and story-telling claimed less attention, but interest was centered particularly in the folk-dances with very satisfactory results.

While the most important work for the girls lay in the sewing classes, the military drill and athletic sports proved especially attractive to the boys, and keen and healthy rivalry was maintained in baseball, basketball and track events. Three companies of the Liver cadets were recruited and drilled, one more than last year. Every playground for boys had a basketball five and each had a senior and junior track team. Where space permitted a baseball nine was organized. Inter-playground ball and basketball games were played and track meets were held, medals being awarded.

MUNICIPAL AND TECHNICAL LITERATURE

Milwaukee Sewerage—Books for Engineers.

The Report of the Milwaukee Sewerage Commission.

In September, [illegible], the council of the city of Milwaukee authorized the appointment of a commission to investigate the sanitary conditions of the city with a view to making additions to and changes in the sewerage system as should be recommended. The commission selected consisted of John W. Alvord, of Chicago; George C. Whipple, of New York, and Harrison P. Eddy, of Boston. They proceeded at once to direct the surveys and investigations necessary and have included their findings and recommendations in a detailed report of about 600 typewritten pages. This report was submitted to the Milwaukee council on April [illegible]. Inasmuch as the city derives its water supply and disposes of its sewage both into Lake Michigan, it was necessary for the commission to determine whether to recommend the purification of the water supply or the sanitary disposal of the sewage. They have recommended the partial purification of the sewage in order to avoid objectionable conditions in the rivers and the lake and the careful purification of the water supply.

The city of Milwaukee is situated at the junction of the Milwaukee, the Kinnickinnic and the Menomonee rivers, at the point where they flow into Lake Michigan. These rivers have been utilized in the carrying of sewage, as almost all of the large sewers of the city empty into them. In the case of the first two mentioned rivers, pumping stations have been built which provide for the flushing of the channels with water from the lake, so that the conditions are not objectionable. But in the case of the Menomonee river, the commission found it to be "foul and offensive." They recommended the construction of flushing works on this river at an early date.

The commission based its recommendations on a population of [illegible] in [illegible], although at present, according to the [illegible] census, the population is only [illegible]. The average sewage discharge at the present time is about [illegible] gallons per day. The rate of flow in [illegible] is estimated at [illegible] per day, or [illegible] gallons per capita.

The commission found that the water supply, though it is taken from the lake at a point four miles from the river mouth, is contaminated by sewage at times. It is furthermore thought that with the increase in quantity of sewage it would soon be impossible to prevent offensive conditions in the three rivers, so that further provision for collection, purification and discharge well out into the lake should be made. It was also thought best to provide for a thorough purification and disinfection of the water supply. These recommendations were made in such form as to provide for the construction of the works designated as the opportunity and financial conditions would permit.

Among the recommendations noted were the following:

That a filter plant be provided for the purification of the water supply, construction to be begun immediately. The estimated cost of such a plant should not exceed [illegible].

That flushing works be provided for the Menomonee river to consist of a pumping station and a main conduit with branches from the lake to the head of navigation, construction to be begun at an early date and completed by [illegible]. The estimated cost of these works is [illegible].

That intercepting sewers be constructed to divert the sewage from the rivers and convey it to purification works, high level sewers to serve the higher portions of the city and low level sewers to serve the areas that lie at an elevation so low that pumping of the sewage is necessary.

That the intercepters already built along the Menomonee and Milwaukee rivers be utilized as a part of the proposed comprehensive system, and that the intercepter serving the upper Menomonee valley be connected at Twenty-fifth street with that serving the lower valley.

That the main low level intercepting sewer from the purification works to Oregon street, where it is to connect with the present Menomonee valley sewer be built at once. The estimated cost of this section and the Twenty-fifth street connection is $909,000. That the low level intercepting system be extended from time to time, as may be found necessary.

That the high level intercepting sewers be constructed as soon as it is desirable to relieve the low-level system or to avoid the operating expense due to pumping sewage which might be collected by the high level system and discharged at the purification works by gravity, none of these sewers being required at present.

That a sewage pumping station be constructed to lift the sewage collected by the low level intercepters, this station to be completed and ready for operation upon the completion of the first section of the low level intercepting sewer by 1915. The estimated cost of this station is $669,000.

That the pumping station at Jones island be abandoned as soon as the new pumping station has been put in operation, thus abolishing the danger to the water supply due to the pumping of sewage from the intercepter directly into the bay.

That suitable sedimentation tanks and accessories be constructed at the Kinnickinnic site for the clarification and disinfection of the sewage, to be completed and ready for operation by 1915; the estimated cost of these works, sufficient in size to serve until 1930, is $754,000.

That the effluent be temporarily discharged into the Kinnickinnic river, pending the construction of the outfall sewer to the lake.

That the construction of an outfall sewer and a subaqueous outlet with orifices located at regular intervals from one mile to one and two-thirds miles from the shore, be begun within a few years so that it may be completed as early as 1920. The estimated cost of these works is $2,213,000.

That as soon as it may be necessary, works for the further purification of sewage, consisting of percolating filters and accessories, be constructed at the lake shore, and that the disinfecting equipment then be transferred to this point. The estimated cost of these works, sufficient in size to serve until 1930, is $1,866,000.

The report states that the purification of sewage will not prevent the presence of injurious bacteria in the lake water. With this fact in view the Commission have provided for purification of the water supply at the North Point Station. Until this purification plant can be constructed, the use of hypochlorite of lime is recommended.

The following summary embodies the different recommendations made by the Commission with their estimated costs.

Water filters, not to exceed..	$1,500,000
Menominee River flushing works	1,162,000
Low level intercepters	2,439,000
High level intercepters	1,671,000
Sewage pumping station	669,000
Kinnickinnic sewage purification works:	
First installation	757,000
Second installation	176,000
Sewage purification works at lake shore:	
First installation	1,866,000
Second installation	802,000
Outfall to lake shore	1,098,000
Outfall, subaqueous	1,115,000
Total cost of all improvements projected, with capacities sufficient until the year 1950	$13,255,000

This total amount is to be expended about as follows:

Cost of work that must be started immediately and pleted by 1915	$ 4,997,000
Cost of work recommended for completion before 1920 (leaving out percolating filters)..	7,210,000
Same work, including percolating filters	9,076,000
Cost of all work	13,255,000

Books for Engineers.

Practical talks on Contracting. Reprints from "The Contractor" of valuable papers. Cloth, 128 pp., $1.50. The Contractor Publishing Company, Monadnock Block, Chicago.

The reprints in this book are made up as follows:

Systematizing a Contractor's Office, by Frank B. Gilbreth, 7 pp.; Organization—How to Effect and Maintain It, 10 pp.; Office System for Construction Work, 26 pp.; Important Things to Consider in Estimating, 12 pp.; The Operation of Camps and Commissaries, by A. O. Davison, 9 pp.; Between Profit & Loss, 30 pp.; How Contractors Use Photography, by E. S. Hanson, 7 pp.; Liability Insurance for Contractors, 5 pp.; Purchasing Records for Contractors, 9 pp.; Tools and Equipment Records, 4 pp.; Earthwork Records, 4 pp., by C. Arthur Warden.

While the papers as above are not at all connected in thought or arrangement, still the contractor who is attempting to keep up to the times and the practice of his competitors, will find many items of interest and many suggestions which can be made of value in every-day work.

Reinforced Concrete, a manual of practice. By Ernest McCullough, civil engineer. Cloth, 128 pp., $1. Cement Era Publishing Co., Chicago, Ill.

The first four chapters in this book contain an attempt to make the formulae for use in designing reinforced concrete beams, columns, walls and footings understood by those without the advantages of a technical education and the attempt is fairly successful. Simple structures may be handled with reasonable success by the careful application of the instructions given. The author very properly refers "the ambitious designer wishing to learn more of the theory of the subject and the design of higher structures to the larger standard treatises" with the statement that this book is in full accord therewith. This is assuming greater uniformity in theory and practice than has really been shown by the books that have been issued, though nearly all of them accept the simple formulae of this author as close enough approximations for the less important structures.

The last four chapters, on design and cost, forms, the conduct of work and tools, contain the practical hints and instructions for which Mr. McCullough's books are noted, and should be of much value to the contractor in reinforced concrete as well as instructive to the designing and supervising engineer.

Concrete from Sand Molds. A practical treatise explaining a simple question of molding ornamental and plain concrete or cast stone with molds of wet sand. This process, heretofore held as a trade secret will successfully mold every class of ornamental concrete work desired. By A. A. Houghton. Cloth, 145 pp., $2. The Norman W. Henley Publishing Co., New York City.

The above statement from the title page seems to express the purpose of the book. The fifteen chapters give instruction in preparing the mixture of sand and clay or other material necessary to hold the sand in place, hardening the mold, using patterns of various materials, cardboard or metal separating plates, making and using cores of sand, combining molds for large work, producing bas-relief effects, molding cast stone blocks for walls, making concrete brick, facing molds with special granite, marble or other crushed material, etc. The author tries to give the impression that the work is simple and that good results can be produced by the beginner, a claim which is not borne out by experience, for, while the processes are simple and the author's explanations may be sufficiently detailed, there are many tricks of materials and manipulation which can only be learned by considerable experience.

Motion Study, a method for increasing the efficiency of the workmen. By Frank B. Gilbreth. Cloth, 110 pp., $2. D. Von Nostrand Company, New York.

This book is in line with advanced thought as to the development of efficiency and is a remarkable example of what may be accomplished in any line when the efficiency engineer is allowed the opportunity to give the proper study and thought to a given problem and then is given the freedom to put his conclusions into actual practice.

Unfortunately the author's study, experience and resulting methods are almost entirely along the line of brick-laying, but the same thought can be carried on along any other trade or occupation, and it is to be hoped that many will be inclined to do so, to the end that the economical production of the nation may be increased thereby.

The author's view point is unique and evidences long observation and a more than usually careful attention to detail.

ORGANIZATIONS AND INDIVIDUALS

Cement Products Exhibition—Brooklyn Engineers' Club—International Municipal Congress—City Planning Conference—Technical Associations—Technical Meetings—Technical Schools—Personal Notes.

Annual Meeting of Cement Products Exhibition Co.

The annual meeting of the stockholders of the Cement Products Exihibition Co., was held at the offices of the company, 72 West Adams street, Chicago, on Tuesday, May 9. The year's transactions showed a surplus of about $3,000,000, after the settling of all accounts in connection with the New York and Chicago cement shows. Officers were elected as follows: Edward M. Hagar, president; Norman D. Fraser, vice-president; J. U. C. McDaniel, secretary-treasurer.

Announcement has been made that the second annual New York cement show will be held in Madison Square Garden, January 29 to February 3, 1912, and the fifth annual Chicago cement show will be held in the Coliseum, Chicago, February 21 to 28, 1912.

Brooklyn Engineers' Club Exhibition of Engineering Materials.

From April 18 to 22 there was held at the clubhouse of the Brooklyn Engineers' Club, 117 Remsen street, Brooklyn, an exhibition of engineering materials, processes and models, that at once became so popular that instead of closing the affair on Friday night as had been the original intention, it was decided to keep open the following Saturday night.

Each exhibit was presided over an expert of its own, and ten-minute talks were given, some a trifle longer when necessary, to fully demonstrate what the inventor or manufacturer had to show.

There were two unusual features of this show: one, the fact that the admission was free to the visitor whether accompanied by a member or not; and the other, that there was no expense to the exhibitor.

Space will not permit a detailed description of each and every exhibit of the show, but attention may be called to the photographic exhibit of the construction work accomplished, by months, along the line of the new Fourth Avenue Subway. Here were also shown in mosaic work, the color schemes and arrangements of the walls and tiling of the various proposed stations along the line.

As the subway question is now uppermost in the minds of all Brooklynites, as well as others in the Greater City, a large map, 4x5 feet was shown, depicting the proposed extensions of rapid transit, that would give to the citizens of the different boroughs of the metropolis, 90 miles of rapid transit, of which 23 miles would be subway and 67 miles elevated, without extra fare.

Another feature attracting considerable attention, was a model dry dock, shown in a specially constructed tank on the stage of the large auditorium of the club house. In this tank of water was the dry dock, and in the dock a full-rigged ship. The mechanism was so arranged that the dock would fill and sink, leaving the ship floating gracefully; and then the water would be pumped out and the dock would rise again, entirely dry. William T. Donnelly is the inventor of the dry dock.

"There is no reason why a steeple should be more pious than a smokestack," was the motto of the M. W. Kellogg Company, who had an exhibit showing, among other things, their chimney blocks.

This is the first exhibition of its kind ever held by an Engineers' Club in New York, and the great credit reflects upon the Brooklyn club for its very successful endeavor to boost Brooklyn, boost their profession, and boost their club.

The Chicago International Municipal Congress and Exposition.

An event of great interest to officials of cities, contractors and manufacturers who sell goods to cities and citizens who are interested in the way their municipalities are run, is promised in the International Municipal Congress and Exposition, in Chicago, Sept. 18-30 next. Enterprising citizens of that city have issued a call for students of city government to assemble at the congress for full discussion of the problems with which cities find themselves confronted. In connection with this, an exposition has been arranged at which the foremost cities of the world will exhibit features of their administration and at which equally important exhibits will be shown by manufacturers of every variety of article used in the government of a municipality.

Chicago will have an important exhibit. New York will display its Budget exhibit. There will be stereopticon views of Berlin. Paris and London will exhibit. Boston, Philadelphia, Cleveland, Toledo and Detroit have arranged to take space. Des Moines will have stucco models of its civic center and river front. Denver, Memphis and New Orleans will be represented. The California League of Municipalities will give a demonstration of what its cities are doing. Spokane and Seattle will exhibit, and moving pictures of Winnipeg will be shown.

The Third National Conference on City Planning.

There was held, in Philadelphia, from May 15 to 17, inclusive, the third National Conference on City Planning. In connection with this conference there was held the first municipal exhibit of city planning ever held in the United States.

This exhibition was held in the mayor's office and the corridors of the city hall, and attracted much attention from those attending the sessions. Photographs, models, drawings and plans comprised the exhibit; and about one thousand different exhibits were shown. England, Holland, Belgium, Germany, Canada and France contributed to the exhibition, besides numerous cities in this country from San Francisco to Boston, and from Savonnah, Ga., to Buffalo and Rochester. In the center of the mayor's reception room was a model of the parkway and grouplings of public buildings of Philadelphia, about thirty feet long and five feet wide. Another exhibit which attracted much attention was the plan for London by Sir Christopher Wren, drawn after the great fire. It is said that if London had adopted this plan many millions spent since in making great changes could have been saved. The famous city plans of Chicago and Washington, which cost great sums in preparation, were exhibited. The newly prepared plans for Portland, Ore., were shown for the first time. Photographs of congested conditions in Philadelphia and other cities, together with the suggested plans for their alleviation, were seen. The exhibit will continue until June 15.

Some very interesting papers were presented during the three days of the conference, and the discussions by the city planning experts, of this and other countries, proved very valuable.

Mayor Reyburn, in his address of welcome, demonstrated the international nature of the city planning movement. The address which followed, by Frederick C. Howe, of Washington, D. C., on "German Municipal Real Estate Policies," emphasized that "the rights of the community are superior to the rights of any individual." This paper was followed by a discussion of the municipal real estate policy by Mayor William A. Magee, of Pittsburg, and Mayor Emil Seidel, of Milwaukee. Thomas Adams, city planning expert, of the Local Government Board of England, of which John Burns is the chairman, brought the greeting of Mr. Burns and regret that he could not come; also the greeting from Ambassador Bryce. Mr. Adams remarked on the variety of constitutions he found in this country, and the variety of interpretations, with a variety of judges of different minds on various questions. He confessed himself perplexed by it all, but he believed that the United States is making great progress; and there is little the country could learn from Germany. Town planning in England, he explained, was based on the co-operation of the town authority and the real estate owner.

Ernest Flagg, of New York, spoke upon "Public Buildings" at the first evening session, held in the Bellevue-Stratford, at which Frank Miles Day, of Philadelphia, presided. Mr. Day read a paper upon "The Location of Public Buildings in Parks and Other Public Open Spaces," in which he held that no buildings or monuments or statues should be placed in small parks, because, in his opinion, they deprive the landscape of its rural aspect.

The second day's sessions were charterized by a consideration of how to make the city improvements pay for themselves, and how to make the water fronts attractive and yet serve the cities cheaply and effectively. At the morning session, Mr. Lawrence Veiller, of New York, secretary of the National Housing Association, spoke on "Buildings in Relation to Streets and Site." Mr. Veiller said there is a popular belief that city planning will solve the housing problem. Nothing could be farther from the facts. This is largely a sanitary problem, he added. He pointed out that certain cities, which have city plans partly worked out, have some of the worst slums. The housing problem, according to Mr. Veiller, is properly solved by regulating the heights of buildings and the depths of lots and alleys. At the same session, Raymond Unwin, leader in the English garden city movement, and author of the most famous work on city planning, "Town Planning in Practice," asserted that "the comparatively small financial gain that accrues from crowding houses on land is not generally recognized." He pointed out that, in the garden city scheme, in London and other parts of England, 423 yards of land are furnished at the rate of 2 cents; whereas, under private enterprise, with overcrowding, 127 yards are furnished at 15 cents.

Lawson Purdy, president of the department of taxes and assessments in New York, presided at the second afternoon session and read a paper upon "Taxes, Assessments and Condemnation." He further defined his subject as "How to Pay the Bill for City Planning."

"The Dock Problem" formed the topic discussed at the evening session at the Bellevue-Stratford. Joseph F. Hasskarl, acting director of the department of wharfs, docks and ferries of Philadelphia, described, at length, local harbor conditions, and suggested improvements in the mayor's comprehensive plans.

Nelson P. Lewis, chief engineer of the New York Board of Estimate and Apportionment, presided at the morning session of the third day, at which street widths and their subdivision formed the topic for discussion. Charles Mulford Robinson, civic adviser in Rochester, N. Y., argued in favor of narrowing minor residence streets, saying that it would be advantageous to tenants and owners of houses.

Walter L. Fisher, secretary of the interior of the United States, presided at the afternoon session, which was devoted to the legal aspects of city planning. Andrew Wright Crawford spoke upon "The Principles of a Uniform City Planning Code," and suggested a statute, which should be created to carry out the dreams of city planners.

Professor Ernest Freund, of the University of Chicago Law School, opposed the zoning, or districting system for American cities, because of the lack of fixity in the business life of the city. Frank B. Williams, of Hartford, Conn., favored a full power of excess condemnation, and the discussion developed a strong general sentiment for excess condemnation and a thorough-going governmental control of how a city is to grow.

The conference closed with a banquet, held at the Bellevue-Stratford, on the evening of May 17.

Technical Associations.

The Natural Gas Association of America held their Seventh Annual Convention in Pittsburg, May 16, 17 and 18. One of the features of the convention was the complimentary excursion on the Monongahela river given by the National Tube Company, of Pittsburg, Pa. The officers of the association are John M. Girard, president; Columbus, O.; and T. C. Jones, secy., Delaware, O.

The American Society of Engineering Draftsmen held a regular monthly meeting at the society's rooms, 116 Nassau street, New York City, on May 17. The committee appointed to investigate bills for licensing engineers now pending before the legislature of New York offered its report, which was favorable to the McGrath bill. The meeting was addressed by Dr. W. E. Eliott, of the topographical bureau of New York, who was one of the supporters of the McGrath bill.

The National Fire Protection Association held their Fifteenth Annual Meeting at the Waldorf-Astoria Hotel, New York City, on May 23, 24 and 25. The following committee reports were offered: "Devices and Materials," "Automatic Sprinklers," "Fire Protection Coverings for Window and Door Openings," "Conference on Building Code," "Fireproof Construction," "Hose," "Hydrants and Valves," "Pumps," "Private Fire Supplies from Public Mains;" and papers on "The Fire Nation," by Charles E. Meek, secretary-treasurer National Association Credit Men and "Standard Hose Couplings and Hydrant Fittings for Public Fire Service," by F. M. Griswold.

The International Association for the Prevention of Smoke will hold their Sixth Annual Convention in Newark, N. J., on June 28, 29 and 30. R. C. Harris, City Hall, Toronto, Can., is the secretary.

At the regular meeting of the Brooklyn Engineers Club, held May 11, Wm. C. Boyrer presented a paper on "Physical Valuation," in which were included various items encountered in appraising railway property.

The Fifteenth Annual Convention of the League of American Municipalities will be held in Atlanta, Ga., October 4, 5 and 6. Among the topics to be discussed are municipal insurance, taxing personal properties, commission government, garbage collection and disposal, and public service franchises. The officers of the League are: Darius A. Brown, mayor of Kansas City, president; John MacVicar, commissioner, Des Moines, Iowa, secretary and treasurer.

At the regular meeting of the New York Electrical Society held in the Engineering Society's building, on April 28, Frank A. Pattison presented a paper on the electrical equipment of the New York public library. George H. Guy is secretary of the Association.

The Cement Products Exhibition Company, 72 West Adams street, Chicago, have announced a competition for plans and specifications for the construction of a concrete bungalow. $300 in prizes are offered.

At the regular meeting of the Municipal Engineers of the city of New York, held in the Engineering Society's building, 27 West 37th street on May 24, Lazarus White presented a paper on "The Construction of the Rondout Pressure Tunnel of Catskill Aqueduct."

At a meeting of the Southwestern Electrical and Gas Association held in Houston, Tex., on April 29, it was decided to make Houston the permanent headquarters of the society. Among the papers presented were the following: "Steam Consumption in Water Gas Plant," by L. B. Moorhouse, San Antonio; "Napthalene," by W. H. Riblet, Houston Gas Company, Houston, Tex.

At the meeting of the Utah Society of Engineers, May 19, at the University of Utah, Mr. George F. Bacon presented a paper entitled, "Notes on the Construction of a Large Concrete Diverting Dam." The new president is Mr. Grosh.

At the meeting of the Cleveland Engineering Society held May 23, a paper on "Some Recent Improvements in Electric Motor Control" was presented by Mr. Claiborne Pirtle, vice-president of the Electric Controller & Mfg. Co. The annual meeting will be held June 13.

At the regular meeting of the Engineeer Club of St. Louis, held May 17, an illustrated paper on "The Sand Drying Plant of the United Railways Company" was presented by Mr. C. L. Hawkins, engineer of the track department of that company.

American Water Works Association.

The thirty-first annual convention of the American Water Works Association will be held in Rochester, N. Y., June 6 to 9, with headquarters at the Powers Hotel. The business sessions begin on the morning of the 6th and reports of the special and standing committees are scheduled for the afternoon. The following papers are distributed over the sessions in the afternoon and evening of the 6th, the afternoon of the 7th, the morning and afternoon of the 8th and the morning of the 9th:

"Fire Line Meters, a Comparison of Efficiency,"—George Houston.

"Pumping Station Management"—Thomas McMillan.

"Some Fundamental Considerations in the Determination of a Reasonable Return for Public Hydrant Service"—Leonard Metcalf, Emil Kuichling, W. C. Howley. (Illustrated by Lantern Sildes.)

"Illustroted Lecture on the Panama Canal"—Dabney H. Maury.

"An Emergency Intake"—Dr. William P. Mason.

"Wood Stave Pipe, Some Questions Answered"—T. Chalkley Hatton.

"Water Rates"—George G. Earl.

"High Pressure Fire Service Compared with Portable Fire Engines"—Charles A. Hague.

"Compressed Air in Water Works Construction"—Alexander Milne.

"The Investigation of Underground Water Waste in Washington, D. C."—W. A. McFarland.

"Water Softening by Means of Zeolith"—Boris N. Simin.

"Stripping Reservoir Sites"—H. G. Coventry.

"Sidney, Australia, Water Supply, Its

History and Management"—Charles Walter Smith.

"Ultra-Violet Ray Sterilization"—A. E. Walden.

"Steel vs. Iron Pipe"—Allen Hazen.

"Hot Water Problems"—George C. Whipple.

"Interpretation of Chemical ond Bacteriological Terms Used in Water Analysis"—Daniel D. Jackson.

"Methods of Keeping Records of Improvements to Established Water Works Plants"—Charles Carroll Brown.

Calendar of Technical Meetings.

National Electric Light Association.—New York City, May 29-June 2. T. C. Martin, secretary, 31 West 39th street.

American Society of Mechanical Engineers.—Annual convention at Pittsburg, Pa., May 29-June 2. Secy., Calvin W. Rice, 29 West 39th street, New York City.

American Water Works Association.—Thirty-first Annual Convention, Powers Hotel, Rochester, N. Y., June 6-10. John M. Diven, secretary, 14 George street, Charleston, S. C.

Engineers' Society of Pennsylvania.—Annual meeting at State College, Pa., June 7-10. Secy., E. R. Dasher, P. O. Box 704, Harrisburg, Pa.

National Association of Comptrollers and Accounting Officers.—Annual Convention, Arlington Hotel, Washington, D. C., June 8-10. George M. Rex, secretary, 525 Industrial Trust Building, Providence, R. I.

International Association of Chiefs of Police.—Eighteenth Annual Convention. Rochester, N. Y., June 11-16. Major Richard Sylvester, Superinendent of Police, Washington, D. C., president.

New York State Association of Chiefs of Police.—Annual Convention, Rochester, N. Y., June 13-18.

American Society of Civil Engineers.—Annual Convention, Chattanooga, Tennessees, June 13-16. Charles Warren Hunt, secretary, 220 West 57th street, New York.

Pacific Northwest Society of Engineers.—Annual convention at Boston, Mass., June 19-23. Secretary, Joseph Jacobs, 803 Central Bldgs., Seattle, Wash.

Intermountain Good Roods Association.—Annual convention, Pocatello, Ida., June 22-24. Caleb Tanner, secretary, Salt Lake City, Utah.

International Association for the Prevention of Smoke.—Sixth annual convention, Newark, N. J., June 28-30. R. C. Harris, city hall, Toronto, Can., secretary.

Firemen's Association of the State of New York.—Watertown, N. Y., August 15-18. A. H. Otto, secretary.

International Association of Municipal Electricians.—Annual convention, St. Paul, Minn., September 12-15. Clarence R. George, secretary, Houston, Tex.

International Municipal Congress and Exposition.—Chicago, Ill., September 18-30. Curt M. Treat, secretary, Great Northern Building, Chicago, Ill.

International Association of Fire Engineers.—Annual convention, The Auditorium, Milwaukee, Wis., September 19-22. James McFall, secretary, Roanoke, Va.

American Society of Muncipal Improvements.—Grand Rapids, Mich., September 26-29. A. Prescott Folwell, secretary, 239 West Thirty-ninth street, New York City.

League of American Municipalities.—Annual convention, Atlanta, Ga., October 4-6. John MacVicar, secretary, Des Moines, Ia.

National Municipal League.—Annual meeting, Richmond, Va., November 13-17. Clinton Rogers Woodruff, secretary, North American building, Philadelphia, Pa.

Technical Schools.

George C. Whipple, M. Am. Soc. C. E., of Hazen & Whipple, New York City, has accepted an appointment as professor of Sanitary Engineering in the Graduate School of Applied Science, at Harvard University, Cambridge, Mass. The appointment will become effective in September, 1911, but will not make necessary the giving up of Mr. Whipple's professional work nor a change of residence. Mr. Whipple graduated from the Massachusetts Institute of Technology, department of civil engineering, in 1889. After being in charge of the Chestnut Hill Biological Laboratory of the Boston Water Department for eight years and director of the Mount Prospect Laboratory of the Brooklyn (later, New York City) Water Works for seven years, Mr. Whipple entered into his present partnership with Mr. Allen Hazen, M. Am. Soc. C. E., in 1904. He has been lecturer on water analysis and on other topics at the Massachusetts Institute of Technology and elsewhere and since 1904 has been consulting professor of water supply and sewage disposal at the Brooklyn Polytechnic Institute.

The May issue of the *Wisconsin Engineer* contains the following articles: "Field Work in Concrete Construction at the University of Wisconsin," by Artnur Peabody, supervising architect; "Some Recent Improvements in Pavement Construction," by Leonard S. Smith, associate professor of civil engineering; "Test of a 4½ Inch Columbia Hydraulic Ram," by D. P. Hale, student; and "Power Plant Efficiency as Determined by the Technical Education of Employees," by C. M. Jansky, associate professor of electrical engineering.

Ernest McCullough, of the staff of Patterson & Davison, constructing and industrial engineers, Chicago, lectured before the Civil Engineers' Club of the University of Illinois recently, on "The Application of Hydraulic Mining Methods in Excavation Work."

Dr. Luther William Bahney, M. Am.

Inst. M. E., assist. professor of metallurgy at Leland Stanford University, California, has been appointed assistant professor of mining and metallurgy at Sheffield Scientific School, Yale University.

George A. Damon, Assoc. Am. Inst. E. E., managing editor of the Arnold Co., Chicago, Ill., has been appointed dean of the School of Engineering of the Throop Polytechnic Institute, Pasadena, Cal.

J. R. McColl, M. Am. Soc. M. E., of the engineering firm of Ammerman, McColl & Anderson, of Detroit, Mich., has been appointed dean of the engineering department of the University of Detroit.

Professor John M. Coulter, in charge of the department of botany of the University of Chicago, a distinguished scientist, has been persuaded to give an address before a joint meeting of the Sigma Xi and Phi Beta Kappa fraternities on June 12, as a part of the program of commencement week at the University of Illinois.

The Twelfth International Congress of Navigation.

The Twelfth International Congress of Navigation will be held in Philadelphia, Pa., at some time during 1912; the exact date to be noted later. This will be the first convention of the association in the United States, previous conventions having been held in almost all of the large cities of Europe. The first meeting was held at Brussels, in 1885, and the permanent international organization was formed in Paris in 1900.

The object of the association is to promote progress of inland and maritime navigation by keeping its members informed regarding the most recent experience in the construction of great public works for navigation and the technical improvements in these works, and by discussion regarding plans and regarding all important questions bearing on technique or policy directly connected with such works. It accomplishes this object by organizing Navigation Congresses, by publishing papers, proceedings, and various other documents, and by acting as an international bureau of information, through which members may obtain the most recent information on all subjects connected with navigation works.

Lieut. Col. J. C. Sanford, Room 344, The Bourse, Philadelphia, Pa., may be addressed for further information regarding the association.

A Commercial Tour of Europe.

The Boston Chamber of Commerce has arranged for a tour of Europe, the purpose of which is to give the industrial leaders of the United States an opportunity to observe European conditions, and to acquire information regarding matters of interest abroad. The trip, as outlined, will embrace all the principal cities of England, Belgium, Netherlands, Germany, Austria-Hungary, Italy, Switzerland and France. The party will leave Boston on June 12, and will return about August 15 or 20.

All details of the trip will be arranged in advance by the Bureau of University Travel of Boston. Full information regarding the trip may be had by addressing Ralph E. Towle, 31 Trinity Place, Boston, Mass.

A Card Index of Catalogs.

You are invited to file with each American consulate a statement respecting the lines of goods you have to offer to foreign buyers.

Heretofore American manufacturers have had the privilege of filing catalogs in the consulates, but the diversity of size and form of catalogs and other printed matter thus far filed, and the filing of this printed matter in English in consulates requiring other languages, has entailed unnecessary time and expense in clerical force, correspondence and translation work in the consulates. It is now proposed to obviate these disadvantages by asking each manufacturer to prepare a brief of his catalogue or printed matter according to card index specifications, these cards to be classified in Card Index Files under proper headings, and to print same in the various commercial languages.

The importance to American commerce of this co-operative plan arranged between the department of state and The Commercial Bureau Company for placing with each American consulate an encyclopedia of the industries of the United States, can scarcely be over-estimated. It is the perfection of system whereby the manufacturer, through the American consular service, may reach all the more important consumers of his products throughout the world.

The classification, compilation and distribution of the cards in cabinets is the work of The Commercial Bureau Company, which, in accordance with arrangements with the Department of State, Washington, D. C., is done without charge to the manufacturer. Full particulars will be given by The Commercial Bureau Company, 50 Church street, New York City.

Personal Notes.

F. K. Carey has resigned as president of the City Planning Commission of Baltimore, Md., because of the pressure of other business.

L. K. Sherman, M. Am. Soc. E. E., formerly assistant engineer of the sanitary district of Chicago, has been appointed assistant chief engineer of the same.

Hiram Allen Miller, consulting engineer, announces that having completed the Charles river dam and basin he has removed his office to 8 Beacon street, Boston, Mass.

Rhinelander Waldo, fire commissioner of New York City, has been appointed police commissioner. Mr. Waldo is an ex-army officer and has previously served the city as a deputy police commissioner.

W. J. Roberts has been appointed State highway commissioner of Washington, with headquarters at Olympia. Previous to his appointment he was practicing as consulting engineer on municipal improvements, with office at Medford, Wash.

L. I. Birdsall has been appointed superintendent of the new rapid filtration plant at Rock Island, Ill. Mr. Birdsall has been with the Illinois Water Survey for two years at various times and also as chemist with Messrs. Alvord & Burdick.

Andrews Allen and John A. Garcia have incorporated under the firm name of Allen & Garcia Company, consulting and contracting engineers. They will engage in steel, concrete, steel bridge foundation and coal mining work. Their offices are in the McCormick Building, Chicago, Ill.

Harwood Frost, who has been identified for a number of years with *Engineering News* as secretary of the company and manager of the book department, has severed his connection with that publication and is engaged in technical writing and advertising work at 226 La Salle street, Chicago, Ill.

Charles J. Poetsch, M. Am. Soc. C. E., for 12 years engineer of the municipal water works and city engineer of Milwaukee, Wis., has associated himself with Mr. G. A. Geiger, under the firm name of Poetsch & Geiger, for business as civil and consulting engineers, with offices in the Mack Bldg., Milwaukee.

Announcement is made by Walter E. Winn, former city engineer of Danville, Ill., that he has opened an office at room 305 Adams Building, as a civil and contracting engineer, for the general practice of engineering. Special attention will be given to all kinds of municipal improvements, drainage, sewer construction, pavements, concrete construction, sidewalks; surveys, estimates and reports on and for industrial enterprises.

Charles C. Hopkins has opened an office at 349 Cutler Bldg., Rochester, N. Y., and will continue therefrom in civil engineering practice as consulting, designing and supervising engineer in the specialties of the firm of Knight & Hopkins (established 1886). Attention will also be given to masonry, foundations and allied work. Enquiries as to work heretofore in personal charge of Mr. Knight may be addressed to Rome, N. Y., and as to that in charge of Mr. Hopkins to Rochester, N. Y.

William J. Wilgus, M. Am. Soc. C. E., of New York City, has been awarded the Eelford gold medal by the Institution of Civil Engineers of Great Britain for a paper on the Detroit River tunnels. Mr. Wilgus was formerly vice-president in charge of construction of the New York Central R. R. and had general supervision of the New York City terminal improvements and the installation of electric power. He was chairman of the board of supervising engineers for the construction of the Detroit river tunnels.

W. M. White, M. Am. Soc. M. E., formerly hydraulic engineer with the I. P. Morris Co., of Philadelphia, Pa., has become associated with the Allis-Chalmers Co., of Milwaukee, Wis., as manager and chief engineer of their Hydraulic turbine department. During the last five years, Mr. White has had charge of designing some of the largest turbine installations in this country, including those of the Toronto Power Co., at Niagara Falls; the Great Western Power Co., of California; and the Washington Power Co., of Spokane, Wash.

MACHINERY AND TRADE

The McGraw Electrical Directory.

The April issue of the semi-annual "McGraw Electrical Directory, Lighting and Power Edition" has just been issued, and brings its lists down to date. These lists include all the central lighting and power stations in the entire United States, Canada and Mexico, with information concerning names of offices, electrical equipment, municipal and other special contracts, etc.; the dealers' and contractors' section, giving a list classified alphabetically by states and cities; and a buyers' manual, in which names are classified under the various instruments, apparatus, machinery and supplies. These lists occupy nearly a thousand pages and are very full. Their accuracy is guaranteed by an offer to give subscribers and advertisers a dollar for every six envelopes correctly addressed from the lists which are returned by the post office as undeliverable, the only exception to this guarantee being the names of individual officers of companies in the central station list. The directory is published by the McGraw Publishing Co., at $10 a year.

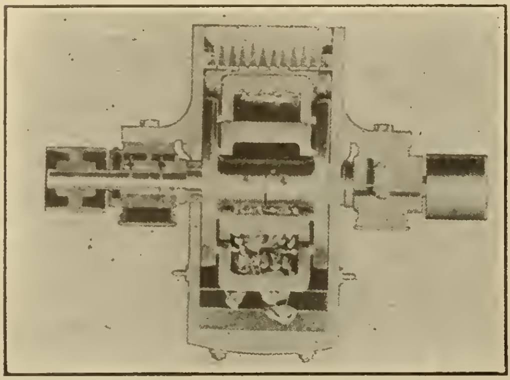
The Gardner Crusher.

There has recently been placed on the market a crusher and disintegrator, which, by reason of its low cost, simplicity and strong construction, has recommended itself to a great number of uses. This machine, known as the Gardner crusher, is manufactured by the Gardner Crusher Co., 556 W. Thirty-fourth street, New York City.

The accompanying photograph shows a

cross-section of this machine and illustrates its method of operation. As will be noted, the machine consists of a strong cast-iron frame in two parts, the lower part forming a base and the upper part a top, much after the fashion of a box. This arrangement permits of quick inspection and ease of cleaning, as well as allowing of ease of replacement of parts.

The main shaft rests on the lower part of the frame in two special blocks with



SECTION OF THE GARDNER CRUSHER.

large bearings and ring-oiled. This main shaft has at either end a disc of larger diameter, to which are connected six beaters or cranks. These beaters, which extend across the width of the drum, are of manganese steel of the best quality.

The method of operation is as follows: The shaft is revolved at a speed of 1,000 to 1,200 revolutions per minute, making the beaters, by reason of centrifugal force, to assume a position at right angles to the axis of rotation. The material is fed into the crusher through a mouth at the top and is seized at once by one of the cranks in motion and pounded to pieces. The moving cranks strike while in rapid motion, and by so doing act in a much more efficacious manner than would a rigid hammer of the same size driven by the same power. They break the stone while giving way to it, and the chips are immediately caught by the following crank, which acts on them with still greater force. Moreover, under the impulse the material is thrown against other pieces of the same character, and in the midst of the vortex of iron formed by the cranks, a nucleus of matter to be crushed is produced, which is carried along by the centrifugal force, belabored and pounded as in a cyclone, to such a degree that few particles thereof can escape without being reduced to fragments minute enough to pass through the fantastic sieve formed by the six whirling cranks.

The capacity of the machine, considering the size and power required, is very great. The beaters act after the manner of a fly-wheel, lessening the amount of power required. The degree of fineness may be changed by reducing the size of screens, shown at the bottom of the cross-section.

The crusher is adapted for grinding any material, wet or dry, to any desired degree of fineness, from one inch to 20 mesh and under. Its operation is single stage; that is, the material is reduced by being passed through the machine once. It may be used, and, in fact, has been used very successfully in a garbage disposal plant, where it is desired to crush the material before feeding it into the destructors. Among the materials for which it is adapted are all sorts of stone and ores, brick-bats, cement clinker, cement rock, cinders, tankage, garbage tankage, trap rock, shells or fertilizing material.

The Sieben Sewer Cleaner in Cleveland.

The accompanying photographs show an obstruction which was removed from a

ROOTS REMOVED FROM CLEVELAND SEWERS BY SIEBEN MACHINE.

sewer in Cleevland, O., during a test of the sewer cleaning machine manufactured by the Sieben System of Sanitation Co., Kansas City, Mo. The obstruction shown consists of a compact mass of roots which had so interlaced as to cause a great deal of trouble. As will be noted they were entirely removed.

The machine consists of a nozzle supported on runners which discharges through a small turbine water motor, causing one or two sets of hook-shaped blades to revolve rapidly. In so doing they stir up the dirt and sediment in the sewer to a thin grout, which the waste water from the turbine carries out. The

SIEBEN SEWER CLEANER IN USE IN CLEVELAND.

machine is drawn slowly through the sewer by means of cables operated by windlasses. Four men are necessary to operate this machine, two on the windlass running the machine through the sewer, and two feeding in hose at the manhole.

Specifications for Pumping Machinery.

Thomas & Smith, Inc., 116-118 N. Carpenter street, Chicago, Ill., have just published, under the title, "Suggestive Specifications," covering "Economy" pumping machinery of their manufacture, a set of specifications which cover pumping machinery especially adapted for fire purposes, automatic water supply, seepage ejection, etc. These are arranged in a convenient manner and supply a large amount of useful information to the architect and will serve to relieve him of much detail and labor in the preparation of specifications.

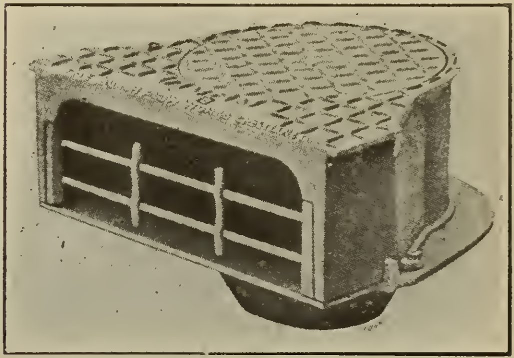
These specifications have been prepared in strict accordance with the most advanced practice in this line. Copies may be secured by architects and engineers upon application.

Manganese Steel.

The Edgar Allen Manganese Steel Co., McCormick building, Chicago, have for distribution a reprint of a paper presented by G. W. Kneisly before the National Brick Manufacturers' Association. This paper deals with the many uses of manganese steel in railroad rails, frogs and switches, in making gear wheels, dredge bins, dipper teeth, latches, etc., on dredge dippers, and for the parts exposed to wear in stone crushers. One recent use to which this material is being applied is in the gears, pinions, screws, screw casings, discs, clay rolls, gear rings and other machine parts used in manufacturing ceramic products. By renson of its exceptional hardness and the fact that it will give warning by bending before breaking, it is very valuable for this use, and many brick plants are being equipped with manganese steel parts.

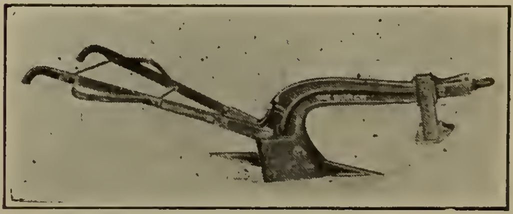
The Burch Plow Works Co.

The Burch Plow Works Co., Crestline, Ohio, manufacture a very complete line of sewer inlets, catch basin tops, iron culvert pipe and other municipal castings. The accompanying photograph shows their sewer inlet number 501. This inlet is made in various depths, with either radius or straight face (no extra



BURCH INLET AND CATCH BASIN COVER.

charge being made if radius is specified), and is provided with a removable iron grate as shown. It has an 18-inch interlocking manhole, lid and a heavy four-inch flange to rest upon the foundation



THE BURCH ROOTER PLOW.

and support the inlet. The sizes for this inlet vary from a 6-inch by 24-inch waterway with a 8-inch by 28¼-inch face of inlet to a 10-inch by 24-inch waterway with a 12-inch by 28¼-inch face of inlet. Many other types and sizes of inlets and catch basin tops are shown in a thirty-page catalogue which will be sent by the company upon request.

The second photograph shows a type of

rooter plow manufactured by the Burch Plow Works Co. As will be noted it has special features which recommend it for use in street grading work.

Large Order for Mixers for Bridge Work.

Officials and representatives of the firm of E. M. Stark & Company, of Des Moines, Iowa, who make a specialty of building city, township and county bridges and viaducts, spent several days at the last Chicago cement show inspecting the different types of batch concrete mixers on exhibition in order to select ten mixers complete on trucks to replace the type of mixers which they have been using After considering the merits of every machine thoroughly from all points of view, they decided in favor of the Eclipse Low Charging Batch Mixer and placed their order with the Standard Scale & Supply Company, Chicago House, for ten machines.

ECLIPSE LOW CHARGING BATCH CONCRETE MIXER.

This was won for the Eclipse Mixer by reason of its low charging platform; and its large open drum; the simplicity in construction and few working parts enabling the complete outfits to be built light so that they can be easily moved from place to place.

The Past Year in the Asphalt Industry.

Evidence of the continued success of the present management of the General Asphalt Co. is contained in the eighth annual report of the company for the fiscal year, ending April 30. Gross earnings for 1910 were $16,004,173, exceeding the gross earnings of the preceding year by $2,011,190. Net earnings were $1,102,075, as compared to net earnings of $1,031,741 in 1909.

The Barber Asphalt Paving Co. constructed 2,349,917 square yards of new sheet asphalt pavements during the year, and 1,341,047 yards of private work and paid repairs, an increase, taking the two classes of work together, of 560,000 yards over 1909. These figures do not include contracts for 1,687,788 yards carried over to the present year.

The first public announcement is made in the report of the discovery of valuable oil deposits on the company's property adjoining the Trinidad asphalt lake. A small amount of oil had been obtained up to September of last year, when a well was being bored, and then at a depth of 915 feet began to produce oil at the rate of 3,000 barrels a day. Aside from this oil discovery, the main development in the company's business, as shown in the report, relates to the increasing use of asphalt in macadam road construction, the tonnage of Bermudez road asphalt being eight times greater in 1910 than the total for 1909.

A New Hydrated Lime Works in Maryland.

There is now under construction the first of a series of hydraulic plants at the Maryland quarries of the Potomac Refining Company on the Chesapeake & Ohio Canal near Harpers Ferry, W. Va. Within ninety days this plant will have an assured annual output of approximotely 50,000 tons or 2,000,000 bags.

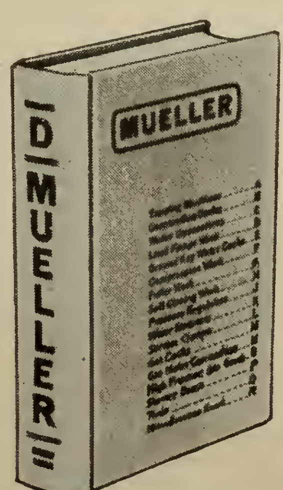
Another, or secondary, hydrating plant will be installed, the company announces, as soon as the first unit is running to capacity, and as upward of 50,000,000 tons of 96.43 per cent. stone is available, the producing capacity of the plant should be unlimited.

Shipments are expected to begin September 1 and several offers have been made for the entire output on yearly contract. Hydrated lime dealers will be interested in the announcement that $5.50 per ton f. o. b. works is the lowest offer made.

In addition to limestone, the Potomac Company has extensively opened up black and gold marble, equal to the best grades of Egyptian; also manganese, ochre and tripoli in great quantity. In addition to hydrated lime, it is planned to excavate and refine manganese, tripoli and ochre simultaneously.

Mueller Catalog "D."

The Mueller Manufacturing Co., West Cerro Gordo St., Decatur, Ill., have issued a catalog showing their line of water, gas, and plumbing brass goods and tools.



MUELLER CATALOGUE.

This catalog is unusual in detail, illustrations being given of all of the parts listed. It numbers about 850 pages, is bound in cloth, and is exceptionally well indexed. Among the parts listed in the catalog are the following: Water connections; tapping machines; corporation cocks; water strainers; service boxes; high pressure gas goods; tools; gas meter connections; meter testers; etc.

The Pillsbury Method of Road Surfacing.

Franklin C. Pillsbury, of 126 Massachusetts Ave., Boston, Mass., who is at present division engineer of the Massachusetts Highway Commission, has developed an apparatus by which the operation of applying oils and tar in road construction and maintenance is simplified.

This apparatus consists of a detachable spraying device which connects with a steel-tank wagon constructed to withstand an internal pressure of steam and provided with gauge and safety valve. Steam may be supplied from the steam roller or tractor, used to haul the tank wagon while in operation, or by a small steam boiler of automobile type attached to the tank wagon.

The operation consists in turning steam into the top of the tank, thus providing pressure that discharges the bituminous material by an original device through the spraying nozzles in a perfect spray and in any quantity desired.

The main point in favor of the Pillsbury method is its simplicity. The spraying device is detachable, so that when one tank wagon is emptied the sprayer is removed and attached to the next full tank.

G. K. Compound in Sewer Specifications.

The township of South Orange, Essex Co., N. J., has issued a set of sewer specifications which have been compiled under the direction of Alexander Potter, consulting engineer. These specifications are very complete in detail and contain several provisions out of the ordinary.

The following paragraphs are given relative to material to be used in forming pipe joints:

The contractor on this work will be required to use G. K. Compound as a cementing medium. This material can be procured from the manufacturer at six and a quarter (6¼) cents per pound in quantities greater than a ton, and six and a half (6½) cents in quantities less than a ton. The following quantities are given by the manufacturer as requisite for each joint:

8-in. pipe, 1½ in. deep, 1.68 pounds per joint.

10-in. pipe, 1½ in. deep, 2.05 pounds per joint.

12-in. pipe, 1½ in. deep, 2.42 pounds per joint.

The amount of pipe to be laid calls for 12,758 pounds of material, so that the six and a quarter cent price will prevail if ordered by the ton. The manufacturer of the compound agrees to furnish the services of an experienced pipe layer for a period of a week, without charge, to break in the regular pipe layer of the contractor. It is claimed that the cost of placing the material is less than the cost of properly laying the joint in cement mortar or with sulphur sand or pozite. The contractor, before making up his bid, must verify this assumption for he will be required to make the pipe joints with this material so that they will be watertight against external or internal pressure of five feet.

The compound mentioned is manufactured by the Union Clay Products Co., 40 Church St., New York City.

The Coapco Comet.

There appeared during April, a publication which is known by the above title. This publication as it asserts consists of the head of solid matter and the tail of hot air. The head is devoted to matters pertaining to fuel economy and is edited by Jos. W. Hays. The tail is all that its name implies. The publication will be issued monthly by The Combustion Appliance Co., Rogers Park Square, Chicago, Ill.

Amiesite.

The question of the destruction of road surfaces by the action of swift-moving automobiles has been too much discussed to need further mention. To prevent this action, it has been almost universally decided that some better binding material must be found for macadam road surfaces, than the mere stone dust and water. There are on the market at this time, a number of such binding materials. One of the most valuable of these, known as "Amiesite," is manufactured by the Amies Road Co., of 584 Bourse Building, Philadelphia. The accompanying photograph of Magnolia road in Camden county. New Jersey, shows a road completed in 1908 and photographed after more than a year's service under heavy automobile traffic.

"Amiesite" is made at permanent mixing plants located at points situated on various railroads with a view to securing the widest distribution at a minimum freight rate. It is loaded directly from the mixers into cars, being in a friable or granular condition, and upon arriving at its destination is ready for use without further treatment.

The mixing process saponifies the asphalt cement, causing a permanent chemical binding which, unlike any other material used, will not evaporate, oxidize or crystallize, but retains its adhesive qualities indefinitely and when so combined and when properly laid and rolled, it becomes a compact mass, resilient, with all the good features of an asphalt pavement and without some of its bad qualities. The fact that the surface is of such compactness offers an excellent drainage as well as providing for the retention of the surface material under abrasive action.

The material, as manufactured under patents issued to Joseph Hay Amies, consists of any stone suitable for road construction, crushed to a size commercially known as 1½-inch, ¾-inch, ½-inch, or gravel as may be deemed best for the work to be performed, mixed with an asphaltic cement composed of refined asphalt containing not less than 90 per cent. of bitumen.

AMIESITE ROAD, MAGNOLIA, N. J.

Good Roads, a publication issued by this company, together with a complete set of specifications, is offered for distribution.

Hy-Rib.

"Hy-Rib" is the title of a booklet issued by the Trussed Concrete Steel Co., of Detroit, Mich., known for their association with the Kahn system. This booklet is descriptive of the use of Hy-Rib steel sheathing in building and other construction. The material lends itself readily to such construction, and has been shown by underwriters' test to be entirely fireproof. A number of other uses, such as for bridge reinforcing and reinforcing of conduits, sewers and culverts, are given.

Ornamental Street Lamp Posts.

The Electric Railway Equipment Co., 2950 Cormany street, Cincinnati, O., have issued a very attractive booklet, showing their original designs in ornamental lighting standards. There are shown in this booklet about forty different designs, ranging from the bracket lamp arms, suitable for use with iron trolley poles, to the designs common in the modern ornamental lighting systems. Full descriptions and photographs of the different designs shown make the book of great value to one interested in the question of street lighting.

Sand Lime Brick.

The International Sand Lime Brick and Machinery Co., 90 West street, New York, is offering for distribution a booklet entitled "Sand Lime Brick." This booklet is devoted to descriptions of the process of manufacture and the uses of the material. It is illustrated from photographs, showing machine parts, the complete machines used in the manufacture of the brick and some examples of its use in building construction. This book will be sent free upon request.

The Port Huron Line.

The Port Huron Engine and Thresher Company, of Port Huron, Mich., have a booklet describing their line of road machinery. Among the machines shown are the Port Huron standard road roller, the Port Huron scarifier, dump wagons, sprinklers and engine tenders.

The description of the rollers gives the details of construction and a number of photographs are shown to illustrate the points noted. Examples of the work of the roller in connection with the New York state roads and a number of comments from those who have used it are given.

The scarifier described is of peculiar construction in that it may be run in either of two directions, the picks being set in such a way that they may be lowered when the machine is dragged forward and raised when it is reversed.

The street dump wagons shown are of heavy construction for use in macadamizing road work. Heavy steel broad tired wheels and all steel dump boxes characterize them.

Trade Publications.

The Allis-Chalmers Company, have issued a reprint describing the Gates Rock and Ore Breaker. This booklet concludes a general description of the gyratory breaker and shows photographs and sections illustrating the points mentioned. Tables of dimensions, estimates of power required, prices, and dimensions of timber mountings are also given.

The Conneaut Shovel Company, of Conneaut, Ohio, have a catalogue describing their line of shovels illustrating the points of advantage claimed, and giving prices and dimensions.

The American Asphaltum and Rubber Company, 600-614 Harvester bldg., Chicago, have have an illustrated book describing the use of asphalt mastic floors. A number of photographs are shown depicting plants in which the floors have been used; and the advantages of this type over wood or concrete are set forth.

The Cement Tile Machinery Company, of Waterloo, Iowa, have a handsome illustrated booklet describing their line. Among the machines shown are cement tile machines, pipe molds, the perfect concrete mixer, cement block machines, dump cars, brick machines, dump wagons, boilers, hoists and various types of contractors engines.

The Universal Portland Cement Company, Chicago, have a pamphlet entitled "The Universal Portland Cement in Ohio." The use of their material in building, bridge and other construction is described and illustrated.

The Dexter Portland Cement Company, Samuel H. French and Company, Philadelphia, agents, have a leaflet illustrating some of the uses of their cement in ornamental concrete work. A photograph is shown of a concrete bridge at Manchester, N. Y., in the construction of which Dexter cement is used.

The National Concrete Company, Traction Terminal Building, Indianapolis, Indiana, have issued a booklet describing the Luten truss in connection with the good roads improvements. Examples are given of its use and contrasting examples of the use of straight rod reinforcing are also shown. Tables and drawings with dimensions give the quantities needed for different span bridges where the Luten truss is used.

The Hays Automatic Gas Collector is described in a leaflet issued by the Combustion Appliances Co., Rogers Park, Chicago, Ill. The Hays Improved Gas Analysis Instrument, the Hays Automatic CO, and Draft Recorder, and the Tilden Automatic Damper Regulator are the titles of other publications issued by the same company.

Trade Notes.

ASPHALT.

Washington, D. C.—Special.—The district commissioners have requested authority to erect a $75,000 municipal asphalt plant.

Kansas City, Mo.—The contract for furnishing 2,000 tons asphalt for municipal repair plant was let to The Texas Co., at $20.40 per ton.

CEMENT.

Rockport, Ill.—Special.—The Rockport Cement Tile Co., has been incorporated by Mary L. Horton, G. A. Gay, J. C. Gay, W. W. Haines and B. B. Horton. Capital stock, $2,500.

Waterloo, Ia.—Special.—The Waterloo Cement Machinery Company has just completed a new steel and reinforced concrete erection shop equipped with a twelve thousand pound electric traveling crane which will enable them to double the capacity of their plant. This shop will be used for the larger sizes of Polygon mixers and relieve the congestion now existing.

LIGHT, HEAT AND POWER.

Aurora, Ill.—The contract for furnishing ornamental street lighting poles, was let to the Flour City Ornamental Iron Works, Minneapolis, Minn., $10,000.

Cincinnati, O.—Special.—The Electric Railway Equipment Co., Cincinnati, O., manufacturers of lighting and railway poles, overhead line material, etc., has appointed John G. Kipp, general eastern representative, with offices at 90 West St., suite 519, New York City. Mr. Kipp was sales manager of the company during the past nine years.

Columbus, O.—Bids will be received June 1, at 12 m., for furnishing the following material for municipal light plant: Item 1: 28,000 feet number 2 T. B. weatherproof wire; 24,000 feet number 4 T. B. weatherproof wire; 60,000 feet number 6 T. B. weatherproof wire. Item 2. Remodeling switchboard. Item 3. Furnishing two 750 kw. transformers, two 150 kw. transformers. Item 4. Furnishing 390 40-foot 7-inch top cedar poles; 75 45-foot top cedar poles; 50 50-foot top cedar poles; 25 55-foot cedar poles; 25 60-foot top cedar poles; 12 55-foot top cedar poles. Certified check 5 per cent. Bond 50 per cent. David A. Jones, clerk, H. S. Holman, director of public service.

East Liverpool, O.—The city is contemplating the installation of about 50 ornamental lights. The purchase of a dynamo and gas engine will be required. J. J. Grafton, director of public service.

MACHINERY AND SUPPLIES.

New Castle, Ind.—Bids will be received June 5, at 2 p. m., for furnishing one or more road graders. W. L. Risk, county auditor.

Brooklyn, N. Y.—Special.—The Standard Scale & Supply Company of Pittsburgh have secured a large contract for scales to be installed at the various pumping plants of the department of water supply, gas and electricity, Borough of Brooklyn, N. Y. These scales aggregate hundred-ton forty-two foot railroad track scales both pit and suspension pattern and a large number of wagon scales of ten-ton capacity, heavy railroad pattern. All these scales are to be built in steel and concrete construction. The contract will be completed during the summer.

Philadelphia, Pa.--Bids will be received June 9, at 11 a. m., for furnishing ond installing one 200 h. p. water tube boiler. Chauncey B. Baker, depot quartermaster, 26th street and Gray Ferry road.

Davenport, Wash.—The Lincoln county commissioners are contemplating the purchase of 75 steel road drags.

MISCELLANEOUS.

Chicago, Ill.—Special.—Mr. H. A. Hunt has been appointed eastern sales agent of the Edgar Allen American Manganese Steel Co., with headquarters at New Castle, Del., which appointment was made in order to fill the vacancy caused by the resignation of Mr. V. W. Mason, Jr. The above change is effective May 16th, 1911.

Mattoon, Ill.—Special.—The H. W. Clark Company was incorporated under date of May 9th, for $50,000, for the manufacture of "Clark Meter Boxes," and a general line of water works appliances.

New York, N. Y.—Special.—The Indian Refining Company announces that the general offices of the company are located at 123-133 William street, New York City. The road and fuel oil, general sales, purchasing, executive, accounting and advertising departments may be addressed accordingly.

New York, N. Y.—Special.—The Lynchburg Foundry Company have removed their offices from 220 Broadway to 2 Rector street, room 1514.

New York, N. Y.—Special.—The Jobson-Gifford Company, 25 East Twenty-sixth street, New York City, has been incorporated, consolidating the interests of the Bowles-Gifford Company and the Jobson-Hooker Company, for the continuance of the structural steel business formerly carried on by the original companies, by the same personnel.

Muskogee, Okla.—The Nelson Sand and Gravel Co. has been incorporated. Capital of $50,000. The directors are Andrew S. and Alex. C. Nelson and Louis Peck, all of Muskogee, Okla.

Oklahoma City, Okla.—The secretary of state has issued a charter to the Sanitary Street Sweeper Co., of Oklahoma City. The capital is $50,000 and the incorporators are Lee F. Wilson, J. O. Eckles and Albert P. Cash, all of Oklahoma City.

Pittsburg, Pa.—The contract for furnishing light road oil for county work was let to the Indian Refining Co., and heavy road oils, to Standard Oil Co.

Nashville, Tenn.—Special.—The patent on the garbage destructor of the Harris Smokeless Furnace Co., 210 Stahlman Bldg., has been granted.

Patents on Apparatus for Engineers, Surveyors and Draftsmen.

906,680. Base for Surveying Instruments. Christian L. Berger, Boston, Mass.

907,329. Device for Determining the Depths and Fixing the Grades of Trenches. Jas. J. Frisco, Montclair, N. J.

907,373. Slide Rule. Willie L. E. Keuffel, Hoboken, N. J.

913,069. Surveyor's Target. Grant T. Stephenson, Wells, Mich.

914,945. Drainage Level. Philip Gutwein, Jr., Francesville, Ind.

915,084. Leveling Investment. Rudolph Eberhard, Stockton, Cal.

915,085. Drafting Table. John W. Fairbanks, Marion, O.

918,599. Drafting Instruments. Joseph Samsonoff, New York, N. Y.

928,557. Gradient Instrument. Robert Sobotka, Hartselle, Ala.

936,408. Hydrostatic Leveling Instrument. John J. Bunting, Grandview, Wash.

939,489. Telemeter Rod. Chas E. Flanagan, Steubenville, O.

943,063. Theodolite. Lewis H. Cooks, Wimbledon, England.

950,581. Surveyor's Measuring Line. Thos. H. Tracy, Vancouver, B. C., Can.

951,719. Sectional Liner. John Baum, Jr., East Liverpool, O.

952,275. Leveling Rod. Gabriel de la Pena, San Antonio de los Banos, Cuba.

955,161. Line Ruling Device. Chas W. Holtz, Weisbaden, Germany.

957,238. Beam Compass. Wm. L. Murphy, Dorchester, Mass.

958,588. Combined Level and Gradient Instrument. John J. Bunting, Grandview, Wash.

966,016. Blue Printing Apparatus. Rembold Herman, Crafton, Pa.

969,732. Surveying Apparatus. Mano W. Tebyrica, Sao Paulo, Brazil.

970,625. T-Square. Vincenc Krajicek, Pardubitz, Austria-Hungary.

971,523. Transit. Augustus N. Buckner, Birmingham, Ala.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Fullerton, Cal.—D. F. Halladay, Central bldg., Los Angeles, has been retained to prepare plans for $175,000 oil macadam roadway improvement.

Monrovia, Cal.—Paving construction, to cost $30,000, is contemplated.

Riverside, Cal.—The macadamizing and oiling of Mulberry street, and the construction of cement and concrete curb and gutter is contemplated.

Washington, D. C.—The district commissioners have requested authority to erect a $75,000 municipal asphalt plant.

Peoria, Ill.—The city is contemplating the paving of N. Orange street.

Taylorville, Ill.—The paving of Second and W. Main streets with vitrified brick is contemplated. Estimated cost about $17,000. James W. Dappert, cy. engr.

Huntington, Ind.—Construction of various stone and gravel roads is contemplated. John Weaver, audt. J. B. Vernon, engr.

Iowa City. Ia.—The paving of about 10,000 sq. yds. with bitulithic or other material and about seven blocks with brick and the paving of several allays with concrete is contemplated.

Baltimore. Md.—A $5,000,000 bond issue for street paving has been voted.

Southbridge, Mass.—The paving of Hamilton street, to cost about $23,000, is contemplated.

Detroit, Mich.—Bids will be requested soon for a $12,000 pavement work.

Virginia, Minn.—Plans have been prepared for the paving of four streets. E. S. Johnson, cy. engr.

Linneus, Mo.—A $16.000 bond issue for road improvement has been voted.

Springfield, Mo.—The paving of Plaza Center with concrete pavement and the erection of eight ornamental light posts are contemplated.

Montclair, N. J.—The paving of several streets with granite block, to cost about $100,000, is contemplated.

North Wildwood, N. J.—A $60,000 bond issue for street paving has been voted.

Hamlet, N. C.—A $50,000 bond issue for street paving has been voted.

Salisbury, N. C.—A $400,000 bond issue for county road improvement has been voted.

Ashland. O.—The paving of Orange street is contemplated. Edgar Koehl, clk.

Ashtabula, O.—The paving of Drexel and Scoville streets is contemplated. Serv. Dir. Brotherton.

Brookville, O.—The paving of Market street is contemplated. H. E. Wheaton, clk.

Columbus, O.—Bids for the paving of Summit street have been rejected, and new bids will be asked.

Delaware, O.—The paving of Central and Elizabeth streets is contemplated. Robert A. Parker, clk.

Millersburg, O.—This city is contemplating about 6,000 sq. yds. of paving.

Bakers City, Ore.—A $45,000 bond issue for paving construction has been voted.

Hillsboro, Ore.—Louis C. Kelsey, engr., Selling bldg., Portland, Ore., is preparing plans for about $140,000 paving and sewer construction.

Eastvale, Pa.—The paving of Main street is contemplated. John Brooks, secy.

Johnsonburg, Pa.—A bond issue of $20,000 has been voted for the purpose of paving various streets.

Reading, Pa.—The city is contemplating the purchase of an asphalt plant, now being operated at Third and L. V. Ry.

Washington, Pa.—The grand jury has approved a $500,000 bond issue for the purpose of improving roads in Washington county, with brick.

Columbia, S. C.—The paving of Hampton and Washington streets with creosoted wood blocks, and the paving of Sumter street with bitulithic, is contemplated.

Brady, Tex.—A bond issue of $75,000 for the purpose of macadamizing roads throughout the county has been voted. An engineer will be engaged to make surveys and estimates. A. M. Martin.

Denton, Tex.—The paving of five blocks of streets is contemplated.

Longview, Tex.—A $90,000 bond issue for street paving and electric lighting has been voted. G. A. Bodenheim, mayor.

Paris, Tex.—A bond issue of $300,000 has been voted for the purpose of constructing roads.

Blair, Va.—Road improvement, to cost about $30,000, is contemplated by Alexandria county.

Chehalis, Wash.—The paving of Lewis street, to cost about $8,930, is contemplated.

Ellensburg, Wash.—The paving of Pearl and Fourth streets with asphalt, to cost about $64,000, is contemplated.

North Yakima, Wash.—The following sidewalk contracts have been let: McKinley avenue, to Root & Bievel, 2 Madison street, Spokane, Wash., $23,431; Garfield avenue, to Gibler & Erricson, $2,89; grading and constructing roadways, to D. P. Daniels, North Yakima, $13,000.

Shinnston, W. Va.—The city has voted bonds for street, water works and sewerage improvement.

Burnaby, B. C., Can.—A bond issue of $80,000 for road improvement and water works extension has been voted.

Nanaimo, B. C., Can.—Asphalt paving work, to the amount of $2,000, is contemplated.

Winnipeg, Man., Can.—The city contemplates the spending of $5,000,000 on improvements to water mains, sewers, sidewalks and imprvements.

CONTRACTS TO BE LET.

Little Rock, Ark.—June 8, 2 p. m. Paving E. Fourth street with creosote block or asphalt. Certified check, $100. E. A. Kingsley, cy. engr.; Claude Ringo, secy.

Bedford, Ind.—June 6, 1 p. m. Constructing eight gravel or macadamized roads. Ezra W. Edwards, co. audt.

Bloomfield, Ind.—June 6, 2 p. m. Constructing macadam roads in Taylor township. Caswell H. Jennings, co. audt.

Brazil, Ind.—June 6, 11:30 a. m. Construction of stone and gravel roads in Harrison township and gravel road in Sugar Ridge township. Edgar A. Staggs, co. audt.

Delphi, Ind.—June 5, 12 m. Constructing gravel road in Tippecanoe township. M. G. Haun, audt.

Greensburg, Ind.—June 5. Constructing macadamized road in Clay township. Frank Ryan, co. audt.

Lafayette, Ind.—June 8, 10 a. m. Constructing five gravel roads. George W. Baxter, co. audt.

Noblesville, Ind.—June 6, 2 p. m. Constructing gravel road in White River township, and macadam road in Jackson township. George Griffin, co. audt.

Petersburg, Ind.—June 6, 2 p. m. Constructing gravel road in Patoka township. John G. Gray, co. audt.

Salem, Ind.—June 9, 7:30 p. m. Improving Hackberry and Cherry streets, under improvement resolutions Nos. 4 and 6. Certified check, 2½ per cent. Albert E. Belle, town clk.

Vernon, Ind.—June 5, 11 a. m. Constructing pike road in Vernon township. M. W. Brogan, co. audt.

Washington, Ind.—June 6, 2 p. m. Constructing three gravel roads in Bogard and Madison townships. Thomas Nugent, audt.

Winamac, Ind.—June 6, 12 m. Constructing two gravel roads. W. E. Munchenburg, co. audt.

Winamac, Ind.—June 15, 12 m. Construction of highway on line between Pulaski and Starke counties. Wm. E. Munchenburg, co. audt.

Davenport, Ia.—June 6, 2 p. m. Paving Myrtle street, about 700 lineal ft. Certified check, $50. E. M. Compton, chm. bd. of pub. wks.

Washington, Ia.—June 7, 6 p. m. Constructing vitrified brick pavement on N. Iowa avenue, 6,991 sq. yds. paving; 3,855 linear ft. combined curb and gutter. Certified check, $1,000. F. S. Steck, cy. clk.

Bowling Green, O.—June 3, 2 p. m. Improving Wooster street, about 1,266 ft. Bid on following proposition: First, curbing and draining; second, grading and macadamizing; third, for whole of said improvement. Certified check, $100 on each bid. W. A. Mariner, serv. dir.

Canton, O.—June 12, 10 a. m. Constructing two miles brick paving on Minerva-New Franklin road; includes 17,600 sq. yds. brick paving, 21,150 lineal ft. curb and 4,000 lineal ft. drain tile. Constructing two miles of brick pavement on Canton-North Industry road, including 20,800 sq. yds. brick paving, 23,600 lineal ft. curb, 770 cu. yds. crushed stone. Certified check, $400. J. H. McConnell, audt. Stark county.

Canton, O.—June 14. Paving Minerva road a distance of about two miles. Co. comr. Stark county.

Cincinnati, O.—June 9, 12 m. Improving Springfield pike, in Springfield township. Bond, $500. Fred Dreihs, clk. Hamilton co. comrs.

Cincinnati, O.—June 16, 12 m. Improving Loveland and Madeira roads. Bond, $2,000. Fred Dreihs, clk. Hamilton co.

Columbus, O.—June 1, 12 m. Paving Spring street and Dublin avenue. Certified check, $500. David A. Jones, clk. H. S. Holton, dir. of pub. serv.

Columbus, O.—June 1, 12 m. Macadamizing 0.88 miles of road in Hocking county. Certified check, $300. James C. Wonders, state highway comr.

Elmwood Place, Hamilton County, O.—June 10, 12 m. Constructing macadamized roadway on Cedar street. Certified check, $500. A. H. Powell, clk.

Greenfield, O.—June 10, 10 a. m. Constructing road in Mississinewa township, consisting of six sections of ½ mile in length, and one section of 1,904 ft. Certified check, $100 on each bid. C. F. Slade, co. surveyor Starke county, O. Frank Snyder, co. audt.

Ironton, O.—June 12, 12 m. Constructing steel superstructure of bridge over Symmes creek, 100-ft. span, 6 panel. Certified check, $100. A. P. Robison, audt.

Mt. Vernon, O.—June 16. Paving Blackberry alley with brick, and Plum alley with brick. $500 bond. Chas. M. Fairchild, dir. of pub. serv.

Salem, O.—June 19. Paving 2,000 ft. of McKinley avenue road. Certified check, $500. Ira Kannal, president bd. of co. comrs. Columbiana county.

Arnold, Pa.—June 5, 8 p. m. Improving Kenneth avenue. Certified check, $400. T. J. Jacobus, chm. street com.

Bedford, Pa.—June 6, 2 p. m. Constructing 2,500 ft. of road in Londonderry township. Bond double amount of contract price. G. R. Shuck, clk.

Bellevue, Pa.—June 6, 6 p. m. Paving Dakota avenue, 4,700 sq. yds. pavement; 2,800 ft. of curbing. Certified check, $500. John McBridge, boro. engr., room 708 Fitzsimmons bldg., Pittsburg, Pa.

Carnegie, Pa.—June 1. Paving Trimball avenue. Certified check, 5 per cent. M. M. Everly, chm. street com.

Franklin, Pa.—June 5, 7 p. m. Paving Eighth, Ninth, Tenth, Eleventh, Fourteenth and Buffalo streets; and repaving Liberty street. Phil Engelskirger, cont.

Natrona, Pa.—June 6, 7:30 p. m. Paving Chestnut, including 2,600 sq. yds. paving and 2,300 lineal ft. curbing, and 71,140 ft. 12-in. storm sever. Certified check, $500. Paving Spruce street, including 4,400 sq. yds paving and 2,900 lineal ft. storm sewer. Certified check, $500. Paving Spruce street, including 4,400 sq. yds. paving and 2,900 lineal ft. curbing. Certified check, $500. W. B. Wiang, clk. of Harrison township, Natrona, Pa.

Sharon, Pa.—June 6, 5 p. m. Paving Oakland avenue, about 1,900 sq. yds.; paving Silver street, about 2,530 sq. yds. Griff W. Nichols, boro. engr. Oscar J. Denny, secy.

Burlington, Vt.—June 1. Constructing cement walks, estimated to cost $8,000. Certified check, $200. Oliver Lafontaine, Jr., vil. pres.

Pasco, Wash.—June 6, 8 p. m. Constructing 78,690 lineal ft. sidewalks and 16,660 lineal ft. concrete curbing. Certified check, $500. L. H. Koontz, cy. clk.

CONTRACTS AWARDED.

Mobile, Ala.—Paving Water street, to Jamison & Halowell, Montgomery, Ala., $31,457.

New Decatur, Ala.—Constructing cement sidewalks, to Halliburton & Brook, Birmingham, Ala., $8,319.

Hermosa Beach Cal.—Paving, to P. S. Venable, Redondo Beach, Cal., $7,000.

Long Beach, Cal.—Paving, to Fairchild-Gilmore-Wilton Co., Pacific Electric bldg., Los Angeles, Cal., $14,000.

Los Angeles, Cal.—The following paving contracts have been awarded: Crenshaw boulevard, to Fairchild-Gilmore-Wilton Co., $24,522; Bonnie Brae, to Barber Asphalt Paving Co., $12,785; Sixteenth street, to Benjamin F. Ford, $11,142;

Camp street, to H. H. Curtis, $2,994; Monroe street, to Walter Overell, $3,072; Fries street, to H. H. Curtis, $6,512; Micheltorena street, to Walter Overell, $11,334; Ninth street, to H. H. Curtis, $7,945; sidewalks on Twenty-fourth street, to John Balch, $853; sidewalks on Gower street, to Will F. Peck, $296; sidewalks on Westmoreland avenue, to E. P. Peck, $1,047; sidewalks on Mohawk street, to John Balch, $575; paving Avenue Forty-four, to E. P. Peck, $1,398; improving Vestal avenue, to G. E. Spain, $6,630; paving Avenue Eighteen, to P. A. Thomas, $6,785; improving alleys, to Fairchild-Gilmore-Wilston Co., $2,927; sidewalks on Bird street, to A. Sikes, $597; sidewalks on Miles street, to J. J. Batac, $841; improving Twenty-fourth street, to W. H. Shartle, $2,965; sidewalks on Annabelle, to C. A. Salada, $721.

Colorado Springs, Colo.—Constructing parking improvements on Wood avenue, to John Stevenson, $11,340.

East St. Louis, Ill.—Constructing 7,175 sq. yds. of vitrified brick paving, to Myers Construction Co.

Bluffton, Ind.—The following road contracts have been awarded: Miller road, to George W. Tabor, $3,795; Max road, to J. M. McMath, $9,667; Gollinger road, to Charles Nash, $5,659; Suttle road, to Alexander & Crofdic, $3,209.

Brookville, Ind.—Constructing two roads, to Sullivan, Mason & Sullivan, $8,415 and $10,225.

Frankfort, Ind.—Paving Barner street, to William Coin, Frankfort, Ind.

Greencastle, Ind.—Improving streets on public square, to Madison Construction Co., of Anderson, Ind., $21,719.

Indianapolis, Ind.—Constructing sidewalks on Alvord street, to R. C. Lackey; sidewalks on California street, to Frank Lawson.

Wabash, Ind.—Paving Manchester avenue, to Western Construction Co., Traction Terminal bldg., Indianapolis, Ind., $33,000.

Cresco, Ia.—Constructing 11,500 sq. yards of cement paving, to Concrete Construction Co., Cedar Rapids, Ia.

Des Moines, Ia.—Construction of paving on various streets, to Bryant-McLaughlin Asphalt Paving Co., Des Moines, Ia., $25,000.

Iowa City, Ia.—Sidewalk contracts awarded to W. J. Barry and J. L. Berry, Iowa City, Ia.

Hutchinson, Kan.—Paving S. Walnut street, to Beebe Construction Co.

Wichita, Kan.—Constructing bridge in Grant township, to Wichita Construction Co., Wichita, Kan., $935.

Bunkie, La.—Road construction, to F. J. Burlin, Cottonport, La., $22,700.

Baltimore, Md.—The following road contracts have been awarded: Monrovia road, to Coblentz & Klipp, $12,554; New-market road, to Ira D. Robinson, $33,092; Patatsco river road, to B. F. Sweeten & Son, $18,375.

Cambridge, Md.—Paving construction, to Field, Barker & Underwood, Arcade bldg., Philadelphia, Pa., $47,208.

Lynn, Mass.—Furnishing curb stone, to John L. Goss, Stonington, Me.

Pittsfield, Mass.—Constructing 4,000 sq. yds. pavement, to Daniel J. Walsh, Pittsfield, Mass.

Holland, Mich.—Paving Central avenue, to Perry Van Der Veen, Grand Rapids, Mich., $17,613.

Duluth, Minn.—Constructing vitrified brick paving on Grand avenue, to P. McDonnell, Duluth, Minn., $50,000; graveling E. Fifth street, to same, $16,447.

St. Paul, Minn.—The following street improvement contracts have been awarded: Charles street, to Gale & Baumgardner, $2,728; Charles street, West, to Keough Bros., $3,300; Burgess street, to Keough Bros., $1,600; alley in block 4, to W. H. Malone, $538.

Fulton, Mo.—Constructing 9,000 sq. yds. brick pavement, to Joseph Pope, Jefferson City, Mo.

St. Joseph, Mo.—Paving Main street with macadam, to Rackliffe-Gibson Construction Co.; paving Highland avenue with brick, to Young Bros. Construction Co.; paving Twelfth street with mineral rubber asphalt, to Metropolitan Paving Co.; paving Charles street with asphalt, to T. W. Billingham.

St. Louis, Mo.—The following paving contracts have been awarded: Asphalt, about $15,000, to Parker-Washington Co.; brick paving, to Ruecking Construction Co., $7,866; brick paving, to William R. Bush Construction Co., $5,663; brick paving, to Skrainka Construction Co., $5,328; brick paving, to Ruecking Construction Co., $5,328; brick paving, to William H. Redemeyer, $2,491; bitulithic paving, to Granite Bituminous Paving Co., $4,479; wood block, to Gustavus A. Heman, $5,103; granite paving, to Heman Construction Co., $3,830; telford pavement, to John D. Turner, $2,660.

Metuchen, N. J.—Paving construction, to Liddle & Pfeiffer, Perth Arboy, N. J.

Newark, N. J.—The following paving contracts have been awarded: Concord and Reynon streets, to the Newark Paving Co., Newark, N. J., $7,788 and $7,634; South and Vanburen streets, to Philip and Peter Jannarone, Bellville, N. J., $24,957 and $3,862.

Depew, N. Y.—Constructing 2¼ miles brick pavement, to Edward P. Beck & Co., Warren, Pa., $53,750.

Brooklyn, N. Y.—Paving Myrtle avenue with granite, to J. J. Burkin, 1 Madison avenue, New York City.

Lancaster, N. Y.—Brick paving, to Niagara Contracting Co., Corning, N. Y., $68,800.

Oneida, N. Y.—Paving Williams street with brick, to Meyer & Ballard, $16,259.

Seneca Falls, N. Y.—Paving State, East and West Bayard streets, to Patrick D. Conley, Ithaca, N. Y.

Syracuse, N. Y.—Contract for highway improvement, to John H. Weidman, Syracuse, N. Y., $35,100; highway improvement, to Burns Bros. & Haley, of Watertown, N. Y., $30,978.

Beach City, O.—Paving Main and West streets with vitrified paving, to P. J. Norman & Son, of Coshocton, O., $12,195.

Caldwell, O.—Improving county road, to Nixon & Juniper, Nelsonville, O., $10,302.

Gibsonburg, O.—Constructing 80 rods stone road, to Ottney & Co.

Marion, O.—Constructing 6½ miles pike roads, to J. M. Stone, Marion, O., $25,900.

Sheridan, Ore.—Constructing 14 blocks of paving, to G. E. Goss, Sheridan, Ore.

Aliquippa, Pa.—Constructing $6,000 paving works, to Freshwater Bros., of Chester, W. Va.

Butler, Pa.—Paving S. Washington and Logan streets, to Tony Morelli; concrete work, to McNanee & McQuistion.

Carnegie, Pa.—The following paving contracts have been awarded: Sansburg avenue, to William Jones; Short alley, to same; constructing concrete wall on Fifth avenue, to Samuel Gamble, all of Carnegie, Pa.

Erie, Pa.—Constructing two asphalt pavements, to J. & M. Doyle, Erie, Pa.

Harrisburg, Pa.—Constructing roadway in Wildwood park, to William L. Martin, Harrisburg, Pa., $3,795.

Monessen, Pa.—Paving, to Hallam Construction Co., Monessen, Pa., $45,452.

New Castle, Pa.—Road construction, to the New Castle Contracting Co., New Castle, Pa.

Pittsburg, Pa.—The following paving contracts have been awarded: S. Eighteenth street, to M. O'Herron & Co., $88,300; Coleman street, to R. D. Thomas & Co., $4,190; Industry street, to Ott Bros. Co., $9,013; Ewer alley to J. D. Sheets & Co., $1,378; Ethel street, to Barber Asphalt Paving Co., $5,580; repaving with block stone, Forty-seventh street, to H. C. Howard, $2,774; Davidson street, to same, $3,344; Oakland street, to M. O'Herron & Co., $2,355; S. Nineteenth street, to Booth & Flinn, $2,837; Mulberry avenue, to Evans Jones Co., $1,069; Millbridge street, to Ott Bros. Co., $2,156; Penn avenue, to M. O'Herron & Co., $12,911; Grandview avenue, $2,628; Pontius street, to Evans Jones Co., $1,487; repaving with brick Pleasant Valley, to H. C. Howard, $1,239; Lotus alley, to H. P. Howard, $1,902; Custin street, to Evans Jones Co., $1,599; Box alley, to Thomas Cronin Co., $3,129. Repaving with asphalt: Holmes street, to Barber Asphalt Paving Co., $7,699; Forty-second street, to Booth & Flinn, $2,398; Fifth avenue, to same, $8,437. Repaving with block stone and asphalt: Greenfield avenue, to Booth & Flinn, $6,395. Repaving with brick and asphalt: Adelaide street, to Booth & Flinn, $4,243. Repaving with creosoted wood block: Ohio street, to M. O'Herron & Co., $8,346.

Washington, Pa.—The following road contracts have been let: Building Charleroi-Bentleyville road, to Donora Construction Co., $31,880; constructing Prosperity-Dunns road and McDonald-Venice road, to John F. Howley & Co., Pittsburg, Pa., $23,671 and $11,612; furnishing brick, to the United Fire Brick Co., Uniontown, Pa., $15.50 per thousand; furnishing brick, to J. M. Porter, $17.25 per thousand.

York, Pa.—Constructing Six Mile road, to Reilly, Fritz & Co., Lancaster, Pa., $40,921.

Austin, Tex.—The following paving contracts have been awarded: Bitulithic, to the Dallas Bitulithic Co., Dallas, Tex., $86,068; wood block pavement, to Knox Johnson, $18,144.

Dallas, Tex.—Paving Pennsylvania avenue, to Texas Bitulithic Co.

Galveston, Tex.—Sloping, surfacing and bulk-heading county highway, to J. P. Kelso, Galveston, Tex., $37,406.

Greenville, Tex.—Paving 10,000 yds. brick paving, to Central Paving Co., Hot Springs, Ark; 91,000 sq. yds. bitulithic paving, to Texas Bitulithic Co., Dallas, Tex.; 33,000 sq. yds. wood block paving, to Creosoted Wood Block Paving Co.; concrete paving, 4,000 sq. yds., to R. C. Stubbs.

Logan, Utah.—Paving, to Madsen-Whittier Construction Co., Boise, Idaho, $19,386.

Centralia, Wash.—Paving construction, to the Lister Construction Co., Berlin bldg., Tacoma, Wash., $56,241.

Olympia, Wash.—Paving Main street, to the Independent Asphalt Paving Co., 604 Savage-Scofield bldg., Tacoma, Wash., $71,526.

Pasco, Wash.—Contract for bitulithic paving on Lewis and Fourth streets, to C. A. Squires, Walla Walla, Wash., $44,630.

Seattle, Wash.—Paving Perry avenue, to J. Reuthe, 418 Highland Drive, $3,957; paving Thirty-sixth avenue, to P. J. McHugh, $35,991; constructing Maryland Place plank roadway, to C. Geske & Co., $1,450; paving Olympic Way, to P. J. McHugh, $52,230; improving Maynard avenue, to J. Ruche, 418 Highland Drive, $8,493.

SEWERS.

CONTEMPLATED WORK.

Fayette, Ala.—City is considering the construction of complete sewer system.

Orland, Cal.—A $25,000 bond issue for sewer system has been voted.

Orangeville, Ga.—A $15,000 bond issue for sewerage disposal system and electric light and water systems has been voted.

Terre Haute, Ind.—The city is contemplating the construction of 44 miles of sewers to cost about $337,000.

Bowling Green, Ky.—State sanitary engineer Hansen has recommended the construction of a $36,000 sewerage system.

Quincy, Mass.—A $30,000 bond issue for sewer improvements has been voted.

Reed City, Mich.—The village is contemplating the installation of a complete sewer system. Mayor Brown.

Cold Springs, Minn.—S. S. Chuce, of St. Cloud, Minn., has been retained to prepare plans for complete sewerage system.

Duluth, Minn.—John Wilson, of Minneapolis, Minn., has been retained as engineer on the proposed Woodland sewer.

Amory, Miss.—A $65,000 bond issue for sewerage and water works extensions has been voted.

Monmouth Beach, N. J.—A complete sewer system is contemplated.

Ocean City, N. J.—Plans for new sewage disposal plant to cost $35,000 have been approved by the state board of health.

Binghamton, N. Y.—City engineer J. A. Giles, is preparing plans for storm sewer on Crandall street.

Canadaigua, N. Y.—Bids will be asked soon on extensive sewer improvements on Clark street. Bd. of st. comrs.

Syracuse, N. Y.—Extensive sewer improvements on thirty streets to cost $50,000 are contemplated.

Ashtabula, O.—The city is contemplating the erection of $4,500 public comfort station.

Coshocton, O.—The city engineer has been ordered to prepare plans for the South Side sewer system.

Hilliard, O.—An $8,000 bond issue for sewer improvements has been voted.

Lancaster, O.—The construction of a sewer on Lake street to cost about $4,000 is contemplated. John N. Wolfe, cy. engr.

Lorain, O.—The city is contemplating the erection and equipping of a public comfort station. Director of service Knight.

Mt. Gilead, O.—The city is contemplating the construction of several lateral sewers and one additional filter bed for Mt. Gilead sewer system.

New Berlin, O.—A $20,000 bond issue for the construction of a sewage disposal plant has been voted.

Drain, Ore.—A $5,000 bond issue for sewer extension has been voted.

Gresham, Ore.—The construction of a complete sanitary sewerage system is contemplated. L. C. Kelsey, Selling bldg., Portland, Ore., engr.

Hillsboro, Ore.—Louis C. Kelsey, engineer, Selling Bldg., Portland, Ore., is preparing plans for about $140,000 paving and sewer construction.

Newport, Ore.—A sanitary sewerage system to cost about $64,000 is contemplated. L. C. Kelsey, Selling bldg., Portland, Ore., engr.

Bhistol, Pa.—Changes in the proposed sewage disposal plant according to suggestions by Dr. Dixon, state comr. of health, are contemplated.

McKeesport, Pa.—The city is contemplating the construction of sewers in the eighth and ninth wards to cost about $200,000.

New Brighton, Pa.—J. E. Chapin, of Akron, O., is preparing plans for a complete sewage disposal system.

Sharon, Pa.—The city is contemplating the installation of a sewage disposal plant.

Weatherly, Pa.—City engineer Moore is preparing plans for a $13,000 sewer system.

Aberdeen, S. D.—A $200,000 bond issue for sewer improvement has been voted.

Madison, S. D.—A $65,000 bond issue for sewer improvements has been voted.

Flatonia, Tex.—The installation of a complete sewerage system is contemplated. J. F. Edwards, myr.

Long View, Tex.—A $90,000 bond issue for the purpose of purchasing sewer system from private corporation and for street paving has been voted.

South Bend, Wash.—A sewer system to cost about $20,000 is contemplated. Chas. H. Mills, cy. clk.

Spokane, Wash.—Plans and estimates have been prepared for sewer extension in Manitowoc Park to cost about $83,000.

Ridgely, W. Va.—Installation of a complete sewerage system in contemplated.

Shinnston, W. Va.—The city has voted bonds for street, water works and sewerage improvement.

Milwaukee, Wis.—The sewer commission retained to report on sewer extensions and improvements has recommended an expenditure of about $13,250,000, including constructing a water filtration plant to cost $1,500,000; constructing intercepting sewers to concentrate at purification works; constructing flushing tunnel in Menomonee river. Bonds will be issued immediately. Members of the commission were John W. Alvord, Chicago; Harrison P. Eddy, Boston; George P. Whipple, New York.

Kamloops, B. C., Can.—A $10,000 bond issue for sewer extensions has been voted.

Winnipeg, Man., Can.—The city contemplates the spending of $5,000,000 on improvements to water mains, sewers, sidewalks and pavements.

CONTRACTS TO BE LET.

Bellefontaine, O.—June 2, 12 m. Constructing reduction tank, contact bed and outlet drains; furnishing and erecting automatic machinery for sewage disposal plant, including the following work: Excavation, 2,100 cu. yds.; concrete, 1,530 cu. yds.; steel, 7,000 pounds; broken stone, washed gravel or screened coke, 8,500 cu. yds.; 6-in. pipe sewer, 3,300 ft.; 8-in. pipe sewer, 800 ft.; 25-in. pipe sewer, 300 ft.; 24-in. outlet drain, 500 ft.; 20-in. outlet drain, 120 ft.; 15-in. outlet drain, 600 ft.; 12-in. outlet drain, 800 ft. Paul O. Batch, clk.

Johnstown, Pa.—June 1, 4 p. m. Constructing the following sewers: McMillan street, 590 ft. 12-in. pipe sewer; Deckman alley, 180 ft. 12-in. sewer; Adleman alley, 450 ft. 8-in. sewer; unnamed alley, 320 ft. 20-in. sewer. Certified check, $200. O. T. Thomas, boro. engr., Johnstown, Pa.

Natrona, Pa.—June 6, 7:30 p. m. Paving Chestnut street, including 2,600 sq. yds. paving, 2,300 lineal ft. curbing and 71,140 ft. 12-in. storm sewer. Certified check, $500. Paving Spruce street, including 4,400 sq. yds. paving and 2,900 lineal ft. curbing. Certified check, $500. W. B. Wiang, clk. of Harrison township, Natrona, Pa.

Pittsburg, Pa.—June 1, 10 a. m. Constructing sewers on the following streets: Hatfield, Tampa, Wall, Worth and Dewey; 12 to 15-in. pipe sewers. Fifty per cent. bond. Joseph G. Armstrong, dir. of pub. serv.

Plankington, S. D.—June 6, 8 p. m. Constructing sanitary sewage disposal system. Certified check, 5 per cent. D. E. Goodlad, cy. audt.

South Bend, Wash.—June 5, 5 p. m. Constructing storm water and sanitary sewers. Estimated cost, $26,000. Chas. H. Mills, cy. clk.

CONTRACTS AWARDED.

Appalla, Ala.—Constructing sewers, to cost $30,000, to J. L. O'Connor, Knoxville, Tenn.

Galexico, Cal.—Constructing sewers, to Watson & Spicer, Colorado Springs, Colo., $26,650.

Los Angeles, Cal.—Sewer construction on Wilshire boulevard, to D. Salada, Los Angeles, $2,132.

San Francisco, Cal.—The following sewer contracts have been awarded: 8 to 18-in. vitrified pipe sewers on Balboa street and Nineteenth avenue, to the City Street Improvement Co., San Francisco; 6 to 24-in. vitrified pipe sewers in section L of North Point main sewer, to the Healy-Tibbitts Construction Co., San Francisco.

Bement, Ill.—Construction of storm water sewer system, to Arthur Birt, Decatur, Ill.

Freeport, Ill.—Sewer construction has been awarded as follows: $29,979, to J. W. Turner, Des Moines, Ia.; $14,967 to Frank Komanski, Watertown, Wis.

Galva, Ill.—Constructing sewage system to H. E. Scuhter, Manitowoc, Wis., $15,702.

Peoria, Ill.—Constructing Swinnerton street sewer, to Ottawa Construction Co., Ottawa, Ill.

Brazil, Ind.—Improving three roads, to Hawkins Bros., about $13,000; and A. M. Shattuck, $2,500.

Indianapolis, Ind.—Sewer on Dearborn street, 1,645 ft., to American Construction Co., 1201 E. Georgia street, Indianapolis, Ind.

Kokomo, Ind.—Constructing intercepting sewers, to Michaels-Minnick Construction Co., Marion, Ind., $47,041.

Michigan City, Ind.—Contract for construction of 12 miles of Porter ditch, to Yoder & Swartz, Napanee, Ind., $10,000.

Ft. Leavenworth, Kan.—Sewer improvements, to A. J. Taussig Construction Co., St. Louis, Mo., $48,928.

Hutchinson, Kan.—Constructing sewers, to Oscar Davis, Hutchinson, Kan.

Bay City, Mich.—Improving Saginaw river, to G. H. Breymann & Bro., Toledo, O., $650,000.

Rochester, Minn.—Constructing sewers on various streets, to Fraser & Danforth, Rochester, Minn., $6,363.

St. Paul, Minn.—Constructing Blair street sewer extension, to B. J. Ryan, St. Paul, Minn., $1,162.

St. Joseph, Mo.—Sewer construction in District 109, to E. F. Midnery.

Aurora, N. Y.—Construction of sewer system, to the Republic Engineering & Construction Co., Buffalo, N. Y., $75,000; construction of disposal plant, to H. E. Bame, Lancaster.

Rochester, N. Y.—Constructing sewer in third section to Ripton & Murphy, 12 Lamberton Park, Rochester, N. Y., $169,-804.

Cleveland, O. — Constructing West Twenty-fifth street sewer, to the J. Duff Construction Co., Cleveland, O., $38,431. Constructing East Seventy-ninth street sewer, to William Lehman, Cleveland, $26,800.

Hubbard, O.—Constructing sewer system and disposal plant, to Harry Baxter, Lorain, O., $23,269.

Niles, O.—Construction of sewers in south side, to Frank Manella, Pittsburg, Pa., $15,496.

Ironton, O.—Constructing sewer in Cedar alley, to Matt A. Mulligan, about $14,000.

Lorain, O.—The following sewer contracts have been awarded: Pearl avenue, to Ernest & Burke; Erie avenue to Farapher and Randall; Wickens Place, to B. G. Nichola.

Niles, O.—Sewer construction, to Frank Manella, Pittsburg, Pa.

Youngstown, O.—Constructing South Side Park comfort station, to Arthur Chesney, $790; constructing Lincoln Park comfort station, to Thompson & Frame, $672.

Oklahoma City, Okla.—Constructing sewers in stock yards district, to Bennett & West, $22,000; constructing sewers in North side district, to J. W. Smith & Sons, $29,204.

Central Point, Ore.—Construction of sewer system, to Jacobsen-Beale Co., $65,-000.

Doylestown, Pa.—Constructing sewage disposal plant, to Julian M. Solomon, Philadelphia, Pa., $2,225.

Carnegie, Pa.—Constructing sewer on Bruce alley and Bank street, to William Jones, Carnegie, Pa.

Chambersburg, Pa.—Constructing 16 miles of sewers, to James Ferry & Sons, Pittsburg, $160,164: trunk line from disposal plant, to Cantrell Construction Co., Philadelphia, $22,963; disposal plant, to Pitt Construction Co., Pittsburg, Pa., $38,-470.

Erie, Pa.—Constructing 9 inch sewers, to F. J. Eichenlaub, Erie, Pa.

Grove City, Pa.—Sewer construction, to Dan Mercer Construction Co., Steubenville, O., $14,758.

Newcastle, Pa.—Constructing $1,000 sewer improvement, to Chas. Staff, Newcastle.

Scranton, Pa.—Laying two pipe sewer system on Main street, to the Pittston Construction Co., Pittsburg, Pa., $42,000.

Burlington, Vt.—The construction of a sewer on Park avenue is contemplated.

Puyallup, Wash.—Constructing 2,200 ft. of 14-in. sanitary sewers, to Cline & McKim, Puyallup, Wash., $2,365.

Seattle, Wash.—Constructing East 71st street sewer, to J. M. Keating, Seattle, Wash., $53,358.

Sedro-Woolley, Wash. — Constructing three miles of sewer, to Sullivan Construction Co., Leary Bldg., Seattle, Wash., $40,092.

Chippewa Falls, Wis.—Sewer construction, to Frazier & Danforth, Minneapolis, Minn.

Milwaukee, Wis.—Building the Third street relief sewer, to P. J. Hickey, 204 Grand avenue, Milwaueke, $45,802.

Kenosha, Wis.—Constructing main sewer, to the White Construction Co., $97,-200.

WATER WORKS.

CONTEMPLATED WORK.

Mena, Ark.—Water works improvements to cost $60,000 are contemplated. John Thompson, chairman bd. of local improvements.

Lindsay, Cal.—Haviland & Tibbetts, Alaska Commercial Bldg., San Francisco, Cal., have been retained to prepare plans for complete water works and sewer system.

Orland, Cal.—A $25,000 bond issue for water works extension has been voted.

Ft. Lupton, Colo.—A $25,000 bond issue for water works improvements has been voted.

South Jacksonville, Fla.—A $60,000 bond issue for the construction of electric light system and water works has been voted.

Oglethorpe, Ga.—The construction of a complete water works system is contemplated; bids will be received about July 1.

Orangeville, Ga.—A $15,000 bond issue for sewage disposal system and electric light and water systems has been voted.

Swainsboro, Ga.—A $40,000 bond issue for the construction of water works and electric light plant has been voted.

Preston, Ida.—The installation of a complete water works system is contemplated.

Gilmore City, Ia.—A $12,000 bond issue for water works improvement has been voted. H. D. Mormon, cy. clk.

Roland, Ia.—A bond issue for constructing water works and electric lighting systems has been voted.

Waterville, Kan.—A $30,000 bond issue for water works improvement has been voted.

North Haven, Me.—The city is contemplating the construction of a complete water works system. J. C. Brown, vil. clk.

Worthington, Mass.—E. P. Davis, Northampton, Mass., has been retained to make preliminary surveys for complete water works system.

Sparta, Mich.—A franchise has been granted to the Sparta Water Works Co.

Amory, Miss.—A $65,000 bond issue for water works and sewerage system has been voted. E. C. Galryndle, cy. clk.

Cole Camp, Mo.—A $10,000 bond issue for water works improvements has been voted. E. Sthward, mayor.

St. Charles, Mo.—A $30,000 bond issue for the improvement of water works system by laying 4,900 feet of 12 inch water main and constructing two concrete reservoirs with a capacity of 1,000,000 gallons each, has been voted. Carr Edwards, cy. engr.

Trenton, N. J.—The city is contemplating the construction of a chloride purifier for the water works system. Gerge A. Johnson, engr.

New York, N. Y.—Plans for filtration plant in the easterly basin of the Jerome Park reservoir have been approved, $8,-690,000.

Concord, N. C.—A $50,000 bond issue for water works construction has been voted.

Morgantown, N. C.—A $35,000 bond issue for water works construction has been voted.

Petersburg, N. D.—A $6,000 bond issue for installation of water works system has been voted.

Akron, O.—Engineers Barbour & Bradbury have recommended the construction of a $1,500,000 municipal water plant.

Lorain, O.—Plans are being prepared for the erection of an outside basin at the filter plant.

New Berlin, O.—A $15,000 bond issue for the construction of water works has been voted.

Steubenville, O.—Philip Burgess, of Columbus, O., has been retained to prepare plans for installing a complete filtration plant.

Kingfisher, Okla.—A $28,000 bond issue for water works improvement, and extensions to electric plant has been voted.

Wetumkah, Okla.—A $10,000 bond issue for water works extension has been voted.

Baker City, Ore.—Bids will be requested soon for the construction of 2,000,000 gallon reservoir.

Elgin, Ore.—J. R. Thompson, 301 Couch Bldg., Portland, has been retained to superintend the construction of a $10,000 water works system.

Haines, Ore.—A $20,000 bond issue for the installation of water works system has been voted.

Hermiston, Ore.—John P. Whistler has been retained to prepare plans and estimates for a complete water works system.

Altoona, Pa.—The water department is contemplating the laying of three miles of 6 to 16 inch water mains.

Juniata, Pa.—H. P. Linton, Altoona, Pa., has been retained to prepare plans and estimates for a $25,000 water works system.

McKeesport, Pa.—Extensive improvements to water works distribution system, erection of standpipe, improving pumping system, and the construction of a retaining wall are contemplated by the city in connection with betterment of water works system.

Dyersburg, Tenn.—A $30,000 bond issue for water works and electric light improvements has been voted.

Georgetown, Tex.—A $45,000 bond issue for water works has been voted.

Christiansburg, Va.—A $40,000 bond issue for installation of water works system has been voted.

Tacoma, Wash.—The city is contemplating the construction of 12-inch water mains on Park avenue and 6-inch wood water mains on South Seventy-third street. Estimated cost $7,004. W. B. Raleigh, cy. engr.

Shinnston, W. Va.—The city has voted bonds for street, water works and sewerage improvement.

Independence, Wis.—A $350,000 bond issue for water works system has been voted.

Manitowoc, Wis.—A $220,000 bond issue to purchase the privately owned water works system has been voted.

Burnaby, B. C., Can.—A bond issue of $850,000 for road improvement and water works extension has been voted.

Kamloops, B. C., Can.—A $30,000 bond issue for extension of water works has been voted.

CONTRACTS AWARDED.

San Francisco, Cal.—Laying 6 to 18-in. hydraulic pressure main, to Michael Murphy, San Francisco, Cal.

Alamosa, Colo.—Constructing complete water works system, to Marshall Bros., Las Animas, Colo., $74,000.

Canton, Ill.—Contract for water works extension and deep well improvement, to Cook Construction Co., Des Moines, Ia., $6,801.

Lewiston, Ill.—Constructing complete water works system, to Cook Construction Co., Des Moines, Ia., $6,801.

Nevada, Ia.—Constructing water works system, to Guy E. Smith, Indianola, Ia.

Arkansas, Kan.—Furnishing complete city water works, to Layne & Fowler Co., Houston, Tex., $13,500.

Hoisington, Kan.—Constructing complete water works system, to Bash & Gray, Joplin, Mo.

Fort McKinley, Me.—Constructing water softening plant, to L. M. Booth Co., 116 Liberty St., New York, N. Y., $6,320.

Holland, Mich.—Furnishing two centrifugal pumps, connected to motors, to Platt Iron Works, $2,158.

Alexander, Minn.—Constructing water works distribution system, to W. B. Bosworth, Ada, Minn.

St. Paul, Neb.—Constructing water works extension, to J. P. Johnson & Sons, St. Paul, Neb.

Toledo, O.—Laying high pressure main water system, to Watters & Tansey, Toledo, O., $117,578.

Youngstown, O.—Constructing 16-inch water main through Lincoln Park, to Republic Iron & Steel Co.

Oklahoma City, Okla.—Constructing sedimentation basin, to Hunter & Hunter, Oklahoma City, $12,987.

Sapulpa, Okla.—Constructing water works system, to Southwestern Engineering Co., Oklahoma City, Okla., $160,000.

Yale, Okla.—Constructing water works system, to W. D. Swanwick Co., Joplin, Mo., $25,000.

Astoria, Ore.—Laying water mains and constructing gate wells, to Jahn Construction Co., Portland, Ore.

Pittsburg, Pa.—Constructing Mission street pumping station, to William Kerr & Co., $93,000.

Zelienople, Pa.—Constructing reservoir for new water works, to Swain & Martin, $20,000.

Park City, Utah—Constructing complete water works system, to A. A. Clark, Salt Lake City, Utah, $47,245.

Seattle, Wash.—Constructing water works extension, to Ferguson-Coit, Arcade Annex, Seattle, Wash., $11,605; laying water mains on Grand boulevard to Jahn Contracting Co., Seattle, Wash., $16,408; laying water mains on Twenty-fifth avenue north, to Nelson & Carlson, 3731 Eastern avenue, Seattle, Wash.

Oconomowoc, Wis.—Constructing dam, to J. Nelson & Co., Oconomowoc.

BRIDGES.

CONTEMPLATED WORK.

Goshen, Ind.—All bids on North Main street bridge have been rejected by the Elkhart county commissioners. New bids will be requested.

Rushville, Ind.—The sum of $3,000 has been appropriated to build a steel bridge to replace a wooden covered bridge east of Dunreith.

Shelbyville, Ind.—Contracts for constructing culverts in the township have been awarded to the following contractors, all of Shelbyville: E. L. Milner; S. S. Gardner; Haymond & Howard.

Iowa Falls, Ia.—The city is contemplating the erection of a new steel bridge over the Iowa river.

Shreveport, La.—Plans for steel bridges across Red river have been approved by the War Department. U. S. Engineer's Office, Vicksburg, Miss.

Portland, Me.—The city is contemplating the construction of two reinforced concrete bridges across Jackson run.

Kalamazoo, Mich.—Plans for concrete steel bridge submitted by Michigan Engineering Co. have been accepted.

St. Cloud, Minn.—The sum of $450,000 has been appropriated for repairing St. Germain street bridge.

Vicksburg, Miss.—Plans for steel bridge across the Yazoo river near Sidon, Miss., have been approved by the War Department.

Lancaster, N. H.—The sum of $2,500 has been appropriated for the purpose of constructing a bridge in South Lancaster. K. T. Brown, pres.

Niles, O.—Construction of Squaw creek concrete bridge, to Western Reserve Lumber Co., Warren, O., $3,898.

Baker, Ore.—The county is contemplating the construction of the following bridges: 55 foot span over Pine creek; 120 over Powder river; 55 foot span over North Powder river; 80 foot span, 75 foot span and 60 foot span at Weatherby over Burnt river.

Cameron, Tex.—A steel bridge to cost $1,400 located near Yarrellton, Tex., is contemplated.

San Angelo, Tex.—Construction of a $40,000 concrete bridge across the Concho river is contemplated.

Richmond, Tex.—J. W. Maxcy, of Houston, Tex., has been retained to prepare plans and estimates for the construction of two bridges.

CONTRACTS TO BE LET.

Boonville, Ind.—June 6, 2 p. m. Constructing four bridges. M. M. Stradley, co. audt.

Franklin, Ind.—June 5, 1 p. m. Constructing seven small reinforced concrete bridges. Wm. B. Jennings, co. audt.

Greensburg, Ind.—June 5. Repairing retaining wall, and repairing bridge. Frank E. Ryan, co. audt.

Davenport, Ia.—June 6, 2 p. m. Paving East River street about 1,776 lin. ft. Certified check $50. A. M. Compton, chairman bd. of pub. wks.

Leavenworth, Kan.—June 5, 12 m. Repairing bridge over Nine Mile creek. Certified check $50. J. A. Hall, co. clk.

Cincinnati, O.—June 16, 12 m. Constructing concrete culvert on South avenue, certified check $500. Construction bridge over Dunlap creek, $500 bond. Fred Dreihs, clk. bd. of Hamilton co. comrs.

Pittsburg, Pa.—June 1, 10 a. m. Constructing the following pavements: Delmont avenue, Hickory street, and Linwood street with block stone class D; and repaving Garden avenue and Fifth avenue with block stone, class A. 50 per cent. bond. Joseph G. Armstrong, director of public service.

Somerset, Pa.—June 7, 12 m. Constructing the following bridges: 33 foot steel beam bridge with concrete floor over Well creek; 38 foot steel truss concrete floor over Blue Lick creek; 33 foot steel beam concrete floor over Blue Lick creek; alternate bid on concrete arch; stone abutment for bridge over Shafer run; 43 foot steel truss bridge over Stoney creek; 33 foot steel bridge over Brush creek. Edward H. Werner, clk. co. comrs.

CONTRACTS AWARDED.

Birmingham, Ala.—Constructing Adamsville bridge and Columbiana road bridge, to Southern Bridge Co., Birmingham, Ala.; concrete work, to A. S. Bearten.

Lonoke, Ark. — Constructing steel bridges, to Vincennes Iron & Bridge Works, Vincennes, Ind.

San Francisco, Cal.—Constructing reinforced concrete viaduct on Mission street, to Healy-Tibbitts Construction Co., $104,200.

Jacksonville, Fla.—Bridge repairs to J. E. Izanoski, Jacksonville, Fla., $2,700.

Champaign, Ill.—Constructing bridge 1, 2, 3, 7, and 8 in Champaign township, to King & Ystrom, Champaign, Ill.; constructing bridges 4, and 6, to Bondville Cement Block Co.

Cissna Park, Ill.—Constructing Hodel bridge, to C. A. Weaver, Clayton, Ill., $2,175.

Hillsboro, Ill.—Constructing bridge, to Laws & Grantham, Irving, Ill.

Joliet, Ill.—Constructing bridge, to Newkirk & Powers.

Saunemin, Ill.—Erecting steel bridge, to Joliet Bridge Co., Joliet, Ill., $1,760.

Shreveport, Ill.—Constructing bridge over Silver creek, to W. H. Shons, $3,106.

Brazil, Ind.—Constructing superstructure of Holmes bridge, to Lafayette Engineering Co., Lafayette, Ind., $1,700; constructing substructure of same, to S. S. Gardner, Brazil, Ind., $872.

Columbus, Ind.—Constructing bridge in Bartholomew county, to National Concrete Co., Traction Terminal Bldg., Indianapolis, $4,450.

Greensburg, Ind.—The contract for bridge construction has been awarded to the following contractors: C. J. Puttman, Lark Walters, H. J. Moody & Son, and W. J. Craig.

Princeton, Ind.—The following bridge contracts have been awarded: constructing seven bridges, to George Fowler, Princeton, Ind.; constructing five bridges, to Vincennes Bridge Co., Vincennes, Ind.

Shelbyville, Ind.—Constructing steel bridge over Big Blue river, to the King Iron Bridge Co., Cleveland, O., $10,000; constructing stone work for same, to Thomas Cummins, Indianapolis, Ind.

Mason City, Ia.—Construction of four concrete bridges, to Hinkle & Burns, of Mason City.

Independence, Kan.—Constructing 4 bridges to the Western Bridge Co., Harrisville, Mo., $9,900.

Henderson, Ky.—Constructing six steel bridges, to the Vincennes Bridge Co., Vincennes, Ind., $9,720.

Hopkinsville, Ky.—Constructing steel bridges, to Beach Manufacturing Co., Charlotte, Mich.

Paducah, Ky.—Constructing reinforced concrete bridge at Wharf street, to J. A. Omberg, jr., Memphis, Tenn., $30,600.

Portsmouth, Me.—Repairing Wentworth bridge, to Alfred Spinney, Eliot, Me., $1,450.

Baltimore, Md.—Constructing Rock creek bridge, to Luten Bridge Co., $3,529.

Glendive, Mont.—Constructing steel bridge over irrigation canal, to A. Y. Bayne & Co., Minneapolis, Minn.

Kalamazoo, Mich.—Constructing bridge south of Milham Park, to Wheaton & Baker, Kalamazoo, Mich., $775.

Red Wing, Minn.—Constructing two highway bridges, to Ibling Bridge Co., 714 Metropolitan Life, Minneapolis, Minn., $6,166.

Jersey City, N. J.—Constructing steel bridge over Morris canal, to Stillman Delahaney & Ferris, Jersey City, $7,620.

Newark, N. J.—Constructing bridge over Third river, to Linde & Griffith, $12,005.

Riverhead, L. I., N. Y.—Repairing North Haven-Sag harbor draw-bridge, to the York Bridge Co., York, Pa., $2,965.

Grand Forks, N. D.—Constructing seven steel bridges, to Minneapolis Bridge & Iron Co., Minneapolis, Minn.

Canton, O.—Constructing small bridge in Marlboro township, to Peter Sphifler.

Hamilton, O.—Construction of bridges, to George Emmons, Chas. H. Guilluame, and William Brace, all of Hamilton, O.

Troy, O.—Constructing concrete culvert to Al S. Fox, Dayton, O.

Pendleton, Ore.—Constructing Main street bridge, to the Coast Bridge Co., Portland, Ore., $35,000.

Allentown, Pa.—The following bridge contracts have been awarded: Furnace bridge, to W. Haag, $2,735; Schlicher bridge, to same, $3,723; Geiger bridge, to G. H. Hardner, $2,695; Boderts bridge, to same, $3,096.

Altoona, Pa.—Bridge construction awarded as follows: reinforced concrete, at Allegheny street, to Fotol & Co.; $3,403; reinforced concrete to same; two reinforced concrete bridges, to Farris Bridge Co., $1,143; reinforced concrete bridge, to Myers, Gable & Ridgway.

Easton, Pa.—Constructing concrete bridge over Lehigh river, to Ferro Concrete Co., Harrisburg, Pa., $109,950.

Philadelphia, Pa.—Constructing bridge over Doe run, to York Bridge Co., York, Pa., $2,744.

Pittsburg, Pa.—Construction of bridge on Larimer avenue, to Booth & Flinn, 1942 Forbes St., Pittsburg, Pa., $175,000.

Reading, Pa.—Constructing Bordners bridges Nos. 1 and 2, to H. E. Ahrens & Co., Reading, Pa., $6,290.

Scranton, Pa.—Constructing Mulberry street viaduct, to the York Bridge Company, York, Pa., $187,147.

Yorkville, S. C.—Constructing bridge on Crowders creek, to the Roanoke Bridge Co., Roanoke, Va., $1,460.

Edna, Tex.—Constructing bridge over Ladaca river, to the Penn Bridge Co., Dallas, Tex., $4,500.

Galveston, Tex.—Constructing bridge across Todds Bayou, to W. W. Shock, Galveston, Tex.

Richmond, Va.—Construction of new bridge, to I. J. Smith Co., Richmond, Va., $232,061.

Mt. Vernon, Wash.—Constructing steel span bridge over Swagit river. Lance & Peters, Walker Bldg., Seattle, Wash., $75,377.

Seattle, Wish.—Construction of University street bridge, to M. G. Heinemann, 2114 East Baler street, Seattle, Wash.

Benwood, W. Va.—Constructing High street bridge, to York Bridge Co., of York, Pa., $2,152.

STREET LIGHTING.

CONTEMPLATED WORK.

Eusaula, Ala.—The city is contemplating the erection of a municipal lighting plant. W. L. Upton, Birmingham, Ala., engr.

Sacramento, Cal.—The Citizens Light & Power Co. has been incorporated with a capital of $2,500,000 to construct electric plant to supply light and power. Geo. Peltier, incorporator.

Longmont, Colo.—A $46,000 bond issue for construction of electric light plant has been voted.

South Jacksonville, Fla.—A $60,000 bond issue for the construction of electric light system and water works has been voted.

Buchanan, Ga.—The construction of an electric light plant is contemplated.

Macon, Ga.—This city is contemplating the installation of a complete magnetite lighting system in the down town district. Extensions to the lighting system in outlying districts of the city are also contemplated.

Orangeville, Ga.—A $15,000 bond issue for sewerage disposal system and electric light and water systems has been voted.

Swainsboro, Ga.—A $40,000 bond issue for the construction of water works and electric light plant has been voted.

Council Bluffs, Ia.—The city is contemplating the installation of an ornamental lighting system.

Milo, Ia.—A bond issue for the purpose of building municipal gas lighting plant has been voted.

Roland, Ia.—A bond issue for constructing water works and electric lighting system has been voted.

Burton, Kan.—The installation of a gasoline engine and dynamo electric light system is contemplated.

Waterville, Kan.—A $30,000 bond issue for municipal electric light and water plant hos been voted.

Wichita, Kan.—The city is contemplating the installation of an ornamental lighting system.

Lancaster, Ky.—A $10,000 electric plant is contemplated to replace one recently destroyed by fire.

Duluth, Minn.—Oscar Claussen, of St. Paul and Charles L. Pillsbury of Minneapolis, have been retained to prepare plans for a $700,000 municipal electric light plant.

Springfield, Mo.—Installation of ornamental street lights on Boonville street is contemplated.

St. Joseph, Mo.—The city is contemplating improvements to the municipal electric light plant to cost about $300,000. Ralph Costigan, chairman light committee.

Bloomfield, N. J.—The city is contemplating the construction of a municipal lighting plant. James E. Brooks, chairman of lighting committee.

Binghamton, N. Y.—An appropriation has been passed to engage an electrical engineer to prepare plans for the boulevard lighting system.

East Liverpool, O.—The installation of ornamental lights on Main street is contemplated. Board of trade committee.

Greenspring, O.—The village is contemplating the erection of an electric light plant.

Sandusky, O.—Director of service Bing has been instructed to advertise for bids for street lighting during the period between January 1, 1912, and January 31, 1913.

Kingfisher, Okla.—A $28,000 bond issue for the extension of electric light and water works systems has been voted. D. H. Francis, supt.

Sentinel, Okla.—A $12,000 bond issue for municipal electric light plant has been voted. J. M. Terry, cy. clk.

Baker City, Ore.—A $25,000 bond issue for construction of electric light plant has been passed.

Salem, Ore.—The Board of Trade is considering the question of installing cluster lights on streets.

Altoona, Pa.—The installation of ornamental lights on Fourth street is contemplated.

Coatesville, Pa.—The city is contemplating the erection of a municipal lighting plant.

Lock Haven, Pa.—The city is contemplating the installation of a boulevard lighting system. John Nolen, landscape architect.

Chesterfield, S. C.—Installation of additional machinery in the electric plant is contemplated. W. D. Craig, supt.

Dyersburg, Tenn.—A $30,000 bond issue

for water works and electric light improvements has been voted.

Manchester, Tenn.—A $25,000 bond issue for elctric light and water works has been voted.

Longview, Tex.—A $90,000 bond issue for street paving and electric lighting has been voted. G. A. Bodenheim, mayor.

Kamloops, B. C. Can.—A $20,000 bond issue for the purchase of automobile fire apparatus, etc., has been voted.

CONTRACTS TO BE LET.

Amsterdam, N. Y.—June 6, 8 p. m. Furnishing and maintaining street lights. Thos. Hazlett, clk.

Columbus, O.—June 1, 12 m. Furnishing the following material for municipal light plant: Item 1, 28,000 feet number 2 T. B. weatherproof wire; 24,000 feet number 4 T. B. weatherproof wire; 60,000 feet number 6 T. B. weatherproof wire. Item 2. Remodeling switchboard. Item 3. Furnishing two 750 kw. transformers, two 150 kw. transformers. Item 4. Furnishing 390 40-feet 7-inch top cedar poles; 75 45-foot cedar top poles; 50 50-top cedar poles; 25 55-foot top cedar poles; 25 60-foot top cedar poles; 12 55-foot top cedar poles. Certified check 5 per cent. Bond 50 per cent. David A. Jones, clk. H. S. Holman, director of public service.

CONTRACTS AWARDED.

Kansas City, Mo.—Installing storage battery plant at substation, to Electric Storage Battery Co., Philadelphia, Pa., $100,000.

Riverhead, L. I., N. Y.—Installation of street lighting system, to Overton & Tuthill, Riverhead.

Leetonia, O.—The contract for lighting streets, alleys and public buildings, to Leetonia Electric Co.

Beaver, Pa.—Installing ornamental lights on Twelfth street, to Beaver Valley E'ectric Light Co.

Easton, Pa.—Lighting streets for a period of ten years, to the Eastern Gas & Electric Co.

Colorado, Tex.—Street lighting for a term of years including tungsten lights in residence district, to Colorado Electric Light Co.

Stoughton, Wis.—Constructing electric lighting plant to the Power Engineering Co., Minneapolis, Minn., $75,000.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Eveleth, Minn.—Removing garbage for period of one year. J. Smolki.

Seattle, Wash.—The construction of a garbage incinerator on the north shore of Lake Union, to cost about $60,000, is contemplated.

Tacoma, Wash.—The city is contemplating the construction of municipal incinerating plant to cost about $120,000. W. B. Raleigh, cy. engr.

Sistersville, W. Va.—Removal and disposal of garbage, to Chas. P. Curtis, $135 per month.

CONTRACTS TO BE LET.

North Braddock, Pa.—June 3, 12 m. Furnishing and erecting garbage disposal furnace of 10, 15 and 20 tons capacity in 12 hours and building to enclose same. J. O. Jones, boro secy.

CONTRACTS AWARDED.

Butler, Pa.—Disposal of city garbage, to A. H. Bohn, Butler, $75 per month.

Seattle, Wash.—Collecting garbage in districts 1 to 8, to C. E. Packard, E. Sixty-second street and Latrona avenue, Seottle, Wash.

FIRE APPARATUS.

CONTEMPLATED WORK.

East Holly, Cal.—The city is contemplating the purchase of an auto propelled chemical engine.

Ocean Park, Cal.—The city is contemplating the purchase of automobile fire truck.

Pasadena, Cal.—The city is contemplating the purchase of a fire engine.

Norwich, Conn.—The city is contemplating the purchase of an auto combination chemical and hose wagon.

Bloomington, Ill.—The city is contemplating the purchase of an auto aerial truck and 3,000 feet of hose. H. Mayer, chief fire dept.

Sterling, Ill.—The city is contemplating the purchase of a combination auto fire truck.

Brazil, Ind.—The city is contemplating the purchase of a combination chemical wagon, horse drawn.

Hammond, Ind.—The city is contemplating the purchase of au auto chemical fire truck.

Terre Haute, Ind.—City is contemplating the purchase of motor fire apparatus.

Boise, Ida.—A $35,000 bond issue for the purchase of an aerial truck and other fire equipment has been voted.

Lewiston, Me.—The city is contemplating the purchase of an auto fire truck.

Greenfield, Mass.—The city is contemplating the purchase of an auto combination chemical and hose wagon.

Holyoke, Mass.—A loan of $10,000 for the purchase of five auto propelled trucks or engines has been voted.

Battle Creek, Mich.—The city is contemplating the purchase of a chief's automobile and 1,000 feet of hose. Chief Weeks.

Omaha, Neb.—The city is contemplating the purchase of an auto fire engine.

Jersey City, N. J.—A bond issue of $12,000 for the purchase of new fire apparatus has been voted.

Westfield, N. J.—The city is contemplating the purchase of automobile fire apparatus. J. A. Dennis, mayor.

Pearl River, N. Y.—The purchase of gasoline engine and combination and hose wagon is contemplated. E. Van Horn, secy. fire committee.

Troy, N. Y.—The purchase of an automobile fire truck is contemplated.

Trappe, Pa.—The city is contemplating the purchase of a fire engine.

Ft. Worth, Tex.—The installation of a complete police and fire alarm system is contemplated.

Barre, Vt.—The city is contemplating the purchase of a combination motor truck.

Montpelier, Vt.—The purchase of auto propelled truck is contemplated.

Vancouver, Wash.—The city is contemplating the purchase of a motor combination chemical hose wagon, 30 h. p.; 1,500 feet hose, and motor runabout for chief's use.

CONTRACTS TO BE LET.

Washington, D. C.—June 15, 2 p. m. Furnishing one second size double action steam fire engine. Bunoh Rudolph, comr.