MUNICIPAL ENGINEERING

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Capital Letters, E. Q, W, etc., Indicate Department Under Which Articles are Classified.

Municipal Engineering.

VOLUME XLIII JULY, NINETEEN HUNDRED TWELVE NUMBER ONE

THE GRADE CROSSING QUESTION.

THE city of Birmingham, Ala., recently had a discussion of the relative rights of the public and of the railroads regarding the abolition of grade crossings, which has resulted in a careful collection of the authorities on the subject, with citations of constitutional and statute provisions and of court decisions.

We are indebted to the city attorney of Birmingham, Romaine Boyd, for an opportunity to take advantage of the work done by the attorneys in collecting these authorities as an aid in preparing this statement of the present state of legislation and judicial decisions, which is somewhat limited, perhaps, by the conditions of the particular case under consideration.

Fifteenth avenue is a street platted before the railroad tracks were laid across it, but seems not to have been used heretofore. It is the only crossing in about a half mile. A new boulevard has been donated to the city and will be improved by a realty company, access to which, and to the platted area belonging to the realty company, is more direct by this route and will be much safer if the grade crossing is eliminated. The newly platted area is as yet not settled upon and the probable increase in traffic over the railroad crossing has not yet taken place. The realty company has petitioned for a subway at Fifteenth avenue. There is a viaduct over the tracks at Twelfth avenue, constructed and maintained by the railroad company as required by the city.

Constitutional provisions of Alabama, which are quoted, are those giving the legislature power to alter, amend or repeal all acts which it may pass, and to alter, revoke or amend any charter of incorporation existing and revocable when the constitution was adopted or created thereafter, when it may be deemed injurious to citizens of the state, but that no injustice shall be done to the corporators. The opinion of Chief Justice Fuller of the United States Supreme Court is quoted that "the inhibitions of the Constitution of the United States upon the impairment of the obligations of contracts or the deprivation of property without due process or of the equal protection of the laws by the States are not violated by the legitimate exercise of legislative power in securing the public safety, health and morals," and that "a power reserved to the legislature to alter, amend or repeal a charter authorizes it to make any alteration or amendment of a charter granted subject to it, which will not defeat or substantially impair the object of the grant, or any rights vested under it, and which the legislature may deem necessary to secure either that object or any public right." (N. Y. & N. E. R. R. Co. v. Bristol, 151 U. S. 566); also from Justice Harlan that "the power, whether called police, governmental or legislative, exists in each State, by appropriate enactments not forbidden by its own constitution or by the Constitution of the United States, to regulate the relative rights and duties of all persons and corporations within its jurisdiction, and therefore to provide for the public convenience and the public good." (Lake Shore, etc. Co. v. Ohio, 173 U. S. 285, 297.)

Alabama statutes referred to confer on Boards of Public Works the exclusive power, control and supervision of the city streets (Sec. 1241); on cities the right to provide for safety, and improve order, comfort and convenience of inhabitants (Sec. 1251); on the city council the right to require any public utility to render streets used by it safe to vehicles and persons and to fix grades of all tracks on such streets and to change the grades without expense to the city (Sec. 1269); and to require railway companies to construct and maintain viaducts, bridges and tunnels, or parts thereof, and approaches over, along or under their tracks at their own expense (Secs. 1296 to 1301); and prescribe methods of enforcement of the ordinances. Connecticut has a similar statute, passed June 19, 1889, which has been held by its Supreme Court as amending the charters of railroad companies affected by it, and has been held by the United States Supreme Court in the Bristol case above referred to as within the power of the State in its police duties in abating nuisances, etc. The court also holds that the legislature can require either party to pay all or any part of the expense. Mississippi has a statute prescribing that the raising or lowering of a highway to abolish a grade crossing must be done by the railroad, which was sustained by its Supreme Court in Illinois Central R. R. Co. v. Copiah County, 33 So. 502.

Many decisions are quoted where, in absence of direct constitutional or statutory provisions governing the matter, the courts have held that the burden of eliminating grade crossings is wholly or largely upon the railroad company. They are briefly stated in the following paragraphs:

The Supreme Court of Georgia, in Cleveland, Receiver, v. City Council of Augusta, 43 L. R. A. 637, states that the railroad constructs grade crossings on the implied condition that it will yield to reasonable burdens imposed by the growth of the neighborhood and must make alterations or separations of grades at its own expense.

The Supreme Court of Illinois, in C. B. & Q. R. R. v. People, 72 N. W. 219, states that the railroad company is bound to make and keep its crossings at its own expense in such condition as shall meet all reasonable requirements of the public as the changed condition and increased use may demand. There was a similar decision by the United States Supreme Court in C., B. & Q. R. R. v. Drainage Commissioners (in Illinois), 200 U. S. 561, in which this principle is extended to cover the change in bridge made necessary by an improvement in a drainage channel, and reference is made to C., B. & Q. R. R. v. Chicago, 166 U. S. 226, in which case it was held that uncompensated obedience to a regulation enacted for the public safety under the police power of the State was not taking property without due compensation.

Indiana cases are Lake Erie & Western R. R. Co.. v. Cluggish, 143 Ind. 347, in which the railroad's duty to restore a stream or highway crossed by its line is stated to be a continuing one, and it must make such alterations from time to time as will meet the increasing needs of the public; and Indiana v. L. E. & W. R. R. Co., 83 Fed. Rep. 284, 287, in the decision of which Justice Harlan says that "the police power of a State embraces regulations designed to promote the public convenience or the general prosperity as well as regulations designed to promote the public health, the public morals or the public safety," and "the validity of the police regulation, whether established directly by the State or by some public body acting under its sanction, must depend upon the circumstances of each case and the character of the regulation, whether arbitrary or reasonable and whether really designed to accomplish a legitimate public purpose.

In Louisiana, in New Orleans Gas Light Co. v. Drainage Commission, 197 U. S. 453, the gas company was declared to have the use of the streets only and the city could later use the streets for its own purposes and the gas company must move its pipes to new and convenient locations for the city's purposes at its own expense.

In Massachusetts, as against the contention that the duties of the railroad were limited to those existing at the time the road was built, it was decided in Cooke v. Boston & Lowell R. R., 133 Mass. 185, 188, that the legislature intended the provision of safe and convenient use of the highway to apply for all time and that increasing use of the highway lays additional duties upon the railroad and it must make such alterations as the present needs of the public demand.

In Michigan, the court held in Attorney General v. Fort Street Union Depot Co., 76 N. W. 85, that the necessities for public safety must exist before overhead structures at crossings can be required. Similar opinions will be found in Mayor, etc., of Newark v. Erie R. R. Co. (N. J.), 68 Atl. Rep. 413, and State ex rel. St. Paul v. Minn. Transfer Co. (Minn.), 83 N. W. 32.

In Minnesota, the Supreme Court in State v. St. Paul, etc., R. R., 35 Minn. 131; 28 N. W. 3, says that the railroad must keep its street crossings so as not to impair or interfere with their free and proper use, by carrying their tracks over or under the highway or the highway over or under the tracks, if it cannot be done without, including all that is necessary to be done to accomplish this result. In the case of the Northern Pacific R. R. Co. v. Duluth, 208 U. S. 583, the railroad company was compelled to assume perpetual maintenance of a viaduct and approaches which was originally constructed and paid for, by agreement, part by the company and part by the city. In this decision reference is made to 98 Minn. 380, for a decision that the police power is a continuing one and cannot be contracted away and a railroad company can be required to improve its street crossings without compensation, without violation of the constitutional provisions regarding taking of property without compensation, and impairment of obligations of contracts. The whole subject is discussed and principles are reaffirmed in State ex rel. Minnesota v. St. Paul, etc., R. C. Co., 28 L. R. A. (N. S.) 298, which was affirmed by the United States Supreme Court in 214 U. S. 297.

In a New York case, Village of Carthage v. Frederick, 122 N. Y. 268, it is stated that compensation has never been a condition of the exercise of the police power, even when attended with inconvenience or peculiar loss, and that if the injury complained of is only incidental to the legitimate exercise of governmental powers for the public good, then there is no taking of property for the public use, and a right to compensation on account of such injury does not attach under the constitution.

A Pennsylvania case is very recent, Cincinnati, etc., R. R. Co. v. Connellsville, 218 U. S. 336, in which Justice Harlan concludes that there was no error in holding that the city could not be compelled to reimburse the railway company for the cost of the bridge which it required the company to build in an embankment, so as to open a street across the railroad on a high fill.

These decisions give ample authority for most of the contracts that are made between municipalities and railroads from time to time for track elevation and grade separation and to legislatures of the States which have passed laws distributing the cost between the parties involved, city, county, State, railroad company, street railroad company, etc. There are many such special laws which are not covered by the investigation above sketched, which was based on general constitutional and common law rights and certain limited statutes of the State of Alabama.

PRACTICAL ROAD BUILDING.*

By John N. Edy, Jun. Am. Soc. C. E., Asst. City Engineer, Billings, Mont.

Culverts.

THE question of culverts must be considered from three different standpoints—size, location and material. The size will be determined by the volume of water to be cared for, which is dependent upon the rainfall, the area drained, the porosity of the soil and the slope of the land. Obviously an investigation to determine these different factors will be without the sphere of the supervisor. He must, however, make some effort to estimate the size of the opening required in order that the culvert may give good service. Different formulæ have been devised for approximating the area of waterway required, but they are all more or less of a guess. However, about the only way in which to designate the size of the opening required is by means of one of these scientific guesses. This fact is to be noted: It is possible and reasonable to increase the capacity of a culvert by laying it on a grade, instead of level. For instance, the discharge of a 24-inch pipe laid on a grade of 3 per cent., or 3 feet in 100 feet, is more than 5 times as great as when laid on a grade of 1 inch in 100 feet. In other words, the grade of the pipe is of more importance than its size. This feature may be observed in box or arch culverts, by laying a floor to the desired grade. In the case of existing culverts, therefore, the known and observed volume of water is of great value, in that it shows the discharge under the given conditions of grade, shape, etc. If a culvert is to be built to carry a given maximum volume of water flowing on a grade less than 3 per cent., it is obvious that an opening of the same area laid on a grade of 3 per cent. will carry more water. The supervisor must not lose sight of the fact that local conditions invariably determine the opening required, and any suggestions given must be used only upon considering these local conditions.

Tables have been presented for waterway area necessary for a given drainage area that do not take account of this feature of culvert grade. It is plain, that inasmuch as an increase in the size of culvert materially increases the cost, every effort should be made to provide a suitable culvert at a reasonable expense. One of the best known formulas for estimating the culvert area required is that devised by Professor Talbot, and is

$$A = C\,D^{3/4}$$

In which A equals the area of culvert opening required, in square feet; C equals a coefficient determined by the nature of the watershed, and D equals the drainage area in acres.

Assigning suitable values for C, and different values for D, a table has been computed showing the opening required for given drainage areas under all conditions of topography, from "prairie" to "very mountainous." From this table it is

*Copyright by John N. Edy.

seen that the culvert opening required for run off from a given area in very mountainous country, is about four times that required for the same drainage area of rolling land. The writer believes that by adopting a size of opening that would answer for the last condition and then laying this culvert on a 3 per cent. grade so as to increase the discharge, variations in topography as well as in rainfall may be overcome. The following table, used in connection with local data, should be of value in determining the proper size of opening for different drainage areas.

practice is expensive, and may be avoided by straightening the channel and using one crossing. Culverts should be placed thru all embankments not otherwise drained. Water coming onto the right of way should not be carried in the side ditches for any great distance, except as mentioned above, to avoid unnecessary culverts. At cross-roads it is often desirable to produce the side ditch of one road by means of a culvert under the other. In this case it is not necessary to use as great culvert area as that of the side ditch, unless it is impossible to work

STANDARD CULVERT OPENINGS.

Laid on grade of 3% or

6-in. fall in 16 ft. 7½-in. fall in 20 ft. 9-in. fall in 25 ft. 11-in. fall in 30 ft.

D equals drainage area in acres.
A equals opening required in sq. ft.

D.	A.	Culvert Suggested
5	0.8	1 12 in. pipe
10 to 20	1.4 to 2.4	1 18 in. pipe
30	3.2	1 24 in. pipe
40	4.0	1 27 in. or 2 18 in. pipes
60	5.4	1 30 in. or 3 18 in. pipes
80	6.7	1 36 in. or 2 24 in. pipes
100	7.9	2 27 in. pipe or 2 ft x 4 ft. box
150	10.6	2 30 in. pipe or 3 24 in. pipe
200	13.3	2 36 in. pipe or 3½ ft. x 4 ft. box
260	16.2	3 30 in. pipe or 4 ft. x 4 ft. box
300	18.0	3 36 in. pipe or 4 ft. x 5 ft. box
400	22.3	5 ft. x 5 ft. box or arch
600	30.3	6 ft. x 6 ft. box or arch
800	37.6	6 ft. x 7 ft. box or arch
1,000	44.4	6 ft. x 8 ft. box or arch
1,200	51.0	7 ft. x 8 ft. box or arch

Whether or not the boxes may be used as given depends on the head room. Furthermore, for large drainage areas there will often be other limiting conditions that fix the span.

Location.—Too often the supervisor will place a culvert to carry water across the road, altho by so doing he will not waste it any quicker. The object in using a culvert is to get the water away from the roadside, and not merely transfer it from one side ditch to the other. A culvert should be placed only where it is needed, and an effort made to relieve the side ditch by carrying the water under the road, at frequent intervals, to an outlet. For this purpose the small pipes (not less than 12 in. diam.) are acceptable. On grades, the culvert should not cross the road at right angles, but diagonally, the entrance end extending up the grade.

Occasionally small boxes are used to serve a drain that crosses the roadway several times in a short distance. This

to an approved grade, which might be true in flat country. Before definitely placing any culvert, if any choice of location is offered, the foundations should be carefully examined.

Material.—We are all very familiar with the wood-box culvert. Certainly such makeshifts are built without regard for service or economy. And because timber is becoming scarce and expensive, its use in culverts can no longer be justified on the basis of low first cost. Tables have been computed showing the cost at the end of long periods of time of culverts built of different materials. These computations clearly demonstrate that timber is by far the most expensive material that may be used for the purpose. This is very evident when one considers that the ordinary wood box must be rebuilt about every five years, while concrete, for instance, is absolutely permanent. Thus if culverts of wood and concrete for the same location cost $25.00 and $100.00 respectively, at the end of 20 years they have cost the same, at the end of 40 years the wood is twice as expensive as concrete, not counting interest on the investment. Furthermore, the permanent culvert gives permanent service, while the other is constantly in need of repair and attention.

The life of different culvert material has been variously estimated, the following being an example:

Material.	Life in Years.
Timber	5
Steel	20
Corrugated iron	20
Vitrified clay	50
Cast iron	80
Stone or concrete	100

The last two materials may last indefinitely. It is usually easier to find good wide, the other being 4 inches. These are laid side by side and fastened together on the 4-inch side with heavy wire. The number of pieces of 2x4 in. will vary with the diameter of the culvert; a 24-inch opening requiring 19 pieces, and a 30-inch opening requiring 24 pieces. The form may be of any desired length, 10-foot sections being very satisfactory. The bound 2x4s are then rolled about circular wooden heads, the diameter of which is 4 inches less than that of the culvert. When placed in the trench the form is held in place by means of small wedges.

To build a culvert, first make the excavation to grade, and of such width that the vertical sides of the trench may be used as outside forms. These sides must be smooth and uniform. The bottom of the trench must be carefully graded, and the bottom material should be well

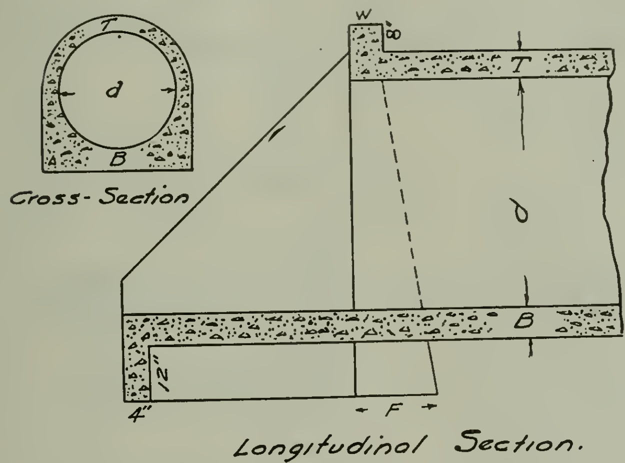


Table of Dimensions

Barrel.

d	T	B	Cu. Ft. per ft.
12"	2"	4"	1.0
18"	3"	4"	2.0
24"	4"	4"	3.2
30"	$4\frac{1}{2}$"	6"	5.0
36"	5"	6"	6.4
42"	$5\frac{1}{2}$"	6"	8.0
48"	6"	6"	9.7

End Str's.

H	W	F	X
2'	6"	9"	6"
3'	6"	9"	6"
4'	6"	12"	6"
5'	9"	15"	9"
6	9"	18"	*
8	9"	24"	*
10	9"	30"	*

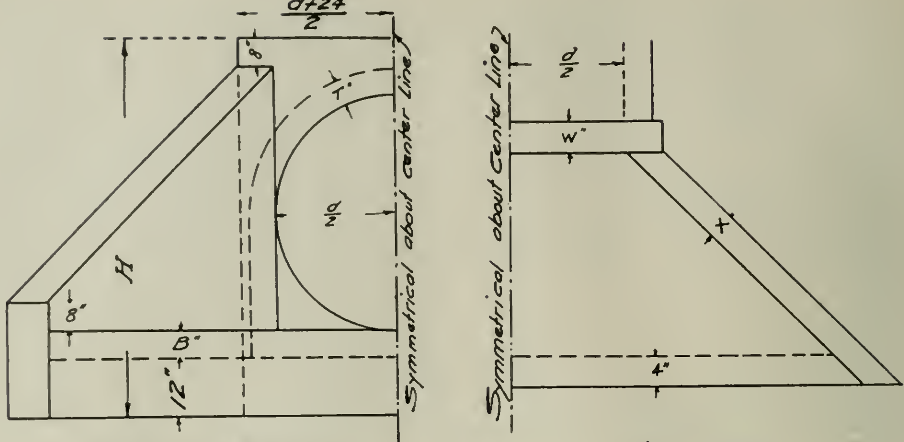
* These wings to be proportioned for "W" and "F" according to the height of the ends.

PLAIN CONCRETE CULVERTS.

concrete stone than good building stone; and concrete is by far the most desirable material for those localities wherein good gravel may be obtained.

Concrete culverts may be built of plain or reinforced concrete and may be either circular or rectangular in cross section. Figs. 1 and 2 show a good design for a plain circular culvert with dimensions for the culvert proper and the end walls.

Culverts of this type are readily built, using some kind of collapsible form, preferably of steel. These forms are easily adjusted, and may be used any number of times. A good collapsible wood form may be made as follows: A number of 2x4s are beveled by ripping along each 2-inch edge until one side is $3\frac{1}{4}$ inches tamped, all soft or spongy earth being removed. It is essential that the subgrade be solid and compact, or there will be settlement, which means destruction to the culvert. The subgrade having been properly graded and compacted, the concrete floor or base is placed in the bottom of the trench, placing a somewhat greater depth of concrete than the final thickness as shown in the table. Set the collapsible form on the newly placed base, and work it down into the concrete until the correct thickness of floor is attained. The concrete side of the forms should be oiled before using. The rest of the concrete is then put about the form and allowed to set, after which the form is removed by knocking in the heads and



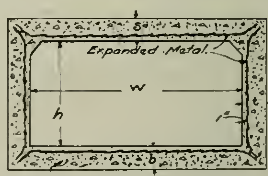
PLAIN CONCRETE CULVERTS :- END WALLS.

drawing out at the end of the culvert. Headwalls and wingwalls may be readily built as shown in the plans, using well-braced 1-inch lumber for forms.

Concrete pipe or flat slabs are sometimes molded in the shop and hauled to the culvert site. When this is done the structure should be reinforced, so as to reduce its thickness and weight. Concrete boxes are usually made in place, the method being substantially as follows: Make the excavation and prepare the sub-grade as previously noted. Place in the bottom of the trench a floor of concrete, as shown in Fig. 3, smoothing with a trowel. Particular attention is to be given the matter of grade; this may be done by leveling across from one side of the road to the other with a carpenter's level, and dropping the outlet end until the required fall is obtained. If the sides of the trench are firm and even no outside forms will be required; the side walls should in this case be made a little thicker to allow for inequalities. The inside form, which is placed on the fresh concrete floor, consists of two sides and a top, of the proper dimensions as determined by the opening. The side forms may be braced together, and held in place with small wedges; the top piece is not nailed, being held in position by means of rectangular wooden headers, so that when the headers are knocked out the form collapses. The concrete is placed in the side wall forms and to a depth of one inch over the top, when the reinforcement is placed. The remainder of the slab is concreted, smoothed with a trowel, and left to harden.

Fig. 3 shows a box culvert, the dimensions of which may be taken from the accompanying table.

Design of Reinforced Concrete Box Culverts using Northwestern Expanded Metal, Uniform Standard.



Capacity 15 Ton Roller: Concr. 1:2:4½

h'	w'	Slab. s	Reinf.	Side walls t	Reinf.	Bottom b	Reinf.
1	1	4	25-3	6	None	4	None
1	2	5½	40-3	6	"	6	"
1	3	6	{30-3 20-3}	6	"	6	"
2	2	5½	40-3	8	"	6	"
2	3	6	{30-3 20-3}	8	"	6	"
2	4	7	{40-3 20-3}	8	"	7	40-3
3	3	6	{30-3 30-3}	8	"	6	None
3	4	7	{40-3 20-3}	8	25-3	7	40-3
3	5	8	{40-3 25-3}	8	do	8	do
3	6	8½	{40-3 30-3}	8	do	8	do
4	4	7	{40-3 20-3}	8	do	7	do
4	5	8	{40-3 25-3}	8	do	8	do
4	6	8½	{40-3 30-3}	8	do	8	do
4	8	10	{40-3 40-3}	10	do	10	do
5	8	10	{40-3 40-3}	10	do	10	do
6	8	10	{40-3 40-3}	10	do	10	do

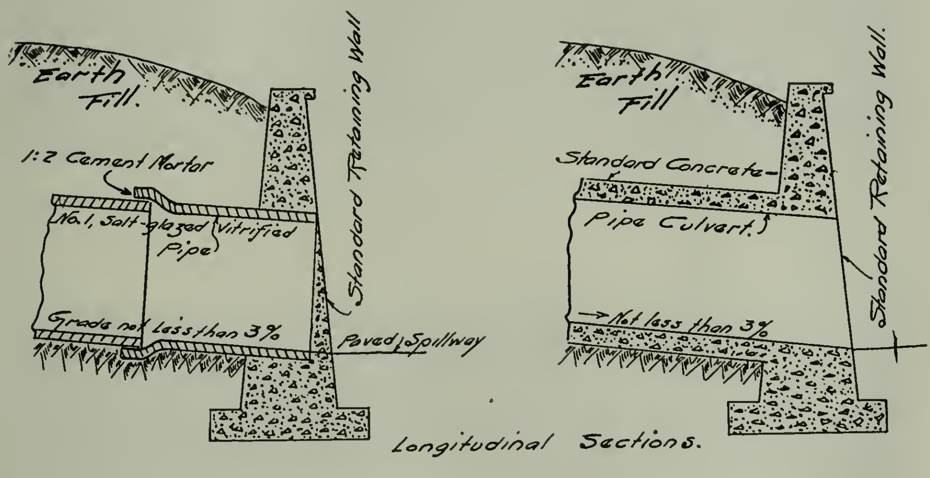
Note: For Exp. Metal may be substituted the bars shown in table, "Reinforced Concrete Slabs."
Minimum fill of 12" on all Culverts.

Wingwalls and headwalls should be built on all culverts, and they are built as shown in Figs. 1, 2 and 3. Headwalls must be constructed on all forms of pipe as well as other culverts. A cut-off wall extends below the floor of the culvert to prevent water washing underneath; the wingwalls are shown extending well below the surface of the ground for the same purpose. The spillway or apron catches the water as it leaves the outlet end, and prevents cutting. These precautions should not be disregarded. They entail but slight additional expense and add materially to the permanence of the structure.

In making a culvert of any kind of pipe, the trench must be excavated to the exact shape of the pipe, cutting away a place for the bell, which is always placed upstream. Vitrified clay or concrete pipe make very satisfactory culverts, but may be laid only on a firm and compact foundation, and must have the joints made watertight with 1:2 cement mortar. Care must be exercised in backfilling and tamping the earth so as not to injure the pipe. For such a culvert the headwalls and spillways may be built of large flat stone laid in cement mortar; however, concrete-end structures, as shown in Fig. 4, are more desirable for this purpose. All culverts must be sufficiently long that a perfectly safe road may be carried over them; 16 feet should be the minimum length. The end or headwalls are to be carried up above the roadway to form a protection, as well as to hold the material in place. When two or more parallel lines of pipe are used for one culvert, their adjacent sides should be separated at least 6 inches, this space to be filled with thoroly tamped earth. Parallel lines of circular concrete culverts made in place may be monolithic. Culverts should be so designed that there will be sufficient covering over the top (at least 18 inches) without sharply raising the grade of the road at that point. A "hump" over a culvert is unsightly, may be dangerous, and damages both the road and culvert.

While the writer advises against the use of timber in culvert construction, he realizes that occasionally such a temporary structure is a necessity. In that case the supervisor must endeavor to build the best he can under the conditions. Wood boxes placed under the ground where they are alternately wet and dry, are only temporary, and very expensive. Furthermore, because it is impracticable to place such a box on a given uniform grade, the opening must of necessity be larger than would be required for a culvert of permanent material with which an advantage of grade may be taken. No perishable material should ever be put under the ground where it cannot be inspected and repaired.

Culverts and bridges should be regularly inspected so that at all times they may be free from obstructions. Structures of permanent material require no repairs, but the earth or macadam covering must be replaced as it wears out.



CONCRETE END-WALLS FOR PIPE CULVERTS

THE SEWERAGE SYSTEM OF BALTIMORE.

By Stuart Stevens Scott.

BALTIMORE'S sanitary sewerage system, which is being installed at a cost of upwards of $14,000,000 and which has presented some of the most difficult and unique engineering problems, is now about one-half completed. Already, however, a considerable portion of the completed system is in actual use and as fast as sections are ready, the connections with houses are being made. The sewerage commission in a recent report states that the entire work will be completed in 1914.

The work of constructing is particularly interesting because of its magnitude and difficulty. It has been the purpose of the engineers to rely, as much as possible, upon gravity. This means that an 8-inch sewer beginning at Forest Park, a suburb to the northwest of the city and 13 miles from the disposal plant, must continue on a constantly falling grade, which cannot be flattened beyond certain rates, ever increasing in size as sewers lead into it from valleys and hills covering 32 square miles.

From Forest Park this main sewer crosses a stream, goes under the B. & O. railroad tunnel, over another stream at one point, and under the same stream at another point, goes under the Pennsylvania railroad tunnel, crosses ravines, swings around hills, goes through ridges, through narrow valleys, by the side of tall buildings, its size steadily increasing until, at the disposal plant, it is large enough to contain two automobiles, one on top of the other.

The system as planned provides that two-thirds of the sewage of the city be intercepted and carried to the disposal plant by gravity; the other third to be lifted by pumps, each with a capacity of 7,500,000 gallons a day, from a point 13 feet below tide to the out-fall sewer, a height of 72 feet, including friction. This is an unusually heavy lift, especially as sewage is more difficult to pump than water. Three of these pumps are now ready for service in the pumping station, which is large enough to contain two more to be installed later. The foundations for these pumps are independent of the foundation of the building.

The difficulty of the construction work is doubled on account of having to build two complete systems of sewers and drains, which cross and re-cross each other at a thousand diffierent places. The necessity for the double system is that the legislature requires every gallon of sewage taken into the sanitary system to be purified before discharging it into the Chesapeake Bay or its tributaries. It was therefore of vital importance that the amount of sewage to be pumped and treated be reduced to a minimum in order to keep down the size of the sewers, pumping station, the disposal plant and the unnecessary constant treating and pumping of clear rain water.

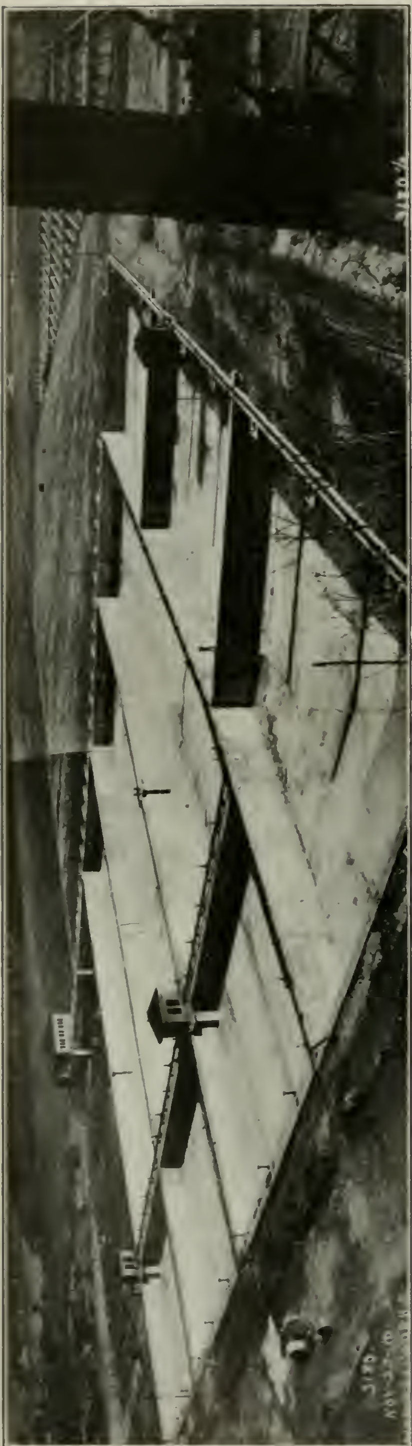
The only way to separate the rain water from the sewage, was by the construction of two independent systems. Therefore, the sanitary sewers will take care of the drainage from bath tubs, kitchen sinks and toilets. The rain water will pass off through storm water drains by inlets at street corners. To install these two systems in the beds of streets of a city more than a hundred years old, in which a mass of pipes had been laid, but in which practically no space was left for the sewers or drains, brought the engineer face to face with a series of problems as complex as they were varied. If the sewers could be laid in the streets, matters would be simplified, but with an eye to saving money for the house-holder, who has to pay individually for the connections, the engineers selected the alleys.

In these narrow thoroughfares not only is there a lack of room, but the workmen are continually hampered by a constant surface flow from kitchen sinks and bath tubs, of leaking water pipes and old sewers. More than that, the new sewers pass close to old brick buildings on shallow foundations and the owners of these buildings are ever alert to find cracks alleged to have been caused by the new construction work. In this respect the engineers have been wide awake. They have a photographic department and before any excavations are made the walls of buildings along the line are carefully examined and wherever a crack in the brick work is noticed, it is photographed. These photographs have played an important part in settlement of contentions of owners who have sought to blame the engineers for something for which they were not responsible.

In the section of the city around the water front the difficulties were materially increased by having to work below tide level and hundreds of feet of cofferdamming had to be built. The sewers completed and the sections under contract measure about 160 miles and a goodly portion of them are large enough to drive thru in automobiles; indeed not long ago the Governor of Maryland, the Mayor of Baltimore, the members of the

THE BALTIMORE SEWERAGE SYSTEM.
Branches Joining Five-Mile Main Sewer.

THE BALTIMORE SEWERAGE SYSTEM.
Jointing Small Pipe Sewers.



THE BALTIMORE SEWAGE DISPOSAL PLANT. Sludge Tanks in the Foreground and Filters in the Rear.

sewerage commission and about fifty guests made such a trip from the outfall end, nearly six miles under ground.

A peculiar feature in connection with the sewerage work is that the greater percentage of visitors are from out of Baltimore. Engineers from all parts of Europe and even China have visited the great disposal works and splashed thru miles of mud to see just how the work is being carried on. A most important feature, from an engineering point of view, is the method by which the work has been divided into sections, each section being considered a unit.

The disposal plant is constructed on the unit system so that it may be added to as the sewerage system is extended. The units so far completed are sufficient to take care of a population of 75,000. The units will be increased until they can take the sewage from a million population.

The method of treating the sewage is as follows:

At the mouth of the outfall sewer are installed screens that catch such things as sticks, rags, etc., which will be removed and burned. The sewage then passes thru the meter house, which measures its flow; then thru hydrolitic tanks, about 450 feet long, requiring 8 hours for passage—a sufficient length of time to allow the solids to settle, the liquids passing on thru an intercepting channel to and thru what is called the gate house, which distributes it to the stone sprinkling filters, located at a level of 15 feet below the hydrolitic tanks, giving a hydraulic head of sufficient force to spray the sewage over these stone beds thru nozzles, or jets, spaced 15 feet apart. The hydraulic head will be controlled by butterfly valves, causing the sprays to rise and fall, varying from close to the nozzles out to the limit of 15 feet, thus utilizing the entire surface of the stone bed, a large portion of which would be wasted if the sprays were stationary. These nozzles will throw a square spray, thereby saving additional space which would be lost if the sprays were circular, as where circles touch there is a lost triangle.

The spraying of the sewage thru the air is essential to the aeration and purification of the sewage. As the sewage falls on the stone beds it trickles down thru 8½ feet of broken stone, varying in size from 1 inch to 2½ inches. The passing of the sewage thru these beds forms a gelatine-like film on the stones, in which certain bacteria multiply in the sewage.

On reaching the bottom of the stone beds, the sewage is practically pure. It is then carried by intercepting channels to a central channel under the stone beds, which finally delivers the purified sewage to the settling basins where it requires three hours to pass thru. These settling basins are not for the purpose of causing additional purification, but to clarify the fluid, as there are certain mineral substances in the sewage which the bacteria in the stone beds do not annihilate, such as are found in the Mississippi river water, which is muddy, but not injurious to drink.

The sewage then passes with a drop of 18 feet to the power house, in which turbines are placed, operated by the flow of the sewage. They in turn run dynamos which generate electricity, giving power to light the plant, run the sludge pumps and lift the clarified sewage to a water tower for flushing purposes. In other words, by the simple gravity flow of the sewage, it is purified and power is obtained to light and run the plant at practically no cost.

A GERMAN TAR AND CEMENT PAVEMENT.

By Dr. Robert Grimshaw, Dresden, Germany.

EXPERIMENTS have been made in Bremen and elsewhere with a street pavement composed principally of tar and cement, and which for one reason or other has been baptized "Terbacca," which has to American ears a familiar klang, not entirely suggestive of street paving.

A test section at the Oldenburg freight station shows, after two years' heavy traffic, but little surface wear and no cracks, altho laid on filled ground. The surface layer remains plain and level and shows less wear than the adjoining sections, which are stone paved on a sand bed and which are more uneven, showing in many places considerable ruts.

The tar-cement pavement is laid on a bed of 5 to 6 inches of beton, or over broken stone slicked with cement mortar, say, about 2 to 3 inches for ordinary streets, ¾ to 1½ inches for foot pavements and 1¼ to 2 inches for courts. The mixture is made up of 90 volumes of hard broken stone of three different sizes, 10 of gravel and sand, and 40 to 60 of Portland cement, mixed dry, then 10 per cent. of water is added and at least five parts of coal tar, thinned down with a solvent. The tar-cement mixture is laid on much more thickly than required finally and tamped down with a six-pound rammer to the required thickness. Where grades are unusually steep, more cement is used than on levels.

To prevent the formation of cracks, it is sufficient in ordinary climates to leave openings of ⅝ inch every 40 feet, filling these with asphalt.

In Gothenburg, Sweden, and on the Kaiserstrasse in Hagen, Westfalia, this pavement has done well; in the latter city the tar-cement covering is only 7 centimeters (1.78 inch) thick, but a week after its laying it was run over by a steam roller without showing any signs of ill usage. Here the grade is 1:60. This street shows a smooth, even surface after about 18 months' use. The Bergstrasse, Elberfeld, on part of which the grade is 1:10, has an equally good appearance after 19 months' use.

As regards the strength of the mixture for sewer pipes and the like, tests of a five-weeks-old pipe 15 cm (5.8 inches) clear diameter, 27 mm (1.05 inch) thick, showed that it could carry 130 metric hundredweight (14,300 pounds).

In the matter of impermeability, after subjecting plates 1 to 2 cm (0.394 to 0.788 inch) thick, to water columns in glass pipes 2 to 2½ meters (5.56 to 8.2 feet) long, for six weeks the under sides of the plates were not wet.

The resistance to chemical action has been shown by tests of a 1:4 mixture in a 3 per cent. solution of hydrochloric acid 30 days; 32 per cent. nitric acid, the same time, and sea salt in water, 5, 10, 20, 35 per cent., one year, without change of color or form in the objects immersed.

PAPERS BEFORE THE AMERICAN WATER WORKS ASSOCIATION.

TURBINE DRIVEN CENTRIFUGAL PUMPS FOR WATER WORKS SERVICE.

By W. O. Beyer, Pittsburgh, Pa.

It is only recently that centrifugal pumps have received the serious consideration of water works engineers, altho their economy and efficiency have long since been demonstrated for supplying water in large quantities to industrial plants. It is our purpose here to show that the combined fixed charges and operating costs of the rotatory unit compare favorably with those of the high-duty vertical triple-expansion unit or other type, where the price of coal is not excessive.

The high duty shown by reciprocating engines in water works service, involving the pumping of large quantities of water against a constant head, without any great variation in rate, has long and justly been regarded as a supreme achievement. Due to the direct connection of the pump and engine cylinders and to the high efficiency realized in the unit when the proper attention is paid to its valves and packings, the triple-expansion reciprocating pumping engine has been able to develop duties that are unapproachable by rotatory units consisting of turbines and centrifugal pumps. However, a careful comparison of the total costs of pumping will show that the balance may be entirely reversed when fuel costs do not exceed a certain price per ton. That is, the high first cost of the reciprocating unit, together with the cost of the foundation required, introduce annual charges for interest, upkeep and depreciation, which more than offset the lower duty of the turbine unit.

Of the several types of pumping engines, the following are chiefly used for water works service: The low-duty compound condensing engines, costing, with foundations, piping and appurtenances, about $2,300 per million gallons capacity per 24 hours; low-duty triple-expansion condensing horizontal engines, costing about $2,800 per million gallons capacity; cross-compound condensing horizontal flywheel engines, costing about $3,300 per million gallons capacity, and high-duty triple-expansion vertical condensing engines, costing about $4,800 per million gallons capacity. The figures given are from a paper presented before the American Society of Civil Engineers, May 17, 1911, by the late Charles A. Hague. Since this paper selected the high-duty triple-expansion vertical engine as the only one to be considered in most cases, it is with this type of engine that we shall make our comparison.

The prices for pumping units given below are, to the best of our knowledge, accurate and include condensers, piping and foundations complete.

No account has been taken of the greater volume required in the buildings for reciprocating units, as a unit volume cost must be assumed which would agree with only one architectural design; similarly, no account has been taken of the greater volume required for the larger boiler installation of the turbine units, for the majority of existing plants usually have their building proportions determined, and a saving could not be made in either room without special complications of no account in this discussion. However, the difference in cost of foundations has been taken into account, because this is an addition in existing buildings and can be computed easily.

In a new station the turbine should be credited with any saving in floor space, buildings, etc., which it may effect, as compared with the reciprocating engine, and the rciprocating engine credited with the saving effected in the boiler rooms.

In a comparison of this kind certain assumptions must necessarily be made. We have tried to eliminate as far as possible arbitrary assumptions, and all figures of first cost of apparatus have been taken from, or estimated from, recent bids on the two types of machinery under consideration. The first cost per boiler horsepower we have taken to be $30, complete with piping, chimney, stokers, etc. (The use of a lower figure would favor the turbine-driven pump as compared with the high-duty engine, but we believe, with everything taken into consideration, this will prove to be an average figure.) We have assumed the following annual charges against pumping machinery:

Interest	5%
Depreciation	3%
Repairs and supplies	2%
Total	10%

We have also assumed the following annual charges against the boiler equipment:

Interest	5%
Depreciation	5%
Repairs and supplies	5%
Labor on maintenance	2%
Total	17%

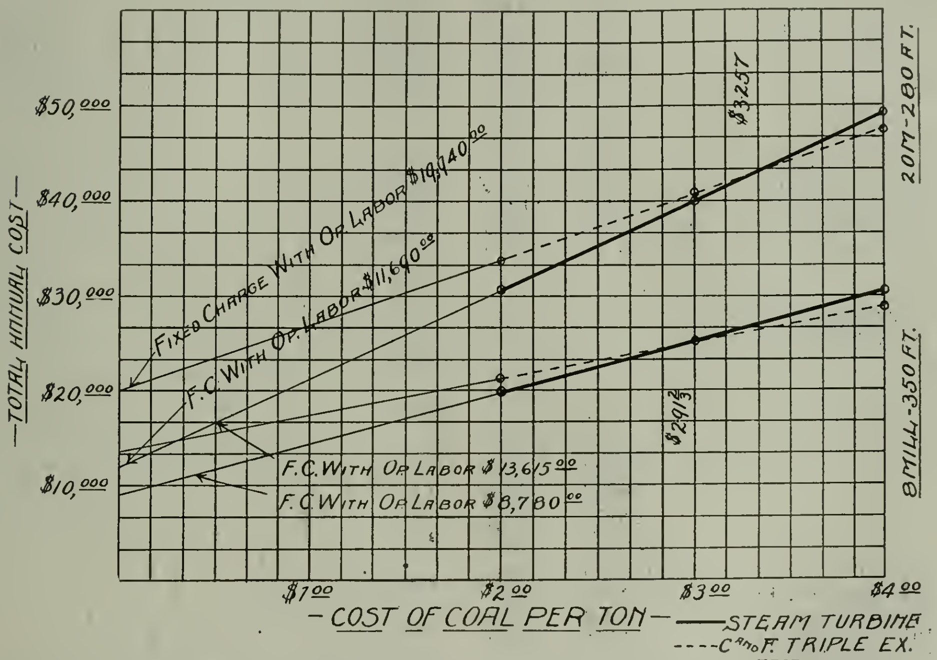
It will be noted in the above that an annual depreciation of 3 per cent. has been taken on the first cost of both the crank and flywheel and turbine-driven unit, equivalent to a life of 33 1/3 years. We have chosen this method rather than one in which the capital charges are figured on a constantly decreasing book value for the pumping machinery and boilers, in order to avoid a complicated method of accounting.

For the reason that less data are available on the life of turbine-driven units than on crank and flywheel units, it is possible more objection may be made to this assumption of a life of 33 1/3 years for each machine. However, as in neither case the question of obsolescence has been taken into account, we believe the assumption a fair one. Viewed in the light of possible future development, it would seem that a longer life should be accorded to the turbine-driven unit than to the crank and flywheel unit, as a very thorough canvass of the whole field of pumping equipment does not bring to light any mechanical apparatus which is being developed to compete with the turbine-driven machinery to the same extent as the turbine-driven machinery is being developed to compete with the crank and flywheel machinery.

It further appears that the steam turbine has reached a stage of development, such that improvements will appear only as refinements of type; and steam economies can only possibly be reduced sufficiently to render obsolete the present good designs by better theoretical design and by better steam conditions. The use of high steam pressures and superheat may be expected to gradually obtain further favor in this country as in European practice, where 250 degrees F. superheat and 200 pounds steam pressure are not unusual. This, however, entails practically no change in turbines as constructed for present steam conditions.

Fuel costs are based on a boiler efficiency of 65 per cent., heat content of 13,000 B.t.u. per pound of coal and 24-hour per day operation.

The duties given are on a basis of 150 pounds steam pressure, with no superheat.



COMPARISONS OF OPERATION COST OF STEAM TURBINE AND TRIPLE EXPANSION ENGINES, SMALL PLANTS.

Three examples are taken, based on coal at $2, $3 and $4 per ton. Where coal can be obtained cheaper than $2 per ton, the advantages of the turbine-driven pump are more clearly marked.

It will be noted that the point at which the total annual costs are equal for the eight-million-gallon crank and flywheel vertical unit and the eight-million-gallon turbine centrifugal unit is when coal costs $2.91 per ton. Also for the twenty-million-gallon vertical crank and flywheel unit and the twenty-million-gallon turbine centrifugal unit, the total annual costs will be equal when coal costs $3.25 per ton. Above these points the reciprocating unit has the advantage, and below these points the rotatory unit has the advantage, on the basis of these calculations.

TABULATION "A."

8,000,000 gallons per day, 350 ft. head, 491 w.h.p.

Item	Vertical C. & F. W. Triple Expansion, 150,000,000 Duty, 3 125 h.p. Boilers	Steam Turbine Centrifugal, 105,000,000 Duty, 3 175 h.p. Boilers.
Cost pump. unit	$72,000	$16,000
Int. dep., etc., 10%	7,200	1,600
Cost boilers	11,250	15,750
Int. dep., etc., 17%	1,915	2,680
Labor, 3 shifts—		
Engines	2,700	2,700
Boilers	1,800	1,800
Tot. int. dep., etc., and labor	13,615	8,780
Fuel cost, $2 per ton	7,467	10,700
Fuel cost, $3 per ton	11,129	16,100
Fuel cost, $4 per ton	14,934	21,400
Tot. annual cost, $2 coal	21,082	19,480
Tot. annual cost, $3 coal	24,744	24,880
Tot. annual cost, $4 coal	28,549	30,180

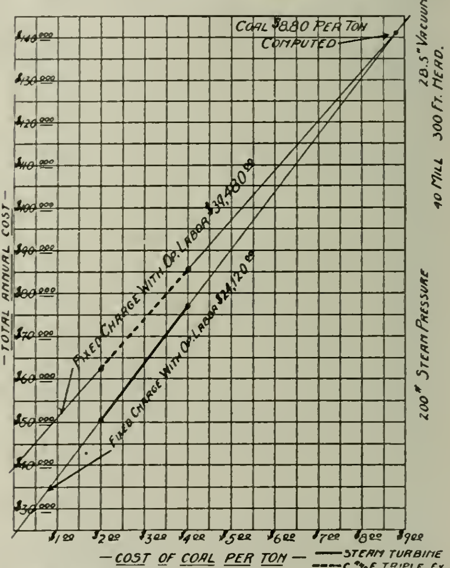
TABULATION "B."

20,000,000 gallons per day, 280 ft. head, 981 w.h.p.

Item	Vertical C. & F. W. Triple Expansion 165,000,000 Duty, 3 225 h.p. Boilers.	Steam Turbine Centrifugal, 120,000,000 Duty, 3 300 h.p. Boilers.
Cost pump. unit	$120,000	$26,000
Int. dep., etc., 10%	12,000	2,600
Cost boilers	20,250	27,000
Int. dep., etc., 17%	3,700	4,590
Labor, 3 shifts—		
Engines	2,700	2,700
Boilers	1,800	1,800
Tot. int. dep., etc., and labor	19,940	11,690
Fuel cost, $2 coal	13,570	18,630
Fuel cost, $3 coal	20,335	27,945
Fuel cost, $4 coal	27,140	37,260
Tot. annual cost, $2 coal.	33,510	30,320
Tot. annual cost, $3 coal.	40,275	39,635
Tot. annual cost, $4 coal.	47,080	48,950

We believe it can be assumed safely that the development of pumping machinery in the future will be along somewhat the same lines as the development of power-producing machinery. At the present time one of the most noticeable features in the development of power machinery is the increasing favor with which larger units are being adopted. In large central station work five years ago, the ordinary size of unit was from 10,000 to 15,000 k.w. Now, not only in European practice, but also in American practice, 25,000 k.w. units are being installed in the large stations. There are two reasons for this development, the first being the continual endeavor to obtain better economy, not only in actual steam consumption, but in capital charges, including first cost, buildings, real estate, etc. The second reason for the development along this line comes from the fact that engineers of today seem to have more initiative than formerly, and where before the development of a 15,000 k.w. turbine would have seemed an impossible task, now the installation of 25,000 k.w. turbines is becoming a matter of course.

We have assumed that there will be progress along this line in water works pumping machinery, and that installations of very large units will be made in



COMPARISONS OF COST OF STEAM TURBINE AND TRIPLE EXPANSION ENGINES, LARGE PLANTS.

the future. We have evolved a comparison between two units of the types under consideration, each having a capacity of 40,000,000 gallons per 24 hours, against a total head of 300 feet. This comparison is based on utilizing the greatest range of steam temperature which the best modern practice has established as commercially practicable, and which at the same time is not too intensely theoretical. We refer here to European practice, in which steam pressures of 200 pounds, 275 degrees superheat and 28.5 inches vacuum are successfully and commercially utilized. Especially important in this connection is the item of high vacuum, since in the case of water works large quantities of water are always available for condensing purposes.

Extremely large capacities and high heads present no difficulties nor disproportionate costs in the construction of steam turbine-driven centrifugal pumping units, since it is an inherent characteristic of the centrifugal pump that the larger the capacity, the greater the efficiency for a given head.

There is practically no development necessary on the turbine to take advantage of these conditions, as the turbine of almost exactly the same characteristics that would be necessary for this installation is now in successful operation in hundreds of power-producing plants today. We have had to assume no steam consumption, as this is a matter of test, and practically have had to assume no pump efficiencies, as we have taken the minimum which we know can be obtained on this size pump.

Further, the turbine is well adapted to take advantage of the improvement in steam conditions as mentioned above, and reciprocating engines can also be designed as to take advantage of the initial and terminal conditions favoring high economy.

The results of this comparison are shown in table "C." It is apparent from these tables that the point at which the two curves of overall economy of the two units cross is at a cost of approximately $8.80 per ton for coal.

It would appear, therefore, that the field of these large capacities at high heads for ordinary coal costs belongs to the turbine-driven centrifugal pump exclusively.

TABULATION "C."

40,000,000 gallons per day, 300 ft. head, 2120 w.h.p., 200 lbs. steam pressure. 275 deg. F. superheat. 28.5 in. vacuum.

Item	Vertical C. & F. W. Triple Expansion, 223,000,000 Duty, 3 350 h.p. Boilers.	Steam Turbine Centrifugal, 193,000,000 Duty, 3 400 h.p. Boilers.
Cost pump	$210,000	$55,000
Int. dep., etc., 10%	21,000	5,500
Cost boilers	31,500	36,000
Int. dep., etc., 17%	5,360	6,100
Labor, 3 shifts—		
Engines	7,200	7,200
Boilers	5,320	5,320
Tot. Int. dep., etc., and labor	39,480	24,120
Fuel cost, $2 coal	23,265	26,800
Fuel cost, $3 coal	34,897	40,200
Fuel cost, $4 coal	46,330	53,600
Tot. annual cost, $2 coal.	62,475	50,920
Tot. annual cost, $3 coal.	74,377	64,320
Tot. annual cost, $4 coal.	85,810	77,720

In conclusion, if the above data are correct—and it has been our sincere endeavor to present only such figures as are fair for both types of machines—it would seem that the steam turbine centrifugal pumping unit must be conceded a place of primary importance in the field of water works engineering.

ICE TROUBLES AT BUFFALO, N. Y.

By Henry L. Lyon, Deputy Water Commissioner.

THE city of Buffalo takes its water supply from Niagara River and Lake Erie and pumps it direct into the city mains. The source of supply is unlimited, it is only a question of being able to get it to the consumers on time. The reservoir holds 116,000,000 gallons, but has not sufficient elevation to supply more than half the city, and would not supply that part satisfactorily for more than a few hours. The daily average consumption of the city is 135,000,000 gallons and at times it runs up to 200,000,000 gallons. The reservoir on the low service and the water tower on the high service act more as balance wheels in regulating the pressure.

The old intake pier is situated about the middle of Niagara river and one thousand feet from the pumping station, which is situated on the bank of the river. The intake is built in the narrowest part of the river, about one mile from the head of the river and the foot of Lake Erie. The current is from seven to fifteen miles per hour. The pier is connected to the suction canals, or wells, in the station by two tunnels under the river. One is 6 feet deep, the bottom being smooth lime-cross section. The ports, to admit the water, are about four feet above the bottom of the river and on both sides of the pier. The river at this point is sixteen feet deep, the bottom being smooth limestone rock, with scattered boulders. On the sides of the pier are ice shields of steel extending to two feet above the bottom of the river, so that the water must come under the shields and give us the water from the bottom of the river, not the surface; but on the sides of the shields are gates that can be opened and closed, so we can take the surface water if ice troubles close the lower levels.

When ice is running down the river, the current turns it over and over and churns it up, forcing large quantities to the lower levels, so the river is a floating mass of ice its whole depth. When the lake becomes frozen over, a certain phase of our ice trouble is over for the winter, and does not bother us again until the break up in the spring.

The location of the pier, however, with a swift running river for a mile above us, so it cannot freeze over, makes an ideal situation for frazil, anchor or ground and slush ice.

Water will freeze and turn to ice if its temperature falls below 32 degrees, even a fraction of a degree. The swift current prevents a surface ice forming. The frozen ice surface in the lake protects the water underneath, as the cold will penetrate water better than ice. When the water flows from under the lake ice, the colder air will cause frazil and anchor ice to form. A heavy snow storm will not melt readily when it falls into the cold water, but becomes water-logged and forms slush.

When we speak of surface ice, anchor ice, ground ice, frazil ice, pebble ice, slush ice, or any other kind of ice, there seem to be no fixed names to separate them, and in a great many cases it is impossible to tell them apart after they have changed their original position or formation and become broken up or mixed. They then become simply slush ice. I will try, in describing them, to take the names that seem to be the more general names given to them.

Surface ice is the form we generally see on the surface of lakes and ponds when their surface is frozen over. It forms first on the surface. As the cold air penetrates the ice and reduces the water directly under the surface ice to a lower degree, it turns into ice, attaches to the upper ice and thus increases the thickness of the ice.

Anchor or ground ice will only form in a running stream on a clear, cold night, the air temperature being very near or below zero. It never forms under surface ice or in cloudy weather. It forms near the bottom of the river and attaches itself to rocks or other hard substances, preferably a dark substance. It loosens itself from the substance to which it is attached when the sun rises or the weather moderates. It is very buoyant, and if stones or other things are imbedded in it will raise them and float them down the stream. It has been known to raise and float abandoned anchors so they could be recovered by the owner or pirates. Small boats should look out for such conditions, because at times it raises in large masses and has been known to overturn such boats.

Frazil ice is only formed in swift running streams, where surface ice cannot form, and then only in very cold weather. It forms best on a dark, windy day or a clear, cold, windy night when the wind is blowing against the current. It is fine crystals, sometimes very hard, and floats readily. When it, as well as anchor ice, is forced under surface ice and attaches to it and to its own particles, it will often fill up the whole bed of the stream and cause floods.

The anchor ice will form on the ports of our intake pier, so as to completely close them. The small particles will seem to rise out of the water like bubbles out of champagne and attach to the sides of the openings, then to each other in lightning rapidity, until the whole opening is closed and cannot be broken by pike poles. We then resort to small charges of dynamite.

Runs of ice of all the varieties, sometimes separately, more often all of them mixed into slush, get into our intake, pass down thru the shafts and tunnels and then into our suction canals, or wells, in such quantities that it clogs the pumps. At times the mixture is so solid that water will not pass thru it to the pumps, and the pumps must be stopped entirely. If the ice is formed at a very low temperature, it is very hard and difficult to melt.

We have revolving screens in the canals with which we can raise large bodies of the ice above the water and then melt it with hot water and steam. We also at times will have a hundred or more men dipping the mixture on to shelves or racks in the wells, above the water, with long-handled scoops, like minnow nets, but made of heavy wire, and then melting it with hot water and steam.

Niagara river, for its full length (35 to 40 miles), is too swift for surface ice to form, so that anchor and frazil ice form readily. It is this ice mostly that runs over Niagara Falls in such quantities that it banks up below the falls and forms the ice bridge every winter, which becomes so solid that people walk over the river just a short distance from and in plain view of the falls. It was this same kind of ice that dammed up the mouth of the river and caused the big floods there a few years ago. And the same kind of ice that has caused the floods at Montreal in the middle of winter when there had been no rains or any warm weather to melt the snow, but the floating anchor and frazil ice had been carried under the surface ice in such quantities as to completely fill the bed of the St. Lawrence, and thus formed a dam over which the whole of the Great Lakes must flow.

Our new intake pier is built at the head of the river and foot of Lake Erie in water 24 feet in depth. The current at this point is only about two miles per hour. The lake freezes over up to and around the pier. We believe we are in a location where anchor and frazil ice cannot form, the surface ice will only form 15 inches in thickness and our ice troubles are probably a thing of the past.

HYPOCHLORITE STERILIZATION AT KANSAS CITY, MO.

By S. Y. High, Chief Superintendent of Water Works.

THE water supply of Kansas City, Mo., is taken from the Missouri river about five miles above Kansas City, at the Quindaro station in Kansas. The water is pumped directly from the river into settling basins. The water is then treated with lime and sulphate of alumina. After leaving the basins thru the back flow or suction pipe, the hypochlorite solution is introduced before the water gets to the pump, the pump agitation making a thorough mixture of the hypochlorite with the water.

From the Quindaro station the water is pumped to the Turkey Creek station twelve-million-gallon reservoir, and from this reservoir to the service mains.

Since the demonstration at Boonton, N. J., in 1909, of the reduction of bacteria by the introduction of minute quantities of "available chlorine" with water more or less polluted, and the acceptance of the process by the courts as a proper method to be employed in connection with a municipal water supply, the question of the efficient introduction of hypochlorite of lime solution and the mechanical appliances suitable for the purpose engaged the attention of the fire and water commissioners of this city. They ordered the city chemist, Dr. W. M. Cross, to make a trip of inspection of several cities known to have the hypochlorite sterilization system in satisfactory operation.

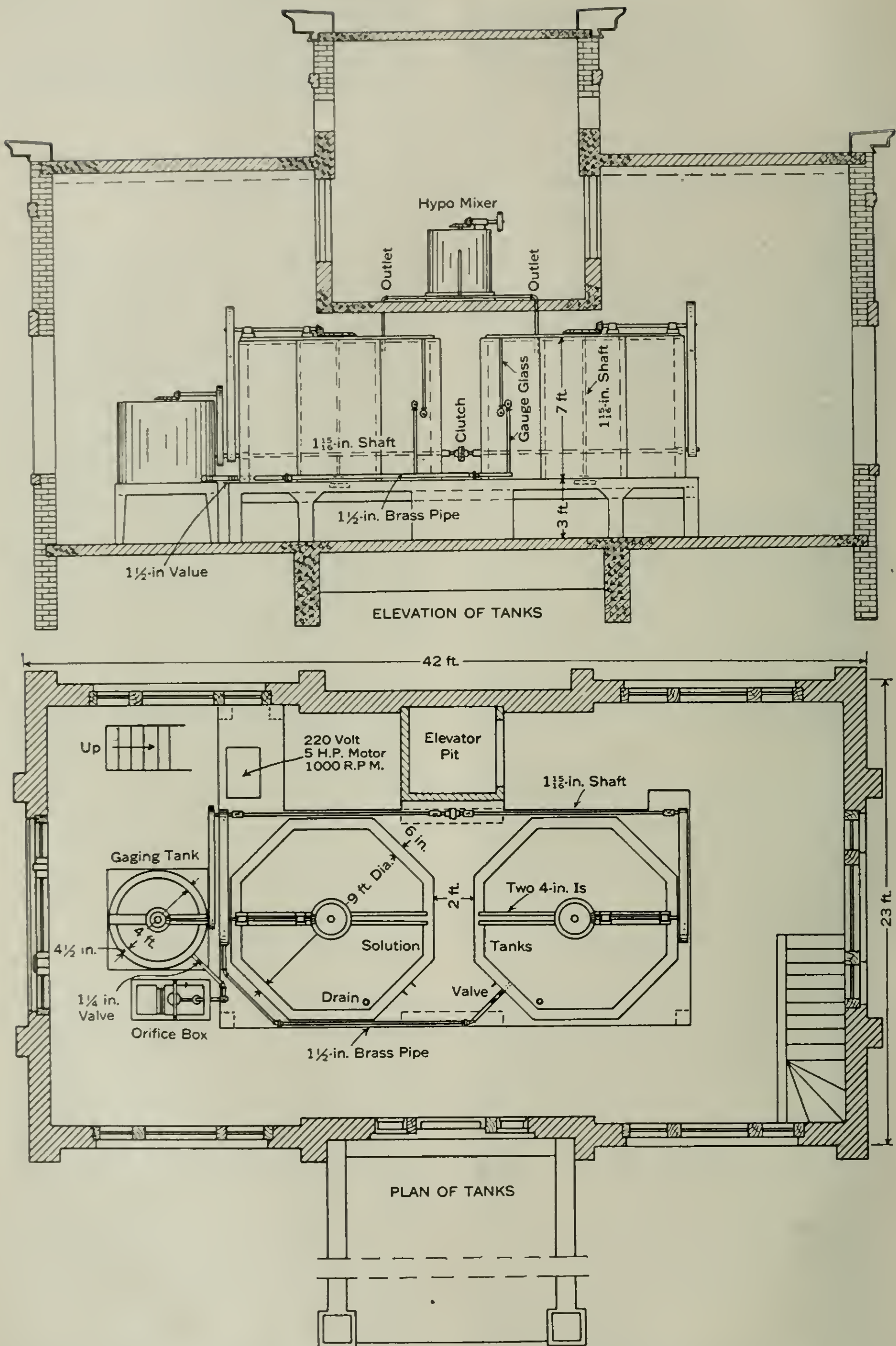
Dr. Cross found the method of installation of the system easy, cheap and satisfactory. During the year 1911 an experimental installation of the hypochlorite process for the approximate sterilization of the entire municipal water supply of Kansas City was so successful that the Kansas City fire and water commissioners undertook the construction of a permanent building and apparatus for the application of this purification process to the entire water supply.

A separate building was constructed to make possible the satisfactory storage, handling and making of the solution of hypochlorite ready for mixing with the sedimented water. The building itself was designed by W. C. Root, an architect, and the apparatus for use in connection with the sterilization process was installed under the direction and supervision of Burton Lowther, engineer in charge.

The apparatus for the handling of the hypochlorite and the supports for it are of reinforced concrete. It is to be observed that no other material is so well suited for use in connection with this sterilizing agent as good concrete, for the reason that all other materials that are capable of oxidation are promptly attacked by the hypochlorite solution and become rapidly deteriorated. The prime consideration with regard to this class of installation is to employ methods of construction and to use material that is so permanent in character as to obviate the necessity of repairs which would force the discontinuance of the application of the sterilizing agent, even for an hour.

The basement of the building is used for storage of the reagent that is kept in reserve. The main floor is used to house the dilution tanks and the feeding devices, while on the floor above is placed the tank, in which the hypochlorite is reduced to paste of a creamy consistency before being delivered to the dilution tanks beneath. This pasting tank, three feet in diameter and four feet high, is provided with a stirring device carrying two rather heavy rollers disposed horizontally at its lower end.

The rollers clear the bottom of the concrete tank only by a fraction of an inch, thus insuring the mashing and disintegration of all of the small lumps that are invariably present in commercial calcium hypochlorite. Owing to the fact that the action of the reagent on bronze is to form on the surface of it a fairly insoluble and protective coating of metallic carbonate and oxychloride, that metal appears to be the most available for use on all bearings and stirring or disintegrating devices that come in contact with the solution. Leading from the concrete pasting tank are pipes so arranged that the contents of the tank may be discharged into either of the large dilution tanks on the floor beneath. The outlet of the pasting tank is placed at a considerable distance from its bottom, so as to avoid the possibility of drawing off with the paste any fragments of considerable size. The pipes



HYPOCHLORITE STERILIZATION PLANT AT KANSAS CITY, MO.

carrying the paste are so arranged as to be readily cleaned in a few minutes in the event that they become clogged. Ultimately, they are sure to become clogged if they are not occasionally cleared, because of the formation in them of carbonate from carbon dioxide absorbed from the air.

The dilution tanks are hexagonal in form, nine feet in maximum diameter and seven feet high. Their walls are six inches thick. Altho the difficulty experienced in properly disposing the reinforcing iron in the construction of a hexagonal tank is much greater than is the case in the building of a round one, the hexagonal tank is to be preferred on account of the fact that in a round tank a rotary stirrer does not produce nearly such thoro agitation and mixing of the solution of hypochlorite as the same stirrer can do in the hexagonal tank. The paste is mixed with water in the dilution tanks until a uniform solution of a strength of 2 per cent. occurs. The use of two tanks makes it possible to accurately adjust the strength of the solution in one solution tank while the contents of the other are being utilized. The dilution tanks are placed on supports high enough to permit the use of a gravity feed to the orifice box, which is placed on the floor of the room housing the big tanks.

Bronze pipes, 1½ inches in size, so arranged as to be readily cleaned in the event of stoppage, connect the dilution tanks with a gaging tank four feet in diameter. This gaging tank contains a float, scale and pointer so arranged that the man in charge can accurately check the speed of outflow of solution from his orifice box into the big water main carrying the entire city water supply from the settling basins to the pumps. The solution passes thru the gaging tank to the orifice box. Each division on the gage represents one gallon of the hypochlorite solution.

The orifice box is oblong in shape and carries a float of about 250 cubic inches displacement. The float operates a valve which, by either opening slightly or closing, maintains the hypochlorite solution in the orifice box to a constant level. One end of the orifice box is of plate glass to enable the operator to see at a glance that the solution is filling the box to the proper height. Attached to the plate glass and covering a hole in it is a hard rubber disc having near its periphery several slits, the adjustment of which fixes the size of stream of the 2 per cent. hypochlorite solution that will be the proper amount to treat the quantity of water passing thru the main. All movements of the hypochlorite solution after its preparation are by gravity. Ample opportunity for the hypochlorite, after its addition to the water, to react with any putrescible organic matter and germs is afforded during the time in which the water passes thru the centrifugal pump, the flow line and a small storage basin at Turkey Creek before it is pumped to the domestic water users.

All stirring devices are run by an electric motor belted to a line shaft carrying clutches so placed as to make possible the running of any one of the stirrers, whether or not any of the others are running.

The principle involved in the construction of practically all hypochlorite installations for the purification of water by the oxidation of germs and putrescible organic matter in municipal water supplies is substantitlly the same as that in Kansas City. Concrete, usually reinforced, is, so far as I know, universally used in the construction of all permanent apparatus for the preparation and solution of the hypochlorite for mixing with the water to be purified.

We find that .30 to .50 parts per million available chlorine is necessary to sterilize, or about one-half part per million, or from 8 to 12½ pounds hypochlorite per million gallons. This amount removes, under ordinary conditions, all B. coli and 99 per cent. of all germs. The cost is about 30 cents per million gallons for labor and material, not including interest and depreciation on plant. As the plant is not yet completed, we are unable to arrive at this additional cost. This additional cost will be small. The 30 cents cost for sterilization is based on a thirty-million-gallon consumption. When the consumption increases, the cost is less than 30 cents per million gallons, so that it probably will not exceed that amount, including interest and depreciation, as the pumpage during the hot and cold months averages over forty million gallons.

In view of the fact that a great many cases of typhoid fever are imported and that there are still open and being constantly used numerous springs, wells and cisterns, known to be contaminated with sewage, the result has been all that could have been anticipated. During the year 1910 no specific attempt was made to destroy pathogenic germs in the municipal water supply. During the year 1911 the hypochlorite process was used thruout the year.

The following tabulation, showing the number of deaths from typhoid fever, month by month, during those years, is illuminating:

DEATHS.

Month.	1910.	1911.
January	17	6
February	21	6
March	10	4
April	8	3

May	3	4
June	7	1
July	9	5
August	8	6
September	6	3
October	6	8
November	4	6
December	8	9
Totals	107	61

Now, with this great source of danger from infection by the municipal water supply removed, it is possible for the health commissioner to so enforce the abandonment of questionable sources of water supply and regulate sanitary conditions as to make the occurrence of typhoid fever and most intestinal diseases an uncommon thing in Kansas City.

The following are some germ counts on the city water supply, showing the improvement of the water by the hypochlorite process:

GERMS IN ONE CUBIC CENTIMETER OF WATER.

Date	Quindaro, Missouri River Before Treatment	Clear Basin Before Treatment	City Hall Hydrant After Treatment	B. Coli After Treatment
March 20	10,000	1,200	75	0
March 21	8,000	1,800	70	0
March 23	4,000	800	100	0
March 24	10,000	500	55	0
March 25	8,000	600	90	0
March 27	8,000	400	25	0
March 28	5,000	260	20	0

The accompanying cut will give a fairly good idea of the disposition of the various parts of the purification installation.

THE COST OF LEAKS IN WATER WORKS DISTRIBUTION SYSTEMS.

By Edward S. Cole, C. E., New York City.

OUR nation-wide movement toward the conservation of natural resources has given to water works men a new interest in the curtailment of water waste, especially during the last few years, and it is hoped that these notes may present some phases of an old subject in a new light.

Water works leakage may be classified as follows:

In Pumping Plants—

(a) Plunger leakage.

(b) Valve leakage.

Such leaks are known as slippage, causing loss of pump capacity, steam and fuel. Also excessive station use for condensers, etc., should be included.

All water works plants, whether pumping or gravity, suffer loss of product in distribution by:

(a) Underground leakage from mains and services.

(b) House fixture leakage—defective plumbing.

(c) Misuse to save ice in summer or to prevent freezing in winter.

(d) Steals by large metered consumers.

Almost every water works manager contends with some or all of the above classes of leakage and he must do one of two things, either allow the leaks to continue at whatever cost, or spend time and money in stopping them. Evidently either alternative is expensive and the conscientious official wants to know which will cost him least.

In a pumping plant we should first know the pump leakage. If tests show 15%, as in Chicago, and we assume that well made pumps should operate with a slippage under 5 per cent., then there is a loss of pump capacity, steam and fuel of fully 10 per cent., which, under Chicago conditions, costs $35,000 yearly for coal alone.

Probably the most serious loss involved in pump slippage is that of fire capacity, especially during the hours of maximum draft. The neglect of pump-leakage has in many cities led to the purchase of additional machinery and boilers long before such extensions were really needed. In this way are incurred unnecessary fixed charges which may also be considered as part of the cost of leakage.

As for losses from the distribution system, we now doubt the old saying that, "leaks always show on the surface." Systematic water waste surveys conducted in Chicago, Memphis, Yonkers, Indianapolis, Washington and New York City have brought to light an immense number of underground leaks running continually into nearby sewers, without showing at the surface. In the city of Washington alone, in the past five years, a total of 30,000,000 gallons daily from about 3,000 underground leaks were found, chiefly in mains and service pipes, none of which showed above ground. A new water supply of this amount would have cost $5,000,000, plus extra operating expenses for the new plant, while the stopping of these leaks actually reduced the operating charges.

By the courtesy of Supt. W. A. McFarland, of the Washington Water Department, I am able to present the following analysis of 2,600 underground leaks, found by him prior to Oct. 28, 1911.

		Gals. daily.
1,373	service pipe leaks	13,669,000
607	main joint leaks	8,076,000
620	miscellaneous leaks	5,520,000
Total 2,600	leaks	27,265,000

Without giving the entire list of 2,600 underground leaks which I have, the following will serve as examples, including the largest leaks reported by Superintendent McFarland:

	Gals.
G St., bet. 21st and 22d Sts., N. W., def. 4-in. plug	165,000
9th St., bet. F and G Sts., N. E., def. 6-in. joint	140,000
Washington Navy Yard, abandoned 2-in service pipe	230,000
Capitol Grounds, blow-off valve open	737,000
C St., bet. 9th and 10th Sts., N. W., broken 6-in. main	302,000
9th St., and B St., N. E., (first high service), def. 6-in. joint	141,000
21 1st St., N. E., def. 2d abandoned service pipe	150,000
5th and T Sts., N. W., 6-in. joint blown out	132,000
N. H Ave. and Dupont Circle, N. W., 4 def. 6-in. joints	109,000
Alley bet. 12th and 13th Sts., and R and S Sts., N. W., blow-off on 4-in. main partly open	150,000
10th and S Sts., N. W., def. abandoned tap	135,203
2d and U Sts., N. W., def. 48-in. joint	180,000

Pressures are reduced thru extra friction loss caused by forcing thru the mains so much more water than reaches the consumers. In a great city where pressures are low this extra friction loss may represent the difference between the first floor and second floor supply in thousands of homes. These families pay the penalty of neglected leaks, and the cost is heavy.

The production cost of water in each particular plant is, of course, the principal basis for estimating the cost of leaks, but there are other elements of value, which I wish to emphasize. The factors determining the cost of water as produced and distributed are too well known to be described here, involving the items of labor, supplies, general expenses and repairs for each of the great divisions:

(a) Purification works.
(b) Pumping station.
(c) Distribution system.

In addition, we should always include overhead charges, interest, sinking fund, depreciation and repairs.

We find a wide variation in the cost per thousand gallons daily, ranging from 3 cents to 10 cents in large plants, while in smaller, less favorably situated, the cost may often run as high as 40 cents, or higher. Hence, it is useless to generalize or even to give the average cost of water in American cities.

We are familiar with the ordinary ordinary items of expense which have been mentioned, but there are other factors which effect the cost of leaks. To take a concrete example:

In the case of Chicago, the Water Survey Engineers have found that the works pump and distribute more than twice as much water as reaches the consumers. It is apparent, therefore, that the elimination of leakage would produce a threefold advantage.

1st. In saving about one-half the fuel.

2d. Increasing pressures by reduced friction loss.

3d. Producing reserve capacity for future growth, thus postponing needed extensions.

To any one familiar with the rate of expenditure for extensions in a great city like Chicago, it is evident that this last item far exceeds all the others in determining the cost of leaks.

Still another basis of value was suggested by the manager of a large private water company last summer, who, during a period of drought, was at his wits end to know how to provide a water supply, not to mention adequate fire protection. At such times of "Peak Load" the real cost of leakage assumes extraordinary proportions.

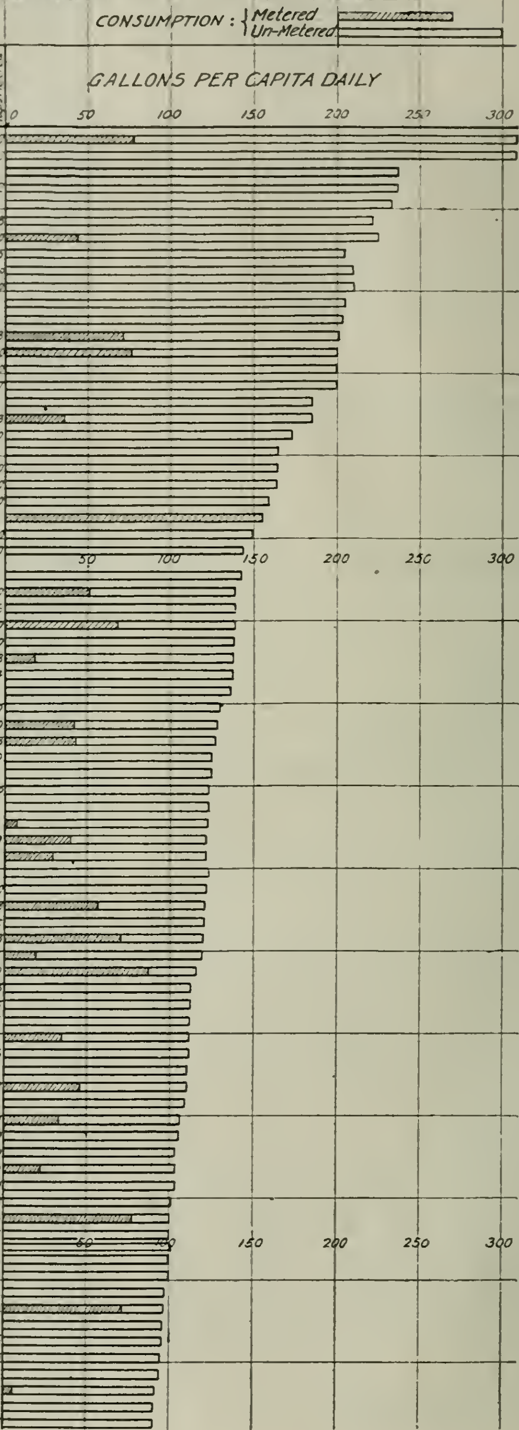
As for steals, it is comparatively easy to appraise the cost of a leak due to theft on the premises of large metered consumers. Such "leaks" are more common than many suppose and when detected usually result in the payment of meter rates.

Having attempted to show that the cost of maintaining a water supply is largely affected by leakage, it is natural to ask how we may determine the extent of leakage in a given city. I have compiled the list of water consumption figures in Table I from the latest available reports of 166 American cities, arranged in order of per capita consumption.

This list illustrates the great variation in total use as commonly reported. It is interesting to compare this table with the water consumption of British cities in Table II, which I have taken from a recently published official directory. We should remember that English cities use few meters, but depend upon the efficient Deacon system of district tests to control leaks.

TABLE I.

WATER CONSUMPTION OF CITIES.



CITY	POP.	DATE	PER CT. Taps Metered
Buffalo. N.Y	423700	'11	4.5
Salt Lake City.	57800	'06	2.2
Waco Tex	25000	'12	
St. John. N.B	46000	'08	3.2
Kingston N.Y.	25902	'08	
Albany. N.Y	100200	'10	23.5
Chicago Ill	2185200	'11	6.0
Erie. Pa	66500	'10	25
Pittsburg. Pa	363000	'06	16.5
Bridgeport. Conn.	82000	'06	5.0
Philadelphia. Pa.	1599000	'10	
Port Huron. Mich.	34700	'10	
Springfield. Ill.	25000	'09	17.8
Grand Rapids. Mich.	81000	'10	42.0
Mobile. Ala.	65000	'12	10.0
Charleston. S.C	25000	'12	37
Peabody. Mass	12600	'09	
Auburn. N.Y	34600	'11	5.3
Lafayette. Ind	20,000	'10	9.0
Camden. N.J.	80000	'08	
Savannah. Ga	65000	'12	2.0
Augusta. Ga	45000	'12	5.0
Jersey City. N.J	267700	'10	9.0
Columbia S.C	27000	'12	100.
Jackson Miss.	21600	'12	15.0
Greensboro N.C	9000	'12	6.0
Bangor. Me.	24800	'07-08	
New London. Conn	19300	'10	15.0
Pawtucket. R.I.	50000	'08	83.6
Lancaster. Pa	45,000	'06	30.0
Binghamton. N.Y.	48400	'10	29.0
Woburn. Mass.	15200	'10	2.8
Atlantic City N.J.	37,500	'06	78.4
Montreal. Can	321,300	'09	
San Antonio. Tex	100,000	'12	16.0
Boston. Mass.	674400	'10	20.0
Cincinnati Ohio.	360,000	'10	32.6
Perth Amboy. N.J.	40,000	'10	29.0
New Brunswick, N.J.	23300	'10	
Meridian. Miss.	20,000	'12	74.0
Evansville. Ind.	69600	'10	
North Adams. Mass.	23,000	'09	
Reading. Pa	98,500	'08-9	11.9
Baltimore. Md	575000	'09	
Schenectady N.Y	72800	'09	
Nashville Tenn	100,000	'12	74.0
Springfield. Mass.	87,500	'10	60.8
Indianapolis. Ind	150,000	'09	5.5
Wilmington. Del	87500	'10	34.3
Haverhill. Mass	42000	'10	17.1
Harrisburg. Pa	64,100	'11	81.0
Kansas City Mo	250,000	'10-11	44.5
Milwaukee. Wis	385,000	'11	81.5
St Louis. Mo.	687,000	'10	6.6
Louisville. Ky.	201,600	'10	8.1
Met. Water Board.	1022200	'10	37.6
Pittsfield. Mass	32000	'10	
Newark. N.J	331000	'09	49.2
Bayonne. N.J.	55,500	'10	99
Holyoke. Mass.	56,900	'10	9.0
Cambridge. Mass	100,000	'10	38.0
Knoxville. Tenn	60000	'12	42.0
Plymouth. Mass.	12,100	'10	94.0
Richmond. Va	127,600	'12	69.0
Peoria Ill	75,000	'12	36.0
Cleveland, Ohio	516,000	'08	93.6
Macon. Ga	50,000	'12	26.5
New York City	4,910,000	'11	
Austin. Texas	35,000	'12	100
Atlanta Ga.	150,000	'12	100
Toronto Ont	360000	'10	4.2
Yonkers N.Y	77,500	'09	100.
Memphis Tenn.	135000	'12	
Holland. Mich.	10,000	'10	96.6
Andover Mass	7000	'07	80.0
Dallas. Tex.	93,000	'12	
East Orange. N.J.	35700	'10	18.1
Beverly. Mass.	18,600	'10	4.1
Stoneham. Mass.	7,100	'10	43.3

TABLE I. (Continued.)

Poughkeepsie, N.Y.	27,900	'08	83.5
Syracuse, N.Y.	137,200	'08	87.6
Jamestown, N.Y.	31,200	'10	51.0
Salem, Mass.	43,600	'10	89.7
Brookline, Mass.	27,700	'10	
Waltham, Mass.	27,700	'10	12.0
South Bend, Ind.	53,600	'10	17.8
Quincy, Mass.	32,800	'10	36.0
Utica, N.Y.	74,400	'10	100
Duluth, Minn.	78,400	'10	51.5
Chelsea, Mass.	32,500	'10	64.3
Hartford, Conn.	85,000	'09	98.8
Bridgeton, N.J.	14,200	'10	
New Bedford, Mass.	92,000	'10	47.8
Arlington, Mass.	11,200	'10	62.8
Spartanburg, S.C.	12,000	'12	37.0
Marion, Ind.	19,300	'10	17.3
Rockford, Ill.	45,500	'10	49.2
Fitchburg, Mass.	37,000	'10	70.2
Columbus, Ohio	200,000	'09	80.0
New Orleans, La.	200,000	'12	100
Somerville, Mass.	77,600	'10	47.8
Lexington, Mass.	4,400	'10	56.6
Everett, Mass.	33,700	'10	22.0
Washington, D.C.	331,000	'10	25.0
Dayton, Ohio	116,500	'09	74.6
Providence, R.I.	224,300	'11	89.2
Worcester, Mass.	149,500	'10	65.7
Lynn, Mass.	85,300	'08	40.0
Revere, Mass.	18,500	'10	26.0
Manistee, Mich.	14,000	'09 '10	9.0
Galveston, Tex.	40,000	'12	99.0
Hamilton, Ohio	35,200	'09	60.0
Taunton, Mass.	32,500	'11	53.0
Watertown, Mass.	12,900	'10	100.
Battlecreek, Mich.	27,000	'11	96.0
Toledo, Ohio	195,000	'11	86.0
Jacksonville, Fla.	58,000	'09	70.0
Melrose, Mass.	15,700	'10	100.
Framingham, Mass.	10,200	'08	77.0
Chicopee, Mass.	25,400	'10	
Winthrop, Mass.	10,200	'10	95.9
Fort Worth, Tex.	80,000	'12	100
Newton, Mass.	39,600	'10	88.6
Fort Wayne, Ind.	63,900	'08	34.5
St. Paul, Minn.	214,700	'10	51.0
Medford, Mass.	23,300	'10	94.4
Covington, Ky.	53,200	'10	100.
Minneapolis, Minn.	315,000	'09	78.8
Tampa, Fla.	50,000	'12	25.0
Newport, Ky.	35,000	'10	31.0
Topeka, Kan.	43,600	'10	68.
Belmont, Mass.	5,600	'10	100
Swampscott, Mass.	6,900	'10	99.1
Westerly, R.I.	12,000	'09	
Nahant, Mass.	2,100	'10	42.7
Norwood, Mass.		'05	
Natick, Mass.	9,600	'09	65.0
Gardner, Mass.	11,300	'09	7.0
Madison, Wis.	26,900	'09	99.0
Gloucester, Mass.	23,000	'09	5.0
Charlotte, N.C.	20,000	'12	100.
Lowell, Mass.	96,300	'08	75.3
Aurora, Ills.	33,000	'09	
Houston, Tex.	105,000	'12	89.0
Attleboro, Mass.	17,500	'10	100
Kalamazoo, Mich.	39,400	'10	96.6
Ware, Mass.	9,000	'09	93.0
Fall River, Mass.	114,300	'09	98.8
Wellesley, Mass.	7,000	'09	100.
Franklin, N.H.	4,800	'08	100.
Lawrence, Mass.	82,000	'09	90.0
Marlborough, Mass.	13,800	'09	65.0
Sioux City, Iowa	25,200	'09	100.
Malden, Mass.	44,700	'10	96.3
Quincy, Ill.	36,500	'10	58.0
Dover, N.H.	13,000	'11	73.0
Methuen, Mass.	12,000	'11	75.2
Lexington, Ky.	45,000	'10	56.8
Danville, Va.	19,000	'08	95.2
Milton, Mass.	7,900	'10	100.
Middleboro, Mass.	7,000	'05	
Concord, N.H.	21,500	'10	57.2
Brockton, Mass.	66,000	'10	99.4
Woonsocket, R.I.	42,700	'10	87.0
Reading, Mass.	5,700	'09	92.0
Auburn, Me.	15,000	'10-'11	
Winchendon, Mass.	6,200	'09	85.0

50 100 150 200 250 300

It is reasonable that we should ask ourselves why there is this great variation among our American cities and between American and English cities in the use of water. The per capita consumption in this country is almost invariably reported as the total use. We lump together indiscriminately, public use, business use and domestic use, which is obviously unfair if comparisons are to be made. In England, on the contrary, the water consumption is usually reported for domestic use as distinct from other uses.

It is evident that the water used for trade purposes in all British cities is small compared with the few available records of manufacturing use in American cities, but I believe that domestic consumption in English cities is not so much lower than it is in many of our own metered cities, if, only we will separate domestic consumption from all other use.

A movement should be started in this country to provide the much needed segregation of use in our water works reports and it is to the interest of all water works men that these data should be forthcoming as rapidly as possible. Our water works literature is rich in meter statistics and these tend to show that domestic consumption in this country need not exceed an actual use of about 30 to 60 gallons per capita daily. Indeed meter readings prove conclusively that the poorer sections of our American cities are using as little as 10 to 15 gallons per capita. We must recognize that there are a few lavish users among the wealthy class in any city, having extensive grounds on which the sprinkler is in continuous operation and having an elaborate supply of house fixtures, but it must be remembered that this extravagant class is exceedingly limited in number and probably has little effect upon the average use of our large cities. Of course we must expect to find greater economy in the older countries of Europe which long ago felt the pinch of a diminishing water supply such as we are likely to suffer in our turn when population has become as dense.

Do not let us deceive ourselves by the use of unfair statistics. It is absolutely necessary to know how we compare in domestic use after deducting water for all other purposes. I would make a most earnest plea that water works men report even approximately, such figures as will help us separate domestic from business use of water. These data would be valuable to every water works man, giving him for the first time the means of demonstrating efficient management and for pointing the way to increased economy thru intelligent comparison.

According to such figures as we have, there are 20 American cities showing a

TABLE II.

WATER CONSUMPTION OF THE LARGER BRITISH CITIES.

City	Population.	U. S. gal. per hd. daily. Domestic.	Trade etc.
Aberdeen	163,681	36.	14.4
Accrington	92,000	19.3	6.9
Airdie, Coatbridge	100,000	30.	15.7
Barrow-in-Furness	84,500	32.	22.2
Bath	74,000	22.7	3.3
Belfast	390,000	29.8	15.6
Birkenhead	115,257	29.8	11.3
Birmingham	837,776	17.9	11.4
Blackburn	143,000	16.9	8.9
Bradford,	288,505	27.	25.8
Brighton	200,000	30.	8.4
Bristol	379,923	30.4	....
Burnley	105,000	22.3	5.5
Cardiff	236,000	16.9	14.5
Carlisle	56,000	25.7	11.2
Chester	54,000	38.9	8.4
Colne Valley	106,000	25.2	....
Coventry	101,000	18.7	4.3
Croydon	169,559	27.6	6.0
Darlington	55,000	25.2	....
Derby	130,000	19.6	10.0
Devonport	75,000	35.3	15.7
Doncaster	54,188	28.	14.0
Edinburgh & Leith	477,000	33.4	8.4
Exeter	63,000	26.4	9.6
Glasgow	1,134,454	44.5	27.6
Great Grimsby	90,000	24.	8.4
Halifax	110,000	18.	15.6
Huddersfield	152,000	19.2	12.
Hull	246,435	36.4	12.5
Ipswich	76,600	19.9	6.2
Leeds	490,985	23.4	1.5
Leicester	282,905	16.0	7.4
Lincoln	60,500	22.	7.0
Liverpool	958,446	22.4	13.3
Manchester	1,200,000	24.	18.
Merthyr Tydfil	90,000	31.2	15.6
Metropolitan Water Board (London)	7,079,251	37.4	....
Newcastle-on-Tyne	585,000	19.5	16.2
Northampton	120,000	15.2	3.7
Oldham and District	231,787	19.2	9.6
Oxford	60,000	28.8	4.8
Plymouth	136,568	34.1	....
Pontypridd	125,000	34.8	4.8
Preston	130,000	30.0	16.8
Reading	97,877	24.9	14.4
Rochdale	125,000	18.	6.0
Rotherdam	100,000	17.3	6.2
St. Helens	90,000	25.2	15.6
South Hants District	97,415	24.8	....
South Staffordshire	701,505	19.7	5.4
Staffordshire Potteries	320,000	19.2	7.2
Stockport	170,000	21.6	6.0
Sunderland and S. Shields	425,000	16.8	7.2
Swansea	120,000	42.6	12.3
Swindon and District	56,000	13.1	....
Tees Valley	260,000	20.	50.4
Wigan	95,221	19.5	6.7
Ystrad	75,000	23.4	3.4

per capita daily use for business purposes of from 3 to 70 gallons, most of them using from 30 to 40 gallons. With this allowance in mind, it is interesting to examine our American list, Table I, and note that many domestic rates comparable with those of the English cities (Table II), would remain, after deducting this amount of business use from the totals reported. Of course any such comparisons must be made with care, for business use may vary from nothing in the residential town to a large part of the entire supply in manufacturing centers.

This discussion of reasonable per capita consumption is presented merely as a basis on which to determine whether or not there are excessive leaks in a given city. Without some such basis, many a city is operating wastefully without knowing the truth.

Metered cities are fortunately placed for such an analysis and it would be an easy matter for them to arrive at this necessary basis for comparison. In the fully metered city it is possible to compare the total pumpage or supply with total registration of all meters. The amount remaining "unaccounted for" is, of course, the most reliable criterion of leakage which it is possible to obtain. Occasionally we find a city with practically every service metered but accounting for only 50 per cent. to 60 per cent. of its total supply. The manager of such a plant should entertain no delusion as to the efficiency of his administration. Either he has underground leakage or there is stealing from his mains—and the one costs as much as the other. The question—does it pay to stop leaks?—answers itself.

In conclusion, I have tried to show:

1. What leakage is.
2. That leakage costs far more than the operating expenses, even with overhead charges added, by reason of friction loss and needless extensions of plant.
3. That there is great confusion in the reported per capita use of water in American cities, due to our failure to separate business and domestic consumption, making comparisons unfair or useless.

FLOOR AREA AS A UNIT FOR ESTIMATING WATER CONSUMPTION.

By William W. Brush.

IN 1908 the writer was placed in charge of the general design of the delivery system to carry to the five boroughs of Greater New York the 500 million gallons per day, which would eventually be available from the Catskill water sheds, this work being carried on by the board of water supply. Studies in connection with the design of this system required a determination of the existing consumption in each borough, and in sub-divisions of each borough, as well as an estimate of probable future growth in consumption.

It was found that the measurements of flow that had been made were not sufficient in extent to give a fair basis for estimating the present consumption in the various sections of the city, and that a per capita basis for consumption was practically useless for this purpose for the Borough of Manhattan, due to the fact that large areas are wholly devoted to office buildings, manufacturing and other business purposes; and also due to the rapid changes going on in the elimination of buildings previously used for residences and the substitution of office buildings, lofts and factories.

While the water consumption of both large and small communities is generally expressed as the average amount supplied "per capita," this unit is used more on account of its convenience than for its usefulness as a basis for comparison of consumption in different towns and cities. The census, national and state, which is usually taken at intervals of five to ten years, gives data from which the population can be determined with a reasonable degree of accuracy and the per capita consumption readily calculated. It is evident that this unit is not one that gives an accurate standard for comparison, as the conditions as to kind and extent of manufacturing and other industries, character of buildings used for residential purposes, character of population, density of population, etc., affect the amount of water required for a community, exclusive of the amount lost thru waste. In examinations made of the per capita consumption in different sections of large cities, variations of several hundred per cent. have been shown, due to the above causes. The highest consumption is generally found in the highest class apartment houses, and the lowest consumption in the lowest class of tenements.

To carry out the work required to satisfactorily design the Catskill delivery system, some unit of consumption was necessary that did not vary to the extent of the per capita unit and that could be applied to business as well as residential sections. An investigation of the available data, on which to estimate future as well as present consumption, showed that the area occupied by buildings would be the fundamental basis for future consumption, especially in the Borough of Manhattan, and that, other things being equal, the amount of water used in any building would be dependent upon the ground area covered and the number of stories in height. It was therefore decided to study the use of the floor area unit as a basis for estimating consumption. The floor area was to be determined by multiplying the ground area of a building by the number of stories, allowing one additional story for basement or cellar. One thousand square feet of floor area was found to be a convenient unit, and one that would give a resultant consumption averaging about three times that figured on a per capita basis. There was no record that the floor area unit had been previously used in other cities, and therefore no data were available for comparison of results obtained by the use of this method in New York City, altho in a few instances the consumption had been determined for the ground area covered by buildings. The consumption per service, consumption per fixture, consumption per unit of length of main and consumption for other units have been computed in special cases.

The main reasons for adopting the floor area basis for New York City are summarized as follows:

First. The amount of water used in any building is proportional to the size and height of same.

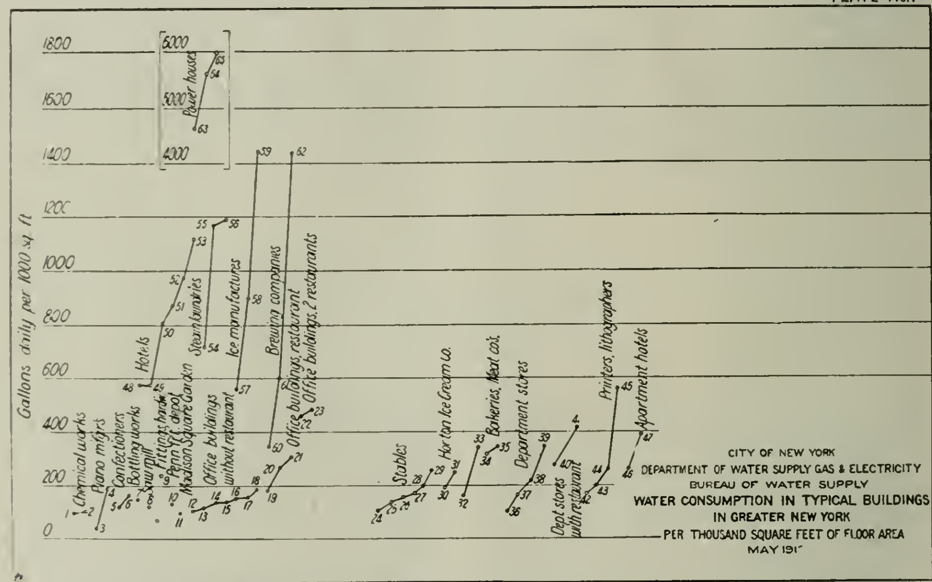
Second. The total floor area could readily be obtained from available atlases.

Third. The very large areas, especially in the Borough of Manhattan, occupied only for business purposes.

Fourth. The large and increasing population, especially in the Borough of Manhattan, which is transient, and therefore cannot be accurately determined for the present nor for the future.

Fifth. The presence of several hundred thousand people in Manhattan, engaged in business, who make their homes in adjoining sections of New York state and New Jersey.

PLATE No. I



I. WATER CONSUMPTION PER 1,000 SQUARE FEET OF FLOOR AREA IN BUILDINGS.

To determine the present use of water per unit of floor area, typical buildings were selected, in which the supply was measured by meters, and the resultant consumption determined. (Plate I.) There were also available measurements of various districts in Manhattan, Brooklyn and the Bronx, which were made by use of the pitometer during waste investigations carried on in 1902-03. The following table gives the results of these measurements, as well as those taken in 1911, a reduction in consumption in 1911 of about 15 per cent. having been effected by house-to-house inspection, while in 1902 no special work had been done on water waste prevention:

GAGINGS—1902-03.

No. of District	Characteristics of Occupancy	Consumption M. G. D.	Population Resident	Consumption Per Capita
1.	Large hotels, high-class residences	1.87	8,396	223
2.	East Side tenements	1.44	38,906	37
3.	East Side tenements	5.40	90,000	60
6.	Residence and high-class apartments	0.76	10,164	75
8.	Business, office buildings, water front, shipping	9.45	11,000	860
9.	High-class apartments and hotels	1.37	8,872	154
10.*	East Side tenements, some water front	20.00	218,023	93
11.	Uptown residences and medium-class apartments	4.89	4,380	112
12.	Upper East Side tenement, water front, power houses and breweries	2.75	39,969	69

GAGINGS—1911.

No. of District	Characteristics of Occupancy	Consumption M. G. D.	Population Resident	Consumption Per Capita
1a.	East Side tenement, some water front (same as District No. 10)	11.44	230,000	50
2a.	All classes	29.48	204,557	144
3a.	High-class apartments and residences	22.18	186,990	118
4a.	High-class apartments, residences and tenements	12.74	138,800	92
5a.	East Side tenement and water front	8.28	84,580	98
6a.	High-class apartments, residences, tenements and water front	14.82	173,000	86
7a.	All classes	13.38	169,100	79
8a.	All classes	13.66	209,393	65

*An error was later discovered in the measurement of flow in this district, which reduced the consumption as given by about 50 per cent.

The above districts are shown on Plates Nos. 2 and 3 (not reproduced, and the consumption plotted on Plate No. 4. (The districts used in 1911 are much larger than those of 1902-3 and are generally in different locations, except that district 1a of 1911 is the same as district 10 of 1902-3.)

With a variation in the per capita consumption of from 37 gallons to 860 gallons daily, it was evident that it would be difficult to apply a per capita basis to different sections of the city to determine the consumption in such sections.

It was found, upon examination, that, with the exception of those buildings where the consumption of water would be unusually high, such as hotels, laundries, ice plants, etc., the use of water per thousand square feet of floor area was from 150 to 300 gallons per day. This covered only those buildings used for business purposes, as under the rules of the water department, meters are not required in buildings used for residences. It was anticipated that apartments of the higher class would show a somewhat larger use of water per unit of floor area than would the tenement class, and that both would show a larger use than private residences. The first computations made of consumption in districts which covered several blocks included a high-class apartment house and hotel section in the vicinity of Eightieth street, on the West Side, and a low-class tenement section on the East Side in the vicinity of Eightieth street. The per capita consumption in these two districts was 154 gallons per day and 37 gallons per day, respectively, the high-class apartment district therefore showing a consumption, on per capita basis, of over 400 per cent. of that shown for the tenement house district. On the floor area basis the figures for these two districts were 181 and 179 gallons per day per thousand square feet, respectively, or a variation of less than 2 per cent. between the two districts. While this close agreement in consumption for the two districts was a coincidence, it strikingly illustrated the uniformity obtained from the floor area basis as compared with the per capita basis in two residential districts where the character of population varied widely. As further studies showed the floor area basis to be a practical one, it was applied generally to the Borough of Manhattan. The ground area was scaled from the atlas, and this area multiplied by the number of stories, the buildings being grouped as far as possible to reduce the labor. It was found that it required the equivalent of about one man's time for four months to determine the floor area for this borough, the area in each block being estimated separately. After the entire area of the Borough of

Manhattan had been determined, the average consumption was computed and proved to be about 300 gallons per thousand square feet.

To determine the prospective use of water in the Borough of Manhattan, the area available for buildings was determined, eliminating street and park areas, and the borough was divided into four groups, the average height of building and percentage of ground area to be built upon in each group being estimated. The future consumption per thousand square feet of floor area was taken as 350 gallons for that section of the city lying below Fifty-ninth street, to provide an ample margin of safety in the estimates. The following gives the units adopted:

Section	Average Height of Building, Stories.	Percentage of Block Built Upon.	Consumption per 1,000 sq. ft. of floor area. Gals. daily.
South of 23rd St....	8	85	350
23rd to 46th St......	10	85	350
46th to 59th St......	8	85	350
59th St. to Spuyten Duyvil	6	75	300

These figures gave an ultimate estimated consumption of 835 m.g.d.

In addition to estimating the ultimate consumption in the Borough of Manhattan, the present and prospective use of water in the various sections of the borough were estimated as a foundation for studies of the size of connections for the new Catskill aqueduct.

The experience of the past three years has shown that the floor area basis is useful also in the following work:

First. To determine what is the reasonable consumption in districts which are being surveyed by use of the pitometer, thus determining whether further investigations to detect leakage are advisable.

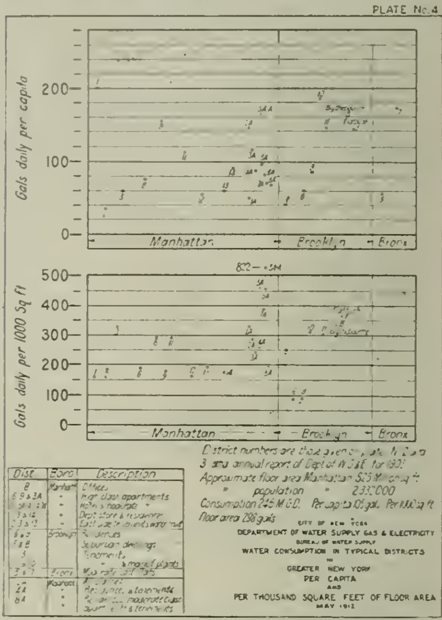
Second. To determine consumption in individual blocks, or groups of several blocks, where it is proposed to extend high service to cover districts previously supplied from low service.

Third. To determine whether metered consumption indicated for large buildings is probably correct, where question has arisen as to the presence of illegal connections.

Fourth. To determine size of tap that should be granted for a new building.

The following illustrations of the use of the floor area basis in connection with gagings of flow into districts and the use of water in buildings are of interest:

In measuring the flow of water into District No. 10 in 1902-03, an error was made in the direction of flow thru one of the large mains included in this district. The flow in this main, which was about 5 m.g.d., was taken as being into the district, whereas it should have been out of the district. The resultant error was, therefore, about 10 m.g.d. or about



IV. TYPICAL WATER CONSUMPTION PER 1,000 FEET FLOOR AREA.

equal to the actual flow into the district. The resultant per capita consumption was 83 gallons, and was not considered to be abnormal. When the floor area unit was applied to this district, it was found that the consumption per thousand square feet was over 600 gallons per day, whereas no other district was found where the consumption had equaled 400 gallons, and few had exceeded 300 gallons. Investigation and subsequent measurements of flow in the district clearly showed the error, which was only discovered by applying the floor area unit.

The question of the presence of one or more illegal connections between the city's mains and the piping system of one of the large hotels was brought up. It was found that to measure the flow in the street mains and thus check the meters in the building would necessitate several taps, and the size of the mains was such that the rate of flow would be too small to give a reasonable degree of accuracy in the reading that might be obtained. To make the necessary taps and take readings would have cost several hundred dollars and would have interfered with traffic on two of the most congested streets in the city. A comparison of the use of water in this building on the floor area basis with that of several other buildings of like character showed that the building in question used more water than any of the other buildings. The evidence, therefore, was conclusive that the full amount of water supplied was passing thru the meters.

The per capita basis for estimating consumption is the most practical one for general use, and will undoubtedly continue to be the standard unit. Experience with the floor area basis in New York City has shown, however, its usefulness in water works operation, and it is believed that other cities than New York will find occasions where the floor area basis can be utilized to advantage.

THE WOOD STAVE FORCE MAIN OF THE ATLANTIC CITY, N. J., WATER WORKS.

By L. Van Gilder, Chief Engineer and Superintendent.

IN preparing this paper for your consideration, it has been the writer's aim to make it descriptive rather than technical, believing that you have all given the subject sufficient study to establish to your own satisfaction the practicability of wood stave pipe, if used under reasonable conditions.

It may, perhaps, be interesting to review briefly the history of the Atlantic City water department, in order to show the reasons for building a wood stave main.

In 1882 the original franchise holders, headed by R. D. Wood & Co., erected a pumping station on the main land and laid a 12-inch cast iron main to connect with the city, a distance of approximately 26,000 feet, of which about 2,000 feet were laid in sand; the balance, across salt marsh.

In 1888 a 20-inch cast iron main was laid parallel to the first, to provide for the city's growing demands.

In 1895 the city purchased the property and franchise, together with a small artesian well plant within the city limits, operated by an independent company, and since that time the water department has been owned and operated by the municipality.

In 1901 the city had outgrown the economic capacity of the old mains, and a 30-inch riveted steel main was laid parallel to the other two.

After careful investigation, the board of water commissioners and Supt. W. C. Hawley, now of Wilkinsburg, Pa., had recommended building a continuous type wood stave main, but the city council (then supreme) overruled the recommendation and adopted steel.

Within two years pit holes began to appear in this pipe, and it is now, after eleven years of service, in such condition that extensive repairs must soon be made or it must be abandoned.

In 1906 the first steps were taken toward building a new and larger force main, both as a precautionary measure and to lower the peak load friction head.

The cast iron mains were materially weakened by softening on the outside, and the steel main was rapidly nearing the end of its usefulness; therefore, the department, now wholly under the control of the board of water commissioners, decided to lay a 48-inch wood stave main as being the most economical, easiest to repair, least flow friction and having the least effect on the water carried.

As to the durability of the wood, there could be no question, years of experience with piling, telegraph poles, etc., having shown that every variety of wood embedded in salt marsh was preserved indefinitely.

The bands and saddles were the doubtful parts, but since there was every reason to believe that they would have an average life of from 10 to 12 years and could be replaced if taken in time without putting the main out of commission, it was decided that a wood stave main should be built.

Of the two types of wood pipe in general use, the spiral-wound, factory-made was not considered advantageous for the three following reasons:

First. Because the thin, flat bands present a much greater ratio of surface to net section than round rods, hence more rapid corrosion.

Second. The failure of a band in one place would endanger a whole section.

Third. Because of the difficulty of satisfactory rebanding with the pipe in service.

As general experience with structural wrought iron and steel has shown the former to be much the more durable when exposed to the weather or to salt water, no consideration was given to the latter, altho its adoption would have effected a material saving in contract price.

The saddles were malleable castings weighing about two pounds each, one saddle for each band.

The bands were 5/8-inch round wrought iron of from 45,000 to 52,000 pounds per square inch, ultimate tensile strength, and spaced 2 inches on centers at the intake end for a minimum working pressure of 65 pounds per square inch.

To provide for uniform strength of band thruout, the threaded end was upset for a standard 3/4-inch nut, and numerous tensile tests showed no weakness incident to threading.

The bands and saddles were heated and dipped at the mill and foundry in hot asphaltum, dipped again in the same material before assembling and were hand-painted with cold asphaltum paint after coopering and cinching.

The wood selected was Washington fir, altho bids were invited and received on California redwood, long leaf yellow pine and white cedar.

The staves were run from 2x6-inch rough stock and were finished 1 5/8 inches thick with straight radial edges, 29 staves to the circle. No two adjacent staves were butted in the same transverse plane, and all butt joints were sealed by inserting 1/8x1 1/2-inch galvanized iron tongues in tight-fitting kerfs sawed in the stave ends. These tongues were somewhat longer than the kerfs, in order that they would be slightly embedded in the edges of the adjoining staves.

Manholes were inserted at intervals of about 1,000 feet, and each manhole was made up of one 48x16-inch flanged tee, one 16-inch blank flange and two 48-inch flange and bell pieces. The staves were entered in the bells and were jointed with jute and lead. With care taken to pour the joints full and solid, no trouble has been experienced with them, altho for extra security the bells were cast 6 inches deep.

All flange joints were made with lead gaskets and bronze bolts, the latter being especially desirable to resist the action of salt water.

The right-of-way chosen involved crossing three navigable streams besides as many drawbridges, and while the War Department permitted us to lay the pipe on trestle work from shore to channel, we were compelled to leave open water the entire length of the draw span and the full depth of the channel, the maximum being about 105 feet wide and 13 feet deep at mean low tide.

These channel crossings were made by ending the wood pipe in a manifold at each side of the draw and laying four 24-inch inverted siphons across the channel, the manifolds and siphons being supported by piling.

Each manifold was made up with one 48x48x48x24-inch cross, three flanges, one bell, three 48x48x24-inch flange tees and two 48-inch blank flanges, all of standard patterns. A valve was bolted to each 24-inch manifold flange, and the siphons were made up of 24-inch flanged pipe and quarter bends.

By this arrangement a leaking siphon can be put out of service and be repaired at pleasure without seriously impairing the efficiency of the main. The only difficult feature of this construction was to provide sufficient resistance to prevent blowing the manifolds off the pipe at the bells. This difficulty was overcome by providing sectional cast iron clamp collars, one behind each bell shoulder and two on the pipe, at short distances apart, the frictional resistance of the two pipe collars when transmitted to the bell by tension rods being sufficient to balance the thrust. As an extra precaution, concrete anchor blocks and tie rods were also provided.

The weight of the pipe as built was about 185 pounds per lineal foot, and the only foundation required was a line of 1x12-inch boards doubled break-joint fashion each side of the trench with light cross-timbers at about 8-foot intervals. This also provided a convenient footway for the workmen thru the soft bottom.

It is interesting to note that the weight of this pipe when full is approximately 970 pounds per lineal foot, whereas the weight of a 48-inch cast iron main, class B, A. W. W. A. specifications, is about 1,565 pounds per foot, filled.

All manhole castings are carried on pile foundations, and, as the piling and caps are below water level, their preservation is assured.

The contract price of the wood stave portion of the main, including trenching not less than 30 inches deep across the marsh, and backfilling, not including extra embankment, was $5.28 per lineal foot. All manhole castings were provided and set for $458.51 each, and the cost of each thoroughfare (navigable channel) crossing, including about 400 feet of creosoted pine trestle work to carry the pipe to the manifolds, was $25,857.25.

Work was begun on this main March 15, 1910. It was put in service July 10, 1911, and has been in constant service since. No trouble has been experienced with the wooden structure, and the leakage has been practically nil.

The thoroughfare crossings have given some trouble, but we believe the weak points have been overcome.

After two years of exposure the bands and saddles do not show serious corrosion; and, while it is too soon to make any reasonable prediction as to their durability, their present condition appears to justify the original assumption that extensive rebanding would not be required under ten years.

METHODS AND COST OF A LEAKAGE SURVEY FOR LANCASTER, PA., WATER WORKS.

By F. H. Shaw, Engineer and Superintendent.

THE city of Lancaster is located in the southeastern part of Pennsylvania on the main line of the Pennsylvania Railroad, between Philadelphia and Harrisburg. It has a population of about 50,000 and is the business center of a rich agricultural district.

The city has an area of four square miles, about three of which are built up, the houses being constructed of brick with practically solid fronts between streets. This method of construction gives a population of about 25 per acre.

The city is supplied with water by a municipal plant the first construction dating back to 1836. The water is taken from the Conestoga Creek, a tributary of the Susquehanna River, having a drainage area of 310 square miles of highly cultivated farming country containing many small towns and a population of 120 per square mile.

The water is filtered and pumped into the city against a head of 250 feet, the supply being measured by a Venturi meter located between the filter plant and the pumping station.

The distribution system is connected with the pumping station by two force mains, one 30-inch and one 36-inch, each being about one mile in length.

The distribution system is divided into high and low service districts. The low service district contains about 0.4 of a square mile and is supplied from the old reservoir constructed in 1836 and in 1850, which have a capacity of 6,000,000 gallons. These reservoirs are filled at night by pumping through the 36-inch main.

The high service district is supplied thru the 30-inch main by direct pumping. The water passing thru a standpipe having a capacity of 400,000 gallons, located on the reservoir grounds. The distribution system consists of 70 miles of pipe, varying in size from 24 inches to 4 inches. The system has been extended outside the city limits by various water companies, their supply mains being metered at the city line. There are about 10,500 services in use, one-third of which are metered. All large consumers are metered and meters are being installed at the rate of about 400 per year, all new properties being metered. The schedule rate for a three-story house having bath, two closets and pave wash is $17.00. The meter rate is 5 cents per 1,000 gallons with a minimum of $10.00.

The daily consumption averages about 7,000,000 gallons, varying between 5,000,000 and 10,000,000, with a maximum pumping rate as high as 12,000,000 for short periods. Assuming a population of 50,000 this will give a per capita consumption of 140 gallons daily. This excessive consumption led to an investigation of causes and methods for correcting same. A general house to house inspection was made during the winter of 1910, at which time all plumbing was inspected for leakage. Results of this inspection were recorded on a card for each property inspected. As a result of this inspection the yearly income from water rents was increased $3,500.00. The city was then divided into four districts, and a regular inspector appointed for each district. A yearly inspection is made of each house and property owners are compelled to repair all leaky fixtures within 10 days, 480 causes being reported and repaired during the last year.

During these investigations the necessity of a systematic search for leakage from mains become apparent and the discovery by accident of a leak which was costing the city about $10,000 per year, brought the matter to a head and the necessary appropriation was made.

The survey party was organized from employes of the Water Department, a foreman who had been in the department for 20 years being placed in charge of the work. The party worked 9 hours per day, and was composed as follows:

Organization.—

Foreman, per day	$ 3.00
Single team and working driver...	2.50
Three laborers at $1.80 per day....	5.40
Total cost per day	$10.90

Outfit.—

One 4-inch meter with 2½-inch connections on truck.

One ⅝-inch meter.

One pressure gage.

Two 25-foot lengths 2½-inch fire hose.

Two hundred and fifty feet 2½-inch galvanized pipe.

One small tool box.

Picks, shovels, wrenches, calking tools, lead, wool, etc.

The first step in preparing this work was an inspection of all valves and repairs to same, placing them in working order and replacing some which could not be operated. This work was done by the men in the distribution department in advance of the survey. The survey was started in March 6, 1911, and stopped for the winter on December 13th. The method of procedure was as follows:

The 4-inch meter was mounted on a small four-wheeled truck and the connections bushed down to 2½ inches with a 2½-inch valve at inlet and outlet. The large meter was by-passed by a ⅝-inch meter for use on small flows. A pressure gage was attached to the outlet end of the large meter. The districts tested had an average area of 12 acres containing about 80 houses. The district to be tested was shut off from the remainder of the system by closing all valves on street mains. The meter was then connected with a hydrant outside the district by means of a 25-foot length of fire hose. The 2½-inch pipe line was laid from the meter to a hydrant inside the district, being connected with it by another short length of hose.

The consumption of the district was then measured for one hour, readings being taken every ten minutes and any reductions in pressure noted. Any considerable drop in pressure indicates either a large leak or that the district is too large to be supplied through 2½-inch pipe. After the consumption had been measured, all connections were shut off inside the houses, an inspection of house plumbing being made at the same time. A test was then made to determine whether any street valves were leaking water into the district by opening a fire hydrant and watching for any flow from the opening.

After everything was shut off the leakage was measured by the large or small water meter according to the amount. This flow, if any, represented the leakage from mains and also from the services. To locate the leaks, the streets inside the districts were cut out one at a time by closing the valves until the leak had been located by using the telephone on curb stops, hydrants and on drills driven down to the main. After the leak had been definitely located, it was dug up and repaired by the survey party and the district tested until found tight.

The work was carried on for 240 days at a cost of about $11.00 per day, or $2,640.00 for the season of labor. The cost of lead, wool, etc., for repairing leaks was very small. One hundred and eleven districts were tested, having a total area of 1,310 acres, or 12 acres per district. There were approximately 9,000 houses in the territory covered.

Following are the leaks discovered and repaired:

Residences.—

Closets	20	
Yard hydrants	10	
Faucets	19	
Service mains	17	
		66
Street valves	12	
Fire hydrants	35	
Street mains	29	
		76
Total number of leaks		142

The leaks varied from 1 to 19 cu. ft. per minute. The largest leak found was a 3-inch elbow split wide open and running at the rate of 205,200 gallons uer day. This line had been by-passed around the meter outside the building and was supplying four buildings. In this case the survey not only stopped the leak, but detected the illegal use of water. This leak amounted to 75,000,000 gallons per year, the actual cost of furnishing which was $2,812.50, or $172.50 more than the cost of the entire survey.

The total mileage of mains inspected was 40.8, varying in size from 4 inches to 24 inches. The total leakage record was 118 cu. ft. per minute, or 1,271,000 gallons per day. Using $37.50 per million as the actual cost of furnishing water, exclusive of interest, the total leakage was costing the city about $17,000 per year.

About one-quarter of the system remains to be tested, also the 20-inch supply main which runs directly across the city. Work is now in progress on this section. One mile of 30-inch force main was laid in 1888, and tested by closing the valves at both ends, and supplying it from the other force main thru a small meter. Leakage was found amounting to $2,000 per year. The joints on this main will be dug up and recaulked during the present season. The results of the leakage survey were not as apparent as was expected for two reasons—one of which was the exceedingly dry summer and failure to provide for street sprinkling by wagons, causing a great increase in the use of individual hcse sprinklers. Another reason was the exceedingly cold weather during the winter which caused an excessive use of water to prevent freezing and also damaged many service mains, all of which have probably not been discovered.

After the present survey has been completed, some of the districts will be retested to ascertain the damage caused during the past winter. A comparison of the consumption before and after the survey shows a decrease of 10,000,000 per month during March and April, and equal consumption from May to September, a decrease of 8,000,000 per month during October and November, a decrease of 24,000,000 during December and an increase of 20,000,000 during January, February and March, while the present consumption is about equal to that before the survey began, while the consumption for 1911 is slightly less than for 1910.

EDITORIAL COMMENT

STANDARD FEES OF CONSULTING ENGINEERS.

The schedule of fees adopted by the American Institute of Consulting Engineers, a small body consisting mainly of engineers with offices in New York City, was published in Municipal Engineering, in vol. xli, p. 311. One prepared by a number of representative St. Louis engineers and endorsed by the Engineers' Club of St. Louis, appeared in vol. xlii, p. 258. In this number will be found the schedule adopted by the Pacific Association of Consulting Engineers with 22 members. The last is modeled to some extent on the first named and there are considerable differences in the three.

It is perhaps natural that the minimum charge per diem should be greatest in New York, which, as the financial center of the country, is the natural location of those who have developed the maximum ability to secure full payment for services rendered. They are apparently quite willing to cut themselves out of the numerous calls for aid upon work which will not warrant payment of $100 a day for consulting service and yet need the temporary assistance of experts who are willing to proportion their charges to the possibilities of the case. The San Francisco minimum charge of $50 a day is open to the same objection in principle, tho it will reach a much larger number of practical cases than the New York schedule. The St. Louis schedule is much more flexible, in that it gives a variable minimum for a brief engagement, two to ten days, of $50 to $100 a day, which is cut in two for the additional days of a more prolonged connection.

The New York and San Francisco schedules provide also for a retainer on general engineering work "where conditions warrant," of $250 to $1,000 and upwards in New York and a "suitable" amount in San Francisco. The double fee of the first few days of the engagement, of the St. Louis schedule, serves in a sense the purpose of this retainer.

The New York schedule provides definitely for the retainer named in cases which will probably involve the giving of testimony. The St. Louis schedule makes such retainer $100 to $500 or such larger amount as may be commensurate with the financial importance of the case or the labor involved, in addition to the per diem.

All the schedules add to the per diem the cost of surveys, traveling and office expenses. The St. Louis schedule charges expenses and salaries of assistants with an addition of 25 per cent. of such salaries as the charge for general office expenses.

Six hours is considered a day, except that when away from the office 24 hours is a day without reference to the number of hours of actual work on the case.

The New York and San Francisco schedules allow the engineer to estimate his work in advance and make a fixed charge for the whole engagement.

Where charges are made by percentages of the estimated cost of the work to be done, the schedules go into some detail. They differ but little in the total results tho they do have some differences in particular items.

It is interesting to note the comparatively small number of differences in the schedules when one remembers the material differences in conditions under which the three sets of engineers operate. The differences, as above stated, are very slight in the percentage fees, perhaps because the ordinary employer is not so seriously affected by a percentage as he is by a lump sum or a per diem, not being so familiar with the number of days required by the consulting engineer himself as he is with the three figures representing his per diem charge, so that engineers are able to approach a uniformity of return in all markets more readily by the use of the percentage system.

The New York and San Francisco schedules are prepared by associations of the highest priced consulting engineers in the country and have the flavor of trade agreements to reduce the friction arising in an open market and to increase the general level of prices in their class of engineers. As above stated, they deliberately cut out a very considerable number of consultation engagements on works of minor financial importance, which are thus left open for expert engineers not belonging to these associations who are willing to serve their fellow men at prices not beyond their ability to pay.

The St. Louis schedule is not made by an association and seems to be intended to cover the whole consulting engineering field, and on this account will probably be found more useful by those not members of the associations named. It is open to the objection that it tends to draw all fees down to the level of the lowest named, but these lowest fees are well safeguarded, and the difficulty may be largely imaginary.

THEORIES OF THE VALUATION OF PUBLIC SERVICE INDUSTRIES.

There is so much loose reasoning among the experts in the valuation of public service industries that they are getting themselves into muddles which are somewhat entertaining to the observer with a sense of humor, when he recognizes the fact that their difficulties arise mainly from their inability or unwillingness to follow a logical course of reasoning to its legitimate end. Sometimes this looks like unwillingness to seem to knock the props out from under an illogical position of a public service operator. Sometimes it seems to be a sheer inability to see a problem from all its sides and to bring out of the clash of apparently conflicting interests the real agreement which exists at bottom, which, when found, is bound to result in justice to both sides, and therefore in ultimate satisfaction to both.

Take the matter of depreciation, for example. In a recent discussion of this subject before a national association one of these experts presented the following:

I have been asked several times why a company cannot make good depreciation in lump sums out of income, when income becomes large enough so that such depreciation investments can be made good, and especially where the average rate of depreciation was not earned in the early life of the business. It is understood, of course, that these depreciation investments are not additions to capital stock, but are strictly renewals of worn-out or useless structures, and may be regarded as in the nature of replacing a depreciation fund which should have been accumulated, but was not as a matter of fact. It is evident that this is not a true sinking fund, but an attempt to make good such sinking fund. But is it not due to the plant that it should renew itself, as has been held by the Supreme Court of the United States, in the Knoxville case? And may not such renewal be made at other times when the income is available for such replacements?

If depreciation funds have not been set aside from the beginning of the life of a plant, so that in valuing such a plant we must deduct what is lacking from the original investment, it is evident that the property will not be maintained if rates are continually predicated upon the new reduced values so found. This in itself is not unjust from the point of valuation, because if the depreciation has been earned and has not been set aside, the owners have withdrawn it from the plant; but if the valuation should continue every year, such as is usual in California, and no depreciation funds should be accumulated, will not the reduction in investment tend to lessen the rates to a point where they are absurd, because they will be reduced to an exceedingly small theoretical sum, when, as a matter of fact, the plant is as capable as ever of performing the service of pumping water up to the time when it must be renewed? To illustrate: If a plant whose life is three-quarters over should be considered, it will be found that only a very small diminution in its earning capacity is effected by reason of such depreciation, and while it is possible that a sum should be accruing to replace it at a certain time, it by no means follows that the structure or the machine is not capable of performing almost as good service as ever it did under some conditions. Now, if depreciation were originally applied to such a plant annually on a sinking fund basis, there would certainly arise the incongruity that the value of the plant would be almost extinguished at three-fourths of its life, when in fact its earning power was greater than ever.

Another question has often arisen as to whether rates in the future should be set aside at the same amount as they are calculated for the past. At first blush it would seem the logical thing that they should be computed precisely in the same manner; but upon second thought it will be remembered that we are able to closely follow the actual depreciation which has occurred in the past, knowing all the contingent and surrounding circumstances which have affected the value of the different portions of the plant, while we have no such foreknowledge as to the future. The question therefore arises, are we not justified in computing the past depreciation on a closer basis, that is to say, a narrower margin, than we are in computing depreciation in the future for rating purposes, where we must confront the possibilities of unknown contingencies, the history of which has not yet developed?

In the first paragraph we have the "depreciation fund," "depreciation investments in renewals of worn-out or useless structures," and a "sinking fund" considered as synonymous terms.

The other paragraphs attack the accuracy of the depreciation charge, and attempt to throw doubt upon the validity of its principle on account of the resulting doubt of the method of application of the principle.

It is hard to see any way out of the mire in which this statement is floundering, unless one goes back to first principles, makes some fundamental definitions of terms, and holds to the differences between the terms, at least from end to end of paragraph.

The first question which arises is as to the difference, if any, between a depreciation fund and a sinking fund. The simplest cases have been stated by Municipal Engineering about as follows, making the necessary assumptions to eliminate all disturbing complications until the principles are thoroughly understood, the preliminary assumption being that there is no loss in the total transaction when finally closed up.

In the first place, we may assume that the plant for a public service industry is constructed entirely with borrowed money. This money is obtained from the sale of bonds which have a definite time to run. Let us further assume that the exact life of the plant is known, and that, like a man, it all goes out of business at once. It is evident, therefore, that the term of the bonds should be the same as the life of the plant and that the plant must earn during its life enough to pay its whole cost, in addition to the cost of operation and maintenance and the interest on the borrowed money.

In the perfect case the managers put aside from the surplus of earnings each year a sum for a sinking fund, which, with the interest obtainable on its investment, will just equal the bonded indebtedness on the day that the bonds become due.

The value of the plant decreases each year by its approach to the day of annihilation, even if it is maintained at the highest possible standard of efficiency. The value of the property of the corporation remains uniform, however, because each year a deposit of cash is made in the sinking fund which offsets the reduction in the value of the plant.

Suppose, now, that the plant is built, not with borrowed money, but with the money of the stockholders themselves. The theory is not changed, for if they are not to lose anything by their operations, they must during the history of the plant receive not only the dividends which represent the interest on the money they have invested, but also the total sum which they have invested. Technically the fund which may be accumulated to make this repayment of the total cost of the plant is not called a sinking fund, although it answers the same purpose, but, for reasons to be shown later, is called a depreciation fund.

Thus, in the simplest case imaginable, the two funds are practically the same, and produce practically the same result, by practically the same means, altho called by different names. The differences between them are differences in methods of handling the funds, due to the complications which arise from various sources in the practical operation of the plant and of the funds invested in it and received from it.

Suppose that the plant in its early days is not able to meet the annual payments to the sinking or depreciation fund. The preliminary assumption of no loss makes it sure that in later years the plant can make up the deficiency, and, to complete the cycle of transactions, it must make it up. It is evident that the company must "make good depreciation in lump sums out of income when income becomes large enough so that such depreciation investments can be made good." The same is true in the case of the sinking fund. The payments thus to be made must put the funds into the required condition, considering both the direct payments to the fund and the interest accumulations thereon. They are "attempts to make good such sinking fund," and the result is the sinking fund itself.

Now, in making a valuation of the plant for purposes of sale, the entire property of the company should be taken into consideration, and the sinking or depreciation fund is a fundamental part of this property. If the plant is to be sold alone, this fund must be deducted from the total valuation, for the first thing the purchasers at the original price would be required to do would be to reproduce this sinking or depreciation fund. Indeed, a larger deduction should be made because the new owners will not receive the interest during the remainder of the life of the plant upon this accumulation in the fund.

If the valuation is made for rate-making purposes the treatment will be somewhat different. If the depreciation or sinking fund is on hand it must be taken into account as one of the productive assets of the company. If it is not on hand, the reason for the deficiency must be ascertained. If it has been spent in dividends, the income of the company for the future should be enough less to make up for the excess in dividends already received, i. e., the valuation of the plant should be decreased. If it has not been earned, then the valuation of the plant should be such as to give the opportunity to earn it in the future.

In neither of these cases is it necessary to modify the treatment of depreciation, provided opportunity is given to complete the depreciation fund or the sinking fund if they are found deficient. They can be taken care of under the "cost of getting business," if desired. In the latter case the deficiency in income is doubtless due either to lack of business or to expenditures in getting business, and it must be made up in future years. The rate-making process must take this into account, and the Wisconsin Railroad Commission computes additions to the capitalization to offset these deficiencies. On the other hand, in the former case the income has been more than sufficient and the excess has been expended in dividends or their equivalent, instead of being put into the depreciation or sinking fund. This may be treated in the same way except that the "cost of getting business" is a negative quantity and the computation will result in a reduction of the capitalization. This is eminently reasonable in theory, notwithstanding the dictum of another expert in valuations that "a minus going value (development expense) is an absurdity, for it is tantamount to saying that a going concern has less value than one that has just begun." He uses "development expense" and "going value" as exactly synonymous terms, another looseness of definition which is responsible for some errors in courses of reasoning and in conclusions. He also fails to differentiate between the conditions in a plant which makes money from the start and in one which must spend money in developing its business.

Most of the experts fail also to take the only logical position in the treatment of public service industries, viz.: that the monopoly granted carries with it the obligation to supply the service with no more than a reasonable return upon the money, ability and efficiency invested in it.

Complications will arise in the practical application of principles, exemplified by such conditions as the following: The construction of a plant in part with borrowed money and in part by capital furnished by the stockholders; expenditure of the depreciation fund in renewals and replacements from time to time, as needed; the differentiation between new construction and repairs; the attempt to keep the plant always up to the most efficient condition, so that it will always be a going concern and will never need to be abandoned or entirely renewed at any one time; the assumption of a depreciation rate which wipes out the book value of the plant before it is itself wiped out; the failure to make the proper transfer from depreciation fund to plant value when the depreciation fund is expended; failure to recognize the difference between actual observed depreciation and estimates of past or future depreciation and between effects of errors in these estimates, etc. Some of these complications and their effects will be considered later, we trust by some of our readers as well as by ourselves.

The necessity in the discussion is to keep the fundamental definitions and principles always in mind. The one controlling principle, the justice of which is now quite generally recognized, is that the most economical and most equitable method of treating a public service industry is to make it in fact what it is in theory and must ultimately be in practice, a monopoly. This decision carries with it the necessity of limiting the returns from the operation of the monopoly to a reasonable compensation for the money, time and ability expended in its operation. We have not yet learned exactly how to determine this return, but we are striving toward the knowledge and are making some headway. If we can eliminate all ideas on the one side of undue profits derived, perhaps, under cover of some apparently innocent provision of the franchise, or on the other side, of gaining undue advantages over the operators of the industry, which, if unjust, must ultimately react against the governmental authority or the customers of the plant, we will advance much more rapidly than if we permit self interest or the demands of political manipulators to befog the vision by their specious arguments.

MUNICIPAL ENGINEERING IN THE WEST.

In order that we may handle our rapidly growing business most advantageously, we have just opened our Western offices, Suite 1945, Commercial National Bank Building, Chicago, under management of Mr. Charles A. Dickens, assisted by Mr. Edw. W. Turk.

Municipal Engineering's friends and patrons are cordially invited to make these offices their headquarters while in Chicago. Stenographer and two unlimited service 'phones (Randolph 4652 and 1815) are at their disposal.

We maintain a competent and skilled corps of artists and assistants at our

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Our Western advertising manager, Mr. Dickens, is a grand nephew of the noted author, and has attained an unusual success as an editorial and advertising writer. He has been connected with several leading publications, and during the past seven years, prior to his present connection with Municipal Engineering, was Western manager of the *Boot and Shoe Recorder*, of Boston.

THE QUESTION DEPARTMENT

Articles and Books on Cost of Sewers and Their Engineering.

Kindly advise me where I can find a book on costs of sewer construction, more particularly what per cent. of total cost goes into engineer on sewer construction in various state. T., ———, Mass.

Books which have more or less information on cost of sewers and a little incidental information about cost of engineering thereon are Folwell's "Sewerage ($3) ; the latest edition of Trautwine's "Engineers' Pocket Book" ($5) ; Gillette and Hill's "Concrete Construction Methods and Costs" ($5) ; Gillette's "Handbook of Cost Data for Contractors and Engineers" ($5) ; Ogden's "Sewer Construction" ($3) ; Staley & Pierson's "Separate System of Sewerage" ($3) ; Kirkhoffers "Diagram for Estimate of Pipe Sewers" (25 cents) ; "Handbook for Cement Users" ($3).

Following is a list of articles in recent numbers of MUNICIPAL ENGINEERING which give much information, particularly as to individual projects:

"An Automatic Sewage Pumping Station," xl, 228 ; "The Mill Creek Intercepting Sewer at Erie, Pa.," xxxix, 176 ; "Exposed Sewers at Leavenworth, Kan.," xxxix, 347 ; "Cost of Pipe Sewers," xxxviii, 39 ; "Early History of Sewers of Memphis, Tenn," xxxvii, 232, giving mileage, cost and percentage cost of engineering each year for about twenty years ; "Number of Brick in Sewers," xxxvii, 335, giving data for computation of cost of brick sewers ; "Prices of Paving and Sewer Work," xxxvii, 326 ; "Sewer Plans and Prices," xxxvii, 398 ; "Concrete Sewer Construction in Chicago," xxxvi, 21 ; "Methods of Sewer Construction in Clinton, Iowa," xxxvi, 300, giving cost per foot of sewers of various sizes ; "Methods and Cost of Constructing Concrete Sewer," xxxv, 71 ; "Sewer Trenching in Wet Sand," xxxv, 143 ; Trench Digging." xxxiv, 97, with references to other earlier articles ; "A Concrete Sewer in South Bend, Ind." xxxll, 190 ; "Cost of Concrete Sewers," xxxi, 20, giving references to a number of earlier articles on this subject ; "Notes on Sewer Design," xxx, 329. There are numerous articles in earlier numbers which can be listed if desired.

So far as cost of engineering is concerned, the list of articles given in the June number, vol. xlii, p. 470, will give much information. Some of these articles give schedules of fees and some of them give figures of actual cost of municipal engineering. The schedules of fees are made in the hope that they will be used, but there are many engineers in need of business who will accept less. The best method of procedure for a city is to select an engineer with reference to his competency first and treat the matter of fees as a secondary consideration. The chances are very great that satisfactory results will not be obtained by opening an engagement for performing an engineering service to competition, and it is seldom that competent men can be obtained at low prices.

Best Material for Village Streets.

To the list of good materials for village streets, given in the June number, vol. xlii, p. 470, may be added Warrenite, Bitulithic, and Bitustone Double Bond, varieties of bituminous pavements of different costs, which have shown their value for the purpose desired.

Automobile Ordinance.

As city attorney of this city, I have been asked to draft an anti-muffler ordinance to apply to automobiles and motorcycles. This is a place of about 3,000 people, and if you can send me a copy of such an ordinance now in use in any city of about this size it will help me out some.
M. C., ——, Iowa.

No ordinance for so small a city is at hand. The following should be applicable, altho the city is much larger than 3,000 population:

It shall be unlawful for any owner or operator of any automobile or other motor vehicle to maintain or use any searchlight or blinding light on said automobile or other motor vehicle using any of the streets, avenues, alleys or public places within the corporate limits of the city, provided that nothing herein contained shall apply to any automobile used by the police for the city when in the performance of their duties. Any person violating the provisions of this section shall upon conviction thereof be fined in any sum not exceeding $20.

tI shall be unlawful for any person, firm or corporation to leave standing in a public street, alley or highway within the limits of the city from one-half hour after sunset to one-half hour after sunrise, any automobile, motor vehicle or other conveyance, carriage, wagon, engine or machine, the motor power of which shall be electricity, steam, gasoline, or any source of energy other than human or animal power, unless there shall be kept burning on the front of said vehicle at least one white light visible for a distance of not less than 200 feet, and on the rear of said vehicle at least one red light visible for a distance of not less than 200 feet.

No person, driver, or operator, in charge of any automobile or motor vehicle, described in the preceding section shall permit the machinery of said vehicle to run while such vehicle is standing in any street, alley or public highway within said city without an attendant for a longer period of time than 5 minutes at any one time.

No person, firm or corporation shall use upon the streets, alleys or public highways of the city any automobile, motor vehicle, other conveyance, carriage, wagon, engine or machine, the motor power of which shall be steam, gas or gasoline, or any like source of energy, unless such vehicle shall be equipped with a sufficient modern and improved muffler to prevent noise from the exhaust of the engine or engines of such vehicle, and said muffler shall be kept and remain closed by the person operating or in charge of such vehicle at all times when such vehicle is in motion.

Any person, firm or corporation violating any of the provisions of this ordinance shall upon conviction, be fined not less than $1 or more than $100, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a second conviction for such offense, said person, firm or corporation shall be fined not less than $25 to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a third conviction for such offense said person, firm or corporation shall be fined not less than $50, to which shall be added imprisonment for a period of not less than 30 days in the county jail or workhouse.

The city ordinances also have provisions regulating speed, licenses of vehicles and of drivers thereof, and limiting ages of persons who can drive automobiles.

Legal Notice to Property Owners to Build Sidewalks.

If we remember correctly, you at one time published an account of a decision rendered by some court about preparing a special assessment for concrete sidewalks that the property owner was not given forty days of god weather in which to build his walk before the city took it in hand. What we would like to know is, does the city have to give the property owner forty days of good weather in which to build his own walk, according to specifications, before the city can stop him from putting it in after they have started to draft the ordinance?

L., ———, Illinois.

The Illinois statute governing the matter, Hurd's Revised Statutes, 1908, part of Sec. 292, provides: "Said ordinance may require all owners of lots or parcels of land touching the line of said proposed sidewalk to construct a sidewalk in front of their respective lots or parcels of land in accordance with the specifications of said ordinance, within 30 days after the mailing of notice of the passage of such ordinance, addressed to the party who paid the last general taxes on the respective lots or parcels; and in default thereof, said city, village or town may furnish the materials and construct said sidewalk in accordance with said ordinance, or may enter into a contract," etc.

This seems to leave the detail to the ordinance passed by the city council, and if that provides for 40 working days then it must be given, otherwise, only the 30 days provided for in the statute would seem to be necessary.

Cost of Bituminous Macadam Roads.

Have you any information regarding bituminous macadam roads constructed in Ohio, Indiana, Illinois or Kentucky, which are in good condition regardless of the material used in building; also have you any cost data in connection with same?

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Illinois reports no bituminous macadam roads up to 1910. There were at that time but 48.75 miles of bituminous macadam roads in Indiana, 35 of which are reported from Ohio County, on the Ohio River, which has but 65 miles of improved roads in all and no railroad, and 1.75 miles from the adjoining county. The other 12 miles is reported by Miami County. No figures of cost are given and there is no report of their condition. Kentucky has but 1.7 miles of bituminous macadam road in one county, Boyd, which cost about $5,000 a mile, the treatment being with 2 gallons of oil per square yard. Ohio reports but few miles of bituminous macadam roads, not more than 20, in four counties. These are of better quality, the cost averaging $5,000 in one county, $8,000 in two counties and $10,300 in one county. These figures do not include the experimental road at Columbus. Some of there roads are now more than eight years old, and their present condition is not reported, but is dependent almost entirely on the care which has been taken with their maintenance.

Damages for Changing Street Grade.

Will you please give me some information thru the "Question Department" of MUNICIPAL ENGINEERING, on the following subject?

When a city changes the grade of a street, either by lowering or raising the surface of the street, what rights has an abutting property owner, as long as the city authorities do not encroach on his property? This city is threatened by a law suit by several property owners who claim that the changing of street grade has damaged their property. Please give me the opinions of the courts in similar cases. Has this case ever been tried in the state of Tennessee? If so, where and with what result?

M., City Engineer, ——, Tenn.

It will first be necessary to define the meaning of changing a street grade. Sometimes the changing of the level of the street in the process of improving it is called changing the grade and, practically speaking, this is a correct use of the term. Such change is not ordinarily subject to the question of damages on account of making the change, because the changes are made for the general benefit and it is seldom that any property owner affected is allowed damages.

From the legal point of view the term "change of grade" may be restricted to the following process. The municipality adopts a grade for a street, which may be entirely upon paper, no improvement being made to make the grade effective, or the improvement may be made so that the street is made to conform to this established grade. A property owner may construct a building or a drainage system or any other improvement in conformity with such established grade, whether actually constructed or not. Later, for some reason, especially if the street has not been actually graded, the municipality may desire to change the grade. In such cases there is an opportunity for damage, even if no construction has been made by municipality or property owner and the question of responsibility for such damage arises. There is no fixed rule as to this, the circumstances of the case determining the amount of damages and the responsibility for them. Ordinarily the establishment of a grade justifies a presumption that damage may result from a change in the grade, but the damage must be proved.

The right of a city to change a grade under the first definition thereof given above is affirmed in Morris et al. v. City of Indianapolis, et al. (Ind.), 94 N. E. 705, quoted in MUNICIPAL ENGINEERING, vol. xli, p. 55.

In California the statute requires a petition of a majority of the property owners to give authority for a change of grade. Wilcox v. Engebretson, et al. (Cal.), 116 P. R. 750, quoted in vol. xli, p. 463.

Damages from change of grade arise only from negligent doing of the work. In the particular case a heavy fill was deemed to require a retaining wall to prevent direct damage to the property from the physical act of filling and the cost of a retaining wall was relevant to the inquiry as to damage. Harper v. Town of Lenoir (N. C.), 68 S. E. 228, quoted in vol. xxxix, p. 216.

In an Iowa case, Meardon v. Iowa City, 126 N. W. 939, it is said that the benefits must be considered with the disadvantages in determining the measure of damages from a change of grade. Quoted in vol. xxxix, p. 217.

Non-abutting property owner has heavy burden to prove damages from change of grade and they must be proximate, immediate and substantial. Ogontz Ave. Case, 225 Pa. Supreme Court 129, quoted in vol. xxxviii, p. 52.

In New Jersey damages for change of street grade after erection of building thereon must be limited to the damage to the building only, and not to the entire property. Delaware, L. & W. R. Co. v. City of Summit, 72 A. 83, quoted in vol. xxxvii, p. 117.

An ordinance is required to change the grade of a street which has been established by ordinance. Powel v. City of Excelsior Springs (Mo.), 120 S. W. 106, quoted in vol. xxxvii, p. 337.

In a Minnesota case, Olson v. City of Albert Lea, 119 N. W. 794, the property owner was deemed not entitled to formal notice of expense to adjust his property to the new street resulting from a change of grade. Quoted in vol. xxxvii, p. 44.

In a Missouri case, McGrath v. City of St. Louis, 114 S. W. 611, the property owner was deemed not entitled to formal notice of lowering of alley grade and seems to have been required to support his own building, whose foundations were affected by the excavation of the alley. Quoted in vol. xxxvii, p. 191.

In vol. xxxvi, p. 44, are quoted two decisions, one in Bernhard v. City of Rochester, New York Sup. Ct., to the effect that the legislature has power to compel compensation for damages from changing the grade of a city street; and one in City of Akron v. Huber, Ohio Sup. Ct., that the city is not liable for damages from a reasonable change of grade where no grade had been established prior to the improvement of the property. On p. 121 is a quotation from the decision in District of Columbia v. Atchison, 31 App. D. C. 250, to the effect that the city is not liable for consequential damages caused by change of grade unless the work was done in a negligent manner, in which case it would be liable for the damages caused by its negligence only. On p. 186 is the statement, from the decision in Dorsey v. Town of Henderson (N C.), 62 S. E. 547, that courts cannot go into the question of the advisability of the change of grade, the municipal authorities being the sole judges thereof. On p. 322 is a decision against a subsequent assessment of benefits for improvement from change of grade where special benefits to lots from the regrade were offset against damages in the original proceedings. Schuchard v. City of Seattle (Wash.), 97 P. 1106.

Change of grade cases in Indiana are cited in Thornton's "Law of Cities and Towns," p. 205.

Change of grade cases in New York are cited in the "Consolidated Laws of New York," under the Village Law and also under the Cities Law.

The writer knows of no Tennessee decision on the subject.

Law Governing Assessments for Street Improvements in New York Villages.

This village is a municipal corporation doing business as such, in accordance with the provisions of a special charter granted in 1893 by the state of New York. There is also the Village Law, being chapter 64 of the Consolidated Laws of the State of New York, which applies to villages having special charters, insofar as the provisions of the same do not conflict with the provisions of our special charter.

The village desires to permanently improve some of its streets by the construction of pavements of stone, brick or macadam. This improvement will involve the expenditure of so large an amount, as to require the issue of the bonds of the village. It is desired to compel property owners adjoining the proposed improved streets to pay a portion of the expense of the improvement by special assessment and tax.

The special charter of the village contains no provisions in regard to a special assessment against adjoining property owners for such an improvement, the only reference to such improvement, so far as I observe, being contained in section 2 of Title VIII, which provides "expense of paving," etc., shall be paid out of the fund raised for highway and street purposes, which is the small annual fund raised for maintenance and repair of all the streets in the village. Section 166 of the Village Law provides, however, a scheme for the paving of village streets and for the assessment of a tax for a portion of the expense of the improvement upon the adjoining property owners.

The principal question to be determined is, whether the village can proceed under the provisions of section 166 of the Village Law, and assess a portion of the expense of the improvement upon the adjoining property owners, and the balance upon the village as a whole. Of course, it will be necessary for the purpose of construction to raise the entire amount immediately by an issue of the bonds of the village; but, in order that the bonds may be sold in the market, it is also necessary that every step of the proceedings leading up to their issue be legal and valid. In this connection, it will probably be necessary to take into consideration the provisions of the General Municipal Law, being chapter 24 of the Consolidated Laws of the State of New York, and the General Construction Law, being chapter 22 of the Consolidated Laws of the State of New York.

F., Village Attorney,
———, N. Y.

This is a question which can be decided authoritatively only by an attorney or official versed in the practice under the improvement laws of the State of New York. For one not expert in such practice, the only answer is the pointing out of the provisions of the laws.

It would seem that under the constitutional provision in New York State, villages incorporated after 1874 were subject to the General Incorporation Act referred to in the question. If incorporated before that date, the town has the privilege of choosing whether it shall operate under its special charter or under the general charter.

The special charter referred to, which assumed its present form in 1893, gives the village authorities no opportunity to expend more than the $2,400 named in it for all street purposes. Streets could be improved by resolution for extraordinary expenditures, which must be submitted to the people. They can also be improved as highways, the board of trustees of the village having the same powers as commissioners of highways in the towns (townships) of the county. Property owners are required to lay sidewalks and curbs, or the board can do this at the property owners' expense on their failure to comply with notice so to do.

If the village elects to act under the general Village Law, the steps of procedure for making street improvements are fully set forth in the law.

It would seem to the outsider that the village could not act under both its special charter and the Village Law, but must choose which it shall follow. The general Village Law makes street improvement comparatively easy, while the special charter makes almost no provision for such improvements, and the provisions of the Village Law lay down quite different methods of inaugurating and carrying thru paving proceedings, as well as different methods of providing for the raising of funds and ultimate payment of assessments and bonds.

Ordinances Governing Operation of Interurban Cars.

Have you any interurban ordinance in print covering the feature of weight on a bridge or limiting the number of cars in a train?

We are also interested in a joint trackage feature of an ordinance.

R. C. H., City Attorney, ———, Ill.

Each interurban or street railway company in Dayton, O., has a different franchise. A provision in one of the street railway franchises touches two of the points mentioned. It reads as follows:

In the event said Peoples Railway Co. makes any traffic arrangement or contract with an interurban or other street railway company or railway company operating cars weighing 15 tons and upward to use its tracks crossing the canal bridge on Valley street, the said Peoples Railway Co. shall remove the present bridge at said point and construct another bridge of the full width of the street sufficiently strong to carry the cars to be operated across it, and the Board of City Affairs shall ...... designate the character, strength and style of the new bridge.

Some of the interurban railway franchises have similar provisions regarding the bridges they wished to use, with the further provision that they shall pay two-fifths of the cost of maintenance of the floor of the bridge.

Dayton has a number of long bridges over its river and several of the street railway franchises have provisions that when the city decides to rebuild the bridges named in the franchises the company shall pay one-third of the cost, and shall also pay one-third of the cost of repairs of the bridges, whether old or new.

The city of Logansport, Ind., provides in one interurban franchise that the bridges crossed shall be strengthened by the company according to plans and specifications prepared by the city engineer. Another franchise requires the company to build independent bridges alongside the city's bridges, this being possible at the particular locations named in the ordinance because of the lack of either public or private improvements of a permanent nature.

As regards joint trackage the following provision in the franchise of the Indianapolis Street Railway Company will be of interest:

And the said party of the second part also agrees and binds itself, its successors and assigns, that it will permit the use of its track or tracks by any incorporated suburban or interurban railroad company authorized by the said act of March 3, 1899, from the corporate limits, or from the nearest connecting point within the corporate limits of said City of Indianapolis to some central point in such city for the purpose of discharging and receiving passengers, with the right of such company to run its cars thereon to some loop and return thereon out of said city whenever such use has been permitted by the Board of Public Works and Common Council of said city, by contract approved by ordinance, and the right is hereby reserved to the said Board of Public Works and Common Council to establish such central point where such passengers shall be received and discharged, and to designate the track, or tracks, to be used by said suburban or interurban railroad company in going to and from such central point, so to be established as aforesaid in such city. That such use of the said track or tracks shall be upon such conditions and under such regulations as the Board of Public Works and the Common Council of such city shall prescribe, and the terms as to compensation and the question as to the furnishing of power and the maintenance of service shall be determined in conformity to the provisions of Sec. 2 of the act entitled, "An act concerning street railroad companies in cities, the population of which exceeds 100,000," hereinbefore referred to. Provided, That nothing herein contained shall be so construed as to in anywise abridge or restrict the powers now had and held by said Board of Public Works and Common Council to exercise jurisdiction over the streets, alleys, avenues or bridges of said city, or to exercise its power to contract with other companies or corporations concerning the occupation or use of the same.

This provision was later extended in a franchise to the Indianapolis Traction and Terminal Company, the lessee of the above company, to include the use of terminal station erected by the new company providing that

Said passenger terminal shall be accessible to any suburban or interurban railway company directly or by the lines hereinbefore provided to be constructed from the line which said company shall be permitted by the Board of Public Works and Common Council of said city to use in going to and from its central point and terminal in said city, and to permit said terminal to be used by said suburban or interurban railway company for all of the purposes of passenger traffic for which the same may be permitted to be used by the Board of Public Works and Common Council of said city, under such reasonable regulations as may be prescribed by said Traction Company, without discrimination in favor of or against or among or between any of said companies, and for such compensation as shall be agreed upon, or upon failure of agreement, as shall be fixed in the manner prescribed in said act of the General Assembly of March 3, 1899, for fixing compensation to be paid by such suburban and interurban railway companies for the use of the tracks of the Traction Company. The right to such use by any suburban or interurban company shall be upon condition that the compensation for such use, agreed upon or fixed by the court, shall be paid as and when it becomes due and payable, and that such reasonable rules and regulations shall be conformed to, and that for failure to so pay, or to conform to such rules and regulations, and so long as such failure shall continue, the suburban or interurban company so failing may be excluded from such use.

Each interurban company's franchise contains the following provision:

And it is also agreed and understood that the said company shall not permit to be used or operated on its said line within said city any car or cars by any other person or corporation, without the consent of the Board of Public Works entered upon the records of such Board, and until after terms for compensation for such use have been agreed upon with said Indianapolis Street Railway Company and the Indianapolis Traction and Terminal Company, or fixed as provided by law. It is further agreed and understood that the right to use the tracks of said Indianapolis Street Railway Company and the Indianapolis Traction and Terminal Company, hereby granted, is subject to the payment by said company, to said railway companies, respectively, of compensation for such use as fixed by agreement or judgment of the proper court, as and when such compensation shall become due and payable, and that in default of such payment, and so long as such default shall continue, said railway companies, or either of them, shall have the right to exclude said company from such use.

The Board of Public Works reserves the right to approve of routing of cars, or, in case of necessity, to fix such routes.

The writer is not familiar with any provision regarding limiting the number of cars in a train. The practical operation of cars around the sharp curves at street corners in municipalities precludes the use of more than three cars in a train ordinarily, and makes the use of more than two cars very difficult, and is not economical of time or power.

Cities Having Police Station Buildings.

Our city is about to build a police station and we would be pleased to get from you if possible a list of the smaller cities which recently built them so we may look them over, where it is practical to do so.

W., Secretary Police and Fire Com.,
———, Mich.

The following cities of 25,000 to 50,000 population have recently increased their investments in police departments from \$5,000 to \$100,000, much of which is for new station buildings:

Mobile and Montgomery, Ala.; Sacramento, Cal.; New Britain, Conn.; Jacksonville, Fla.; East St. Louis, Rockford and Springfield, Ill.; South Bend, Ind.; Davenport, Iowa; Malden and Newton, Mass.; Joplin, Mo.; South Omaha, Neb.; Atlantic City and Bayonne, N. J.; Oklahoma City, Okla.; Allentown, McKeesport and York, Pa.; Chattanooga, Tenn.; Spokane, Wash.

Testing Water Pipes by Compressed Air.

I would like to receive information as to whether there is any practical method of testing newly laid water mains before covering up by means of compressed air. The idea would be to cap the last pipe laid by a special cap which has provision for attaching the connection from the compressed air, also a connection for attaching the gage.

L., City Engineer, ———, Can.

Can our readers give any instructions from their own experience? Air-tight caps, properly clamped to the ends of the section of pipe to be tested are readily constructed, with taps for attachment of air pipes. Indeed, it should be possible to use the same apparatus which is now used for testing lines of pipe by water pressure. Coffin's specifications for testing gates and suction mains by air pressure applied by an air pump, the trench being filled with water enough to cover the pipe, are given in Goodell's "Water Works for Cities and Towns," (\$3). The same method, used by A. L. Holmes in testing leakage, is described in an article on "Submerged Pipe," in MUNICIPAL ENGINEERING, vol. xxiii, p. 275, and is suggested for a particular case in vol. xxviii, p. 384.

FROM WORKERS IN THE FIELD

Binder Course for Asphalt Pavement.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In a recent issue of a certain prominent trade publication, it was stated, with reference to sheet asphalt construction, that the binder course is a useless and absurd expense, its only purpose being to hold the wearing surface in firm contact with the foundation to prevent undue movement and that the recent practice in the West and Canda having a tendency to omit the binder course was a step in the right direction.

White it is, as stated, the purpose of the binder course to prevent movement in the wearing surface, it has another and very valuable mission also. It prevents moisture from attacking the wearing surface from beneath.

It is true that the now almost obsolete "open binder" was of very little advantage in this respect, but with the modern practice of employing a dense binder containing a minimum of voids and which is, in itself, practically a wearing surface, the deleterious action of moisture from beneath is eliminated to a very large extent. Even when the subgrade is properly and thoroughly drained-concrete foundations will exude a moisture under certain atmospheric conditions and around man holes and along car tracks, headers and gutters the opportunity for moisture to get beneath the wearing surface is great. Where no binder is employed, all these liquids as well as that still more injurious solvent, illuminating gas, have easy access to the upper surface. Therefore, the decided advantage of a properly constructed binder course can be readily appreciated.

That the use of a dense binder will materially increase the stability of a sheet asphalt pavement cannot be disputed. The writer cannot recall a single instance where the wearing surface has noticeably shoved when supported by a dense binder, but on the ocntrary, a great many instances have come under his observation where excessive shoving has taken place where the surface mixture was laid directly upon the concrete foundation. Where the concrete is left rough the tendency to shove is materially lessened, but not entirely eliminated.

There are, undoubtedly, instances where the binder course can be omitted without material damage to the pavement, but these instances, unless a paint coat is employed, are the exceptions rather than the rule, and to eliminate the binder course from sheet asphalt construction, generally, would be a serious mistake.

The same article stated further with reference to the wearing surface, that too much bitumen was just as bad in the surface mixture as too little. Experience has demonstrated that an insufficient amount of bitumen is a real detriment, frequently causing the asphalt pavement to crack and disintegrate in a very short time. An excess of bitumen, on the contrary, usually results advantageously. While it produces a pavement which may mark excessively from the standing traffic during the first or second summer, it undoubtedly adds a number of years to the ultimate life of the pavement.

ISAAC VAN TRUMP,
Asphalt Chemist, Chicago, Ill.

The Effect of Creosote Oil on Bituminous Fillers for Creosoted Wood Block.

To the Editor of MUNICIPAL ENGINEERING:

Sir.—With a view of ascertaining the effect of adding creosote oil to bituminous fillers for creosoted wood block a series of experiments was made by taking various bituminous fillers and after taking the melting point of the original material and the penetration at 77 degrees Fahrenheit, 5 per cent. and 10 per cent. creosote oil was added. The melting points and penetrations were again taken and the results obtained as shown in the table below.

These tests indicate that a higher melting point should be required of fillers for creosoted block than for brick and also that a filler of lower penetration at 77 degrees Farenheit can be used with creosoted block than with brick since the creosote oil acts in a manner as a flux, softening the filler and lowering the melting point. It will also be seen from the table that some materials are very much more affected than others, and for this reason it might be good policy to require in a filler specification that the melting point shall not be less than a certain number of degrees, depending on climatic and other conditions, after say 5 per cent. or

10 per cent. creosote oil has been added to it.

The method used for taking the melting point was that recommended by the American Society of Civil Engineers.

TABLE SHOWING THE EFFECT OF ADDING CREOSOTE OIL TO BITUMINOUS FILLERS.

Designation. Penetration at 77 Degrees F.	Melting Point. 5 Pct.	Creosote. 10 Pct. Creosote.	Melt-ing Point	Penetra-tion at 77 Degrees F.	Melt-ing Point	Penetra-tion at 77 Degrees F.
A ...	25	142	138	..	122	..
B ...	20	168	149	34	138	53
C ...	14	152	136	26.5	126	42
D ...	28	170	168	42	159	54
E ...	30	292	292	31	266	33
F ...	35	167	140	57	122	112
G ...	30	198	187	38	172	52
H ...	33	169	150	52	136	98
I	28.5	190	188	38	168	52
J	20	211	204	23	188	32
K ...	30	273	234	33	210	36

A B and C are tars.

D, E, F, G, H, I, J and K are asphaltic materials.

HENRY H. MILBURN,
Chemist, Testing Laboratory, Engineering Department, City of Omaha.

Concrete Roads—What They Cost.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The American people will not stand for misrepresentation. It matters not whether it be ignorantly or purposely perpetrated. Tho oftentimes indulged in for the purpose of gain, it will not secure in the long run any benefit to those who indulge in the use of it; but it is the duty, nevertheless, of every patriotic citizen to refute, to deny, and to put truth in the place of falsehood wherever and whenever opportunity occurs, where and when, at least, the citizens' interests are in any way affected. If falsehood and misrepresentation are allowed to pass unchallenged it often happens that persons innocently but carelessly help to distribute misinformation who would not knowingly be guilty of such an oense.

I have heard reputable public speakers assert that they could build a concrete road for $3,500 a mile. In an article in the *Cleveland Motorist,* April 19, Mr. D. S. Humphrey is made to say, in speaking of the concrete roads out of Detroit, that they are being constructed at about $8,000 a mile as against $15,000 to $16,000 a mile for vitrified brick roads.

We have before us the third annual report of the Wayne County Road Commissioners for 1909. In that report the commissioners say they constructed one mile of Woodward road, exactly 5,280 ft. in length, with a concrete width of 18 ft. and 6½ in. deep at a cost of $13,537.59.

In addition to the actual charges in the cost of this road we note in the same article the statement of the commissioners, namely, "Your commisisoners have exercised a close supervision of the work as it progressed, beout and over the road daily."

We notice also that the general engineering expenses of the board foot up	$4,612.38
We note again that there were charged off as worn out discarded and depreciated of tools, equipment, etc.	70.53
Depreciation of same...........	3,850.88
Items of expenditure in advertising, salaries, blue prints, etc....	3,496.89
Total of miscellaneous expenditure	$12,030.68
The report shows a present investment in equipment, machinery, etc., of	$21,821.71

The road commissioners doing this work for the county have expended these sums in the execution of their road building work, which represent, in a way, the overhead contractor's expenses, and which would be in case of a contractor doing the work, included in his contract price.

Unquestionably, therefore, a certain portion of this equipment of $21,821.71 and a certain portion of the miscellaneous expenditure of $12,030,66 must be fairly chargeable to the construction of the mile of road which appears to cost as per items directly charged in the report as stated; to-wit, $13,537.59. Just how much one cannot say, but as the board's entire expenditure amounted to but little more than $300,000, a part of which was contract work, this 5,280 feet of concrete road must have shared in this miscellaneous expenditure.

The legitimate cost, therefore, is more than the actual charge of $13,537.59.

The fifth annual report of these same Wayne County Road Commissioners discloses the following as the cost per mile of concrete roads built by them during the current year, from October 1, 1910, to September 30, 1911.

Ft. road, 12 feet wide............	$10,592.74
Eureka road, 12 feet wide..........	9,354.92
Gratiot road, 16 feet wide..........	13,157.23
Grand River road, 16 feet wide...	17,824.89
Wayne Road, 15 feet wide........	10,112.12
Van Dyke Road, 15 feet wide......	14,467.45
Michigan Road, 18 feet wide......	17,288.03
Mt. Elliot Road..................	14,732.80

In this fifth annual report, as in the report of 1909, the overhead or miscellaneous expenditure which is a legitimate charge as a part of the cost of these roads, is as follows:

Office expense	$5,689.71
General engineering expense......	6,983.29
New contracting equipment.......	21,088.24
Total	$33,761.24

This amount if apportioned to each mile built by the commissioners will add to the cost of each mile, approximately, $1,700.

A careful examination of these Wayne county roads discloses clearly that the grading and preliminary preparation for the construction of these roads has required but a minimum expenditure.

Sometimes a misrepresentation or misinformation obtains wide circulation thru a semblance of truth. A name may carry with it the impression that it is a boy, when it is a girl.

If it is intended by the manipulation of the use of any word or words to deceive, it is a fraudulent act.

The intention of those interested in the sale of this pavement is to create the impression that it is cheap as compared with certain other forms of pavement. By such conduct superiority is recognized in pavements they oppose.

But aside from all this. Is this a cheap and economical pavement? It is, from figures shown, but little if any more economical in the first cost than other pavements of durable and permanent character.

At the very best, these roads cannot be regarded by any prudent man in any other light than experimental. The oldest of them have borne the wear of but two summers, now approaching the third. The one longest in use shows a greater erosion from wear in three years than hundreds of brick streets and roads that are properly built and in evidence, subject to much more severe traffic and covering a period of fifteen and more years.

A close inspection of conditions shows that the coarser aggregates in these roads are regularly being whipped out by the automobile traffic, so that the surface of the roads is full of little pits, from which the aggregates have been drawn.

This in truth and reality, considered in the light of the original cost of such roads, is going on at a rapid rate. The numerous cracks from expansion and contraction, unprotected from any additional wearing surface, widen and ravel out rapidly, the units of the aggregate being so small that they are readily whipped out or worn off.

If the cheapest possible protection to this surface is prepared and applied from any of the asphaltum or tar preparations, such as have been in use in the experiments made in Ann Arbor, Mich., it can be no more effective for the purpose of country highways than it is on the streets of that city. For it is a well known fact that the Ann Arbor streets are subject to very moderate use indeed; and yet this wearing coat on all of the Ann Arbor streets has practically disappeared during the winter, and it is conceded that it must be applied annually, and frequently repaired as well. So this protection is nothing more nor less than a case of annual repair, but which in the case of a country highway 18 feet in width could not possibly cost less than $528 per mile—a sum for annual repairs that no tax-paying community will stand.

Now this is exactly what the taxpaying public of Wayne County have got. This is what the taxpayers of any county in the Union will get in attempting to follow in their footsteps.

As compared with the cost and maintenance of a brick road, instead of the burden being lightened, it is made far more excessive and with a road much less effective for the purpose; as a brick road can be built in compliance with the directions for its construction as published by the National Paving Brick Manufacturers' Association, which will absolutely insure a road without any repairs whatever for a great many years to come.

The artificial wearing surface as recommended by these Wayne County Road Commissioners, is 7 inches deep, with a 1-1½-3 mix. Such a road will cost approximately as much as the most approved type of vitrified brick road, having a 4-inch concrete base of a 1-3-5 mix, a 2-inch sand cushion and a 4-inch wearing surface of brick, with the joints filled with a 1-1 mix, 10 inches deep in all.

The 2-inch sand cushion afforded, almost entirely prevents injury to the brick surface due to the cracking and rupture of the concrete in the foundation.

No one will pretend to question the superiority of the vitrified brick wearing surface, over that of the concrete, even if the action of the automobile should whip out some of the cement concrete from the joints, which is improbable, because of its strength and quality. There is no such thing as whipping out the brick units. To get the brick surface out of the way, it must wear out and that means the undetermined lapse of many years.

There is a certain infatuation to many people in experimentation, but the disposition to do so should not be indulged in except in a very limited way, at the expense of the taxpayer's money. Enough for the experiment is sufficient, but it is a bad proportion to experiment with all or even a considerable portion of what you have.

What the public demands of its officials is a careful and conservative expenditure of money in highway building, that which will afford the largest return for the dollar expended.

The vitrified brick roads are not an experiment. They are in no sense, whatever, theoretical. Hundreds and hundreds of miles of those properly constructed, subject to excessive use, have not called for repairs, covering a period of ten to twenty years, and those moderately well built have called for slight repairs. It is in the truth about and in the proof absolute, found in vitrified brick as a surface wearing material, that our challenge of superiority cannot be met by any other material.

Persons under the halo and surprise of something accomplished beyond their expectations, see in it something above and beyond the extraordinary.

The road commissioners of Wayne County, Michigan, have devloped very suddenly a great contrast in the roads that were, and the roads which they have built and are now. It is wonderful to them, but, with their vision, they are not competent to judge of the highest and best adaptation of highways for future use in this country.

We are in the midst of a revolution in the use of highways and this condition is supplemented and aggravated by a revolution of ideas in which are to be seen the wide extended advantages of the public highway to our civilization never before appreciated.

The roads must be built with the economy in the first instance, meeting all of the requirements of the coming transportation, yet with that durable quality without which every hope in this direction must fail.

In the light of what is possible and what has been accomplished, in the building of highways that so nearly eliminate maintenance charges, the Wayne County roads at their best, in their present condition, and in the promise they bear for future worth, are comparative failures.

The one foreboding aspect spectering the enthusiasm with which taxes are levied and bonds are issued, for the improvement of our streets and highways, is the wastefulness of money in the purchase of the roads that are not worth the cash paid for them and if greater caution and the utmost wisdom is not to be exercised henceforth, the source from which the money is being so bountifully supplied will dry up, the enthusiasm subside and road and street building will be greatly hindered and delayed, and in all probability, cease for a time.

It does not avail any information or benefit either to the public or engineers, to give any weight to the failures in any kind of road construction or road building, that will occur from time to time through ignorance or unskillful workmanship.

One of the Wayne County roads which was let by contract is a serious failure. Like results occur in the construction of other roads. It requires a certain amount of skill and especially requires disposition on the part of the contractor and his workmen to follow the instructions to build any road at its best.

In this discussion, however, we are not taking into consideration any exceptional failure. We are only looking to such roads as seem to be built at their best, which is the only way out of which a final and best conclusion can be reached.

WILL P. BLAIR,
Cleveland, O.

Monuments and Maps for Locating Water Mains and Appurtenances.

To the Editor of MUNICIPAL ENGINEERING:

Sir.—In regard to T. R. M.'s request on page 392 of the May number of MUNICIPAL ENGINEERING, in regard to maps for locating valves, dead ends, etc.

Draw a map of the town to scale. With streets 60 feet wide, 100 feet to the inch is large enough. On the map plat the pipe lines to scale, also locating the valves, etc. Indicate the water pipe lines in blue. Have some letter like V for valves, D E for dead ends, or simply E.

From any good permanent objects such as telephone poles, corners of buildings, block corner stakes, etc., take ties or perpendicular offsets and put the distances on the map.

If the town has permanent range points or lines from which to locate lots and blocks, the points make good references.

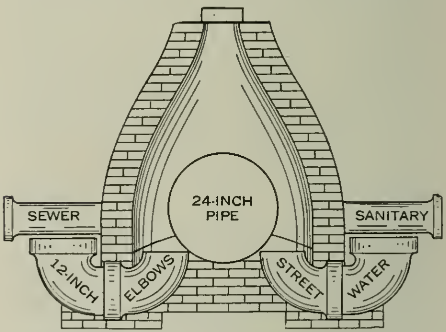
I herewith send a small sketch to show the meaning of my letter. The valves are in impossible places, possibly, but I merely wished to indicate the method. The scale of the plat is shown. The streets are 60 feet wide. Block corner stakes and fence posts are undesirable on account of possible destruction when buildings are erected. Corners of buildings are good if near enough. The water pipes are supposed to be parallel with the sides of the streets and on the sketch are 25 feet from the lot lines. Thinking this may help T. R. M., I herewith send to him through you.

W. A. PECK, C. E.
1643 Champa St., Denver, Colo.

Inlet to Sewer for Street Water.

To the Editor of MUNICIPAL ENGINEERING:

Sir.—I would like to have your opinion on the inclosed sketch. After going over the old style street catch basin, I formed this plan. I have about 25 of them in use, and they never have given me one minute's trouble or expense in two years. I never have



SEWER INLET FOR STREET WATER.

any dirt or trash to take out of them; they seem to be self-cleaning.

My sewer grade is 2 inches to 100 feet (24-inch pipe). The inclosed diagram is self-explaining. We have just bonded the city for $15,000 to extend our drain and sanitary sewer system.

C. E. HARRIS, C. E.
Apalachicola, Fla.

The plan for sewer inlet shown is apparently justified by its success. When sewers have sufficient grade and flow to permit the admission of street water directly without removal of such materials as would be collected in catch basins, the inlets should be trapped and so planned as to be as nearly self-cleaning as possible. There is more force to the water to keep the trap clean when the trap is at the bottom of the inlet pipe as shown, and the line will therefore keep itself cleaner under ordinary circumstances. On the other hand, it will be more difficult to reach the upper side of the trap to clean it in case a stick too long to get through the trap, obstructs the passage and causes the closure of the trap to the flow of water. A grating at the street level would reduce the chances for this, provided boys do not put such materials through the grating. If there is plenty of water running in the 24-inch pipe, say half full or thereabout, the sewage will have velocity sufficient to keep the sewer clean.

Beneficial Effect of Forests on Stream Flow.

That the forest cover of the White Mountains has a distinct and measurable effect upon the navigable streams which head in that region is the unequivocal and emphatic statement of the United States Geological Survey.

The report is based on the results of exhaustive investigations and specific field tests which have been carried on during the last year. The investigations are believed to solve definitely a problem that has long been a source of strenuous contention among scientists, and while these investigations have direct reference to the entire White Mountain area, they establish a principle which is of far wider application.

In the southern Appalachian Mountains tracts aggregating 1,962,800 acres have been certified to by the Geological Survey as affecting the navigability of streams by reason of the excessive erosion which follows deforestation in these areas. Owing to the geologic conditions in the White Mountains, no excessive erosion, according to the Survey geologists, can be shown to follow deforestation. Therefore the Survey carried forward its further investigation in the White Mountains along the lines of trying to show that deforestation and subsequent burning of the forest mulch results in a more rapid run-off and therefore tends to make unstable the flow of streams.

The hydrometric showing presented in the preliminary report covers results on two small, almost exactly similar drainage basins of about 5 square miles each, on the east branch of Pemigewasset River, one largely clothed with virgin timber and the other deforested and burned. The facts observed are so striking as to render the position of the Survey impregnable. Careful measurements of precipitation over the areas and of the run-off of the respective streams show that not only was the snow held better in the forested area, but that during a period of 17 days in April, including three extended storms, the run-off of the stream in the deforested area was a comparative flood—practically double that of the stream flowing thru the forested area. The run-off of Shoal Pond Brook (forested area) during three storms in April, 1912, was 6.48 inches. That of Burnt Brook (deforested area) during same storms was 12.87 inches.

In the Shoal Pond Brook basin (the forested area) the Survey established 7 rain gages and 20 snow gages and the engineers visited these continually during the winter on snowshoes, the snow being from 4 to 7 feet deep; in the adjoining Burnt Brook basin (the deforested area) it established 9 rain gages and 18 snow gages. On both streams hydrometric stations were established and the stream flow determined with a high degree of accuracy. The Survey report shows that the maximum flood from the forested basin was only 67 per cent. of that from the deforested basin.

During the period of these storms Burnt Brook (deforested) contributed a much greater volume of water to Pemigewasset River than did Shoal Pond Brook (forested). "The stream of the forested basin is observed to be the steadier of the two and in proportion to its drainage area it tends—at least during the spring months—to promote a steady flow of water in the master stream of which it is a tributary."

The conclusions of Director George Otis Smith, of the Survey, are as follows:

"The comparison between two adjacent basins during critical periods is presented in this preliminary statement as a sufficient showing for the purposes of the National Forest Reservation Commission. While data covering longer periods for both these and other basins in the White Mountains have been collected and will be available for the more complete report, the particular case of the Burnt Brook and Shoal Pond Brook basins is typical for the region and establishes the general conclusion that a direct relation exists between forest cover and stream regulation.

"The results of the Burnt Brook-Shoal Pond Brook studies are held to show that thruout the White Mountains the removal of forest growth must be expected to decrease the natural steadiness of dependent streams during the spring months at least."

Such an actual demonstration and quantitative measure of the performance of different areas, some forested and others deforested, has never been attempted in trying to determine the effect of forest cover on stream flow. Efforts to arrive at definite conclusions have always been based on a study of long-time records of precipitation and stream discharge; but owing to the many qualifying factors, such efforts have simply resulted in divergent opinions and inconclusive controversies. The results of the present actual measurements in these mimic drainage basins, so accurate and refined in method as to approach laboratory experiments, where exact results may be expected, leave no doubt as to the conclusion. Forest cover and the resulting forest mat in the White Mountain granite area does, to a considerable and measurable degree, steady and regulate stream flow, and therefore must be stated as an important factor in maintaining the navigability of streams whose headwaters lie in such areas.

MUNICIPAL MATTERS IN COURT

Water Service Connections.

In a decision rendered by the Supreme Court of the United States on April 1, 1912, a judgment, requiring a water company to make its own service connections, was affirmed.

In the case in question, the Consumers Water Company, of Coeur d'Alene, Idaho, had of its own free will and accord, and altho not required to do so by its franchise, laid a water main on Third street, an ungraded street of the village, now city of Coeur d'Alene. A citizen, Albert L. Hatch, erected a dwelling upon a lot situated on this street and laid a water pipe to the curb in front of his property. He then applied to the water company to connect the pipe at the curb line with its service main, so that a regular supply of water might be obtained. The water company, however, declined to make the desired connection, because of the refusal of Hatch to pay, as required by the regulations of the company, $8.50, the cost of making the connection, or to comply with alternative regulations adopted for the purpose of enabling the water company to recover such cost. An action in mandamus was then commenced in the Supreme Court of Idaho, and culminated in a judgment, in substance finding the regulations requiring a consumer to pay for service connections unreasonable, and ordering the water company to make the connection at its own cost, and to supply water to the premises of Hatch upon payment of the established monthly rate. This writ of error was then prosecuted upon the assumption that rights of the water company, protected by the constitution of the United States, had been wrongfully invaded.

The grounds for the claim in question were in substance that, as the water company was not required by its charter in express terms to make a service connection, and the benefits of such connection would inure solely to the house owner, to compel the water company to bear the cost of the connection would amount to a confiscation of its property, in violation of the due-process clause of the fourteenth amendment, and also would be to impair the obligation of its contract. A further claim of impairment of contract was based upon the contention that, as it was optional with the water company, under its franchise, to lay mains in ungraded streets, there was no duty to supply water from a main voluntarily placed in an ungraded street.

In the opinion of the Supreme Court, which was delivered by Chief Justice White, these contentions were held to be devoid of merit. The court held that it was the duty of the company, under its charter, to make the service connections for Hatch at its own cost. This was based upon the view that, as it was clearly settled by both the statute law and decisions at the time the charter was granted that it was the duty of the water company to make service connections; and its further duty being to supply water to consumers, by necessary implication the charter imposed the obligation to pay the cost of the service connection which it was incumbent upon the company to make; and that the fourteenth amendment had not been violated by the order of the Supreme Court of Idaho to that effect.

As respects the claim based upon the clause of the charter, which provided that the water company should not be "required" to extend its distributing system in any ungraded street or alley within the then village (now city) of Coeur d'Alene. It was held that there was nothing supporting the claim of impairment of contract, because the Supreme Court of Idaho was clearly right in deciding that no contract provision was impaired, since the water company had voluntarily laid its main in the ungraded street in question, and was supplying water from such main to residents on the street, and its duty was to supply water "without distinction of persons." Consumers Company, Ltd., Plff. in Err, v. Albert L. Hatch, 32 Supreme Court Reporter 465.

Decisions of the Higher Courts of Interest to Municipalities.

Assessing Cost of Cross Walks Against Corner Property Constitutes Fraud in Assessment.—A contractor was required by the city to give bond to observe the regulations adopted by the council in doing the work and the directions of the city engineer, among which was one that he would not construct a walk, unless through to the curb line. The engineer was forbidden from laying out the grades until the owners of corner lots agreed to construct and pay for the cross walks, the cost of which the city was not authorized by statute to impose upon the corner or other lots. Held, that the attempt to assess the cost of crosswalks against corner lots amounted to a fraud, which was ground for enjoining the levy of the assessment. Kagnor v. City of Cedar Falls et al. (Ia.) 135 N. W. R. 564.

A Declaratory Ordinance of Intention is Sufficient to Initiate Proceedings for Public Improvements.—A declaratory ordinance of intention of a city to construct a sewer between designated streets, along each of the alleys bisecting the numbered blocks, which provides that the improvement is for the exclusive use of the property abutting on and approximate to the streets and alleys designated, and which fixes the limits of the district by reference to such streets and alleys, and which provides that the cost will be assessed against the property benefited, is sufficient to initiate proceedings. Collins et al. v. City of Ellensburg et al. (Wash.) 122 P. R. 1010.

Requirements Prior to Tax for Public Improvements.—Where the mayor of a city constructing a sewer took charge of the construction work and called to his assistance a competent engineer, who did the work under the personal supervision of the mayor, who was constantly in direct supervision of it, and the engineer submitted a report of the completion and cost of the work to the mayor, who in turn verified the computation and submitted it to the municipal authorities as his own computation, and they accepted and approved of it and ordered the issuance of tax bills, there was a substantial compliance with the statute requiring an engineer or other officer to have charge of the work, who shall compute the whole cost thereof; the mayor being an officer in charge of the work. Gratz v. City of Kirkwood et al. (Mo.) 145 S. W. R. 870.

Tax Bills for Improvement Are Not Void on Ground of Exceeding Estimate.—Where the estimate of the cost of the construction of a sewer totaled in gross a specified sum, and the details thereof were of service only as specifications of the particular work to be done, and a bid for the work totaled a less sum, though the price of some of the items exceeded the estimate thereof, and the amount allowed the bidder obtaining the contract for the work was less than the bid, the special tax bills issued for the cost of the work were not void, on the ground that the cost of the work exceeded the estimate, within a statute providing that no contract shall be entered into for any work for a price exceeding the estimate; an "estimate" meaning a rough calculation. Gratz v. City of Kirkwood et al. (Mo.) 145 S. W. R. 870.

Bond to Secure Operation of a Public Service Plant is Liquidated Damages.—Under a municipal franchise to operate gas works in a city, which required grantee to give a bond for $5,000 to secure that the plant should be in operation within one year after granting of the franchise, providing that such sum should be considered liquidated damages, in a suit after abandonment of the franchise, brought on the bond given under such provision, that sum must be treated as liquidated damages, and not merely as a penalty. Grayson et al. v. City of Marshall (Tex.) 145 S. W. R. 1034.

Establishing and Locating Street Lights.—A provision in a municipal gas franchise that the grantee should, if directed by the city, install and maintain street lamps at such points as should be selected by the authorities at a specified rate, did not obligate the city to allow the grantee to furnish any number of lights; the matter of establishing and locating the lights being optional with the city. Grayson et al. v. City of Marshall (Tex.) 145 S. W. R. 1034.

Damages Due to Public Improvement.—The true measure of damages to a lot abutting on a street, occasioned by a change in the grade line of the street, is the difference between the value of the lot immediately before and its value immediately after the street improvement, less any special or peculiar benefits to the lot because of the improvement of the street, but leaving out of account such general benefits as accrue to it in common with other proper similarly situated. Rutherford v. City of Williamson (W. Va.) 74 S. E. R. 682.

Bitulithic is a "Kind of Pavement" as Distinguished from Sheet Asphalt.—A bitulithic pavement consisting of a stone foundation upon which rest layers of small stone coated with coal tar, pitch, asphalt, or a mixture thereof or other equivalent bituminous material, which pavement is patented, is a "kind of pavement," as distinguished from a sheet asphalt pavement, and not merely a different make, style, or brand of the same kind. Union Paving Co. et al. v. Board of Contract and Supplies of City of Schenectady et al., N. Y. S. 740.

Issuance of Permit for Sinking Shafts Does Not Render City Liable for Damages Due to Contractor.—The fact that a city issued permits for the sinking of shafts from the surface of the street along the line of an excavation, which it authorized a contractor to make, would not make the city liable for negligence of the contractor in constructing the excavation, whereby he broke into a water pipe; such shafts not having contributed to the breaking of the pipe. Von Lengerke et al. v. City of New York et al. (N. Y.) 134 N. Y. S. 832.

A Water Company Does Not Exhaust Right of Condemnation Upon One Case.—The right of a water company to condemn land is not exhausted by a single condemnation, where the condemnation of other land is necessary to supply the increasing need of the public. Burkhard et al. v. Pennsylvania Water Co. (Pa.) 82 A. R. 1120.

MOTOR VEHICLES

Motor Fire Apparatus in Indianapolis.

Beginning with the purchase of a motor squad car in January, 1911, automobile apparatus has steadily increased in favor with the Indianapolis Fire Department, until it is doubtful if any fire apparatus other than that which is motor propelled will be purchased in the future. The types of motor apparatus chosen up to the present time and the location of the different pieces in the various fire houses are to be commended, and not a little of the efficiency of the apparatus and its consequent favor with the department, is due to these factors. There are now seven pieces of automobile apparatus in service, including the chief's car, and of these, four machines are stationed at the department headquarters in the business district.

Squad car No. 1, shown at the left of the first photograph, was the pioneer of Indianapolis motor apparatus, and has been in service about 17 months. It is of the "auxiliary" or "flying squad" type of machine, which is so efficient in the more congested districts of cities. The chassis is the standard Packard "30," having instead of the seven passenger body, a special body with a driver's seat and two longitudinal seats at the sides with rails and running boards and a chemical tank mounted back of the driver's seat. The chemical tank is of the "soda and acid" type of 35 gallons capacity and with 250 feet of ¾-inch hose. The weight of the machine alone is 5,020 lbs., and with the six men who compose the squad in service the weight is slightly over 6,000 lbs. It is capable of making a speed of 60 miles an hour. During the time this apparatus has been in service it has covered effectively a wide range of territory, and ever since the addition of a second squad wagon it covers the business district, four miles to the north, three and one-half miles to the east and three miles to the west on first alarm. Of a total of 328 fire alarm boxes, Squad No. 1 answers 168 on first and 313 on second alarm.

An American La France combination hose and chemical apparatus is stationed at headquarters. It replaced a similar machine, which was moved into the residence district on May 14 of this year. It is a heavy machine, weighing about 9,500 lbs. when carrying the 7 seven men who compose the company. The engine is rated at 72 horse power. The frame and body are made particularly heavy to carry the equipment, consisting of a 40-gallon chemical tank, 200 feet of ¾-inch chemical hose, 900 feet of standard 2½-inch hose, hand extinguishers, tools and a squad of seven men. The front wheels have 38x4½-inch "airless" tires, that is, solid tires, having transverse cells to allow greater resiliency. The rear wheels are equipped with two each of the same size and kind of tire. The machine is chain driven, and has under test developed a speed of 60 miles an hour.

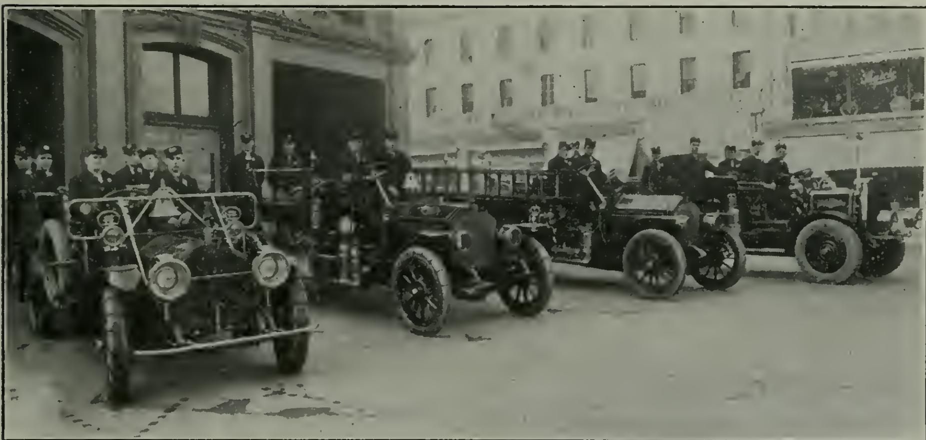
The third fire fighting machine stationed at headquarters is a Mais hook and ladder truck, shown in the second photograph. It is a stock chassis with special wheels and body. The motor, a four-cylinder standard make, is rated at 30 horse power, and can drive the truck at a speed of from 30 to 40 miles an hour. The truck has a number of special features worthy of note. Two rear axles are provided, one of which supports the weight of the truck while the other by means of an internal gear on the rear wheels, furnishes the driving power. The tires, as will be noted from the photograph, are very large (38-inch by 8-inch) pneumatics with irregularly surfaced treads. They are inflated to a pressure of 160 pounds per square inch. The weight of the truck complete is 7,450 pounds and with 6 men is 8,545 pounds. It carries the following equipment: One 35-ft. extension ladder with two 20-ft. sections; one 30-ft. extension ladder with two 17-ft. sections; one 20-ft. wall ladder; one 18-ft. wall ladder; one 15-ft. trussed ladder; one 12-ft. roof ladder with folding hooks; two fire hooks and holders; two perforated steel baskets and axes; two 6-gal. hand fire extinguishers; crowbars; plaster hooks; nozzle plugs; a 10-inch locomotive bell; one 9-inch revolving searchlight mounted on dash, and a large tool box.

The combination chemical and hose apparatus, which is shown next to squad wagon No. 1 in the first photograph, was on June 1st, moved to station No. 5, about a mile from headquarters, into the wealthier residence district. It is an American La-France machine similar to the one previously described, except for a few later improvements which have been added to the newer machine. Its equipment consists of a 35-gallon chemical tank, 250 feet of ¾-inch hose, 800 feet of 2½-inch hose, light tools and hand extinguishers.

In the extreme northern part of the city a new "bungalow" style firehouse, built to harmonize with the class of residences in that district, was constructed to house an American La France motor combination pumping engine and hose truck. The engine is of the same size as those on the combination chemical cars. It has a chain drive, and is capable of making the same speed, namely 60 miles an hour, when carrying the company and full equipment. A rotary impeller pump geared to the driving shaft is placed directly behind the driver's seat. This pump has delivered on test 500 gallons of water with a pressure at the engine of 190 pounds, practically the same as a third size steamer. It is provided with for the weight which is carried. The car weighs 5,200 pounds without the men.

The officials of the Board of Safety, the officers and men of the fire department, all express their entire satisfaction with the motor apparatus. Some even state that some regret is felt on account of the purchase of two horse-drawn steamers, simultaneously with the later motor apparatus. The speed with which the automobile pieces cover the ground brings them to the fire ahead of the horse-drawn apparatus, and often the chemicals can "knock down" an incipient blaze which with a few minutes' lost time, would require tons of water to extinguish.

The quick-moving motor pumping engine is stationed in a district which is built up with costly houses set at a great distance apart and served by hydrants which are seldom near, and in some cases there are only



MOTOR APPARATUS AT INDIANAPOLIS FIRE DEPARTMENT HEADQUARTERS.

two-way connections, so that two lines of hose can be attached. An automatic relief valve allows of the discharge pipes being suddenly closed without injury to the pump. The apparatus carries, in addition to the pump, equipment consisting of 1,000 feet of 2½-inch hose, a 20-foot extension ladder, a 10-foot scaling ladder, and two 4-gallon chemicals.

In the south business and wholesale district is the largest station in the city. It houses thirty men, with Assistant Chief Barrett, four pieces of horse-drawn apparatus and squad car No. 2. It has also a Packard stock 30-horsepower engine of the latest type, dual ignition, and dash adjustment on the carbureter. The equipment consists of a 35-gallon chemical tank, "soda and acid" type, 250 feet of chemical hose, hand extinguishers and light tools. A special frame and heavy spring system are provided wells and cisterns from which to draw water for fire fighting. The pressure maintained at these hydrants is usually adequate for service near at hand, but in cases where the hydrants are remote from the fire, the pumping engine can lay out a thousand or more feet of hose to their suction line and deliver water at fire pressure. This pumping engine covers a territory extending two miles south into the densely-settled residence district, about three miles to the west with an amusement park at its extremity, three miles to the east into the railroad, shop and factory districts, and a mile or more north into the sparsely settled residence section. It is the only practical equipment for work in this territory. It is, of course, reinforced by horse-drawn apparatus at a number of stations, but it gives excellent protection service to the portions covered. A minor feature which has been found to give excellent assistance on night runs is a searchlight controlled from the driver's seat. It enables the men to pick out house numbers and street signs when running on "still" alarms and provides assistance to the firemen in working at the scene of the fire. Finally in the case of large fires requiring several pumping engines, the motor pump and hose car can be first on the ground and have several lines of hose laid preparatory to the arrival of the other apparatus. Captain Blackwell is in command of the combination pumping engine and hose car.

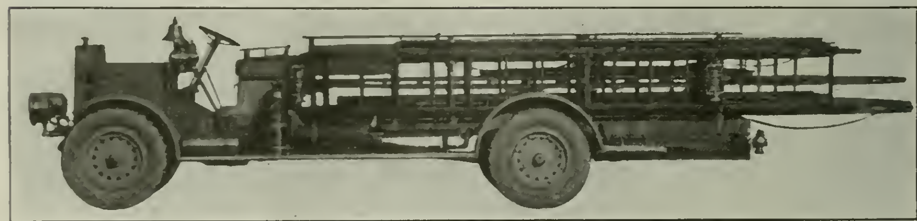
The two combination chemical and hose wagons are also well placed. The one which is at headquarters covers a comparatively narrow strip thru the business section and factory district and extending to Irvington on the east and Haughville on the west, the two being small suburbs connected by a few built-up streets to the city. The distances to these suburbs are three miles and five and one-half miles respectively. The second combination chemical is in the residence district and covers about 20 square miles, the most distant alarm box being something over four and one-half miles from the station The work which these two pieces of apparatus perform is to arrive on the scene of the fire before the blaze has gained much headway, in which case the chemical tank is effective. Failing in this, sufficient hose and a number of men capable of laying a number of hose lines are at hand for immediate service. In the case of a recent fire in the business section, which started in the rear of a large book and stationery store, the motor combination chemicals and squad-car chemicals extinguished a blaze which in a very short time would have gained such headway as to cause great water damage if not a serious conflagration. Captain Lowes and Captain Hoyle have charge of the two combination chemicals.

The fast Mais hook and ladder truck is able to reach a fire almost as soon as the motor hose wagons. This renders the ladders available for service in most cases, long before the arrival of the horse-drawn trucks. It has been found in actual service that the combination cars, and the squad apparatus cover about five times as much space in a given interval, as the horse-drawn equipment. The motor hook and ladder truck is four times as rapid on long runs as the horse-drawn ladder truck and can, moreover, cover a much greater territory. Captain Love is in charge of this machine.

The squad cars, a type of apparatus which has been developed by the use of the automobile, are, from the nature of their service, the most efficient of the motor equipment. Squad No. 2, which is stationed south of the business section and in the factory and warehouse district, covers 94 boxes on first alarm in this crowded section. The territory covered is about 3 miles by 4 miles, all among this same class of buildings, namely, factories, warehouses and crowded dwellings. In describing the work of squad No. 2, Captain Call mentions the following points in which their type of apparatus is efficient:

Small fires can, by reason of the quickness with which they arrive on the ground, be extinguished by the chemicals.

The men are available, in the case of larger fires, for detail to the other companies. Their training enables them to reinforce hose, steamer or aerial companies.



MAIS HOOK AND LADDER TRUCK.

At times when the squad car is not in service it is occasionally driven about over the territory which they cover and the men familiarize themselves with the location of all public hydrants, those hydrants connected with the private water supply of large manufacturing concerns, and the method of approaching and handling particular hazards. This feature makes for higher efficiency in the men and renders their service more prompt and sure.

Since the installation of squad car No. 2, in February, it has covered a total of 719 miles, which mileage is divided into runs to fires and the scout service, outlined above. Some idea of the comparative mileage is given from the following:

	Fires.	Miscellaneous.
February	38.3	50
March	19.3	57.1
April	16.5	70.9
May	22.8	53.8
Until June 15th	10.0	124.4

The higher mileage in June was due to

testing out the machine with some new improvements on the engine.

Squad car No. 1 has been the longest in service, having been located at headquarters since January 7, 1911. Captain Fulmer, who was put in charge of the car at that time, has been with it continuously since then. In addition to the points before noted wherein the squad car is valuable, Captain Fulmer mentions the ability to respond to an alarm immediately following a run; the perfect control of the machine which renders both the apparatus and other traffic more safe when making a run; and the lack of that sympathy for the horses which makes a driver hesitate to "crowd" them on long runs. Another service of the men on the squad car is to act as a supplementary company on large fires, gathering the few remaining sections of hose from a number of hose wagons to lay an additional or "bum" line to the fire.

Squad car No. 1 has made a total of 1,547 miles, divided as follows:

	Fire Mileage.	Miscellaneous.
Total 1911	751.9	260.8
Until June, 1912	423.8	100.5

The total cost of gasoline during 1911 was $37.60. For gasoline, oil, heavy and light, and alcohol for the radiator in cold weather, etc., the total cost averaged $4.23 per month. The cost item for tires has not been appreciable as one free replacement and some retreading has been the extent of the repairs of this class.

All the machines are well maintained, all of the minor repairs being made by the drivers. The effect of the motor apparatus upon the spirit of the men in charge, the knowledge that they can place perfect dependence on their machines, and the corresponding increase in the company efficiency are by no means the smallest items in favor of the motor appaartus. Automobile fire fighting machines have slowly and surely proved their worth to the Indianapolis department and it is doubtful if in future any horse-drawn apparatus will be purchased. The next addition to the department will probably be a chief's car and after that motor apparatus will replace each horse-drawn unit as it passes its period of usefulness or is disposed of.

Motor Garbage Trucks in Homestead, Pa.

After considerable investigation by the sanitary committee of the city council, the city of Homestead, Pa., purchased a five-ton motor truck for collecting garbage and hauling it to the disposal plant. The truck was delivered early in June, and after a day's preliminary trial it was put in service regularly.

It was found that, owing to the saving of time in going to and from the disposal plant, a more frequent and systematic collection could be made. The hill-climbing ability of the truck, taken with the greater capacity and speed, has made its superiority over the horse and wagon even more pronounced.

Additional Motor Apparatus for New York City.

With the purchase of two automobile hook and ladder trucks on June 18, the total number of pieces of motor fire apparatus in New York City was brought up to twelve. Under direction of Fire Commissioner Johnson, motor apparatus, and particularly the heavier fire fighting machines, are being given a thoro trial with the result that the city is replacing horse-drawn apparatus as fast as conditions warrant.

A Motor Road Oil Distributer.

To insure the best results from oil treatment, it has been found necessary that the upper surface of the roadbed be uniformly saturated with the oil; and one of the most satisfactory ways of accomplishing this is by means of the power-operated pump, which sprays the oil under pressure equally over the entire roadbed.

The first motor truck ever built in this country, equipped with this system of oil-spraying devices for road work, is shown in the photograph. It was made by the Knox Automobile Company, of Springfield, Mass., for the American Car Sprinkler Company, of Worcester, Mass., and has now been in service over a year.

MOTOR ROAD OIL DISTRIBUTER.

It is equipped with a tank holding about 1,200 gallons of oil, and has a powerful circulating pump driven directly from the transmission shaft, forcing the oil under pressure thru a series of small nozzles, so arranged as to secure a very uniform distribution. The pump can be readily thrown in or out of action instantly by the driver, and the nozzles also regulated without leaving the seat.

ORGANIZATIONS & INDIVIDUALS

The Convention of the American Water Works Association.

The thirty- second annual convention of the American Water Works Association was held in the Seelbach Hotel, Louisville, Ky., on June 3-8. The sessions were marked by a full attendance of members, guests and manufacturers' representatives. The registered attendance was 560, of which number about 250 were active members of the association. Dow R. Gwinn, of Terre Haute, Ind., first vice-president, presided in the absence of Alexander Milne, St. Catherines, Ont., president.

The first day of the convention was devoted to committee meetings, and a reception by the Engineers and Architects' Club of Louisville. The second day was divided into morning and evening sessions, with a visit to the Cherokee pumping station of the Louisville Water Company in the afternoon. In the morning session the following committees reported: Publication, standard specification, electrolysis, uniform accounts for water works, national department of health and permanent headquarters. At the evening session Edward Wegmann read a very interesting paper on "Ancient and Modern Water Works." This paper was illustrated by means of lantern slides, showing the famous aqueducts of the Romans and Greeks and other contemporaneous peoples. These works, the greatest of ancient times, were compared with the modern New York City system. William W. Brush also presented a paper, "Floor Area as a Basis for Estimating Consumption," which is given on page 25 of this issue.

The morning of the third day was devoted to discussion of a number of questions, which had been submitted for consideration, and to the election of officers. In the afternoon Captain H. G. H. Ton read a paper entitled "More Than Fifty Years of Reminiscence in Water Works," followed by a paper presented by a representative of I. M. de Varona on the Bureau of Water Supply of New York City. Elihu C. Church, who has charge of the purchasing department of the Board of Water Supply of New York, then discussed the general practice of the board in purchasing. He stated that the fundamental principles underlying purchasing are to get the correct goods in the proper quantities at the right price. He emphasized the need of using goods in rotation; i. e., in the order in which they were purchased, the value of proper storage and periodical inventory. Harrington Emerson then addressed the convention on "Efficiency Management," bringing out those factors with which the water works men were most concerned.

In the morning session of the third day, W. O. Beyer, of Pittsburgh, read a paper on "Turbine-Driven Centrifugal Pumps in Water Works Service," which is given on page 12 of this issue. In the discussion which followed, Mr. Chester, of Pittsburgh, and L. E. Strouthman, of the Allis-Chalmers Company, Milwaukee, questioned the conclusions of the paper on the grounds that, as uniform load conditions are assumed and uniform load conditions are rare in water works service, the turbine-driven pump is not adaptable to water works service. Following Mr. Beyer, Alexander Potter presented a paper on the details of a settling basin he designed for Muskogee, Okla., and M. L. Worrell described two stream crossings made at Rome, Ga. In the afternoon an inspection trip was made to the Crescent Hill filtration plant of the Louisville Water Company.

A session was held Friday morning, when several additional papers were presented and others read by title only. A number of papers prepared for the convention will be found on pages 12 to 32, inclusive, of this issue.

Dow R. Gwinn, president and manager of the Terre Haute (Ind.) Water Company, was elected president. The first to fourth vice-presidents elected were, respectively, Robert J. Thomas, of Lowell, Mass.; John A. Affleck, of Harrisburg, Pa.; George G. Earl, New Orleans, La., and Theodore A. Leisen, of Louisville. All of the officials mentioned were elected without contest, each being advanced one office higher than that held during the past year. Charles B. Henderson, of Davenport, Iowa, was elected fifth vice-president in a vote by the members. John M. Diven, of Troy, N. Y., was re-elected secretary-treasurer. Minneapolis was chosen as the next meeting place of the association.

The American Road Congress.

All the efforts that have been made in the last decade to give the United States a system of public roads equal to the one possessed by France will come to a focus in Atlantic City from September 30 to October 5, when the American Road Congress holds its first annual session. The date and place for holding the congress have just been announced by Logan Waller Page, director of the United States Office of Public Roads and active president of the congress.

The American Road Congress will mark the consolidation of the conventions of forty of the most important road organizations in the United States, including the American Assciation for Highway Improvement and the American Automobile Association. Atlantic City has tendered the use of the million-dollar pier for the great gathering, and it is there that the daily sessions will be held. President Taft is honorary president of the congress, which has for its active president Director Page, and for its treasurer, Lee McClung, treasurer of the United States.

The National Association of Road Machinery and Material Manufacturers has voted to hold its exposition of materials and equipment in conjunction with the congress. Among the members of the Manufacturers' Association are many of the largest manufacturing companies in the world. Every industry relating to the building and care of roads and bridges will be represented, and it will be possible for the road builders and road users to acquaint themselves fully with all the labor-saving devices, methods and formulas that American ingenuity and inventive genius have brought out during the past century.

The first two days of the congress will be assigned to the road users, under the auspices of the American Automobile Association; the second two days to the great problems of legislation, finance and economics, under the auspices of the American Association for Highway Improvement; while the last two days will be given up to the engineers, who will discuss problems for construction and maintenance, and to the various associations, which will meet and map out their plans of action, correlate their efforts and make definite arrangements to pull together in the greatest campaign for road improvement and wise, conservative management ever undertaken.

The New York Fire Exhibition and International Conference of Fire Prevention.

Madison Square Garden will be the scene of the first international conference and exhibition, embracing every phase of fire prevention, fire protection and fire fighters, next October, from the 2nd to the 12th.

Fireproof building construction and all accessories, fire alarm systems, automatic sprinklers and fire extinguishers, motor fire apparatus, fire escapes, and, in fact, every device and manufacture in the fields of fire prevention and extinguishment will be exhibited and demonstrated; and, in addition, an important conference will hold sessions daily, providing the first general consideration of the fire question by architects, builders, engineers, insurance men and fire chiefs and fire fighters on the same platform.

The mayors of the principal cities of the United States have already appointed their fire chiefs and commissioners as delegates to attend the conference and exhibition.

The committee of this Fire Conference and Exposition includes Thomas J. Ahearn, New York state fire marshal; Joseph Johnson, New York City fire commissioner; D. E. Waid, representing the American Institute of Architects; Charles H. Cole, fire commissioner, of Boston, Mass.; Chief Charles E. Swingley, of St. Louis, Mo.; Richard H. Johns, president board of fire commisisoners, Baltimore, Md.; Charles F. Seyferlich, Chicago fire marshal; Chief Edward A. Waters, Philadelphia, Pa.; Henry R. Yates, fire chief, Schenectady, N. Y., and secretary New York State Association of Fire Chief Engineers; John Stephen Sewell, late major Engineers of United States army and United States government expert on fire protection; C. A. Palmer, Michigan fire marshal and president Fire Marshals' Association of North America; Felicien Michotte, the French fire protection expert and president and engineer of the Society for the Prevention of Accidents and Fire, of Paris, France. The committee also includes a number of other fire chiefs, insurance officials and fire marshals, with A. D. V. Storey, 1269 Broadway, secretary and general manager.

Changes in the Maryland Road Commission.

Simultaneously with the retirement of Samuel M. Shoemaker, F. G. Hutton and Charles B. Lloyd, from the Maryland road commission, came the resignation of Chief Engineer Walter W. Crosby, making a marked change in the personnel of the state's highway organization. Major Crosby had for some time contemplated resigning, in order to engage in other professional work, and had agreed to remain only until the new members of the commission were appointed by Governor Goldsborough.

Major Crosby is one of the best-known highway engineers in the country, and most of the important road work in Maryland has been done under his direction. He was induced to come to Maryland in January, 1901, by Samuel Shoemaker, who was largely instrumental in having passed the original Baltimore County Roads Law, which provided for a roads engineer for the county. It was the first county in the state to have such an official, and Major Crosby held the office for three years, until 1904.

In 1904 he became general superintendent of the Baltimore system of parks, and held that office for a year, when he was elected chief engineer of the Geological Survey, to which had been intrusted the work of building roads under what is known as the Shoemaker Law, or the State-Aided Roads Act.

When Governor Crothers succeeded in having passed the present State Roads Law, he was chosen the engineer to do the road building, serving both as engineer for the Geological Survey and the State Roads Commission.

Major Crosby will be succeeded by Henry G. Shirley, who has for some time been associated with the Maryland commission.

Technical Associations.

At the annual meeting of the Milwaukee Engineering Society, held on June 12, Henry Weikel was elected president; Emil A. Vilter, vice-president; Louis E. Bogen, secretary, and M. A. Beck, treasurer.

The annual convention of the Pacific Highway Association will be held August 5, 6 and 7 in Convention Hall of the St. Francis Hotel, San Francisco, Cal. Among the speakers are Governor Hiram Johnson, of California; P. J. Walker, president of the California State Automobile Association; Samuel Hill and Hon. Thomas Taylor, minister of public works, of British Columbia.

At the annual meeting of the New York Electrical Society, held on June 12, Earle L. Ovington presented a paper on "Aeroplane Wireless and the Problem of the Modern Flying Machine."

At the annual meeting of the stockholders of the Cement Products Exhibition Company, held at the offices of the company, 72 West Adams street, Chicago, on May 14, the following officers were elected. President, Edward M. Hagar; vice-president, B. F. Affleck; secretary and treasurer, J. P. Beck.

R. Keith Compton was elected president of the Engineers' Club of Baltimore at the annual meeting on June 6, and George W. Wright was elected vice-president, W. W. Pagon, secretary, and J. F. Apsey, treasurer. The name of the association was changed to the Engineers' Society of Maryland.

At the regular monthly meeting of the American Society of Engineer Draftsmen, held on June 20, William B. Harsel, vice-president, Am. Soc. E. D., read a paper on "Sheet Metal Industries," and Prof. William Noyes, Teachers' College, Columbia University, lectured on "American Woods for Commercial Purposes."

The tentative program for the Los Angeles convention of the National Municipal League, July 8-12, announced by Secretary Woodruff, of Philadelphia, includes discussions on expert city planning, simplicity, publicity and efficiency in municipal affairs, commission form of government, commission government and city planning, municipal finances and taxation, excess condemnation, civil service laws, honesty plus efficiency, state vs. municipal regulation of public utilities, street railway franchises, direct legislation measures, operation of woman's suffrage, home rule in cities, home rule in counties, the boss in politics, socialism in municipalities, commercial value of city planning, housing, municipal help, municipal housekeeping, the proposed new charter for Los Angeles and other matters of like interest to all cities. The officers of the league are: President, William Dudley Foulke, of Indiana; treasurer, George Burnham, Jr.; secretary, Clinton Rogers Woodruff, of Philadelphia.

W. Rees Jeffreys' Tour for the Third International Road Congress.

W. Rees Jeffreys, secretary of the British Road Board and honorary general secretary of the Third International Road Congress, which will be held at London, England, June, 1913, is visiting this country in the interest of the congress.

On the evening of June 5 he was the guest of honor at a dinner given at the Hotel Astor, New York, by the American Road Builders' Association. About fifty members of that organization were present. The president of the association, Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York, presided.

The chief speech was made by Mr. Jeffreys, who explained his mission to this country. He stated that the meetings of the congress, which will be held in London a year hence, will be particularly useful to Americans interested in similar work, and that the excursions will give an opportunity of becoming familiar with some features of British highways, which are considered superior to anything to be seen elsewhere. He laid particular stress upon the strength of British roads and the organization and methods for maintenance. He is about to make an extended tour of this country and Canada, to give a personal invitation to state, county and municipal officials to send official delegates to London next year, and he will also appear before both committees of Congress, which have practically agreed to recommend an appropriation for membership in the permanent organization in charge of the main business of the International Road Congresses.

While in this country, Mr. Jeffreys will visit Boston, Philadelphia, Baltimore, Washington, Chicago and Detroit. On June 27 he will go to Toronto, Canada, and thence to Niagara, Ottawa, Montreal and Quebec.

Technical Schools.

Prof. Waldemar Lindgren, chief geologist of the United States Geological Survey, has been appointed head of the department of geology of the Massachusetts Institute of Technology. He succeeds Dr. T. A. Jaggar, Jr., who is to be director of the Hawaiian Volcano Observatory for five years.

Prof. W. C. Hoad, Assoc. M. Am. Soc. C. E., professor of civil engineering at the University of Kansas and engineer of the Kansas State Board of Health, has been appointed professor of sanitary and municipal engineering at the University of Michigan.

E. S. McCandliss has been appointed instructor in civil engineering at the Missouri School of Mines, Rolla, Mo. Mr. McCandliss is a graduate of Purdue University.

A course in the design of motor trucks has been arranged for the department of mechanical and electrical engineering of Rensselaer Polytechnic Institute. It includes the theory of current practice in design and a laboratory course to study actual performance. An electric motor truck has been installed in one of the laboratories.

"Superheated Steam in Locomotive Service," by W. F. M. Goss, has just been issued as Bulletin No. 57, of the Engineering Experiment Station of the University of Illinois. It presents, in abridged form, the information which originally appeared as Bulletin No. 127, of the Carnegie Institution of Washington.

Calendar of Technical Meetings.

National Municipal League—Annual meeting, Los Angeles, Cal., July 8-12. Clinton Rogers Woodruff, North American Building, Philadelphia, Pa.

International Association of Chiefs of Police—Annual convention, Toronto, Ont., July 9-13. Major Richard Sylvester, superintendent of police, Washington, D. C., president.

Fire Marshals' Association of North America—Annual convention, Hotel Cadillac, Detroit, Mich., July 10-12. State Fire Marshal Palmer, president, Lansing, Mich.

Virginia State Firemen's Association—Twenty-sixth annual convention and tournament, Roanoke, Va., August 28-30. L. E. Lookabill, vice-president, Roanoke, Va.

International Association of Municipal Electricians—Seventeenth annual convention, Peoria, Ill., August 26-30. Clarence R. George, secretary, Houston, Tex.

International Association of Fire Engineers—Annual convention, Denver, Col., September 17-20. James McFall, secretary, Roanoke, Va.

New England Water Works Association—Thirty-first annual convention, Washington, D. C., September 18-19. Willard Kent, secretary. Headquarters, Boston, Mass.

Central States Water Works Association—Sixteenth annual convention, Detroit, Mich., September 24-26. R. P. Bricker, secretary, Shelby Ohio.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment—Seventh-first Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

American Society of Municipal Improvements—Annual convention, Dallas, Texas, November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

Personal Notes.

Chris P. Jensen has been elected city engineer of Sanger, Cal.

C. E. Phillips has been appointed city engineer of Springfield, Mo.

Manley Osgood has been appointed city engineer of Ann Arbor, Mich. He was formerly assistant city engineer of Lima, Ohio.

The Board of Water Supply of New York City has retained Prof. Arthur H. Blanchard, of Columbia University, as consulting highway engineer.

Rudolph Hering, New York City, has been retained by the board of public works, Los Angeles, Cal., to map out a system of garbage disposal for that city.

John B. Truman, Lafayette, Ind., who has been for the past seven years city engineer of Lafayette, has joined the firm of F. Merten's Sons, of Cumberland, Md.

Walter J. Francis, consulting engineer, of Montreal, Quebec, has been retained by the city of Edmonton, Alta., to prepare plans for proposed water supply extensions.

L. D. Shobe, formerly associated with the Columbia Paving Company, of Columbia, Mo., has resigned to become connected with the special road district at that place.

John I. Riegel has been appointed district engineer of highways for the territory comprising Lackawanna, Wayne, Wyoming, Susquehanna, Pike and Monroe counties in Pennsylvania.

John C. McMynn, A. B., M. M. E., formerly for sixteen years with Robert W. Hunt & Co., has become associated with the Allen Engineering Company, 1233 First National Bank Building, Chicago.

One of the first official acts of C. A. Mullen as street superintendent of Schenectady, N. Y., was to secure an asphalt repair contract for $1.16 per square yard, which is about one dollar a yard cheaper than under former conditions.

George A. O. Ernst, the head of the Boston (Mass.) Bureau of Municipal Research, died on a train near Batavia, N. Y., June 13. He was a lawyer, a graduate of Harvard University and of Harvard Law School. He was sixty-two years of age.

Major W. W. Crosby, consulting engineer, of Baltimore, was given the degree of doctor of science on June 12 by the Maryland Agricultural College, in recognition of his work for the improvement of the highways of the state.

Edward C. Sherman, having completed the designs for the regulating works for the Panama canal, of which he was in charge, has opened an office for the practice of civil engineering at 6 Beacon street, Boston. He will give special attention to hydraulic, sanitary, structural and municipal engineering.

George B. Hull, M. Am. Soc. C. E., assistant engineer, Department of Public Works of Canada, has been appointed district engineer for the Department of Public Works in British Columbia.

MACHINERY AND TRADE

An Automatic Water Level Recorder.

A reliable instrument for keeping a continuous record of the water level in a stream has been needed for many years, and the need seems now to be filled by an instrument called the hydro-chronograph. It was invented primarily for stream gaging at isolated points, but many other uses have been found for it, and there are now various designs obtainable for almost any desired duty.

The instrument consists chiefly of a very large recording drum, set with its axis vertical and perfectly balanced for a minimum effort in rotation, moved by clockwork, and a recording pencil moved vertically by a worm and bevel gearing actuated by a float and counterweight acting on a sprocket chain.

The various types cover all ranges of variation in elevation of water surface from 10 to 30 feet, and one design has three sprocket wheels, so that it can be used on streams of various ranges of flood height from 15 to 30 feet. The standard recording drums are designed for a record of a week or a month. One type has two recording pencils and can be used for recording height of both head and tail water, thus giving the effective head directly from the record at any moment.

Floats are designed according to the work to be done, the standards being 3 and 8 inches in diameter. The design of this end of the apparatus is quite important, and several methods of determining the regular fluctuations of the water with as little disturbance from waves as possible are presented.

The instrument is in use by many city water works and water power plants for keeping record of stream and reservoir fluctuations and by the U. S. government and various state departments in their investigations of stream flow, irrigation, water supply and hydraulic problems generally.

Full information concerning the apparatus can be obtained from the Hydro Manufacturing Company, Philadelphia, Pa.

Bridge Action of an Unsupported Pavement.

A recent storm in Houston, Tex., made a natural bridge when the water emptying into an excavation made by the gas company for the repairing of a broken main washed out the dirt beneath the street for a distance of 30 square feet, leaving the bitulithic paving laid some three years ago to stand as a natural bridge for the accommodation of the traffic.

The damage done was slight, only in that it necessitated opening the paving for some distance that the men might be able to make the fill. The company experienced some difficulty in making the opening, because of the extreme hardness of the paving. It took two men wielding heavy sledges on a chilled steel cutter in order to make the opening necessary.

The edges of this opening were measured by some interested citizens, who state that there had been no wear in the three years of service given even tho the traffic is extremely heavy.

The Atlantic Diaphragm Pumping Engine.

The J. B. McCrary Company, Atlanta, Ga., one of the largest contracting firms in the municipal field in the southeastern states, has stated its entire satisfaction with the Atlantic diaphragm pumping engine. The company purchased one of these outfits early in January, 1912, and since that time it has ordered six additional pumping engines of the same type. Four of these pumps are in use in Atlanta, Ga., and the other three are being moved from place to place on different contracts thruout the south.

W. O. Lumpkin, general superintendent of the company, states that it considers the pumping engine to be a "world beater," and that every outfit has paid for itself several times since it has been put in use.

The engine, which has been described in these pages, is manufactured by the Harold L. Bond Company, 383 M. Atlantic avenue, Boston, Mass.

The Anderson Sidewalk Tools.

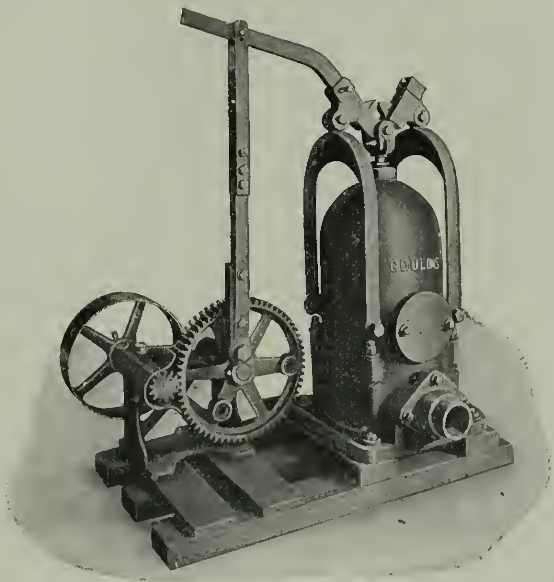
The W. H. Anderson Tool & Supply Company, Detroit, Mich., have placed on the market a line of cement working tools for use in laying artificial stone sidewalks, which are made from their own design. The firm, which has been in business since 1871, has put into their later patterns the results of their former experience. All of their tools are made of a special brass mixture which gives toughness and wearing qualities, and security against corrosion by action of the cement and water.

In their most recent price list a very complete line of tools is shown, not only in the brass, but, for those who desire cheaper tools, the same designs are furnished in iron.

Among the tools of which distinctive designs are shown are the following: Center knives, jointers, round corner smoothing trowels, square corner smoothing trowels, grout cutters, driveway impression frames, gutter templates and sidewalk edgers. In addition to the sidewalk tools mentioned the W. H. Anderson Company furnishes a line of general contractors' tools for all kinds of cement, reinforced concrete and masonry work.

Adapting Diaphragm Pumps for Power Drive.

The Goulds Manufacturing Company, 131 Falls streets, Seneca Falls, N. Y., has recently developed a power attachment for use in connection with its line of diaphragm pumps. The equipment consists of a jack with pitman for connection to the engine, and a special arm, which is substituted for the hand lever on the pump.



POWER DRIVE FOR DIAPHRAGM PUMP.

The extended end of the pinion shaft on the jack can be equipped with pulley, gear or sprocket as desired for belt, gear or chain connection to the engine. When connected to a gasoline engine or electric motor by means of this jack, the diaphragm pump makes a specially convenient, large capacity outfit for contractors' and builders' service in pumping out excavations.

The equipment is made for adapting any of the Goulds diaphragm pumps for power drive. The illustration shows it as used with the odorless diaphragm force pump.

The Jeffrey Catalog.

The Jeffrey Manufacturing Co., Columbus, O., has just issued its catalog No. 82, which is a classic as regards the completeness and value of the information contained.

Every kind of elevating and conveying machinery, power transmission machinery and mine equipment is shown in this catalog. The book of itself is a revelation as regards the development of carrying and hoisting machinery, every possible adaptation of such equipment being shown in detail, from the heavier loading and conveying machinery in factories, mines, power plants and lumber yards, to the lighter moving stairways and amusement park "scenic railways" and "figure 8's."

The catalog is of value to the engineer who wishes to adopt the very latest and best design in carirers and conveyors.

A Felt Paving Joint.

The Philip Carey Company, Lockland, Cincinnati, O., is putting on the market a new sort of paving joint for use in brick, wood block or other streets where an expansion joint is necessary.

The joint is to take the place of tar or asphalt joints, and is said by the company to serve the purpose of these materials at a reduced cost.

Carey's Elastite Paving Joint, as the joint is called, is made of a high-grade felt thoroughly saturated, coated and bonded with a special waterproof asphalt compound, making a compact board which is easily handled. It is made in widths for the thickness of the paving material being used, usually 3½ inches, and is put in as the street is laid. When the street is completed, there is no further trouble and expense of removing the wood strips and filling the cracks left by them with pitch. The thickness varies from ½ inch to one inch, as desired, for wood or brick streets, and for granite streets special joints are made from 5 to 7 inches in width and 1 to 1½ inches in thickness.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Montgomery, Ala.—July 11, 12 m. Surfacing one mile of state aid road with chert. W. S. Keller, state highway engineer.

Hardin, Ill.—July 6, 7 p. m. Constructing 12,000 sq. ft. of granitoid sidewalk. A. D. Campbell, clerk.

Columbus, Ind.—July 5, 10 a. m. Constructing three gravel roads. Philip J. Sater, auditor of Bartholomew county.

Fowler, Ind.—July 8, 11 a. m. Constructing a stone road on the county line between Benton and Newton counties. Lemuel Shipman, auditor.

Frankfort, Ind.—July 6, 2 p. m. Constructing gravel roads in Center, Perry, Ross, Michigan, Warren, Owen, Johnston, and Forest townships and one on line between Kirklin and Sugar Creek townships. Chas. F. Cromwell, auditor.

Goshen, Ind.—July 8, 1:30 p. m. Constructing two highways in Elkhart township. John W. Brown, auditor.

Goshen, Ind.—July 15, 1:30 p. m. Constructing a road in Concord township. John W. Brown, auditor.

Greencastle, Ind.—July 3, 11 a. m. Constructing macadamized road in Greencastle, Washington and Jackson townships. E. L. Airhart, auditor.

Huntington, Ind.—July 8, 10 a. m. Constructing a gravel road in Jefferson townhsip and two gravel roads on line between Jefferson and Lancaster townships. Harold Guthrie, auditor.

Indianapolis, Ind.—July 22, 11 a. m. Constructing a stone road on boundary between Marion and Hendricks counties. W. T. Patton, auditor of Marion county.

Lawrenceburg, Ind.—July 2, 12 m. Constructing a road in Washington township. William F. Fagaly, auditor.

Shelbyville, Ind.—July 2, 7:30 p. m. Lowering grade of portion of Vine street and Morris avenue and constructing sidewalk on Vine street. L. E. Webb, city clerk.

South Bend, Ind.—July 8, 10 a. m. Constructing macadam road between Penn and Center townships. Warren Sedwick, auditor.

Sullivan, Ind.—July 2, 12 m. Constructing stone road in Jackson township. W. F. Bicknell, auditor.

Washington, Ind.—Aug. 6, 2 p. m. Constructing a road between Davies and Greene counties. Lew F. Core, auditor of Daviess county.

Winchester, Ind.—July 3, 11 a. m. Constructing highways in Washington, Greensford, Middle Creek, Stoney Creek, Wayne and Jackson townships, eight roads in all. Henry F. Wood, auditor of Randolph county.

Ft. Dodge, Ia.—July 8. Constructing brick block paving in a number of alleys. W. T. Tang, city clerk.

Marion, Kan.—July 8. Paving 7 blocks with brick, asphalt, asphaltic concrete or concrete. H. A. Rowland, engineer, McPherson, Kan.. Mildred Williams, city clerk.

Vicksburg, Miss.—July 11. Constructing 1,600,000 yds. of earth work on government district. J. A. Woodruff, major of engineers.

Cincinnati, O.—July 5, 12 m. Repaving the Duck Creek road under specification No. 339. Certified check $500. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cincinnati, O.—July 12, 12 m. Oiling the Cleves Miamitown road under specification No. 358. Certified check $500. Albert Reinhardt, clerk board of Hamilton county commissioners.

Cleveland, O.—July 3. Paving 37 sections of street with brick. W. J. Springborn, director of public service. W. K. Kirby, secretary.

Cleveland, O.—July 5, 12 m. Paving Hower avenue by the city of Cleveland and of East Cleveland, with brick. W. J. Springborn, director of public service, Cleveland, O.; J. A. Fogle, director of public service, East Cleveland, O.

Elyria, O.—July 2, 12 m. Paving construction as follows: Seventh street with brick, sheet asphalt or block asphalt, certified check, $500; East River street, 1st section with brick, grout filled, and 2nd section with brick sand filled, certified check, $500; Broad street with brick; Harrison street with brick or sheet asphalt, certified check, $500. E. H. Lewis, director of public service.

Grandview Heights, O.—July 16, 12 m. Constructing bituminous macadam roadway on Bluff avenue, Glenn avenue, Elmwood avenue and Dale avenue. Certified check, $5,000. John Hinterschied, village clerk.

Lisbon, O.—July 3, 10 a. m. Paving the Salem-Ellsworth road with brick, under state highway G. petition No. 379. Length 5,280 ft., width 10 to 14 ft. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner. Commissioners of Columbiana county, Lisbon, O.

Harrisburg, Pa.—July 9, 10 a. m. Road construction as follows: Reconstructing 10,115 ft. of asphaltic macadam road, 16 ft. wide, in Bucks county, certified check $1,500; reconstructing 49,394 ft. of macadam road, repair in Blair county, certified check $1,000; reconstructing 8,354 lin. ft. of asphalt macadam road, penetration method, 16 ft. wide, Berks county, certified check $1,500; reconstructing 16,300 lin. ft. of asphaltic concrete road, 16 ft. wide, in Lehigh county, certified check $2,000; reconstructing 40,143 ft. of asphaltic macadam road, 16 ft., in Northumberland county, certified check $5,000; reconstructing 8,048 lin. ft. of asphaltic macadam road, 16 ft. wide, in Bucks county, certified check $1,500; reconstructing 13,735 ft. of asphaltic macadam road, penetration method, 16 ft. wide, in Jefferson county, certified check $2,000; reconstructing 3,760 lin. ft. of brick paving, 16 ft. wide, in Chelleroi borough, certified check $1,000; reconstructing 14,807 ft. penetration method, 16 ft. wide, certified check $2,000, in Mercer county; reconstructing 10,756 ft. of asphalt macadam, penetration method, 16 ft. wide, on route No. 57, certified check $1,500; reconstructing 9,632 ft. of asphalt macadam, penetration method, 16 ft. wide, in Mercer county, certified check $1,500; reconstructing 18,843 ft. of asphalt macadam, penetration method, 16 ft.

wide, in Delaware county, certified check $2,000. Edward M. Bigelow, state highway commissioner.

Pittsburgh, Pa.—July 16, 10 a. m. Constructing the following roads: Bakerstown and Culmerville road, 6 miles, certified check, $2,000; West Run road, 4.1 miles, certified check, $2,000; Spring Run road, 1.6 miles, certified check, $1,000; Center road, an extension, 0.7 mile, certified check, $1,000. R. J. Cunningham, county controller.

Washington, Pa.—July 6, 1 p. m. Paving Wylie avenue with brick. Certified check, $500. James B. Wylie, chairman, supervisors of Canton township.

Huntington, W. Va.—July 22, 12 m. Constructing 3 blocks of brick streets and 27 blocks of brick alleys. Certified check, $500 on each bid. L. A. Pollock, commissioner of streets; A. B. Maupin, city engineer.

Edgerton, Wis.—July 15, 10 a. m. Improving Fulton street with an asphalt macadam pavement, with concrete curb and gutter. H. B. Knapp, city clerk.

Janesville, Wis.—July 11, 2 p. m. Constructing 175 sq. yds. of brick paving along alleys in oes subdivision. James A. Fathers, chairman board of public works.

CONTRACTS AWARDED.

Little Rock, Ark.—Paving Louisiana street with creosoted wood block, to E. J. Watterstrom, $96,345. The district includes 38,600 sq. yds. Southern yellow pine will be used.

Hartford, Conn.—The following state highway contracts have been awarded: 17,083 ft. of gravel road, to B. Terini, Ashland, Mass.; 5,977 ft. of Telford macadam, to A. Brozos & Son, Middletown, N. Y.; 2,789 ft. of gravel to W. C. Wilcox; 4,950 ft. of gravel, to A. E. Douglas, Glastonbury, Conn.; 11,600 ft. of gravel, to the Jones & Corcaro Construction Co., Willimantic, Conn.; 4,100 ft. of macadam, to A. Brozos & Son, Middletown, N. Y.; 4,129 ft. of macadam, to Olmstead & Olmstead, Hartford, Conn.; 1,245 ft. of macadam, to Jones & Corcaro Construction Co.; 18,652 ft. of gravel, to C. W. Tryon, Meriden, Conn.

Waynesboro, Ga.—Constructing 8 miles of cement sidewalk, to A. H. McDaniel, Augusta, Ga.

Boise, Ida.—Constructing 2 miles of concrete roadway, to the Inland Empire Hassam Paving Company, about $25,000.

Elgin, Ill.—Paving South State street, to Logan & Pierce, Elgin, Ill., about $35,000.

Rochelle, Ill.—Paving a number of streets, to Arthur E. Rutledge, Rockford, Ill., $77,197.

Peoria, Ill.—Paving in the Broadway paving district, to Jansen & Zoeller, Pekin, Ill.

Peoria, Ill.—Paving Ravine avenue with asphalt, to John W. Bushell, $9,255; paving Ravine avenue, second section, to the same, $1,872.

Jasper, Ind.—Constructing gravel roads in Patoka and Bainbridge townships, to Traylor & Kremp, Jasper, Ind., $14,600.

Marion, Ind.—The following road contracts have been awarded: Road to Knotts & McDerman, $10,347; Reed road, to William Yates, $1,838; Dubois road, to John W. Slater, $10,400; Emerick road, to John W. Slater, $16,180; the Whitlock road, to Knotts & McDerman, $7,403; the Parcoast road, to Miles Shaffer, $13,440.

Portland, Ind.—Constructing 3 miles of gravel road in Jackson township, to F. J. Wright, $7,848.

Terre Haute, Ind.—The following gravel road contracts: Strole road, to Thomas Ferguson and Lon Lee, $5,500; Hanker road, to James McGuire & Sons, Brazil, Ind., $10,763; the Rigney road, to Thomas Ferguson and Lon Lee, $3,100.

Valparaiso, Ind.—Constructing a road in Pine township, to Ray Demass, Chesterton, Ind., $12,000.

Des Moines, Ia.—Constructing 37,000 yds. of bithulithic paving, to James Horrabin Co., at $1.95 per sq. yds. Total cost $62,140.

Des Moines, Ia.—Paving Woodland avenue and Forty-fourth street, to the Des Moines Asphalt Paving Co., Des Moines, Ia.

Des Moines, Ia.—Paving Grand avenue with concrete, to Lytton & Rankin Construction Company; paving Eighth street with brick, to the J. W. Turner Improvement Co.

Fort Dodge, Ia.—Constructing 50,000 sq. ft. of sidewalk, to J. A. Conway, Fort Dodge, Ia., at 8.84c a sq. ft.

Greenfield, Ia.—Constructing 14,860 sq. yds. of concrete paving, to D. W. Wright & Co., Bedford, Ia., $24,722. Iowa Engineering Co., Clinton, Ia., engineers.

Greenfield, Ia.—Constructing ten blocks of concrete paving, to E. W. Wright & Co., Bedford, Ia.

Grundy Center, Ia.—Constructing 18 blocks of concrete paving, to the Dearborn Construction Co., Waterloo, Ia., $1.17 per sq. yd.

Iowa Falls, Ia.—The contract for 30,000 yds. of pavement which was awarded to Camery & Co., Harlan, Ia., has been sub-let to the Dearborn Contracting Co., Waterloo, Iowa.

Iowa Falls, Ia.—Constructing 30,000 sq. yds. of concrete paving, to M. A. Camery & Co., Harlan, Ia.

Iowa Falls, Ia.—Constructing 30,000 yds. of concrete paving, to M. A. Camery & Co., Harlan, Ia.

Vinton, Ia.—Paving Washington street with brick, to Loomis Bros., Cedar Rapids, Iowa.

Waverly, Ia.—Paving 35,000 sq. yds. with brick block, to the Ford Paving Co., Cedar Rapids, Ia., $1.69 per sq. yd.

Winterset, Ia.—Paving 28 blocks with asphalt, to R. A. Elzy, Marshalltown, Ia., at $1.71 per sq. yd.

Baltimore, Md.—Paving the Fallsway, to the D. M. Andrews Paving Co., $74,000.

Boston, Mass.—The following paving contracts have been awarded: Constructing bitulithic pavement on River street, to Warren Bros. Co., $4,038; constructing sidewalks and grading, to John McCourt Co., $1,571; constructing tar macadam roadway on Stuart street, to J. T. Coleman & Sons, $1,264; constructing wood block pavement, Washington street, to William J. Barry, $105,299.

Alma, Mich.—Constructing 15,000 sq. yds. of concrete pavement, to the Markle Cement & Coal Co., about $40,000.

Hamtramck, Mich.—Paving Smith and Clay avenues and Dubois street, to R. D. Baker, about $14,000; paving Florian avenue, to R. D. Baker, $5,500.

Hillsdale, Mich.—Paving Broad street, to Carpenter & Anderson, Grand Rapids, Mich., $17,324.

Hillsdale, Mich.—Constructing $18,000 worth of new pavement, to Carpenter & Anderson, Grand Rapids, Mich.

Manistique, Mich.—Constructing 5 miles of state aid macadamized road, to the Delta Contracting Co., Escanaba, Mich., $25,600.

Marquette, Mich.—Constructing 5 miles of state road, to the Delta Contracting Co., Escanaba, Mich., $25,600.

Saginaw, Mich.—The following paving contracts have been awarded for 1912: All asphalt paving, to F. F. Saxton; all brick paving with stone curb, to G. & J. Lalonde; all brick paving with cement curb, to W. M. Sager.

Aurora, Minn.—Constructing 4 miles of road, to Andrew Thompson, at $915 per mile.

South St. Paul, Minn.—Paving Concord street and Grand avenue, to Fielding & Shepley, St. Paul, Minn., $16,374.

Albany, N. Y.—The following road contracts have been awarded by the state highway commission: Slingerlands to Albany, 4.23 miles, to J. & T. Murphy, Cobleskill, at $52,515; Watervliet city, Nineteenth street, 0.46 mile, Thomas H. Karr, Troy, $12,788; Cohoes city, Columbia street, 0.43 mile, Thomas H. Karr, Troy, $6,009; De Freestville, south, 0.67 mile, Arnold & Shearer, Albany, $8,061; Troy city-Brunswick turnpike, 0.95 mile, Corliss Construction Co., Troy,

$15,900; Troy city-Oil Mill hill, 1.58 miles, County Construction Co., Troy, $19,163; West Sand Lake-Averill Park, 3.66 miles, Marin Murray Co., Troy, $38,476; Central Bridge-Quaker street, 4.16 miles, Ruddy & Saunders Construction Co., Troy, $38,316; Cairo-Windham, 3.39 miles, Catskill Construction Co., Catskill, $38,454; Coxsackie-Ravena, 4.62 miles, Griswold & Malloy, Mechanicville, $48,853; Hunter-Jewett Center, 6.13 miles, Thomas H. Gill Co., Binghamton, $88,588; Piseco-Lake Pleasant, 7.92 miles, Creeden & Pitou, New York city, $109,669; Kelsey Corners-W. Exeter, 6.38 miles, Harry W. Roberts Co., Utica, $59,185; Collins-Maryland, 5.69 miles, L. L. Melius Co., New York city, $49,849; Schuylerville village, 1.05 miles, Lang & Norton, Schuylerville, $28,919; Ballston-High Mills, 1.77 miles, H. L. Baker, Cambridge Mass., $15,282; Elizabethtown-Keene, 6.21 miles, Beebe Bros., Keene Valley, $91,809; Upper Jay-Keene, 6.06 miles, Flood & Van Wirt Co., Hudson Falls, $91,346; Fort Plain-Hessville, 6.20 miles, Union Paving Co., Schenectady, $92,802; Schenevus-Schoharie county line, 12.20 miles, L. L. Melius, New York city, $110,886; Chatham Center-Rider Mills, 6.71 miles, L. L. Melius, New York city, $73,166; Jay-Upper Jay, 5.69 miles, Boynton & McNally, Keeseville, $50,719; Elizabethtown-Keene, 6.18 miles, Boynton & McNally, Keeseville. $84,301; Stillwater-Schuylerville, 7.52 miles, Lang & Norton, Schuylerville. $76,186; Esperance-Esperance Station, 1.37 miles, J. J. Malloy, Schenectady, $14,107, and Warrensburg-Thurman Station, 3.52 miles, Joseph Walker Construction Co., Albany, 35,776.

Brooklyn, N. Y.—Constructing 12 highway and sewer contracts in the borough of Queens, to Hicks-Johnson Contracting Co., $187,288.

Fulton, N. Y.—Paving West Broadway, to W. J. Harnett, Fulton, N. Y., $27,955.

Niagara Falls, N. Y.—Furnishing 750,000 asphalt blocks, to the Newcastle Asphalt Block Co., Newcastle, Pa.

Columbus, O.—Constructing an experimental stretch of road for the state of Ohio, to Thomas J. McKim, Lawrenceburg, Ind., $80,000.

Hamilton, O.—Constructing 4.15 miles of macadamized road on the Middletown road, to the Garver Construction Co., $25,250.

Warren, O.—Constructing 2.69 miles of the Hartford-Northern road, to Findlay, Ward & Co., Sharpsville, Pa., $18,400.

Youngstown, O.—The following paving contracts have been awarded: Garfield avenue, $23,945, and Worthington, $10,847, to Fleming & Platt; Darrow street, T. & P. J. Grady, $4,113; Hughes and Olivet court, $6,663, and Homer avenue, $9,203, to Miller Bros.

Youngstown, O.—Macadamizing 1.5 miles of road west of the village of Canfield, to I. W. Coy, Calla, O., $11,903.

Hamilton, O.—Constructing 4.15 miles of macadamized pike on the Middletown road, to the Garver Construction Co., $25,250.

Aliquippa, Pa.—Paving Erie avenue for a distance of 2 blocks, to S. B. Markley, Woodlawn, Pa., $10,497. The bid of Freshwater Bros., of Chester, W. Va., was rejected for the reason that they did not comply with the specifications.

Connellsville, Pa.—Constructing 6,300 ft. of brick road in German township, to John G. Hoover, Uniontown, Pa., $35,000.

Easton, Pa.—The following paving coning contracts have been awarded: 225 ft. of granolithic sidewalks, to Mucci & Miller, $134; furnishing 389,000 vitrified blocks, to the American Sewer Pipe Co., New Cumberland, W. Va., $23.64 per thousand; furnishing 40,700 hillside paving blocks, to the same, $24 per thousand; repaving North Hampton street, to Frank McInerney; paving Bank street with vitrified brick, to the Miles-Tighe Contracting Co.; paving Dock street with vitrified brick, to Frank McInerney.

Harrisburg, Pa.—Constructing a section of the national road near Claysville, to R. B. Taylor, Bellefonte, Pa., $98,337.

Hazleton, Pa.—The following paving contracts have been awarded: North Pine street, to Ario Ruth, $8,892; Diamond avenue, to Crolomo Tecemo, $26,166.

Verona, Pa.—Constructing block pavement on Wildwood avenue, to J. B. Sheets & Co., Pittsburgh, Pa., about $16,000.

Logan, Utah.—Constructing 12 miles of road, to James E. Wilson, Jr., $9,541.

Aberdeen, Wash.—Paving Broadway for a distance of 7,750 yds., to Barber Asphalt Paving Co., $13,000. Chas. Ewart, city engineer.

Everett, Wash.—Paving Pine street, to Welsh & Christenson Construction Co., Everett, Wash., $11,152.

Kent, Wash.—Paving 9 blocks with Dolarway, to the American Contracting Co., Seattle, Wash., $18,415.

Seattle, Wash.—Paving Genesee street, to Geo. C. Dietrich, Globe Bldg., Seattle, Wash., $62,670.

Tacoma, Wash.—Constructing a boulevard thru South Tacoma, to the Washington Paving Co., $88,447.

CONTEMPLATED WORK.

Concord, Cal.—The macadamizing of several streets to cost about $50,000 is contemplated.

Lordsburg, Cal.—A $36,000 bond issue for road construction has been voted.

Hartford, Conn.—James H. MacDonald, state highway commissioner, has decided to advertise for bids for state road work as follows: Chatham, 15,783 ft. of grading and 6,080 ft. of macadam; Wilton, 8,500 ft. of gravel; Monroe, 7,650 ft. of gravel; Canterbury, 2,000 ft. of gravel; Naugatuck, 4,000 ft. of gravel; Winchester, 3,250 ft. of macadam.

Fitzgerald, Ga.—A $120,000 bond issue for paving streets has been voted.

Des Moines, Ia.—Horace Susong, city clerk, has been instructed to advertise for bids for a creosoted wood block pavement on Grand avenue bridge.

Des Moines, Ia.—The paving of University avenue with bitulithic, about 40,000 sq. yds., is contemplated.

Effingham, Ill.—A $35,000 bond issue for the construction of macadam road has been voted.

Moline, Ill.—The paving of Second avenue in East Moline with asphalt, to cost about $36,400, is contemplated.

Oakland, Ill.—Extensive street improvements have been ordered by the city council. C. L. James, Mattoon, Ill., is city engineer.

Pontiac, Ill.—The city will pave 32 blocks of street with brick and 5 blocks with creosoted wood block during this summer. T. C. Knight, city engineer.

Rockford, Ill.—Paving Harlem avenue and Main street with brick at an estimated cost of $71,047 is contemplated. City Engineer Main.

Logansport, Ind.—A $13,000 appropriation has been made for paving Burlington avenue and Fifth street.

Baltimore, Md.—The following paving work is contemplated by the paving commission: Grady street, with vitrified brick; Exeter street, with granite block; Front street, with vitrified block; Castle street, bituminous concrete; Richmond street, with bituminous concrete; Low street, with vitrified block.

Minneapolis, Minn.—The county commissioners have appropriated $10,000 to pave one mile of Superior boulevard with concrete.

Jackson, Miss.—Hinds county has voted a $100,000 bond issue for road construction.

Meridian, Miss.—A $100,000 bond issue for street improvement has been voted. C. W. O'Leary, city clerk.

Camden, N. J.—The street committee has decided to advertise for bids for the construction of an asphalt plant for the city, to cost about $15,000.

Bath, N. Y.—A $30,000 bond issue has been voted for the paving of Liberty, Steuben, West Morris and West Washington avenues.

Canisteo, N. Y.—An $18,000 bond issue for road construction has been voted.

Jamestown, N. Y.—The city council has voted to pave Prendergast avenue with asphalt block at a cost of $42,000.

Watertown, N. Y.—A $110,000 bond issue for paving construction has been voted.

Canton, O.—City Engineer Weber has prepared plans for the paving of Dueber avenue, to cost $34,000.

Youngstown, O.—Poland township has voted a $15,000 bond issue for road construction.

Beallsville, Pa.—The borough of Deemston, Pa., has voted a $10,000 bond issue for paving improvement.

Claysville, Pa.—A $12,000 bond issue has been voted for street improvement. C. S. Miller, borough clerk.

Collingswood, Pa.—Arrangements are being made for constructing street pavements, to cost about $50,000.

Houston, Pa.—A $20,000 bond issue for street improvement has been voted. J. S. Gantz, borough secretary.

Lansdowne, Pa.—A $68,500 bond issue has been voted for highway and sewer improvement. John W. Davis, borough secretary.

Uniontown, Pa.—About $78,000 will be spent in road improvements in Fayette county this summer. H. B. Stevens, division superintendent of the state highway department.

Greenville, S. C.—Bids will be requested immediately for the paving of Augusta, Pendleton, East Washington and Buncombe streets. B. T. Ballenger, city engineer.

Bastrop, Tex.—An $80,000 bond issue for road construction has been voted by the precinct number one.

Ennis, Tex.—A $55,000 bond issue has been voted by the Palmer road district for the construction of roads.

Franklin, Tex.—Robertson county has voted a $100,000 bond issue for road construction.

Franklin, Tex.—A $100,000 bond issue for permanent road construction has been voted.

Marshall, Tex.—A $28,000 bond issue for street improvement has been voted. H. S. Rice, city secretary.

Orange, Va.—A $125,000 for road construction has been voted by the Barbour and Taylor district of Orange county.

Fairmont, W. Va.—A $300,000 bond issue for paving ten miles of road has been voted by Mannington district.

Hurley, Wis.—Iron county has voted a $35,000 bond issue for road construction.

SEWERS.

BIDS REQUESTED.

Hartford, Conn.—July 9, 11 a. m. Furnishing and erecting equipment for the East Side sewage pumping station. Certified check, $1,000. Joseph Buths, secretary, board of contract and supply.

McPherson, Kan.—July 12. Constructing 6.75 miles of 8, 10 and 12 and 15-inch sewers. H. A. Rowland, city engineer.

New Orleans, Ia.—Aug. 1, 12 m. Constructing a reinforced concrete siphon under the new basin navigation canal at Broad street, under contract No. 45 D. George G. Earl, superintendent. F. S. Shield, secretary.

Albert Lea, Minn.—July 3, 7:30 p. m. Constructing the following sewers: 1,319 ft. of 6-in., 4,278 ft. of 8-in., 2.697 ft. of 10-in. sanitary sewers, 48 manholes, 1 ejector for 16-ft. well, 1 ejector for 22-ft. well, 2 100-gal. capacity air lift ejectors, 1 air compressor and 1 air reservoir. Certified check, 10 per cent. T. J. Dudley, city clerk.

Chinook, Mont.—July 6. Constructing complete sewerage system to cost $30,000. L. C. Smith, city engineer.

Cambridge, O.—July 6, 12 m. Constructing sanitary sewers and appurtenances on South Ninth street, Campbell avenue, Woodlawn and East Beatty street, 4,600 ft. in all. Certified check 10 per cent. J. M. Logan, director of public service.

Hastings, Pa.—July 11, 8:30 p. m. Constructing 14,000 ft. of sewers. C. F. Hoyt, borough clerk; Chas. E. Schlicher, Spangler, Pa., engineer.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing sanitary sewer extensions to Sullivan, Long and Hagerty, $49,905.

Texarkana, Ark.-Tex.—Constructing sewer in district number 17, to Geo. Conway, $17,-000.

Santa Barbara, Cal.—Constructing the Santa Maria sewer system, to Miatenovich & Dilcie, Los Angeles, Cal., $28,986.

Lakeland, Fla.—Constructing 25 miles of sanitary sewer, to J. W. Gurley & Co., Mobile, Ala., about $75,000.

Charles City, Ia.—Constructing 2 miles of sewer, to C. B. McNamara Contracting Co., Dubuque, Ia.

Creston, Ia.—Constructing the Sycamore street pipe sewer, to W. L. Thomas, Corning, Ia., $2,009. Theo. F. Delay, city engineer.

Iowa City. Ia.—Constructing the East End sewer system, to William Harrabin, Iowa City, Ia., $16,184. James W. Berry, city engineer.

Iowa City, Ia.—Constructing sewer on LaFayette street, to Hoar & Parkison. James W. Barry, engineer.

lands Co., Cornelius J. Ton, president, has awarded a contract to Irwin D. Groak, Monadnock bldg., Chicago, for a drainage pumping plant, including three 50-horsepower Olds engines and three American Well Works, centrifugal pumps, with a total capacity of 104,000,000 gallons in 24 hours. The Allen Engineering Co., First National Bank bldg., Chicago, Ill., engineers.

Keokuk, Ia.—Frank L. Griffey and Co., a new firm, were low bidders for four blocks of sanitary sewers.

Sandwich, Ill.—Constructing sewerage system and sewage disposal plant, to the E. R. Harding Co., Racine, Wis., $38,301.

Boston, Mass.—Constructing sewers in Dartmouth and Stuart streets, to Andrew & Cusack, $7,696.

Wilmar, Minn.—Constructing complete sanitary sewer system, to W. B. Bosworth, Ada, Minn., $27,500.

North Tonawanda, N. Y.—Constructing several miles of sewers, to the Frontier Contracting Co., Buffalo, N. Y., $5,442.

Syracuse, N. Y.—Constructing the Harbor Brook intercepting sewers, to the Marnell Co., $20,886.

Columbus, O.—Constructing the West Side storm sewer, to D. E. Sullivan & Son, about $60,000; constructing the Medill avenue and Twentieth street sewers, to A. G. Hunt, $22,-000.

Columbus, O.—Constructing sewer to cost about $82,000, to D. E. Sullivan & Son, A. D. Hunt.

Dallas, Ore.—Constructing sanitary sewer system, to Dennis & Christensen, McMinnville, Ore., about $20,000.

Lock Haven, Pa.—Constructing sewer in village of Johnston Creek, to Frank P. Mansfield, about $6,000.

Dallas, Tex.—Constructing storm sewer on Exposition and Parry avenues, to the Dallas Lime & Gravel Co.

Chicago, Ill.—The New Orleans Nether-

Norfolk, Va.—Constructing sewer, to Geo. M. Guild & Co., Chattanooga, Tenn., $200,000.

Walla Walla, Wash.—Laying 6-inch lateral sewer on Maple street, to the T. H. Sutherland Co.

Ashland, Wis.—Constructing sewerage system east of Bay City creek, to E. R. Harder & Co., Racine, Wis.

Winnipeg, Man., Canada.—Constructing trunk sewer on Dawson street, to Van Hornbeck & Co., $147,651.

CONTEMPLATED WORK.

Sisson, Cal.—A $40,000 bond issue for the construction of a sewerage system and the building of a city hall has been voted.

Apalachicola, Fla.—A $15,000 bond issue for extension of the sewerage system has been voted. C. R. Harris, city engineer.

Burley, Ida.—An $85,000 bond issue has been voted for a water and sewerage system and extending the electric lighting and heating system.

Holstein, Ia.—A $17,000 bond issue for the construction of a sanitary sewerage system has been voted.

Mansfield, La.—Estimates have been prepared for water works extensions to cost $56,000 and a sewerage system to cost $38,000.

Flint, Mich.—Henry E. Riggs, Ann Arbor, Mich., has been retained to prepare plans and estimates for the construction of a sewer system to cost about $50,000.

Howell, Mich.—A $48,000 bond issue for sewer construction has been voted.

Kenmore, O.—The Payne Engineering Co., of Akron, O., has been retained to make plans and recommendations for a sewage disposal plant.

Meridian, Miss.—A $20,000 bond issue for sewer improvement has been voted. C. W. O'Leary, city clerk.

Lestershire, N. Y.—A $14,000 bond issue for sewer construction has been voted.

Saranac Lake, N. Y.—A $50,000 bond issue for sewer construction has been voted. Seaver A. Miller, village clerk.

Celina, O.—An $80,000 bond issue for sewer improvement has been voted. James H. Carlin, village clerk.

Cleveland, O.—The state board of health will, in the near future, instruct the city to issue $2,000,000 in bonds to construct a sewage disposal plant.

Coatesville, Pa.—Alexander Potter, 114 Liberty street, New York City, has been retained to prepare plans and estimates for a sewage disposal plant.

Dallas, Tex.—Bids will be opened about July 24, for the construction of a sewage disposal plant. James H. Fuertes, consulting engineer, New York, N. Y.

Bellingham, Wash.—W. H. North, city engineer, has prepared plans and estimates for construction of sewers in various streets, to cost about $5,000.

Warwood, W. Va.—A $15,000 bond issue for sewer construction has been voted. Charles B. Miller, city recorder.

WATER WORKS.

CONTRACTS AWARDED.

Oakland, Cal.—Constructing auxiliary steel pressure line in Fourteenth street, to William Heasey, $11,455.

Milliken, Colo.—Constructing water works system complete, to G. A. Smith, Denver, Colo., $12,000.

Burr Oak, Kan.—Constructing municipal water works system, to Des Moines Bridge & Iron Co.

Bolivar, Mo.—Extending water works system and constructing an electric light plant, to the Commercial Construction Co., Kansas City, Mo., $15,750.

Louisville, Neb.—Constructing a water works plant, to the Alamo Engine & Supply Co., Omaha, Neb.

Findlay, O.—Furnishing a 3,000,000-gal. pumping engine for the Riverside Park pumping station, to the Canton-Hughes Pump Co., Wooster, O.

Navarre, O.—The following contracts have been awarded for the construction of the $25,000 water works system: Laying pipe, to John Sorenson & Son, Ravenna, O.; furnishing tank and tower, to the Des Moines Bridge & Iron Co., Des Moines, Ia.; furnishing pipe, to the United States Cast Iron Pipe Co., Pittsburgh, Pa.; furnishing valves and hydrants, to the Kennedy Valve Mfg. Co., Elyria, O.; constructing pumping station, to Silas Engleman, Navarre, O. The pump contracts have not yet been awarded.

Norwalk, O.—Furnishing pipe for water main extension, to the Massillon Iron & Steel Co., Massillon, O.

Holdenville, Okla.—The following water works contracts have been awarded. Constructing power house and reservoir, to Brittain & Dotaw, $1,650; constructing pipe line, pump house and pit in river, to the J. S. Ferry Construction Co., $4,459; furnishing 500,000 gallon filter plant, to the Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., $6,098.

Erie, Pa.—Improving water works system, to Henry Shenk Co., Erie, Pa.

Syracuse, N. Y.—Furnishing the following water works equipment: Curb boxes, to W P. Taylor Co.; furnishing corporation cocks, to Pratt, Cody & Co.; furnishing 50,000 lbs. of lead pipe and 25,000 lbs. of soft pig lead, to Pierce, Butler & Pierce Co.

Tarentum, Pa.—Constructing a municipal water works system, to J. I. Dick, Tarentum, Pa., $60,133.

Spokane, Wash.—Constructing water main extensions in Manito Heights, to A. Wold, $9,750.

CONTEMPLATED WORK.

Redlands, Cal.—A $600,000 bond issue for the purchase of the water works system has been voted by the municipality.

Redlands, Cal.—A $600,000 bond issue for water works construction has been voted. R. Warner Thomas, city clerk.

Johnstown, Colo.—A $20,000 bond issue for water works construction has been voted. J. F. Thomas, city clerk.

Montrose, Colo.—The city engineer has been instructed to prepare plans and specifications for enlarging the water works system at an estimated cost of about $70,000.

Jesup, Ga.—A $35,000 bond issue for water works construction has been voted.

Burley, Ida.—An $85,000 bond issue for a water and sewerage system and extending the electric lighting and heating system has been voted.

Ashton, Ill.—The installation of a complete water works system is contemplated.

Greenfield, Ind.—The village has voted in favor of constructing a water works system.

Dunlap, Ia.—An $8,000 bond issue for water works construction has been voted. R. W. Wettengel, city clerk.

Logan, Ia.—A $20,000 bond issue for the construction of a water works system has been voted.

Storm Lake, Ia.—A $15,000 bond issue has been voted for extending the water works system and installing a complete filtration plant.

Mansfield, La.—Estimates have been prepared for water works extensions to cost $56,000 and a sewerage system, $38,000.

Highland Park, Mich.—A $49,500 bond issue for water works extensions has been voted.

Stockbridge, Mich.—A $20,000 bond issue for the installation of a water works system has been voted.

Meridian, Miss.—A $170,000 bond issue for water works improvement has been voted. C. W. O'Leary, city clerk.

College View, Neb.—The village has voted a $25,000 bond issue for the installation of a water works system.

Dewitt, Neb.—A $21,500 bond issue for water works construction has been voted.

Albion, N. Y.—A $130,000 bond issue for

water works construction has been voted. E. S. Eaton, village clerk.

Newburg, N. Y.—A $75,000 bond issue for water works improvement has been voted.

Oneida, N. Y.—A $7,000 bond issue for water main construction has been voted. O. J. Covell, city clerk.

Akron, O.—A $1,250,000 bond issue for water works improvement has been voted.

Gresham, Ore.—A $5,000 bond issue has been voted for water works construction.

Natrona, Pa.—Natrona Water Company will at once extend water mains 2,000 to 3,000 ft.

Blackville, S. C.—J. M. Johnston, Florence, S. C., has been retained to supervise the construction of a city water works system, and a sewerage system.

Mount Vernon, Tex.—A $20,000 bond issue for water works construction has been approved by the acting attorney general.

BRIDGES.

BIDS REQUESTED.

Aurora, Ind.—July 2. Constructing the following bridges: Salt Fork bridge; the Cold Springs bridge; the Rumsey Ford bridge; the Asche bridge and the Pike creek bridge. W. Magaly, auditor of Dearborn county.

Greencastle, Ind.—July 29, 11 a. m. Constructing two bridges in Washington township. E. L. Airhart, auditor.

Corydon, Ind.—July 2, 2 p. m. Constructing steel bridge at Milltown, between Harrison and Crawford counties. William Taylor, auditor of Harrison county.

Valley Falls, Kan.—July 15, 12 m. Constructing two reinforced concrete bridges, costing about $1,000, and one reinforced concrete bridge, costing $230. Dwight A. Bliss, county clerk.

Vicksburg, Miss.—July 3. Constructing steel bridge over Ball Ground creek in 5th district. J. B. Laughlin, city clerk.

Sidney, Nebr.—July 8. Constructing complete four steel beam bridges. H. P. Doran, county clerk.

Washburn, N. D.—July 8.—Constructing a steel I beam or truss bridge. Certified check 5 per cent. D. C. Wright, chairman of county board; T. E. Thompson, county auditor.

Cincinnati, O.—July 12, 12 m. Constructing a concrete box culvert, under specification No. 351. Certified check $500. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cleveland, O.—July 3. Constructing a concrete bridge on the Solon road under report No. 2952. Certified check 10 per cent. John F. Goldenbogen, clerk of Cuyahoga county.

Cleveland, O.—July 20, 11 a. m. Constructing concrete bridge on Drake road under Report No. 2945. John F. Goldenbogen, clerk of Cuyahoga county.

Columbus, O.—July 5, 12 m. Construction work as follows: Estimate No. 397, constructing reinforced concrete bridge on King avenue; estimate No. 398, constructing limestone rip-rap on King avenue; estimate No. 399, constructing west abutment of bridge on the Worthington and Elmwood avenue. Certified checks as follows: Estimate No. 397, $1,000; estimate Nos. 398 and 399, $200 each. F. M. Sayre, county auditor.

Morristown, Pa.—July 8. Constructing county bridge over Tacony creek at Cheltenham, Pa. J. N. Jacobs, controller.

Valparaiso, Ind.—July 2, 10 a. m. Constructing gravel roads in Morgan and West Chester counties. T. L. Blathly, auditor.

CONTRACTS AWARDED.

Bloomington, Ill.—Constructing bridge over Funk's branch at Danvers, to the Porter-McCulley Construction Co., Mackinaw, Ill.

Hillsboro, Ill. — Constructing concrete bridge on line between Irving and East Fork townships, to G. E. Wiley, Irving, Ill.

Taylorville, Ill.—Constructing a bridge across the south fork of the Sangamon river, to Frank R. Miller, Springfield, Ill.

Bloomfield, Ind.—Constructing bridges in Green county, to the Vincennes Bridge Co., Vincennes, Ind., $14,400.

Newcastle, Ind.—Constructing 7 bridges in Henry county, to the Burk Construction Co., Newcastle, Ind., about $13,000.

Princeton, Ind.—The following bridge contracts have been awarded: Fifteen bridges, to Geo. Soller; 2 bridges to the Vincennes Bridge Co., Vincennes, Ind.; 2 bridges, to Wm. Eiglemann; 3 bridges, to J. A. Berger. The total cost of contracts let is $16,551.

Sullivan Ind.—Constructing 18 bridges to cost about $12,000, to the Sullivan Bridge & Supply Co., Sullivan, Ind.

Wabash, Ind.—Constructing the Beldon bridge, to the National Concrete Co., $12,997.

Council Bluffs, Ia.—Constructing 3 bridges, to the Lana Construction Co., Council Bluffs, Iowa.

Marshalltown, Ia.—Constructing four 17-ft. span reinforced concrete bridges, to the Capitol City Construction Co., Des Moines, Ia.

Kansas City, Kan.—Remodeling the West Kansas avenue bridge, to the Kansas City Bridge Co.

Louisville, Ky.—Constructing 2 bridges in Washington township, to the Attica Bridge Co., Attica, Ind.

Baltimore, Md.—Constructing a number of sewers, to Ryan & Reilly, $44,241.

Lincoln, Neb.—Constructing 2 state bridges, to Stutt Bros., St. Louis, Mo.

Albany, N. Y.—Constructing 5 superstructures and 1 substructure for highway bridges over the Erie canal, between Lyons and Palmyra, to the Owego Bridge Co., Owego, N. Y., $59,616.

Altoona, Pa.—The following bridge contracts have been awarded: Two arch bridges, to Edwin H. Brau, Hollidaysburg, Pa., $1,747, $1,992; concrete girder bridge, to Fogel & Co., $1,282; double arch bridge at Ironsville, to the Ferro Concrete Co., $9,495.

Altoona, Pa.—Constructing the steel span of the Seventh street bridge, to the Penn. Bridge Co., Beaver Falls, Pa., $30,110.

New Castle, Pa.—The following bridge contracts have been awarded; Nine bridges, totaling $10,914, to the Farris Bridge Co.; 3 bridges, totalin~ $4,176, to the Nelson Meddith Co.

Osceola, Pa.—Constructing a bridge over Moshannon creek, to Geo. I. Thompson, Clearfield, Pa., $7,883.

CONTEMPLATED WORK.

Maywood, Ill.—Proviso township has voted a $20,000 bond issue for bridge construction.

Quincy, Ill.—The county supervisors have appropriated $14,939 for bridge construction. Ed. Miller, supervisor.

Fullerton, Ky.—Plans and specifications have been prepared for the construction of 4 bridges in Greenup county.

Baton Rouge, La.—A company has been incorporated for $1,000,000 to build a terminal station and a bridge across the Mississippi River. The incorporators are Hugh Chamberlain, Baton Rouge; Jos. E. Hedges, New York City; L. F. Stuart, Kansas City, Mo.; Walter Bynum, Baton Rouge; W. P. Chamberlain, New Orleans; and E. B. McQuety, Baton Rouge.

Meridian, Miss.—A $30,000 bond issue for the construction of a railroad viaduct has been voted. C. W. O'Leary, city clerk.

Medford, Ore.—A $20,000 bond issue for bridge construction has been voted. E. B. Foss, city recorder.

Bay City, Tex.—The United States government has appropriated $12,000 for the constructing of two bridges over the Intercostal Canal.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTRACTS AWARDED.

Atlanta, Ga.—Constructing a garbage disposal plant to the Heenan Destructor Co., thru their southern headquarters at Birmingham, Ala., $376,800.

Boston, Mass.—Constructing refuse receiving station at South street, to Lawler Bros., $71,333.

CONTEMPLATED WORK.

Iowa City, Ia.—The city desires to purchase a street flushing machine. James W. Berry, engineer.

Hagerstown, Md.—The Board of Trade is discussing the installation of a garbage disposal system.

Erie, Pa.—Street Superintendent Tracy has requested four additional street flushing wagons.

Philadelphia, Pa.—Specifications are being prepared for street cleaning, garbage collection, gasoline lighting contracts for 1913. Bids will be requested soon. Morris L. Cooke, director of public works.

Morgantown, W. Va.—The city council has authorized the purchase of a site for the proposed garbage incinerating plant.

STREET LIGHTING.

CONTEMPLATED WORK.

Jacksonville, Fla.—The installation of an ornamental lighting system for Hogan street is contemplated. F. W. Bucky, improvement association of Hogan street.

Burley, Ida.—An $85,000 bond issue for a water and sewerage system and for extendng the electric lighting and heating system has been voted.

Dow City, Ia.—A $5,000 bond issue has been voted for electric light improvement. E. T. Higgins, town clerk.

Marshalltown, Ia.—A public utility franchise for gas, electricity and the operation of street cars has been awarded to Col. William Dows, Isaac B. Smith, John A. Reed and R. S. Cook, of Cedar Rapids.

Moville, Ia.—A $7,800 bond issue for the construction of a municipal lighting plant has been voted. W. H. Rockefeller, city clerk.

Axtell, Kas.—A $10,000 bond issue for electric light plant construction has been voted. T. M. Fabor, city clerk.

Osawatomie, Kas.—A $20,000 bond issue for the construction of an electric light plant has been voted.

Osborne, Kas.—A $15,000 bond issue for the constructon of a municipal light plant has been voted.

Olivet, Mich.—The village is contemplating letting a contract to the Commonwealth Power Co., for the lighting of the streets. Ellsworth Long, village president.

Bethany, Mo.—A $25,000 bond issue for the construction of an electric light plant has been voted. J. D. McClure, city clerk.

Millville, N. J.—The city council has voted to retain a consulting engineer to have charge of the construction of a municipal light plant.

Lockport, N. Y.—The installation of an ornamental lighting system on Main street is contemplated. Address Pres. John Moon, of the Chamber of Commerce.

Northwood, N. D.—An $8,000 bond issue for electric light improvement has been voted.

Philadelphia, Pa.—Specifications are being prepared for street cleaning, garbage collection and gasoline lighting contracts for 1913. Bids will be requested soon. Morris L. Cooke, director of public works.

Sharon, Pa.—An $85,000 bond issue for the construction of a municipal electric light plant has been voted.

Columbia, S. C.—The installation of an ornamental lighting system on West Main street is contemplated. R. C. Keenan, councilman.

Palestine, Tex.—The Young Men's Business League are planning an ornamental lighting system for the city.

Danville, Va.—A $150,000 bond issue for the construction of an electric light plant has been voted.

FIRE APPARATUS.

CONTEMPLATED WORK.

Talladega, Ala.—The purchase of motor fire apparatus is contemplated.

Alameda, Cal.—The city clerk has been instructed to advertise for bids for an auto tractor for use on a hook and ladder truck.

San Diego, Cal.—A. D. Dobson, superintendent of the fire department, is preparing an ordinance for the purchase of four automobile chemical wagons.

Santa Clara, Cal.—The city will purchase a combination water, chemical and hose wagon.

Sterling, Ill.—Plans and specifications for an automobile fire truck has been prepared.

Caldwell, Ida.—A $10,000 bond issue has been voted for the purchase of fire apparatus.

Peru, Ind.—T. Dunn, city clerk, has been instructed to secure bids for motor fire apparatus.

Waltham, Miss.—A $6,000 appropriation was made for the purchase of motor fire apparatus.

Winchester, Mass.—The purchase of motor fire apparatus is contemplated.

Grand Rapids, Mich.—The board of police and fire commissioners will advertise for bids on motor fire apparatus, including two automobile hose wagons, a motor drive tractor and an automobile for the fire marshal.

St. Paul, Minn.—The purchase of a motor driven fire engine is contemplated.

St. Joseph, Mo.—Alfred Meier, president of the board of public works, has recommended a bond issue for the purchase of motor fire apparatus.

Tekamah, Neb.—The council has voted to add a motor propelled chemical engine to their fire equipment.

Mansfield, O.—The director of public service will advertise for bids for motor fire apparatus.

Mansfield, O.—The director of public service has been instructed to secure bids for a motor combination hose and chemical car. Geo. Knofflock, chief of fire department.

Oklahoma City, Okla.—The purchase of an automobile chemical car is contemplated.

West Chester, Pa.—The city is contemplating the purchase of an automobile fire engine and other motor apparatus.

Abilene, Tex.—A $10,000 bond issue for fire equipment has been voted.

Fort Worth, Tex.—The purchase of two automobile pumping engines is contemplated.

Milwaukee, Wis.—An ordinance has been prepared providing for the purchase of two combination hose and chemical automobiles. Thomas A. Clancy, chief of fire department.

Superior, Wis.—The purchase of a number of motor propelled fire engines is contemplated. Mayor Konkel.

Municipal Engineering.

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PRACTICAL ROAD BUILDING.*

By John N. Edy, Jun. Am. Soc. C. E., Assistant City Engineer, Billings, Mont.

CONCRETE CULVERTS AND BRIDGES.

ONE of the most important, and at the same time most neglected, phases of road work has to do with the construction of culverts and bridges. No matter what the state or condition of the road, these structures must be provided for the safety and convenience of the traveling public. It is the purpose of the writer to offer such suggestions regarding this work, as will be of practical value to the supervisor.

CONCRETE.

Concrete is a dense, rocklike mass composed of cement, sand, and stone or gravel. These ingredients are so proportioned that the cement will more than fill the voids or air spaces in the sand, forming a mortar; and the quantity of mortar must be sufficient to more than fill the voids in the stone. Upon the addition of water to a perfect mixture of the materials above, concrete is formed, the strength of which depends upon its density and the percentage of cement it contains. The value of the concrete then, is determined by the nature of the materials selected, and the proportions and thoroness of mixing. From this we see that it possesses no inherent quality that insures good results when improperly used; the mere fact that a structure is built of concrete in no way fixes its worth or durability. And on the other hand, well-made concrete is perhaps the most durable and permanent building material known. It is easily handled, lends itself readily to molding and shaping as desired, may be made from local materials, and its strength increases with age. It is practically everlasting. The first cost of a concrete structure is its last and only cost; there is no painting, no maintenance of any kind. But as noted, the materials must be handled with intelligence. The supervisor should thoroly understand the correct methods of proportioning and mixing the ingredients.

Cement. Only Portland cement of known and standard brands should be used. If the structure is to be placed in alkali soil, or subjected to the action of alkali water, the cement should preferably be "Alkali Proof" Portland cement, which has apparently proved itself able to withstand the disintegrating effects of alkali. If this brand can not be obtained, use standard Portland, but mix richer than for use under favorable conditions. It will not be necessary for the supervisor to test the cement, as its manufacture is so standardized that the quality of well-known brands is practically uniform. It is usually sold by the barrel, and is shipped in sacks of about 94 pounds each. It is customary to consider one sack of cement as equivalent to one cubic foot, and to use the cubic foot as the unit of measure. When stored or left on the work, the cement must be well protected by placing on a temporary platform and covering with heavy canvas, rubber sheeting, or other suitable material.

Sand. The sand used should be clean and sharp. In size it should range from ¼-inch down to fine. Sand screened from gravel thro a No. 4 screen will usually give excellent results. It must not contain more than 10 per cent. of clay or loam.

Stone or Gravel. The stone should be hard, durable material. If crushed, all dust is to be screened out, and no flat or scaley pieces used. For thin culverts and reinforced concrete the size of stone should vary from ⅜-inch to 1½-inch; for ordinary walls, stone up to 2½ inches may be used, and in heavy work larger stone will give good results. Gravel makes very good concrete, and may often be found at the bridge site. Sand should be removed from the gravel by screening, and then added in the correct proportions.

Water. The water must be reasonably clean, and free from alkali.

Proportioning. The proportions shall be by volume, the unit of measure being the sack of cement. The following may be used:

For reinforced concrete floor slabs, beams and girders, 1: 2: 4.

For plain culverts, concrete pipe, 1: 2½:5.

For abutments and wing walls, 1:3:6.

For heavy foundations, 1:3:7.

The expression 1:2:4 means: 1 sack (equals 1 cubic foot) of cement, 2 cubic feet of sand, 4 cubic feet of stone or screened gravel.

The supervisor must understand that 1 part of cement, 2½ parts sand, and 5 parts of broken stone will not give 8½ parts of concrete. The exact quantity will depend upon the percentage of voids in the sand and gravel, but probably not over 5½ parts of concrete will result. Again in using unscreened gravel and working to the proportions 1:2½:5, do not assume that one sack of cement should be used with 7½ cubic feet of natural gravel. If the sand were separated from this quantity (7½ ft.) of material, we would get about 6½ or 7 cubic feet of screened gravel, when only 5 cubic feet were wanted. A test should be made to determine the percentage of sand in the natural gravel, and only that quantity used that will give a mortar of the desired strength, to which may be added enough screened gravel to give the proper quantity of large aggregate. For instance, if it is desired to use natural gravel in the proportions 1: 2½:5, and upon screening several batches of 5 cubic feet of gravel it is found that 2½ cubic feet of sand and 4½ cubic feet of gravel are obtained, then to the 5 cubic feet of natural gravel may be added ½ cubic foot of screened gravel for each batch of concrete, using 1 sack of cement. If it is not desired to screen any of the material, use the natural gravel in the proportion 1:5.

As a rule, the voids in sand will not run over 40 per cent, and often less. In screened gravel of graded sizes, the voids are about the same. To determine the percentage of voids, proceed as follows:

Take a given quantity, say one cubic foot, of screened gravel, and place in a watertight vessel, shaking slightly. A cubical box 12x12x12 inches holds just one cubic foot, as does a cylindrical vessel 14⅞ inches in diameter and 10 inches deep. One cubic foot is approximately 30 quarts. Pour water into the vessel of stone or gravel, counting the number of quarts of water used until the water is just flush with the top of the stone. The water fills the air spaces or voids, and measures their volume. If 12 quarts are required to fill the voids in one cubic foot or 30 quarts of gravel, then the percentage of voids is 12 divided by 30, which equals 40. In the same way the voids in the sand may be measured, except that in this case the process is reversed, and the sand is poured into the water.

Another method of making this determination is as follows:

Weigh a given volume of sand or gravel, and call this weight G.

Weigh the same volume of water, and call its weight W.

Then,

$$\text{Percentage of voids} = \frac{(2.65 \times W) - G}{(2.65 \times W)} \times 100$$

If the volume used were one cubic foot, this equation reduces to

$$p = \frac{165 - G}{165}$$

While the method is the same, the above figures do not apply except when sand, gravel, or limestone is used. For other stone, substitute for 2.65 as shown below:

Trap	3.00
Granite	2.70
Limestone	2.60
Sandstone	2.50

Having ascertained the voids in the materials, we may proportion a dense concrete as follows: Use with any volume of sand enough cement to overfill the sand voids by 10 per cent. of these voids; then use with this mortar enough stone that the voids in the stone are overfilled by the same amount. For instance, assume the voids in the sand to be 36 per cent., and in the gravel 40 per cent. Thirty-six per cent. plus 1-10 of 36 per cent. equals approximately 40 per cent. Therefore, we will use 2½ volumes of sand for each volume of cement. Then 40 per cent. plus 1-10 of 40 per cent. equals 44 per cent., and we know that 2½ volumes are 44 per cent. of the quantity of stone to be used, which we find to be 5.7 volumes. A perfectly good and dense concrete, under the assumption, would be proportioned as below:

One part cement, 2½ parts sand, 5½ parts stone or screened gravel; and the volume of concrete would be a little less than 6, due to the slight excess of mortar used. These points are mentioned that the supervisor may know how to proportion the materials economically. As the strength of concrete depends upon the amount of cement it contains, as well as upon its density, and as reinforced concrete structures demand concrete of maximum strength, the proportion noted above for reinforced concrete: namely, 1:2:4, will be used for such purpose.

Mixing and Placing. Given good materials, the real value of the structure depends upon the thoroness of mixing and the care used in placing the concrete. Machine mixing is always preferable to hand mixing, but except on large jobs or a number of small ones, is not economical. When a machine mixer is used, it should be of the revolving drum type.

The materials should be placed in the mixer in measured batches, and not shoveled in, and depending on a count of the shovelsful to determine the quantity. A few trial batches should be run out, dry, and the number of revolutions of the drum determined that will give a uniform mix. In all cases the materials should have some dry mixing before the water is added.

Altho machine mixing is to be preferred, ordinarily the concrete will be mixed by hand, and satisfactory results may be obtained if care is used in so doing. If screened stone or gravel is to be used, proceed as follows: Make a mixing platform by nailing planks on 2x4-inch stringers spaced about three feet apart. The plank should be dressed on the top side and laid with close joints. The platform should be at least 8x10 feet, around the edges of which are nailed 2x4-inch strips laid flat, to prevent water running off the board. A bottomless box of suitable dimensions, with narrow strips nailed on the sides near the top for handles, is used for measuring materials.

Spread the sand for one batch in a thin layer, and over it spread the cement. These materials are then mixed by turning with short-handled shovels. Two or four men face each other on the platform and turn the mixture towards the edge of the board, with a spreading motion of the shovels, as the sand and cement leave them. The materials are then turned back, and this operation is repeated until the mass has been turned at least three times, or until it has an even, uniform color. The mixture is then spread and mixed with enough water to form a wet, but not sloppy mortar. The stone is placed on the mortar and the whole turned until every fragment of stone is coated with mortar, when it is ready to place. Sometimes the stone is placed and mixed with the dry sand and cement before the water is added. In any event, the sand and cement must be mixed dry until of a uniform color, and the whole mass mixed wet until the stone is uniformly coated with mortar.

In using unscreened gravel, place the gravel in a thin layer, spread the cement and mix dry before adding the water. A wet, but not fluid, mix will be found to give the best results.

Concrete may be wheeled or shoveled into place, as is the most convenient. Steel barrows are best for wheeling. As the concrete is deposited in the forms, it should be carefully spaded, so as to expel all air, and the stone worked back from the forms in order to get a smooth surface. It must be worked in and about the steel reinforcement, if any, being careful not to disturb the steel and to leave no air pockets. Do not attempt to use a plaster cast on the concrete surface. If a more uniform surface is desired than is obtained by using oiled, dressed lumber for forms and spading, the concrete may be rubbed with a wooden float as soon as the forms are removed; a little water dashed on the surface will aid in floating. After floating, the surface may or may not be painted with a cement grout.

Forms. The lumber for forms must be sufficiently heavy and braced to hold the weight of the concrete. Ordinarily, 1½-inch to 2-inch stuff is used, except for light work, when 1-inch material will do if properly braced. Cut the lumber as little as possible, so that it may be used several times. Forms for walls, abutments, etc., are held together with wires; all forms should be dressed on the inside and oiled with crude oil or softsoap.

The time that forms should remain in place depends on the cement used and the weather conditions. With a wet mix in warm weather, wall forms may be removed usually in two to four days. Small culverts require about the same time, but should not be loaded immediately. Bridge floors, beams, etc., should be left in the forms for one or two weeks, leaving the false work under the structure for three weeks or longer. In all cases the forms must be left on until the concrete has set sufficiently to stand. The supervisor must be sure that the forms are not removed too soon. When alkali-proof cement is used, it will be found to harden more slowly than ordinary Portland, hence it must be left in the forms for a longer time.

Green concrete must never be exposed to the direct rays of the summer sun. In hot weather the work should be covered with canvas or other protection, and sprinkled at least once a day for five days. Concrete requires moisture for hardening; and when the weather is warm and the evaporation rapid, the moisture that is thus lost must be supplied by sprinkling. This is a very important point. Quite frequently well-made concrete is porous and crumbly because it has been permitted to dry out before hardening.

Safe practice would suggest no concreting in freezing weather. If, however, the temperature suddenly drops while the work is in progress, the following precautions should be observed:

Procure an old smoke stack and cut longitudinally into two pieces, so as to give two semi-circular forms about eight feet long. Place these on the ground a few feet apart, build a fire under them and shovel the sand and stone over and about them. This is done to heat the materials. Also heat the water, with which may be used common salt equal to 10 per cent. of weight of water. The use of the heated materials and salt lessens the chance of freezing before setting. The concrete in place must be protected by covering with canvas, over which may be spread a thin layer of earth or manure. Never permit manure to come in contact with new concrete. As the concrete sets more slowly in cold weather, the forms must be left in place for a longer time.

Concreting Under Water. Quite frequently it is necessary to place concrete in a trench that is partly filled with water. Especially is this true when building wing walls and abutments. Under such conditions the following precautions should be observed: First, before starting the excavation, it is wise to drive a double row of 2x6-inch sheet piling about the trench line, breaking joints and allowing plenty of room for the trench. Place mud or sacks filled with mud against the inside of the sheet piling, to aid in keeping out the water. Bail out (or preferably pump out with a hand pump) all the water that can so be removed. Continue the excavation to the required depth, pumping at the same time if necessary. Place the forms as quickly as possible. Mix the concrete that is to be placed under water (there will usually be some leakage) somewhat dry, but add some water; that is, never place perfectly dry cement and gravel in water and depend upon this trench water to properly wet the concrete. Having mixed the concrete as noted, it may be placed under water by means of a wooden bucket with a door opening downward from the bottom, or by means of a tight, closed chute, or by placing in cement sacks which are lowered to the desired location. The particular difficulty to be overcome is the separation of the materials which will weaken, if not render absolutely valueless, the concrete. Under no circumstances should concrete be shoveled into a trench in which there is any appreciable amount of water. If the sheet piles are driven with care and some effort made to render them water-tight, a very unpleasant condition may be removed, and the concreting continued with every assurance of success.

In no other type of construction does the personal equation enter so strongly. Given good materials and correct proportions, the strength and value of the product is wholly dependent upon the judgment exercised in mixing, placing and curing the concrete.

BALTIMORE SEWAGE DISPOSAL PLANT.

IN the general description of the sewerage system given in the July issue of Municipal Engineering by Stuart Stevens Scott, a general idea was given of the magnitude and difficulty of the problem of providing Baltimore with a complete system of sewers. The very magnitude of the work as well as the more interesting points warrant a more complete account of various parts which go to make up the system.

The legislature of the state of Maryland, in 1909, provided that a disposal system should be constructed to provide the "highest practicable degree of purity" before the sewage should be discharged into Chesapeake bay. A board of engineers chosen to make recommendations to this end stated that the disposal system should include preliminary settling tanks, sprinkling filters, secondary settling tanks and intermittent filters, which would provide at least one operation in the purification more than is demanded in most cities. These recommendations were made in 1906, and it was substantially according thereto that the system was constructed, except for the fact that the intermittent filters were regarded as unnecessary, provision being made for the treatment between the filters and secondary settling tanks with hypochlorite of lime.

All sanitary sewage from the low level district flows by gravity to the disposal plant, but about one-third of the total amount of sewage which will reach the disposal plant must be raised against a total head of 72 feet.

Provision was made in designing the pumping station for a population of 1,000,000, and five 27,500,000-gallon-per-24-hour pumps will be installed ultimately. It is estimated that two of the pumps will take care of the maximum flow for that population, leaving the other two to be worked alternately then, and a fifth for emergency service in case of breakdown. Three of these pumps are already installed and ready for service.

The pump station building contains in addition to the pump and engine room, boiler room and screen chamber, offices for the station superintendent, drafting rooms, store rooms, etc. The engine room is 180 feet long, 54 feet wide and 68 feet

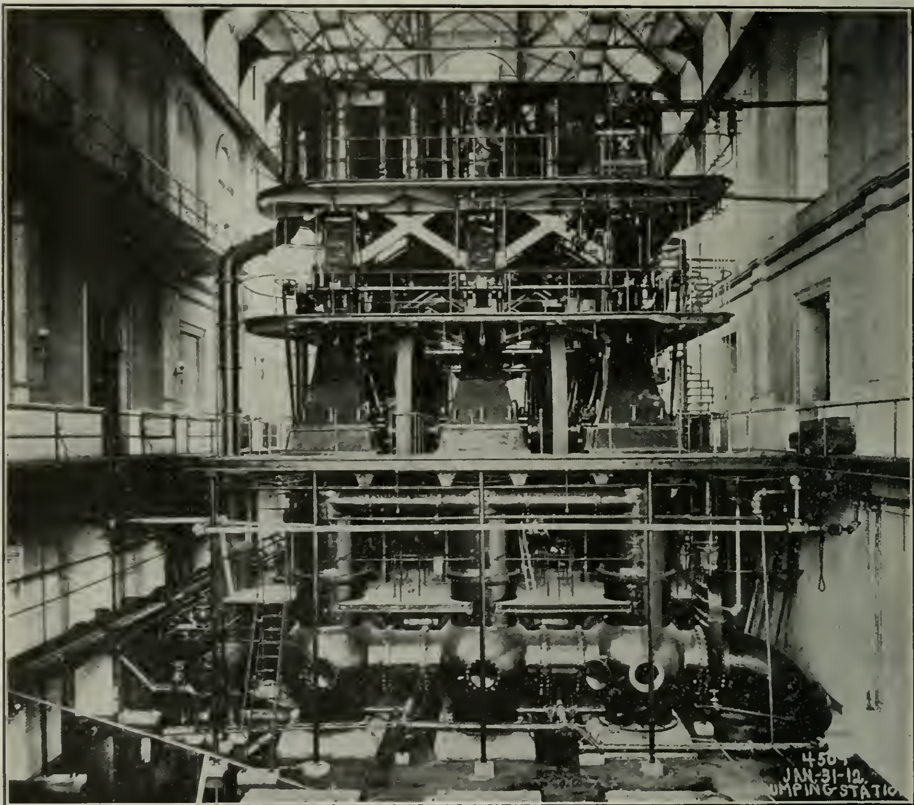
BALTIMORE SEWAGE DISPOSAL.
Exterior of Low Level Pumping Plant.

high to provide for the enormous pumps. It is lined with enamel brick for its full height. Besides the five pumps mentioned this room will contain two drainage pumps, valves, piping, etc., and a twenty-ton electric crane.

The sewage pumping units are vertical triple-expansion crank and flywheel condensing engines, having three steam cylinders, 22, 41 and 62 inches in diameter, and three single acting plungers 40 inches in diameter, all of 60-inch stroke. The pumps operate at 20 r.p.m. The discharge is thru 42-inch force mains leading to the disposal plant. The drainage pumps are provided to pump the water from the under drains laid beneath the intercepting sewers, discharging it either thru the condensers of the large pumps or into an outer drain, as desired. There are two 12-inch centrifugal pumps operated by 40 h.p. compound condensing engines. The pumps have a capacity of 3,000 gallons per minute, each.

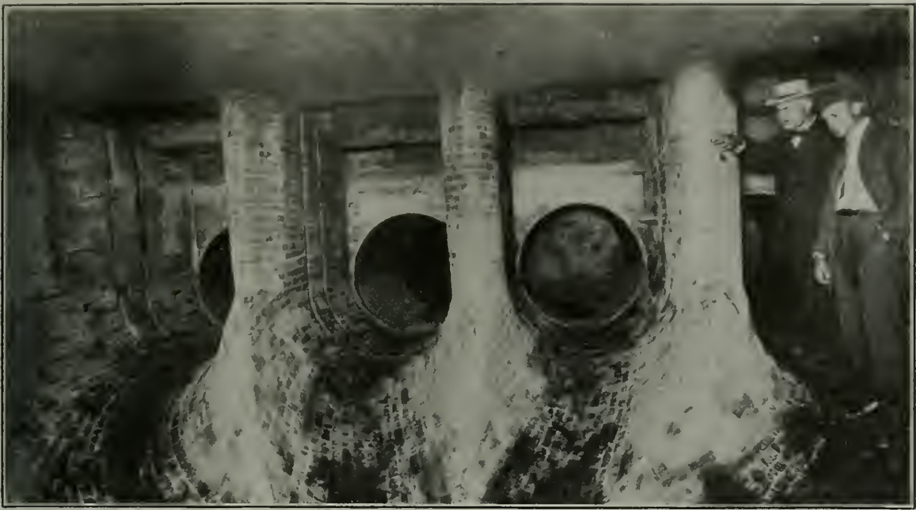
The raw sewage in the low level district flows directly from the intercepters into a screen chamber located between the pump room and the boiler room. Here it is screened, first thru a set of movable screens, and then thru fixed screens over suction pipes of the pumps. These screens remove the coarser elements, such as small sticks, rags, toys, etc., from the sewage, so as to prevent clogging of the pumps.

After leaving the pumping station, the sewage from the low level district flows thru the force mains, previously mentioned, to the disposal plant, where it is handled together with that which flows by gravity from the high level district. A photograph shows the discharge chamber at the upper end of the force mains from the pumping station.



BALTIMORE SEWAGE DISPOSAL.
Pumping Unit at Low Level Pumping Plant.

The sewage from the main outfall sewers is first screened thru a series of coarse screens consisting of stationary iron bars with ⅞-inch openings serving the same purpose as the fixed screens at the pumping station. These screens are at present cleaned by hand by means of rakes, tho it is probable that some me-



BALTIMORE SEWAGE DISPOSAL.
Force Mains Entering the Discharge Chamber.

BALTIMORE SEWAGE DISPOSAL.
Lowering Sections of Wooden Outfall.

chanical cleaning device will be adopted later.

All sewage which enters the disposal plant is first measured thru a Venturi meter, having a diameter of 42 inches at the entrance and with a 21-inch throat casting. Recording dials register the flow of sewage in units of millions of gallons per day, and keep a record by the week of the total amount treated.

The first process in the disposal plant consists in passing the sewage thru the hydrolitic or settling tanks. The passage thru these tanks requires about eight hours, allowing time for the solids to settle, after which the liquid remaining passes on to the gate house. The hydrolitic tanks are about 450 feet long, and have a capacity of 4,000,000 gallons. The bottoms of the tanks are built on a slope and have channels along them to allow the sludge to be more easily removed. From the hydrolitic tanks the sludge is washed thru floor drains into conduits, and thence into a main pump well. From this well it is forced thru a series of 12-inch mains to the sludge digesting tanks. The sludge pumps are electrically driven centrifugals, receiving their power from the turbine plant operated, as will be noted later.

The sludge passes into digesting tanks, which are three in number, and have a capacity of about 1,400,000 gallons. Here the bacterial action within the sludge is carried on under clear water, after which it is removed to drying beds.

The sewage after the sludge is removed passes on to a gate house, after passing thru a series of fine screens of the rotary drum type, where all matter which might perhaps clog the nozzles of the sprinkling filters is removed.

From the gate house the sewage is applied to any one of a number of filter beds located at a level of about fifteen feet beneath the hydrolitic tanks. This provides a sufficient head to cause the liquid to be sprayed over the stone beds and filter down thru about 8½ feet of broken stone ranging in size from 1 inch to 2½ inches. The sprinkling nozzles throw a square spray so as to utilize the greatest possible area of the filter surface, and a very ingenious arrangement of the cam-driven butterfly valves regulates the flow, causing it to pulsate and so throw the spray at varying distances from very close to the sprinkling heads to the most remote points of the filter beds. Twelve acres of these filter beds are now in service, and the sewage is applied thru about 2,400 nozzles.

The spraying action provides sufficient aeration for the sewage, and the succeeding operation as the liquid is finely divided in passing down thru the stone beds allows of the completion of the bacterial action.

After leaving the filter beds the sewage is practically purified. It is drained off from the floor to a central channel and thence into settling basins, thru which it requires three hours to pass. These settling basins serve merely to rid the liquid of any sediment which remains, which sediment is practically sterile, and, in fact, little different from the soil which is stirred up in a river during flood seasons.

The next stage in the progress of the sewage thru the plant is one of the most unique features of the Baltimore disposal system. An 18-foot drop was available at this point before the liquid was discharged into the outfall pipes. Two turbines are at present installed, and another will soon be added, which make use of the power available from this drop. These turbines are connected to 110 k.w. generators which will supply current to run a 600-gallons-per-minute centrifugal pump, which will lift the purified liquid from the sewage to an elevated tank from which it may be used for washing the sludge from the sludge beds, etc., and also sufficient current to light the plant thruout, and operate various small motors which control some of the operations in the plant.

From the turbines the liquid flows into Back river thru two five-foot wood-stave pipes, each 2,500 feet long. The accompanying photograph shows the method of lowering these pipes into their places on the river bed. They were constructed on trestle built out into the river, both pipe lines being constructed at the same time and in 1,250-foot sections. They were then suspended by means of bands and vertical threaded rods to the trestle as shown. Then with a man at each bend of the trestle, operating a wrench on the nuts suspending the rods, they were gradually lowered to the river bottom, the operation being assisted by boxes of sand added to give additional weight. The two halves of each pipe line were then joined beneath the water by divers.

The disposal plant is operating with only a small amount of sewage at the present time, for only a small percentage of the connections have been made. If the work proceeds with the same rapidity as it has in the past, it is probable that all of the sanitary sewers mentioned in the sewerage commission report in 1906 will be completed in 1914. The number of units now ready for service will purify the sewage from about 275,000 people. The cost of both the sanitary and storm water systems complete will be approximately $20,000,000.

Calvin W. Hendrick, formerly in charge of sewer construction for New York City, directed the design and construction of the entire sewerage work. Ezra B. Whitman was resident engineer, and H. C. McRae was engineer in charge of the works.

PAPERS BEFORE THE AMERICAN WATER WORKS ASSOCIATION.

ELECTROLYSIS FROM STRAY ELECTRIC CURRENTS.

By Albert F. Ganz, Professor of Electrical Engineering, Stevens Institute of Technology, Hoboken, N. J.

ELECTROLYSIS is defined as chemical decomposition by means of electric currents. Stray electric currents, escaping from grounded electrical distribution systems which reach underground pipes, cause destruction from electrolysis where these currents leave the pipes for the surrounding soil, because soil is an electrolytic conductor. Theory and experience show that the weight of metal destroyed by electrolysis is independent of the voltage, except insofar as this determines the amount of current produced, and that this corrosion is directly proportional to the amount of current leaving the pipe and to the time during which it leaves.

In practice the only serious sources of stray currents are single trolley direct-current electric railways. In these railways the running tracks are used as the return conductor, and for this reason they are connected to the negative bus-bar at the power station by return feeder cables. In most systems the tracks are connected to the negative bus-bar directly at the power station, and there are many systems where there are no further return feeders. The running tracks of such single trolley railways are usually in contact with ground; and since there is a drop in voltage in the rails, current leaks from the rails to flow thru ground, the amount of stray current depending upon the drop in voltage in the rails and upon the resistance of the path thru ground. Since electric current can only flow in a closed circuit, all current which leaks from rails and flows to ground and on underground pipes must again leave these pipes where negative return feeder cables are connected to the rails, in order to flow back to the negative terminal of the generator and so complete the electric circuit. Where these stray currents leave these underground pipes to flow to the surrounding soil, electrolysis corrosion is produced, resulting in a destruction of 20 pounds of iron in one year for every ampere of current. It has been disputed whether the amount of destruction produced is always equal to the theoretical amount; a number of laboratory experiments made recently by the author under practical conditions with current densities as low as those found in practice on underground piping seem to indicate that the actual amount of destruction is always at least equal to the theoretical amount, and is often even greater than the theoretical amount.

Since stray currents flowing thru the ground and thru underground piping are caused by potential differences between the pipes and rails set up by the drop in voltage in the rails, the simplest way to determine the probable existence of stray current on underground piping is to measure the potential differences between pipes and rails. Such measurements made thruout a system constitute the usual potential survey. These potential differences are, however, not a measure of the current flow between pipes and rails, as this is determined also by the resistance of the path thru the intervening ground, and this resistance cannot be practically measured. Since the actual electrolysis danger of a pipe is determined by the amount of current flowing on the pipe, it is necessary to make current measurements at many points thruout a piping system. The existence and direction of current flow on a pipe can be determined from drop measurements between service connections, but the magnitude of the current flowing cannot be determined from such drop measurements. To determine the actual amount of current flowing, a length of pipe is exposed and the drop in potential along a known length of continuous pipe is measured, and this drop is divided by an assumed resistance for the included length of pipe.

Since the positive potential of a pipe referred to rails, plus the negative potential of the pipe referred to rails, plus the drop in the pipe, is equal to the drop in the rails; the potential and current surveys enable one also to form an estimate of the drop in rails, and thus to form an idea as to the condition of the railway return circuit.

After drop and current measurements have been made at a sufficient number of points, they are conveniently plotted on a mains map, and a study of this map will indicate where current is leaving the pipes. Such points will always be found in the regions where the pipes are positive to the rails. Other points remote from the positive region will in most cases also be found where current leaves the pipes to flow to other pipes or to other underground metallic structures, or to flow to ground in cases where the negative bus-bar is grounded thru low resistance ground connections. The author has found large stray currents leaving water pipes in districts where these pipes were from ten to twenty-five volts negative in potential to the trolley rails, and more than five miles away from the railway power station. At points where the current survey indicates current leaving, excavations should be made and the pipe examined for evidences of electrolytic corrosion.

Besides the danger from electrolytic destruction of the pipes, stray currents where they flow on underground piping systems frequently enter buildings thru service connections and produce a serious fire hazard. For example, current may flow into a building thru a water service pipe, then flow from the house water piping to the house gas piping, and then out from the building thru the gas service pipe. Such contacts between service pipes or between a service pipe and the lead sheathing of a telephone or a power cable frequently occur thru metal ceilings or where the pipes rest against each other. Since dangerous heating may be produced where the current flows thru such contacts or where vibration may momentarily separate the contact and produce an arc, nearby inflammable material is in danger of being set on fire. The author has in fact found many cases where currents up to 30 amperes were flowing into and out of buildings thru service pipes or lead cable sheaths. Evidences of arcing having occurred between such contacts in buildings have also been found. There is no doubt that many fires have started in this way, but it is always difficult to prove the cause of a fire because of the destruction resulting from the fire.

There is only one complete remedy for electrolysis and that is the use of a completely insulated return circuit. Such railways may be provided with double overhead trolley wires, as used, for example, in Washington, D. C., Cincinnati and Havana; or with an insulted outgoing and return conductor in underground conduits, as used, for example, on the surface lines on Manhattan Island; or with separate insulated third and fourth rails for the outgoing and return current, as is used on the Metropolitan District railway in London. With these systems the running tracks are not used as a part of the electric circuit, and as both positive and negative sides of the circuit are insulated no stray currents are produced.

Where a road operates on a private right-of-way, the rails can often be practically insulated from ground and the escape of current from the tracks prevented. For surface roads this can be practically accomplished by placing the rails on wooden ties above ground and using broken stone for ballast and keeping the rails out of contact with ground. In the case of railway lines operating on elevated structures, the rails can be fastened to wooden ties and kept out of contact with the structure. These rails, supplemented where necessary with negative feeder cables, also insulated from the structure, can then be used for the return conductor. In this way the return circuit is quite thoroughly insulated from the elevated structure and from ground, and stray currents are entirely prevented.

A number of remedial measures intended to reduce stray currents from electric railways using the grounded rails for a return conductor have been tried. These methods may be divided into two classes, the first class aiming to remove the current harmlessly from pipes by metallic connections or bonds between the pipes and the railway return circuit, and the second aiming to minimize stray currents thru ground.

Since stray currents cause damage only where they leave pipes to flow to the surrounding soil, attempts are frequently made to prevent destruction from electrolysis by connecting or bonding the pipes or other structures by means of metallic conductors to the rails or to the negative return circuit, so as to remove the electric current by metallic conduction and thus prevent corrosion from electrolysis. This method can protect lead cable sheaths because they form continuous electrical conductors, but is not generally applicable to underground piping systems, because the latter do not form continuous electrical conductors, but are more or less discontinuous networks. While lead calked joints usually have a relatively low resistance, it frequently happens that they develop such high resistances as to make them practically insulating joints, due undoubtedly to the formation of oxide coatings. Cement joints and cement pipes have such a high resistance compared with iron pipes that they are practically insulating. Bonding of pipes to the rails or to the negative return circuit can only afford local protection to the extent that the piping connected forms a continuous metallic conductor, and this latter is an unknown and uncertain quantity in a piping network. In the practical working out of a bonding or drainage system two opposing tendencies develop. First, there is a reduction in the difference of potential between pipes and rails in the positive areas and consequent reduction of damage in those areas. Second, there is an increase of current flow on the pipes thruout the entire system, thus increasing the danger of trouble at high resistance joints or other places where two piping systems, or separate portions of the same system, are electrically discontinuous. As a rule, in the early stages of this system, and especially in small networks when there are comparatively few bond connections and the resistances of the paths over the pipes are therefore relatively high, the effect is apt to be beneficial, reducing the danger in positive areas more than it increases the danger elsewhere. As the system grows and the load increases, more and heavier bonds become necessary. The current on the pipes may finally become so great that the trouble from current shunting around joints or between separate systems will increase more rapidly than the danger in the positive areas is reduced, and any further increase in the bonding becomes an actual source of danger to the system. Since bonding transfers the trouble from the region where it was most evident to a new locality where it may require several years to manifest itself, the false impression is created that the trouble has been removed. It is largely this obscure and slow manner in which trouble develops that has caused this method to become quite widely used. A number of cases have been reported where a main bonded to the negative return circuit at the power station was completely destroyed from electrolysis a block or two away because of a high resistance joint in the main, forcing the current to shunt around the joint and leave the main a short distance away from the power station. In one of these cases one entire block of main had to be replaced. In another case the water main on one side of the street was bonded to the negative return circuit at the power station, and a main on the opposite side of the same street, altho connected thru cross-piping to the bonded main, was completely destroyed because high resistance joints had developed in the connecting pipes. In addition, bonding pipes as a means of protection always renders the bonded structures a part of the negative return circuit, and therefore a source of danger to other underground structures which are not bonded. It has, in fact, been frequently found that where gas or water service pipes cross-bonded cable sheaths, currents are induced to flow from the service pipes to the cable sheaths and produce gradual destruction of the service pipes. In the case of one city, nineteen service pipes were destroyed in the course of one year directly where these pipes cross telephone ducts containing cables whose sheaths are bonded to the railway return circuit. One engineer, who has studied this problem very carefully and entirely impartially, has very aptly likened bonding to the drug habit, producing temporary relief at the expense of permanent and perhaps irreparable injury to the victim, which injury is, however, too rarely attributed to the true cause.

Experience shows that where there is serious trouble from electrolysis caused by large stray currents leaking from the street railways, the bulk of this trouble is due to defective rail bonding, to ground connections from the negative bus-bar, and to lack of return feeders to bring the current back from the rails to the power station. While stray currents can only be entirely eliminated by insulating the return circuit by the use of a double trolley, either overhead or in conduit, it is, nevertheless, a fact which is not generally appreciated, that where large stray currents exist, these can always be reduced to a small fraction of their present value by removing all ground connections of the negative bus-bar and installing insulated return feeders proportioned for equal drop from radially-disposed points in the track system located at some distance from the power station. By this method the rails are drained of current, and any desired part of the voltage drop can be removed from the rails and transferred to insulated conductors from which currents cannot leak. In Europe such radial insulated return feeders for bringing current back from the rails to the power station are made necessary by regulations limiting the allowable drop in voltage in the rails, and in most cases such installations of insulated return feeders have substantially removed serious trouble from electrolysis. This system of minimizing stray currents by the means of radially-disposed insulated return feeders has also been installed in a number of American cities, and the method is gradually being recognized as by far the best for minimizing stray currents. This system, in fact, removes the root of the trouble by draining the rails of current and removing voltage drop from the rails and thus preventing substantial leakage of current thru ground, and is therefore correct in principle. The railroad companies frequently object to this system, claiming that it is prohibitively expensive. This is certainly not the case, as is evidenced by the fact that the method is in general use in Europe and in a number of American cities today. The fact is that in many electric railways there is practically no installation of negative feeders and the railway companies are often not willing to install even a moderate amount of return feeder copper. A mistake is often made in confusing the radial insulated return feeder system with paralleling the rails with copper. Of course where the negative bus bar is connected to the rails at the power station, and these rails are paralleled with copper feeders, the drop in the rails is reduced in the proportion that the conductivity of the return circuit is increased, but no part of the drop is actually removed from the grounded rails. The amount of copper paralleling the rails that would be required to reduce stray currents to a negligible amount would in all large systems be absolutely prohibitive. This, however, is not the case with the radial insulated return feeder system. With the latter system any desired reduction in rail drop and consequently in the amount of stray current can be secured, independent of the amount of copper installed, the amount of copper being determined by the allowable drop or power loss in the return circuit. The railway company can divide the annual charge of interest on copper invested and operating expense in any ratio within wide limits without affecting the amount of stray current produced from the system. The pipe owning companies suffer constant expense on account of stray railway currents in the form of repairs and depreciation of their underground structures, and in the form of liability for accidents, and this can be reduced with certainty to any desired extent, short of complete elimination, by the assumption on the part of the railway company of expense in the form of interest and power charges for its return circuit. The railway companies should in all fairness assume this expense and responsibility. If the railway companies would apply as much engineering knowledge and money to their negative circuits as they do to their positive circuits there would be but little trouble from electrolysis. The pipe owning companies should co-operate with the railway companies by affording them access to their pipe for making necessary measurements, etc. After a railway company has installed a reasonable and fair return circuit, it sometimes happens that it is desirable to eliminate any remaining current on pipes by the use of properly located insulating joints. Under these circumstances the pipe owning companies should be willing to co-operate with the railway company in the installation of such joints.

In the decree recently filed in the celebrated Peoria case, the railway company is enjoined and restrained from injuring the property of the water company by electric current escaping from the rails or structures of the railway company. No particular method for preventing escape of current is prescribed in the decree, because the Court in its decision has already stated that a Court does not have the power to prescribe by injunction any specific system, and that this power resides only with the legislative bodies. In its decision the court, however, lays great stress upon the insulated radial return feeder system, which is spoken of as a quadrilateral system. The decree also requires the water company to cooperate with the railway company to the extent of giving the railway company access to its piping system for the purpose of measuring flow of current upon its system, and of determining whether injury from electrolysis is being continued, in order that the railway company may determine whether it is complying with the terms of the decree. It is evident from this decree that the expense of providing a proper return circuit for the railway system so as to minimize escape of current falls entirely upon the railway company as it should in all fairness. One section of the decree states that within six months after the expiration of one year after the date of the decree, the railway company may apply for a hearing on the question whether it should be permitted to make an experimental use of the drainage system, in order to ascertain whether such drainage or limited use thereof can be practically applied to the piping system. It appears from the decision and the decree that the railway company must within one year improve its return circuit so as to prevent as much as possible the escape of stray electric currents from its system. If, after this has been done, it is found that stray currents still exist on the piping system, then the railway company may apply to the Court for a hearing to determine whether the water company should be directed to permit the railway company to try a drainage system as an experiment to remove the remaining current harmlessly. A drainage system such as contemplated as a possible final measure by the Peoria decree, when properly controlled so that only small currents are drained from the pipe, does not have the objectionable and dangerous features of promiscuous bonding where large currents are made to flow on the pipe as often found in American cities, and may even be a safe final method where the soil conditions are favorable and where the underground structures are all continuous electrical conductors. It nevertheless seems to the author very unfair that any pipe owning company should be compelled by a Court order to permit an electric railway company to use its pipe as a return conductor for its railway system, even to the slightest extent. If the Court does not have the power to compel the railway company to adopt any specific method for eliminating the danger from electrolysis, then it certainly should not impose any specific method upon the pipe owning companies. The latter may for example prefer to remove any small remaining stray currents by means of properly located insulating joints.

It is the author's firm conviction that such remedial measures as pipe drainage or insulating pipe joints should be used if at all only as a final measure and never until the return circuit of the railway has been improved so that only small amounts of stray current remain on the underground structures. This view appears to be entirely in accord with the Peoria decision, and is certainly in accord with the best engineering practice.

THE WATER WORKS OF NEW YORK.

By Edward Wegman, New York City.

THE greatest water works of modern times are, beyond question, those of the city of New York. Prior to 1774 the inhabitants of this city obtained the water required for domestic purposes from the public wells, which were generally placed at the street corners. The first of these wells was sunk in 1658 in front of the old fort at Bowling Green.

In 1774 the first public water works were constructed for New York, according to plans prepared by Christopher Colles, an English civil engineer. Water was pumped by steam engines from the old "Collect Pond," which occupied the space where now stand the Tombs and the surrounding blocks, to a reservoir constructed on the east side of Broadway between Pearl and Walker streets. The water was distributed through hollow logs laid in the principal streets of the city. Owing to the insufficient supply and the confusion caused by the revolution, these works were soon abandoned.

In 1799 the Manhattan Company obtained a charter for supplying the city of New York with pure and wholesome water. This company sunk some wells near the northwest corner of Reade and Center streets, from which water was pumped into a reservoir built on the north side of Chambers street, between Broadway and Center street, whence the water was distributed through hollow logs. The supply furnished by the Manhattan Company was insufficient in quantity and bad in quality.

In 1834 the legislature of the state authorized the city of New York to obtain a supply of "pure and wholesome water" from Croton river. The works necessary for securing this supply were constructed in 1837 to 1842.

A "fountain reservoir" was formed by building a dam, 50 feet high, across the Croton river, about nine miles above its mouth. From this reservoir the water was conveyed to the city in a masonry conduit, 8 ft. 5½ ins. high and 7 ft. 5 ins. wide. For the greater part of its length the aqueduct followed the east bank of the Hudson river, being generally built as "cut and cover work." Small mountain spurs were pierced by tunnels and valleys were usually crossed by dry stone embankments on top of which the conduit was built. The Harlem river was crossed by a fine aqueduct bridge, having fifteen semi-circular arches, viz.: eight of 80 feet span and seven having spans of 50 feet.

The works described above were first put into service on July 4, 1842. For nearly fifty years they supplied the city, altho they were severely strained to keep up with the increasing consumption. According to the original plans, the Old Croton Aqueduct, as the conduit described above is now called, was only to deliver about 36,000,000 gallons per day. To keep up with the consumption this conduit was forced by 1880 to deliver about 95,000,000 gallons daily.

In 1880 to 1884 a small additional supply of 23,000,000 gallons per day was obtained from the Bronx and Byram rivers.

In 1884 to 1891 a second aqueduct, having a capacity of about 300,000,000 gallons per day, was built from the Croton valley to the city of New York. This conduit, known as the New Croton Aqueduct, is 13.53 feet high and 13.6 feet wide. From the Croton valley to a terminal gate house at 135th street and Convent avenue in the city, the new aqueduct was constructed entirely in tunnel, with the exception of a few short sections, aggregating 1.12 miles in length, where the conduit was built in open cut. The Harlem river was crossed by a siphon tunnel, about 1,300 feet long, excavated about 300 feet below tide. From the gate house at 135th street and Convent avenue the water was connected with the distributing pipe system by eight lines of mains, each 4 feet in diameter. The new aqueduct was put into service in 1890. Its construction cost about $20,000,000.

In order to obtain as much water as possible from the Croton river, a number of storage reservoirs were built from time to time on the main river or its affluents, in order to retain the excess of water during periods of flood to feed the river during times of droughts. The reservoirs that have been constructed in the Croton watershed are mentioned in the following tables, showing date put in service and storage capacity in millions of gallons:

STORAGE RESERVOIRS IN THE CROTON WATERSHED.

*Old Croton Lake	1842	.....
Boyd's Corners	1873	2,727
Middle Branch	1878	4,155
East Branch	1891	5,243
Bog Brook	1891	4,400
Titicus	1893	7,617
Carmel or West Branch	1895	10,668
Amawalk	1897	7,086
New Croton	1905	33,815
Cross River	1908	10,823
Croton Falls	1910	15,753
Total		102,387

*Included in New Croton reservoir.

Besides the storage mentioned above, the city obtains an additional quantity of water by drawing down a number of lakes and ponds, which it either owns or controls, which are with storage capacity in millions of gallons:

STORAGE IN LAKES AND PONDS IN THE CROTON WATERSHED.

White Pond	200
Barret's Pond	170
Lake Gleneida	165
Kirk Lake	565
Lake Mahopac	575
Lake Gilead	380
Total	2,055

From the two tables given above it is seen that the total quantity of available storage in the Croton watershed amounts to 104,442,000,000 gallons.

The works which have been described are those of the former city of New York which forms since 1908 the boros of Manhattan and the Bronx of the Greater New York. Each of the boros of Brooklyn, Queens and Richmond has its own water works.

The three aqueducts supplying Manhattan and the Bronx can deliver about 400,000,000 gallons per day. In case of a severe drought the Croton, Bronx and Byram rivers will not yield more on an average than about 300,000,000 gallons a day.

As the two boros mentioned consume, at present, more than 300,000,000 gallons a day, it is evident that some new source of supply must be drawn on. This fact was realized in 1900.

In 1902 a commission of three expert engineers—Professor William H. Burr, Rudolph Hering and John R. Freeman—was appointed to investigate all possible sources from which New York could obtain an additional supply of water.

This commission recommended that a daily supply of 250,000,000 gallons be obtained from the streams in Dutchess county, immediately north of the Croton watershed, and that an additional supply of 250,000,000 gallons be derived from streams in the Catskill mountains.

An act passed by the legislature prevented the city of New York from diverting any water from Dutchess county, and the city had, therefore, to go to the Catskill mountains to obtain its supply.

The necessary works to secure a supply of 500,000,000 gallons per day have been in course of construction since 1905, under the direction of a Board of Water Supply, composed at present of the following three commissioners: Charles Strauss, Charles N. Chadwick and John F. Galvin. J. Waldo Smith is the chief engineer of the board.

The work when completed will consist of an aqueduct 17 feet high by 17½ feet wide, capable of delivering daily 500,000,000 gallons. This water is to be distributed to all of the five boros of Greater New York.

The Catskill Aqueduct, as the new conduit is called, will consist of:

Cut and cover aqueduct	55 miles.
Grade tunnel aqueduct	14 miles.
Pressure tunnel aqueduct	17 miles.
Steel siphon pipes	6 miles.
Total	92 miles.

The aqueduct begins at the Ashokan reservoir on Escords creek, which will have a storage capacity of 130,000,000,000 gallons, and terminates at the city line, at the Hill View Reservoir, which will store 900,000,000 gallons. The Hudson river is crossed by a siphon tunnel, 14 feet in diameter, which was bored thru solid rock about 700 feet below the surface of the river.

To provide for emergencies, the Kensico Reservoir is being constructed on the Bronx river, 30 miles north of the City Hall. It will store 40,000,000,000 gallons.

From the Hill View Reservoir the water will be distributed to the boros thru circular pressure tunnels 15 feet in diameter, which are to be excavated deep below the streets in solid rock. From two terminal shafts in Brooklyn steel and iron pipes will convey the water to the boros of Queens and Richmond. The total length of this distributing system is 34 miles.

The works now in course of construction will cost about $200,000,000. The supply from Esopus creek will only average about 250,000,000 gallons per day. In the future additional reservoirs will be constructed to obtain another daily supply of 250,000,000 gallons from the creeks in the Catskill mountains.

The works briefly mentioned above are of such magnitude and involve so many details that it would require a large volume to describe the Catskill water works adequately.

ORDINANCES REGULATING BILLBOARDS.

ONE of the difficult problems of the workers for the "City Beautiful" is the control of billboards and like structures, which are themselves blots upon the landscape and cut off views which would add much to the pleasure of existence. The city of Chicago passed an ordinance in January, 1907, regulating the construction and maintenance of sign or billboards, which was held void by the courts in 1909, because one section provided that all lands abutting rights-of-way of railroads were exempted from its provisions, "an unjust and unreasonable distinction in favor of the owners of such lands." Each section of the ordinance was passed upon in the opinion prepared for the court by the master in chancery and some were declared valid and others invalid, but the ordinance as a whole was considered invalid, because the elimination of the proviso objected to would extend the application of the ordinance over lands expressly excluded by the city council from the control of the ordinance.

In 1911 the city of Portland, Ore., under the provisions of the initiative, passed a billboard ordinance differing only in a few details from the Chicago ordinance. Upon request of H. E. Plummer, the building inspector, City Attorney Frank S. Grant made a thorough study of the ordinance and expressed his opinion of the provisions of each section, quoting from decisions of Illinois, New York, New Jersey, Kansas, Missouri and Colorado courts on billboard cases, and from many other cases involving validity of restrictive city ordinances.

Following are some of the restrictions which are void, according to the decisions noted or quoted:

One making the inspector of buildings the judge of the character of design or work which will be accepted. It is held that the council must fix the specifications for construction, and to the building inspector can then be delegated the duty of determining whether the billboards are constructed according to the ordinance. Commonwealth v. Maletsky, 203 Mass. 241, on delegation to chief of fire department the power to issue licenses for rag picking buildings on his own rules; Winthorp v. New England Chocolate Co., 180 Mass. 464; Newton v. Belger, 143 Mass. 598, are other cases, in which no regulations or qualifications were set up by the ordinance for the guidance of the city official, and the ordinances were therefore void. Chicago v. Gunning System, 214 Ill. 628, 70 L. R. A. 230, is the case referred to above, and the section making this provision was considered void, because the conditions in various parts of the city differed greatly and so much discretion as to the propriety of proposed structures could not be left to a city employe.

A general provision that all billboards must be made of incombustible material is void, according to the Chicago decision, because this is not necessary in many cases and discriminates against billboards located outside the fire limits. The provision would not be void if restricted to the fire limits or equivalent conditions.

A restriction of size of billboards on buildings without reference to their safe construction is considered void. In People v. Murphy, 195 N. Y. 126, 88 N. E. 17, L. R. A. (N. S.) 735, such restrictions of "sky signs" were declared void, because the restriction was applied to signs or billboards and not to other structures or to ornamentation on buildings, such as flagpoles, balustrades, finials, chimneys, towers, tanks, etc., no distinction being made between parts or appurtenances of the buildings and attachments wholly foreign thereto, such as the billboards under consideration.

The same is asserted of a provision that no sign should be put on a building more than two stories in height, nor on a sloping roof.

Sections limiting height of billboards, without reference to the safety of their construction, are void. Curran Bill Posting and Dist. Co. v. Denver, 47 Colo. 221, 107 Pac. 261, 27 L. R. A. (N. S.) 544, is referred to as a decision directly to this effect. Crawford v. City, 51 Kan. 756, 20 L. R. A. 692, 37 Am. St. Rep. 323, 33 Pac. 476, is a Kansas case, which decides that a regulation requiring billboards to be set back of the lot line is void, police regulations extending to the manner of construction, but not to location upon private property. Passaic v. Paterson Bill Posting, Adv. and Sign Painting Co., 72 N. J. L. 285, 111 Am. St. Rep. 676, 62 Atl. 267, 5 A. & A. Am. Cor. 996, is a similar case, denying the right of the city council to limit position of billboards to ten feet or more from other structures.

A provision making the ordinance retroactive is void. In Whitmier & F. Co. v. Buffalo, 118 Fed. Red. 773, is a decision that "As to billboards erected before the restrictive ordinance under consideration the injunction is continued."

A provision that the consent of a majority of the property owners in the block must be obtained before erecting a billboard is deemed void, because in every state but Illinois power to determine what is a lawful business, not injurious to public health or morals, to be carried on in the immediate neighborhood of a citizen, cannot be delegated to him. Decisions on this point regarding ordinances requiring consent of property owners are noted as follows: Re Quong Woo, 13 Fed. 229, ex parte Sing Lee, 95 Cal. 354, 24 L. R. A. 195, 31 Am. St. Rep. 218, 31 Pac. 245, as to location of public laundry; State v. Garibaldi, 44 La. Am. 809, 11 So. 36, regarding establishment of private market; St. Louis v. Howard, 119 Mo. 41, 41 Am. St. Rep. 630, 24 S. W. 770, regarding establishment of slaughter house; Re Kiely, 13 Ont. Rep. 451; St. Louis v. Russell, 116 Mo. 248, 20 L. R. A. 721, 22 S. W. 470 (overruling State ex rel. Russell v. Beathe, 16 Mo. App. 131), regarding establishment of livery stable; the Chicago case above quoted, as to provision requiring consent of property owners to erection of billboard; State v. Omaha, 110 N. W. 680, 8 L. R. A. 978, regarding location of gas tanks; Tilford v. Belknap, 126 Ky. 254, 103 S. W. 289, regarding erection of frame building.

A provision that no fence on property line shall be more than eight feet high is deemed void. Rideant v. Knot, 148 Mass. 368, and Bordeaux v. Green, 22 Mont. 254, are cases in point, the latter allowing a fence 40 feet high; Western Co. v. Knickerbocker, 103 Cal. 111, sustaining one 20 feet high; Metzger v. Hocholin, 107 Wis. 267.

The decisions upholding billboard ordinances were reviewed by Judge White in the Denver case referred to above. In the ordinances declared valid in the cases of Rochester v. West, 164 N. Y. 510, 53 L. R. A. 548, 79 Am. St. Rep. 659, 58 N. E. 673; Gunning System v. Buffalo, 75 App. Div. 31, 77 N. Y. Supp. 987; and Whitmier & F. Co. v. Buffalo, (C. C.) 118 Fed. 773, the height of billboards was limited in Rochester to six feet and in Buffalo to seven feet, unless the consent of the council was first obtained in a manner provided. In re Wilshire, (C. C.) 103 Fed. 620, a Los Angeles ordinance limiting the height of billboards to six feet was upheld, because they "are usually, if not invariably, cheap and flimsy affairs, constructed of wood."

In the St. Louis Gunning Co. v. St. Louis, 137 S. E. 929, the ordinance complained of required a permit for the erection of and repairs to bill and signboards, fees for same, removal of signs existing before the passage of the ordinance, a certain method of construction, height, area, etc., and also fences of a certain height and construction. The court took cognizance of the menaces to public safety and welfare incident to the usual methods of billboard construction and of their inartistic nature in the following words, quoted from the opinion accompanying the decision upholding the ordinance:

"The signboards and billboards upon which this class of advertisements are displayed are constant menaces to the public safety and welfare of the city. They endanger the public health, promote immorality, constitute hiding places and retreats for criminals and all classes of miscreants. They are also inartistic and unsightly.

"The amount of good contained in this class of business is so small in comparison to the great and numerous evils incident thereto, that it has caused me to wonder why some of the courts of this country have seen fit to go so far as they have in holding statutes and ordinances of this class void, which were only designed for the suppression of the business itself."

This decision was made in May, 1911, and is the first which gets away from the strictly business consideration and recognizes the rights of the public to protection of its right to beauty as well as utility in its surroundings. There has always been some way to get around the strictly business demands for location of a certain structure or industry in a neighborhood mainly devoted to fine residences, and this is the first decision which attempts to do the same thing for all classes of people without reference to the amount of money which they may have invested in their business.

Spite fences are altogether possible under some of the decisions quoted above, altho usually such obstructions are eliminated by court order, often not getting beyond the police court. Nearly every opinion from which quotations are made as well as the dissenting opinion of one judge in the St. Louis case, takes a fling at the "aesthetic view," presented in St. Louis by a "civic league or confederation of civic leagues," which "undertakes to condemn structures on the basis of the use to which they are to be put." The dissenting St. Louis judge voices the opinion of the other judges opposing billboard ordinances when he says:

"Such lawful use cannot be stricken down to please the eye. Of course, under the police power the character of the advertising could be scrutinized. Further, the character of the structure as to public safety, health and morals may be regulated, but such are the limits of the police power."

The only material difference between the two opinions in the St. Louis case and between the opinions sustaining and those condemning ordinances controlling the erection and maintenance of billboards is as to how far the police power of the city can be extended. One side apparently would restrict the application of the police power to the insurance of the safety of the structure from overturning or burning, while the other would take under consideration also the shutting off of light and air, the obstruction of view, the objectionable nature of the advertisements, or of any advertisement whatever, the added dangers from other than fire or overturning to the adjoining property, not the least of which is the difficulty of close police supervision of the area shut off from public view and the resulting possibility of crime and misdemeanor from porch climbing to indecency and violation of health laws.

These seem to the members of the civic leagues to be quite as important as the simple strength of construction; indeed, to be more important, because their neglect affects the comfort and moral well-being of thousands of citizens all the time, while the danger of overturning or of fire affects the life or property of but few for short times and but seldom.

The world does move, and the St. Louis decision may be the first of a series which will bring about the reforms which so many good citizens are striving for.

After criticising the Chicago billboard ordinance and the old Portland ordinance, Mr. Grant presented an ordinance which, he believes, does not contain any of the void or voidable features of those ordinances, and this ordinance was passed by the city council of Portland, and went into effect on April 26, 1912. It reads as follows:

Ordinance No. 23564.

An ordinance licensing and regulating the erection, construction and maintenance of billboards within the corporate limits of the city of Portland, providing a penalty for violations thereof and repealing all ordinances and parts of ordinances in conflict therewith.

The city of Portland does ordain as follows:

Section 1. Within the meaning of this ordinance any structure over four feet in height erected, maintained or used for the purpose of posting advertisements thereon, or painting advertisements or signs thereon, and all such structures having connected therewith any electric sign, shall be held to be a billboard or signboard; provided, however, that electric signs composed only of letters or figures painted and outlined with electric lights and not used in connection with any billboard or signboard, shall not be subject to the provisions of this ordinance.

Sec. 2. No person, firm, co-partnership or corporation shall erect within the city of Portland any billboard or signboard over four feet in height, and as provided for in this ordinance, without first having secured a permit from the building inspector therefor. Said permit shall be granted to the applicant therefor upon payment of a fee of fifty cents and upon furnishing the said building inspector with a drawing and description of construction and location of said billboard or signboard to be constructed. Said description and drawing shall be in conformity to the provisions of this ordinance, and shall be dated, filed and kept by said building inspector in convenient form for reference.

Sec. 3. Every billboard or signboard shall have displayed thereon a name plate, or imprint, designating the name of the person, firm, co-partnership or corporation owning, controlling or maintaining same.

Sec. 4. It shall be unlawful to display on any billboard or signboard any advertisement or advertising matter which is immoral, offensive, improper, indecent, lascivious or obscene.

Sec. 5. For the purposes of this ordinance, billboards and signboards shall be divided into two classes:

First: Billboards or signboards erected upon buildings or other structures.

Second: Billboards or signboards erected upon the ground.

Sec. 6. It shall be unlawful for any person, firm, co-partnership or corporation to erect or maintain within the city of Portland any billboard or signboard which is not constructed in accordance with the following specifications:

Any billboard or signboard erected upon the roof of a building or structure within the fire limits, the surface of which is over three feet in height and not to exceed ten feet in height, shall be attached to a frame work consisting of uprights or posts of angle iron 3-16x1¾ inches in dimensions or of wood completely covered with iron, not less than 2x6 inches in dimensions, set not more than eight feet apart, securely bolted or anchored to the roof of the building or structure with metal fastenings. Said uprights to be securely braced with angle iron braces not less than 3-16x1¾ inches in dimensions of wooden braces completely covered with iron, not less than 2x6 inches in dimensions, not less than one brace to each upright, securely fastened to the top or within three feet of the top of said upright, the other end securely fastened to the roof or fire wall of the building or structure by bolts or metal fastenings. Said braces to be placed at an angle of not more than 60 degrees from the horizontal. There shall be stringers of angle iron not less than 3-16x1¾ inches in dimensions or of wood covered with iron, not less than 2x4 inches in dimensions, running the entire length of the billboard or signboard, securely attached to each post or upright to which the surface of said billboard or signboard shall be attached. There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height. The surface of such billboard or signboard shall be of metal with the exception of wooden strips for stiffening and ornamental wooden molding not to exceed four inches in width, the entire surface to be securely attached to said stringers and framework.

Any billboard or signboard erected upon the roof of a building or structure within the fire limits, the surface of which is greater than ten feet in height and not to exceed twenty feet in height, shall be attached to a framework consisting of uprights or posts of angle iron 3-16x2 inches in dimensions, or of wood completely covered with iron, not less than 4x6 inches in dimensions, set not more than seven feet apart, securely bolted or anchored to the roof of the building or structure with metal fastenings, said uprights to be securely braced with angle iron braces not less than 3-16x2 inches in dimensions, or wooden braces completely covered with iron, not less than 2x6 inches in dimensions; not less than two braces to each upright, one securely fastened to the top or within five feet of the top of said upright, the second brace to be attached at a point not less than ten feet nor more than fifteen feet below the top of the sign. The other ends of said braces are to be securely fastened to the roof or fire wall of the building or structure by bolts or metal fastenings, said braces to be placed at an angle of not more than 60 degrees from the horizontal. There shall be a counterbrace of angle iron not less than 3-16x2 inches in dimensions, or of wood completely covered with iron, at least 2x6 inches in dimensions, securely attached at or within three feet of the bottom of each post or upright and extending upward and securely attached to or near the middle of each brace.

There shall be stringers of angle iron not less than 3-16x2 inches in dimensions, or of wood covered with iron, not less than 2x4 inches in dimensions, running the entire length of the sign, securely attached to each post or upright to which the surface of said billboard or signboard shall be attached.

There shall not be less than one stringer for each four feet or fraction thereof the said surface of said billboard or signboard is in height.

The surface of such billboard or signboard shall be of metal with the exception of wooden strips for stiffening, and ornamental molding not to exceed four inches in width, the entire surface to be securely fastened to said stringers and framework. It being provided that no unsupported length of angle iron taking compression strain shall exceed ten feet in length, and that no wood 2x6 inches in size taking compression strain shall have an unsupported length in the six-inch direction of over sixteen feet, or in the two-inch direction of over nine feet.

Any billboard or signboard erected upon the roof of a building or structure shall be set back from the fire wall of said building or structure a distance of at least three feet, and so as to leave a clear passageway around and in front of same. The bottom of the surface of said billboard or signboard shall be at least four and not to exceed eight feet in the clear above the roof of said building at its nearest point, and so as to leave a clear passageway under the same.

All materials used in the construction of such billboard or signboard shall be of the best quality and attached in such manner as to make a thoroly strong, substantial and workmanlike construction, so as to preclude the possibilities of said billboard or signboard being blown from the building.

The construction of any billboard or signboard erected upon the roof of any building or structure within the fire limits, the surface of which exceeds twenty feet in length, shall be same as that provided for those less than twenty feet in height, except the framework shall be proportionately increased in strength.

Sec. 7. Any billboard or signboard erected upon the roof of any building outside of the fire limits shall be constructed in the same manner as those within the fire limits, with the exception that the framework and surface may be built of wood.

Sec. 8. Any billboard or signboard, the surface of which is over seven feet and not to exceed ten feet in height, built upon the surface of the ground within the fire limits, shall be securely attached to a framework consisting of wooden posts or uprights not less than 4x4 inches in dimensions, not more than ten feet apart and not less than three feet in the ground. Said posts shall be braced by wooden braces not less than 2x6 inches in dimensions, one brace to each post, said brace to be securely attached at the top or within three feet of the top of said post; the other end securely attached to an anchor post of not less than 4x6 inches in dimensions, set not less than four feet in the ground, well tamped. Said braces shall be placed at an angle of not more than 45 degrees from the horizontal. There shall be wooden stringers not less than 2x4 inches in dimensions, running the entire length of said billboard or signboard, securely attached to the posts or uprights, to which shall be attached the surface of said billboard or signboard. There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height.

Sec. 9. Any billboard or signboard, the surface of which is over ten feet and not to exceed twenty feet in height, built upon the surface of the ground within the fire limits, shall be securely attached to a framework consisting of wooden posts or uprights not less than 4x6 inches in dimensions, not more than eight feet apart and set not less than four feet in the ground. Said posts shall be braced by wooden braces not less than 2x6 inches in dimensions, not less than two braces to each post, one brace to be securely attached at the top or within five feet of the top of said post, the second brace not less than eight feet and not more than twelve feet from the top of said post. The other ends of said braces are to be securely attached to anchor posts of not less than 6x8 inches in dimensions, set not less than five feet in the ground, well tamped. Said braces shall be placed at an angle of not more than 60 degrees from the horizontal. There shall be wooden stringers not less than 2x4 inches in dimensions running the entire length of the billboard or signboard, securely attached to the posts, to which shall be attached the surface of said billboard or signboard.

There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height.

The construction of any billboard or signboard built upon the surface of the ground within the fire limits, the surface of which exceeds twenty feet in height, shall be the same as that provided for those less than twenty feet in height, except the framework shall be proportionately increased in strength.

Sec. 10. The surface of each billboard or signboard erected within the fire limits shall be of iron or some other non-combustible material. All materials and fastenings used shall be only of the best quality and attached in such a manner as to make a thoroly strong, substantial and workmanlike structure, such as will preclude possibility of said billboard or signboard from being blown down; provided that where natural conditions are such that it is impossible to follow strictly the specifications herein set out, all billboards or signboards shall be braced in some other equally strong, durable, substantial and workmanlike manner.

Sec. 11. It shall be unlawful for any person, firm, co-partnership or corporation to permit any unsanitary condition to exist under or around any billboard or signboard, or to permit waste paper, refuse, garbage or rubbish to accumulate under or about any billboard or signboard, and all billboards or signboards shall at all times be kept in a clean and sanitary condition.

Sec. 12. Any billboard or signboard over seven feet in height, erected upon the surface of the ground outside of the fire limits, shall be constructed and maintained in the same manner as those constructed on the surface of the ground within the fire limits, with the exception that the same may be of wood.

Sec. 14. Any person, firm, co-partnership or corporation owning or operating, maintaining or in charge, possession or control of any billboard or signboard within the city of Portland, who shall neglect or refuse to comply with the provisions of this ordinance or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this ordinance, shall, upon conviction thereof, before the municipal court, be fined not less than $25, nor more than $200 for each offense, and each day on which any such person, firm, co-partnership or corporation shall permit or allow any billboard or signboard owned or operated, maintained or controlled by them to be erected, constructed or maintained in violation of any of the provisions of this ordinance, shall constitute a separate and distinct offense.

It may be suggested here that two practical points are omitted in this ordinance which are very important from the moral and sanitary points of view. Theoretically, they are doubtless left to the tender mercies of the policemen, but practically, they are essential to the safety of the public

First, the bottom of the signboard or billboard should be two or three feet above the surface of the ground, at least three feet, if weeds and grass are permitted to grow about them. Policemen cannot keep constant watch of the rear of billboards, especially if at a distance from the street line, and the ground under them must be left sufficiently open so that the public can see thru. This provision will also make it easier to keep the vicinity of the billboards, especially the rear, free from deposits of rubbish and filth. Second, the structure should be located fifteen feet or more from any building. The sneakthief or burglar finds a closely built billboard a convenient ladder to an unprotected upper story, and the city has no business to permit the increase of the property owners' hazard needlessly.

The judges whose decisions are noted above would possibly consider these unwarranted restrictions of the use of private property, but it must be remembered that the billboard is not a building under occupation, but is set out and left unwatched and unoccupied and is usually located on ground leased for the purpose by a company not interested in the welfare of the property or the neighborhood. It would seem that the city has the right to regulate the construction and use of such structures so as not to increase the burdens of the adjacent property owners and of the passersby, not to mention its duty to protect the moral well-being of the community.

A few ordinances and court decisions have been published in MUNICIPAL ENGINEERING. The New York Murphy case, above referred to, will be found in vol. xxxvii, p. 264. In the case of C. J. Sullivan Adv. Co. v. City of New York, 113 N. Y. S. 893, quoted in vol. xxxvi, p. 387, it was decided that the city had no right to permit a billboard on the outside of a shed constructed over a sidewalk, under an ordinance requiring that signs, billboards, etc., shall be erected entirely within the building line. The Buffalo ordinance above referred to is briefly described in vol. xxiii, p. 197, and an extract from the decision upholding it is given on p. 398.

An extract from a decision in Galland v. City of Wilkesbarre, Pa., Sup. Ct., vol. xxxviii, p. 52, allows police regulation of billboards within legitimate bounds from falling on passersby, endangering property from fire, smelling badly, spreading disease or offending moral instincts of mayor and police.

In Fifth Ave. Coach Co. v. City of New York, 86 N. E. 824, quoted in vol. xxxvii, p. 43, an ordinance prohibiting advertising wagons solely for that purpose is held valid, altho the ordinance permits thereon the usual business notices of the operators of the wagons.

In State v. Inhabitants of City of Trenton, 53 Atl. Rep. (N. J.) 202, quoted in vol. xxiv, p. 39, the right to restrict the operation of an ordinance regulating signs to certain streets or city areas is upheld.

Some of the decisions quoted in an article on "Power of State to Control Use of Property by Sanitary Regulations," vol. xli, p. 298, may be of interest in this connection.

The provisions of ordinances of Cleveland, Ohio, regulating billboards and signs on streets or on buildings on the street lines, quoted in vol. xlii, p. 249, are more strict than any which have been mentioned above, but do not cover such structures entirely on private property.

GAS FOR HEAT AND POWER.*

By E. B. Rosa, U. S. Bureau of Standards, Washington, D. C.

THE use of gas for heat and power has rapidly increased in recent years, partly due to a reduction in the price of gas and to improvement in the service rendered by gas companies, and partly to the improvement of gas appliances in the direction of greater convenience and efficiency, and to the invention of new appliances for the accomplishment of many results in new ways. With more than 1,300 gas companies in the country, with a combined capital of $1,000,000,000 and annual sales of $200,000,000, it is one of the most important of the industries.

Coal Gas. The first recorded suggestion of the use of gas for fuel was in the patent (taken out in England in 1805) by F. A. Winsor for a process of "extracting inflammable air" from coal. The product was to be applied to heating as well as to lighting; but, in spite of his great enthusiasm, Winsor was not successful in bringing about the utilization of gas for fuel, and little was done along this line until about 1825, when the first gas cooker was invented. From that time until about 1880 development was very slow.

One important invention, however, was that of Delbruck, who placed one tube inside another, using one for the gas and the other for the passage of the air, using the two at the point of ignition.

What are usually called Bunsen burners, in connection with gas stoves, are a modification of Bunsen burners invented by Thomas Fletcher, of England. The true Bunsen consists simply of the familiar open tube of the laboratory, with the gas nozzle and air ports at the base. Fletcher was the first to use a cap to diffuse the flame and reduce its liability to flash back.

The last thirty years have witnessed a wonderful development of every kind of heating appliance, and the most modern gas lighting units making use of the gas for heating solid materials to incandescence instead of deriving the light from the luminosity of the flame itself.

Acetylene Gas. Although acetylene gas was discovered in 1836, it was not until 1892 that its commercial development was made possible by Willson, who discovered a method of producing calcium carbide in large quantities. The application of acetylene to heating and power has been very recent indeed, and the use of acet-

*From a lecture before the Franklin Institute.

ylene and oxygen in the blow pipe has produced almost the highest temperature known to chemistry—a temperature approximating that of the electric arc, probably above 5,000 degrees F. Thru this means welding has been successfully accomplished and several other important industrial applications have been found. Large steel bridge girders can thus be cut apart with ease. There seems to be a great field open for the oxy-acetylene flame.

Natural Gas. The first use of natural gas in this country was probably in Fredonia, N. Y. (1821), and before long it was being used in rare instances for heating purposes. In 1859, Drake drilled the first oil well, and, as natural gas was found in abundance, its use was greatly increased. At first it was only used near the wells, but from time to time some enterprising individuals would run pipes from nearby wells to their homes and villages. At first it was used in the coal or wood stoves for cooking and heating, and at the wells for power, by piping it directly to the cylinders of steam engines and using its expansive force as a substitute for steam. The waste of gas for many years was very great, no interest being taken in making economical appliances, or even in turning the gas off when not wanted. The first company formed exclusively for the distribution of natural gas was in 1872 in Titusville, Pa., since which time its use has become quite extended.

As a fuel, natural gas is burned in almost exactly the same way and with almost the same appliances as manufactured gas. It may be used in the ordinary gas range, hot plate, water heater or other gas burning appliances, the only change necessary being that, because of the higher pressure, the gas orifices should be smaller, and because of the higher heating value less gas is necessary to produce the same results. Furthermore, the application of natural gas to coal burning installations of all kinds is very simple and, as a rule, very efficient.

The growth of the business in the last thirty years is shown by these figures from the United States Geological Survey, representing the approximate value of natural gas produced in the United States:

Year.	Value.
1882	$ 215,000
1892	14,870,714
1902	30,867,863
1909	63,206,941

Producer Gas. Producer gas, a gas made from cheap fuels, using oxygen from the air to produce carbon monoxide, has come into prominence within the last twelve years. Altho only a few scattered installations are reported as having been made in the United States prior to 1900, there are now probably 200 or more plants together having an output of over 50,000 horsepower.

The two principal types of gas producers are the suction plant, used for small units below 300 horsepower capacity, and the pressure plant used for larger outputs. The suction plant receives its name from the fact that the engine develops its charge of gas in the producer by the means of its own suction stroke. The pressure plant develops its gas under a slight pressure due to the introduction of an air and steam blast, and the gas is stored in a holder until it is required by the engine.

In Europe producer gas has been applied much more generally than in this country, but it is fast working its way into the industries here, such as glass furnaces, brick, pottery and terra cotta kilns, lime and cement kilns, sugar house char kilns, silver chlorination and ore roasting furnaces, etc. Altho its use is accompanied by some dangers and disadvantages, the fact that it is the cheapest gas made per unit of heat and contains more of the energy originally in the coal than any other, and that it is possible to use very pure fuel in its production, make it a very economical gas when properly applied.

Conditions for Good Combustion. One of the principal points to consider in the construction of heating appliances is the combustion of the gas. Efficiency, maintenance and many other important items are largely dependent on this feature. Some of the conditions for good combustion are:

(a) Complete and equal combustion of the gas must be had over every part of the burner and from every opening in the burner.

(b) Good mixing of air and gas, and equal proportion of primary air in all parts of the burner are essential.

(c) There must be plenty of secondary air in the proximity of the burners, so that the flames will not be smothered, and good draft thru the appliance to carry away the products of combustion.

(d) Flames should not impinge on cold surfaces in such a way as to cause incomplete combustion, and so waste the heat and perhaps produce carbon monoxide.

(e) In those appliances where an adjustable air shutter is used, this shutter should be easily adjustable, and yet should remain as adjusted. In those appliances that have a fixed air supply, the spuds should be readily accessible. Each different form of appliance offers problems of its own, but the observance of these general conditions is important.

Development of Gas Cooking. In the

patent taken out by Mr. Winsor in 1805 for the manufacture of coal gas, we find the first recorded suggestion of the use of gas for cooking; but the actual utilization of gas for cooking was much later. Our earliest knowledge of a gas stove is to be obtained from a magazine of the year 1825, which described it as a piece of "gas apparatus for cooking by inclosing the circle of gas flames with its reflecting cone in a cylinder of tin, from the top of which a pipe takes off the burnt air." A drawing of the burner was also given and the writer adds: "A hot plate has been heated by the gas, and it has also been employed to heat an oven. * * * It cannot be expected to succeed, however, except in the hands of persons whose scientific knowledge enables them to employ it with safety."

For a number of years there seems to have been little done in the way of actual trial, altho the geniuses of the time were thinking about it and taking out patents. It is unlikely that we shall ever know who was the first user of gas for cooking; all we know definitely about the subject being that James Sharp, of Northampton, England, demonstrated the availability of gas cooking in his own house about 1830 or 1832, and a year or two later John Barlow, of Islington, London, had an apparatus for roasting, boiling and steaming in the kitchen of his house. This consisted of a tin oven, around the four sides of which, near the bottom, ran a gas pipe, fitted with small burners about an inch apart; on a stand alongside the oven were two or three rings of piping with burners, and over these were placed the boilers and saucepans. After this, inventions for cooking by gas became more numerous, altho the gas range at first gained very slowly in popularity.

In 1850 James Sharp, then of Southampton, delivered a lecture entitled "Gastronomy," in the course of which he roasted before the audience 34 pounds of beef, 15 pounds of mutton and 12 pounds of pork, and boiled and steamed 24 pounds of mutton and codfish, 4 fowls, 8 plum puddings, vegetables, etc., and baked pies and tarts, the whole being done with the expenditure of 156 feet of gas.

In the following year (1851) Alexander Graham, a well-known hotel proprietor of Glasgow, exhibited in the great exposition in London a gas cooking oven, which was fitted with luminous jets inside. Mr. Graham made and sold a limited number of cookers for hotels and restaurants, but so far the use of ovens for domestic purposes was practically unknown.

A stove used in Philadelphia prior to 1860 is still in existence and formed part of the exhibition in connection with the gas centenary. It has a peculiar boiling burner which consists of a piece of one-eighth-inch pipe, bent upwards into a sheet iron truncated cone, containing a perforated baffleplate of the same material. The upper end of the cone contained a fine wire screen covered with about one-half inch of fine gravel.

From this time on until about 1880 the history of the use of gas for cooking was an exceedingly slow development. In 1860 the Cincinnati Gazette said: "At the present about 100 families are cooking with different kinds of gas stoves."

The development has taken a faster pace in recent years and thus has brought us to the present state of efficiency and convenience. The gas cooking range of today is distinguished by the following features: The flow of the hot products of combustion from the oven burners is so directed that the food is evenly cooked top and bottom in any part of the oven; air space insulation of the oven walls prevents the loss by radiation of an undue quantity of heat; adjustable air mixers on all burners permit of the complete elimination of soot; the boiling burners are so set that the placing of vessels over them does not smother the flames, nor cause incomplete combustion; the boiling burners and their fixtures are easily removed by the cook for purposes of cleaning, are put in place again with equal ease, and all details are aimed to combine efficiency and convenience.

Tests of the relative heat efficiency of gas ranges have been made, but such tests have not been sufficiently standardized so that numerical statements can easily be made. Further tests are desirable, and if greater attention is given to the question of efficiency and economy, it is probable that considerable further improvement will be made by manufacturers.

Gas Water Heating. About 1825 Robert Hicks took out a patent in England for "Heating water in baths by means of burning spirits of turpentine or carbonetted hydrogen gas in chambers, in the bath, or in tubes passing thru or under them."

Up to about 1890 there were really no convenient and economical water heaters. Since then the instantaneous hot water heater has been developed, and this has greatly augmented the use of gas ranges, the one being a very important adjunct to the other. Gas water heating is one of the most important of the domestic uses of gas, and it is very desirable that water heaters be tested systematically and the results of tests made public for the information of users.

Gas Room Heating. About the year 1833 a patent was granted to one Richard Barnes for heating buildings by the combustion of gas or oil, applying the flame either externally to tubes or chambers thru which currents of air were passing, or else placing the flame inside the tubes or chambers.

Peckston in his "Practical Treatise on the Manufacture of Gas," published in 1841, says: "Coal gas has of late years been applied to the heating of churches, chapels, shops, counting houses, etc., * * * and has been found to answer the purpose intended." The stove described very closely resembled the cooking stove of 1825, except that it was provided at the top with a register instead of the flue.

A form of stove now very popular in England under the name of the "Gas Fire," consisting of lumps of incombustible material heated to a greater or less degree of incandescence by gas burners, so as to resemble a coal fire, was patented by Edwards in 1849. Seven years later Nathan Defries was granted a patent for a similar device, the "argillaceous material" specified having fastened upon it fibers of asbestos, which, upon lighting the gas, became incandescent. This was followed three years later by a patent granted to Reece for a stove in which the asbestos was the main feature.

In spite of the limited use of gas for fuel, a company called "The Gas Fire Company" was incorporated in England in 1852. This seems to be the forerunner of the many ill-fated attempts to do a purely fuel business by artificial gas. Room heating is now one of the common uses of illuminating gas.

The Use of Gas for Industrial Purposes. In 1806 Josiah Pemberton exhibited various forms of gas lights in front of his factory at Birmingham. He was the first to construct a gas stove, using it for the soldering required in his button factory.

About 1840 a Scotch manufacturer by the name of Mackintosh made several tons of "cemented" steel by submitting iron at a dull red heat to the action of lighting gas. The carbon for the steel was derived from the gas.

In 1857 a patent was granted for the heating of irons for laundry work by means of gas, and in 1859 a soldering apparatus for continuous soldering by means of gas was described in the *Technical Press.* This included the use of a blast worked by a foot bellows.

In an advertisement of Elsner, of Berlin (July, 1859), it was pointed out that there was scarcely a brand of domestic work, of industry or of business for which a gas cooking or heating apparatus could not be recommended. Thus it is evident that the use of gas for industrial purposes is not of recent origin, and that it has not been brought about thru a falling off in the use of gas for lighting, due to the increased use of electricity.

At the Paris Exposition (1867) there was exhibited singeing apparatus for use in wool works, dye works and bleaching works. Jewelers were also using gas. Plants for chemical and metallurgical purposes and laboratory ovens were also shown.

About thirty years ago what seems a curious method of using gas was considerably in favor. This was its use under boilers for generation of steam for engines up to about two horsepower. At the Royal Agricultural Societies Exhibition, held in 1879, several forms of such boilers were exhibited.

In 1879 the South Shields Gas Company, an English concern, gave an exhibition of over 300 appliances, in which gas was to be used for other purposes than lighting.

Today there are about 1,000 practical applications of gas in the industries, and a conservative estimate places the proportion of gas sold for fuel at one-half the total sales.

Air Under Pressure vs. Gas Under Pressure in Industrial Appliances. The subject of air and gas under pressure is one that is receiving considerable attention at the present time, altho the field has not been as extensively explored as the others that have been described.

In England and on the continent there are a number of companies now operating to furnish gas at high pressure for private establishments as well as for the public street lamps. The result is that in Europe there has been more done with the gas under pressure than in America, while, on the other hand, America has probably made more use of the air blast with low-pressure gas: "The disadvantage of the latter for furnace heating is that the efficiency depends upon the two pressures remaining constant. Experience shows that, under working conditions, it is too much to expect that these will remain constant; but the main defect in air-blast burners up to quite recently has been that they were badly designed, their mixing arrangements being inadequate. Such gas burners as those recently designed, which do away with secondary air and improve the mixing of the air and gas, are a great advance on previous designs.

"High-pressure gas should have a great field before it in the industrial world. It can be applied to all heating processes with efficiencies reaching in some cases at least 90 per cent. Its chief charm is its cleanliness and its simplicity; and in by far the majority of cases it compares well in cost with solid fuel."

List of the Processes in Which Industrial Appliances Are Used. Some of the processes in which gas has been used in the industries are as follows:

(1) Hardening, tempering and anneal-

ing of steel, and the heating of automatic heating machines.

(2) The melting of base and precious metals.

(3) Forging and drop forging.

(4) Welding, brazing, soldering and rivet heating.

(5) Developing power and generating steam.

(6) Boiling liquids and melting of solids.

(7) Tire heating and the heating of mangles and steel rolls.

(8) Heating japaning and embroidery ovens.

(9) Air tempering.

(10) Singeing of cloth.

(11) Heating branding irons.

(12) Firing china.

(13) Melting barium chloride and cyanide of potassium for hardening steels.

(14) Embossing and stamping presses.

(15) Heating muffle furnaces and assay work and reducing sweeps.

(16) Heating oil tempering furnaces.

(17) Pressing irons, stoves and machines.

(18) Heating searing irons.

(19) Matrix drying in printing.

(20) Roasting coffee and nuts and popping corn.

(21) Sterlizing and pasteurizing.

These are only a few of the many processes that might be mentioned, but they are typical as showing the wide variety of applications of illuminating gas.

Development of the Gas Engine. The gas engine really dates from the year 1791, when John Barber patented an engine driven by gas obtained by heating wood, coal, oil or other substance in a retort. After the gases had been cooled they passed thru a pump, in which they were mixed with air, to an "exploder." At the orifice of this exploder the gas was lighted and issued in a continuous stream of flame against the vanes of a paddle wheel. This was not only the first gas engine, but was the first gas turbine.

In 1794 Robert Street designed a pump driven by the explosion of turpentine vapor below the motor piston. In 1801 Phillippe Lebon took out a patent for an engine to give alternate explosions on each side of the piston. Samuel Brown, in 1823, designed a motor to operate by atmospheric pressure in which he used an explosive gas flame to expel the air from the chamber.

In 1823, L. W. Wright patented his double-acting, vertical engine combined with a governor to regulate the speed. In 1838 William Barnet suggested the compression system of gas motor. This experimental period of gas engine research may be said to have lasted for 70 years: 1791-1860. In the latter year, Lenoir, of Paris, produced the first practical gas engine to work rapidly and silently, with electric ignition by jump-spark. In the years that have followed, improvement after improvement has been made until the amount of coal gas necessary to develop ignition horse power has been reduced from 100 cubic feet to 14, and even 12, cubic feet per hour. Only the principal steps in the development can be mentioned.

In 1861 Million proposed compression and the use of a compression or combustion chamber. In 1862, Beau de Rochas took out a descriptive patent of the compression, four-stroke cycle now known as the Otto.

Otto and Langen exhibited their free-piston, atmospheric engine at Paris, in 1867, and in 1876 Dr. Otto brought out his famous engine with the Beau de Rochas cycle.

In 1878 and 1879 Mr. James Robson, and in 1882 Mr. Dugald Clerk, patented two-cycle engines. In 1884 Atkinson brought out a "differential" type with the strokes of the cycle of different lengths.

In 1890, when the Otto patent expired, many firms who had been making gas engines upon other lines brought out new designs, all working on the Beau de Rochas cycle. This gave a great impetus to the sale of gas engines. With the close of the century came the utilization of producer gas for power purposes; the manufacture of large-sized units, over 600-horse power, by John Cockerill Company, in Belgium, and by Crossley and the Premier engine in England; the design of the Westinghouse throttling governor, and the Sargeant engine, with cut-off governing, the rise of the natural gas engine in large units, and the double-acting gas engine with compression in America.

The two great classes of gas engines today are: (1) The four-cycle or "Otto" type; and (2), the two-cycle or "Brayton" type. The former, called also the internal combustion type, with heating at constant volume, has only one working stroke in four, the four strokes being: Charging, compressing, firing, exhausting. The two-cycle type, with heating at constant pressure, usually has two cylinders, one a compressing pump and the other the working cylinder. A third type of engine which should be mentioned is the cycle with heating at constant temperature or Carnot cycle. The nearest actual approach to this cycle using gas is the Diesel engine.

I am indebted to the Chairman of the Committee on Gas Appliances, American Gas Institute, for most of the material contained in the above sketch of the history of gas appliances.

REMODELING PARK SYSTEM OF LOS ANGELES.

By Burt A. Heinly, Los Angeles, Cal.

LOS ANGELES, in the van of most American cities in all that tends to municipal progressiveness, until two years ago was hindermost in all that went for civic beautification. This city by the western sea in little more than a decade has grown from a well-to-do town of 100,000 souls to the metropolis of the southwest, with a population of more than 400,000. The increase brought great need of all the absolute necessities of the modern city, i. e., sewers, water works, street paving and cleaning, etc., etc. In addition Los Angeles has nearly reached the limit of her bonding power in building a water works system at a cost of $24,500,000, erecting hydro-electric power plants costing $3,500,000, and building a municipal harbor at an expense of $10,000,000.

Another reason for the dilatory position of Los Angeles was that nature, in climate and soil, has been most lavish in her gifts. Now, no municipality in the country has a greater need of parks. In the eastern states a park is really usable for only about five months in the year, but in southern California the parks winter and summer are breathing spaces constantly in service. Los Angeles is essentially a tourist city. And two years ago Los Angeles awakened to the fact that she had the poorest park system of any first-class city in the United States, and that it behooved her to busy herself with her parks and streets.

The plans as they have been mapped out and partially undertaken provide for a system of boulevards and city highways which will bind together twenty-two parks embracing 3,850 acres of rich land already planted to trees and flowers and watered by ample lakes and streams. The total length of the boulevards will be nearly 100 miles, and these will branch in every direction from the Plaza, or center of the city.

Los Angeles has set about her task in the right way, and when I have finished I feel certain that more than one idea which the city has developed for her improvement and profit, as here set forth, will be found equally serviceable by other municipalities.

In the first place a new park board was placed in office. The appointments were not handed around on a silver platter. The commission was selected with the greatest care. Charles Silent, the president, is a man whose hobby is outdoor gardens, and he is the owner of an estate that is one of the show-places of southern California.

H. W. O'Melveny, a lawyer, has given many years of attention and study to the growing of plants under glass.

J. B. Lippincott, already in the employ of the city as assistant chief engineer of the Los Angeles Aqueduct, is a man who, in the pursuit of his calling, has combined the love of nature with it.

These three men, serving without pay and dependent upon the city council for appropriations to carry on their work, were given a free hand by the mayor and told with western frankness "to pitch in."

Here were the assets of the new board: A perfect climate, with a growing season of 365 days in the year, in which most of the trees, shrubs, flowers and vines of the temperate, semi-tropic and tropical zones flourish as the green bay tree; a soil of bountiful richness; and a topography of plain, hill and dell that changes mile for mile, and in its diverse aspects lends itself admirably to the great scheme of beautification that has been mapped out.

The commission found that it has under its care twenty-two parks, ranging from nine-hundredths of an acre to 3,015 acres, and with an aggregate area of 3,850.99 acres. Absolutely nothing had been done to bind these breathing spots together in order to form a complex whole, nor had plans been made to this end. The parks themselves were a repetition of each other. If you saw one you saw them all. At the forcing gardens the shrubs, bulbs and annuals were divided up so that yearly each park received its proportional allotment. For six or eight weeks beds set down in the midst of green lawns were a riot of bright colors; after that black patches of ground showed where flowers had been. Trees had been planted without regard to their order or kind, and ten grew where one should have grown.

The park system had been cared for by a secretary, a superintendent, 19 foremen and 75 day laborers. The department had no maps of the property it managed, and its business was transacted from a single desk in one of the public rooms of the City Hall.

Now the new commissioners had a very well conceived idea that flower gardens stuck in the midst of a green lawn and overhung by matted trees did not necessarily make a beautiful park, or in fact any park at all. They thought it foolish to plant hundreds of thousands of annuals of kinds which nearly every citizen might grow in his own garden and develop more perfect specimens thru individual care than could the park forces. They believed that a park as a cool, pleasant place to rest could be made more inviting with a broad green lawn properly shaded than an area of flower beds surrounded by wire chicken fence. And they did not believe very thoroly in "Keep Off the Grass" signs.

Fortunately the board found a park superintendent who had a similar conception of natural beauty. Mr. Frank Sherer, educated for his work by the English government at the Royal Botanical Gardens of Edinburgh, Scotland, and with years of training in America, was the man selected to be in charge of operations.

For the first eighteen months the work was largely in undoing things that had been done incorrectly. Assaults were made in all the parks upon the excessive tree growth. There was a general cleaning up, and this is still going on, the usable wood being sawed into stove lengths, corded and sold.

All this was done with a scientific knowledge of the end desired. Where trees were cut down, it was to give other more vigorous trees an opportunity to grow; where they were pruned, it was to direct the growth in the right direction. This was accomplished under the supervision of a forester from the government service. Trees that were in a process of decay, or dying thru injury, and which it was desired to preserve, were placed in the care of a tree surgeon. In the two years interval this weeding out and corrective process has made a striking improvement in all the parks. In Los Angeles great things are possible with vegetable life in a comparatively short time. What it requires nature seven years to accomplish in the east is brought about in southern California within two years.

Lawn areas wherever possible were increased and old lawns were refertilized. In this semi-arid region, sprinkling must be done nearly every day in the year, and fertilizer must be applied frequently. This had not been done, or, if so, with little knowledge of proper methods. In Central Square a five-acre tract in the heart of the city, indeed, it was necessary to remove the old sod and top-soil, replace the removed material with new soil and replant.

REMODELING THE PARKS OF LOS ANGELES.
A Vista in East Lake Park.

Central Square, in fact, was an object lesson. With great possibilities as a beautiful public square frequented by thousands, it had come to the point that women shunned passing thru it by day and men gave it a wide berth by night. A disfiguring grandstand enclosing a convenience station marked its center, and from this point gravel paths radiated. The grandstand has been supplanted by an electric fountain banked with shrubbery and set in the center of a semi-Spanish court, which is shut off from the lawn by a high cement curb that serves as a continuous seat around the enclosure.

The rambling gravel paths have given place to broad diagonal walks of brick set in concrete and lighted at night by ornamental electroliers. A concrete curb with balustrade entrances was then built entirely around the square. A modern convenience station was added at a cost of $10,800. Many trees were cut out; others were added, so that to-day this park is one of the most beautiful of its kind in America. The total expenditure for the remodeling of the park was $33,000, and eighteen months were required for the completion of the work.

The alterations, particularly the pruning of the rank sylvan growth, were not made without some protest from the public. To many good citizens it seemed like desecration, and, after all, everything in the park was a sort of landmark. Civic agitation of six months ago has to-day given place to civic pride in the reformation. But the commissioners learned a valuable lesson. They learned the value of publicity. To-day the board takes the public into its fullest confidence—tells what it is doing, what it wants to do, why, and what will be the cost. As an instance: Mr. Citizen thought a brick walk through Central Square was out of date and in every way inferior to concrete until it was explained to him that the city had used vitrified brick imbedded in concrete at an additional expense over the usual concrete squares in order to harken back to the old Spanish days of the puebla; that it was all a carefully worked-out design.

"Why, of course," said Mr. Citizen, and forthwith told his neighbor what a happy conception it was to bring back the memories of the days when old Spain ruled over the land.

I would make this one of the strongest suggestions to engineers, park boards and officials striving to beautify their cities. Take the public into your confidence, explain your plans, make them see that the improvement should have been made years ago. A thing is too often deemed extravagant or expensive or unnecessary only because its use or its beauty is not fully understood. To many, the details of a picture must be pointed out before the canvas can be appreciated.

REMODELING THE PARKS OF LOS ANGELES.
A Side Hill in Hollenbeck Park.

With the same desire for assistance and support from the public, the park board secured the co-operation of the Men's City Club and the Women's City Club (California is equal suffrage), two of the largest, most influential and militant civic organizations in Los Angeles. These clubs appointed a joint committee, which works in conjunction with the park board for certain well-defined improvements. Illustrated lectures are given by those identified with the park movement, and in every way the effort is made to create and hold popular enthusiasm in the work planned or under way.

While the cleaning up of the parks was in progress an efficient organization was being developed. An engineering corps was formed and began the mapping of all the parks. Detail surveys were made, showing the lawn areas, shrubbery, trees, flowers, walks, buildings and lakes. With this completed, each foreman was called in and asked just how much trimming, planting, sweeping and sprinkling could be done by an average man in an eight-hour day. Following this, the park superintendent interviewed the jobbing gardeners along the same line.

From all the data collected it was found that an average man could care for 3 acres of flat lawn or 2 acres of hill lawn; or 3 acres of flowers or 2 acres of walks or playgrounds; or 1.25 acres of flowers or 5 acres of shrubbery. In other words, a unit system of work was made for the entire park area, and was then applied to each park as it was shown topographically on the plats prepared by the engineering corps. For example: The number of men at Eastlake Park was 12 before the unit system was investigated. But the unit system showed that 9 men should be able to do the work. Three men were weeded out, and this weeding out process was followed in every park in the city where there was found to be need for it. Indeed, it demonstrated that in some instances men were doing much more than the average man was expected to do, but were receiving the average man's pay. In these cases wages went up forthwith. In place of paying a flat rate of $2.50 per day, a minimum wage of $2 for eight hours was adopted, the men being paid from that amount up to $3.50 as they were able to demonstrate their value. The result here is that labor has an incentive to do its best. Again, politics has nothing to do with a man procuring employment or retaining it. He remains with the department only so long as he is able to demonstrate his willingness and efficiency.

REMODELING THE PARKS OF LOS ANGELES.
Mocohuenga Canon in Griffith Park.

The bonus system of payment had been found to work with great success in the construction of the Los Angeles Aqueduct. The same plan was therefore adopted in the care of the parks. The amount of work done, the general appearance and the economies pursued all go to form the basis for bonus payment. Every three months the park board makes an inspection and votes upon the best park showing. To the park receiving a majority vote a bonus of $5 is paid to each man who has been employed therein for thirty days or over. The park foreman, moreover, receives commendation thru the press. The result is that there is a great rivalry for excellence in all of the twenty-two parks.

The department then advertised that it would undertake to train 20 or 30 young men in the park business; that these boys would be accepted as "apprentices" at the rate of $2 per day, and would be advanced as they demonstrated their efficiency. Double that number applied. To-day Los Angeles is training her own foremen and superintendents. Mr. Shearer watches his men for improvement as he watches the development of a rare plant, and for the ambitious man advancement is certain.

REMODELING THE PARKS OF LOS ANGELES.
Central Park After Improvement.

In three ways besides that of the unit system of work were large economies thought out and practiced. The use of fertilizer is constant thruout the year. It is one of the chief items of monthly expense, amounting to from $15,000 to $18,000 per year under the old system of purchase. A small municipal fertilizer plant was installed at the park stables, where the horse droppings and park cuttings were given chemical treatment. The result was a far better grade of common fertilizer than could be purchased and at about one-third the expense. Two other plants much larger in size are being erected in parts of the city where large numbers of horses are stabled. The saving here will ultimately amount to $8,000 or $9,000 annually. I have not here the space to elaborate upon the method, but the details are obtainable from the park department.

As fertilization is constantly necessary, so is the need of irrigation. It was found that the services of many men were required to do nothing else than hold a hose. When Central Park was remodeled the 5 acres was gridironed with water mains, to which were attached standpipes that ended in sprinkler heads set flush with the ground, so as not to interfere with mowing and raking. To-day the whole area is sprinkled by one man in two hours where formerly it required two men eight hours to do the work; the daily saving being $3.50, which in a year amounts to $1,277.50. The system is more expensive to install than the usual hose system, but the saving in labor amounts to more than 80 per cent. This system is being extended to other parks as fast as money is available for the purpose. At Exposition Park 39 acres of lawn are now being placed under this system.

The third saving was accomplished in the establishment of a store and purchasing department. Formerly everything was purchased by the single piece as needed. To-day all labor-saving tools and equipment, stock, material and supplies are bought in quantity ranging from the dozen to the carload. When a thing is needed it is delivered on the work within a couple of hours—there is not the delay of a week to ten days in getting a requisition thru the council for it. The saving here amounted to 33 1-3 per cent.

In a preceding paragraph reference was made to the fact that all the parks where any development had been carried on previously were similar in appearance. To overcome this defect will, of course, require years of planning and development, but already a most encouraging start has been made, as will be seen by a comparison of the accompanying illustrations.

And as a furtherance of this idea, the aim is to connect the parks by avenues and boulevards in which the informal and the architectural parkings will be blended gradually and almost insensibly one into the other by these threads of communication.

Where streets are not paved it will be possible to extend the curbs and by the saving from the cost in paving defray the cost to replace the curbs and put in the parking.

East Lake and West Lake Parks, Elysian, Hollenbeck and South as well as a number of smaller parks where much has been accomplished by previous administrations must be metamorphosed gradually into the general scheme of things, but in Exhibition and Griffith Parks and in the Arroyo Seco, the present forces have fullest play for their ability.

Griffith Park, with an area of 3,015 acres, the second largest municipal park in the United States, is still in its wild state. It has the latent possibilities of being converted into the finest park in America. One of the necessities for the development of the park, which until now has been largely lacking, is a water supply. This is soon to be made available from the Los Angeles aqueduct. The great acreage includes a small domain of mountain, hills and dale, valley, undulating field and river bottom. The mountain sides are clad with copse and California live oak, while along the river bed there is to be found a dense growth of alder and willow, from whose branches hang tropical mosses in graceful festoons. Here, within ten miles of the heart of Los Angeles, are still to be found deer, quail, rabbits, wild cats and other native game living in their natural state.

REMODELING THE PARKS OF LOS ANGELES.
Drive in West Lake Park Lined with Palms.

So far the development of this park has

consisted largely in the making of picnic grounds, and roads and trails in which nature in some of her happiest moods has been little or not at all disturbed.

A zoo also has been started. Here, with the balminess of the climate that is always manifest, opportunities are offered for permitting the animals to be confined under their natural conditions, and to this end the moat system, conforming with the German idea, will be adopted. A separate organization of public men whose interest has been aroused in this phase of the park board's work has been formed to assist the commissioners in the enterprise. Ultimately the zoo at East Lake Park will be moved to the new quarters, and the city is now seeking a competent director who can not only create and develop plans, but present them to the public in a way to gain its active co-operation.

Next in importance to the improvement of Griffith Park is the proposed parking of the Arroyo Seco (Spanish for "dry river"). This old water way begins in the mountains of the Sierra National Forest Reserve, six miles north of the city of Pasadena, and runs for a distance of firteen miles thru Los Angeles county, the cities of Pasadena and South Pasadena to a junction with the Los Angeles river opposite Elysian Park, which is a five-minute ride from the City Hall. Much of it is heavily wooded and of great scenic beauty, Sycamore Park being already included within its limits. This project, as will be seen, is one in which the interested cities as well as Los Angeles county must and will co-operate.

Exposition Park will be entirely formal. The three great buildings of the Byzantine style of architecture that the State of California is erecting, are to be set in a court of thirty acres and will be tied together by a sunken garden of which the balustrade and the wall will be of red brick, architecturally in keeping with the three edifices. In the center of the court a fountain commemorative of the construction of the Los Angeles aqueduct is to be erected by popular subscription. As a unique and distinctive feature, the entire park is to be surrounded by a conuous hedge of roses. The city in its agreement with the State has provided for the expenditure og $100,000 in ten annual installments for the improvement of this area.

The foregoing gives in large detail the improvements that have been accomplished or are under way in the Los Angeles park system. Los Angeles has been awakened and is cognizant of its laxity hitherto.

One thing has been impressed upon the Park Commission. That body at the present time finds that it acts purely in an advisory capacity to the City Council and both its plans and finances are limited by the graciousness or ungraciousness of that body. The Commission believes that the best interests of the city demand that the Park Board shall have control and supervision over the park area and make rules and regulations for the territory under its jurisdiction. It seeks the power to create and maintain boulevards with the establishment of a sub-department of forestry, which would determine and enforce the planting of trees best suited to the styles of architecture in the different districts. For maintenance it would have a separate tax levy, the same as those now provided for a public library and schools.

These broad changes can only be made by revision of the city charter, a thing which is now being developed on a scientific basis. With the assistance of the city clubs with their several thousand militant citizens, it is hoped to secure these broader powers for the Board as above mentioned in order that the great plans may be accelerated rather than hampered.

ROAD STUDY IN ENGLAND.

By an English Correspondent.

IN the gritting of street surfaces the English Roads Improvement Association discovered that where material was used in the wooden pavements exceeding a quarter of an inch gage, practically no foothold was afforded until the material had been crushed by the traffic. The flint pebbles were either picked up by the rubber tires or kicked to the gutter by the horses' feet. So the metropolitan borough authorities were duly circularized on this point, as gritting with small material gave horses a good foothold greatly reducing the damage to rubber tires, and it was found that there was sufficient elasticity in a rubber tire to enable it to pass over a small piece of grit without the skin of the cover being lacerated. After conducting a large number of experiments in regard to the complaints in connection with tarred roads, it was found that the cheaper and commoner forms of tar, badly or carelessly applied to the road surfaces, were the cause, and that, with the use of a higher-grade binding material, such as bitumen and asphalt, a much more efficient road-surface was formed.

With regard to complaints that a tarred road-surface is unduly slippery for horse traffic, the Roads Improvement Association on investigation found that the causes were either one or another of the following, all capable of remedy: (1) The application of tar, or similar material, to the road in wet weather, or under conditions when the road metal is not in a fit state to receive it, as a consequence of which the tar never becomes properly incorporated with the road material, and the surface is never satisfactory. (2) The application of tar to a road where, owing to trees, walks, etc., the passage of air and sunlight is limited. (3) An excessive amount of tar being applied when completing the work; this gives an unduly smooth surface, which becomes slippery in certain weathers and specially applies to certain types of tar macadam work. (4) The injudicious use of calks upon horses' hoofs, as these chisel-like devices have the effect of piercing the waterproof coating of tarred surfaces and allow the water to get underneath the tar, which is then lifted and forms a greasy substance. (5) Various local circumstances, such as unsatisfactory road foundations, which cause the surface to become broken up by the traffic, excessive camber, etc.

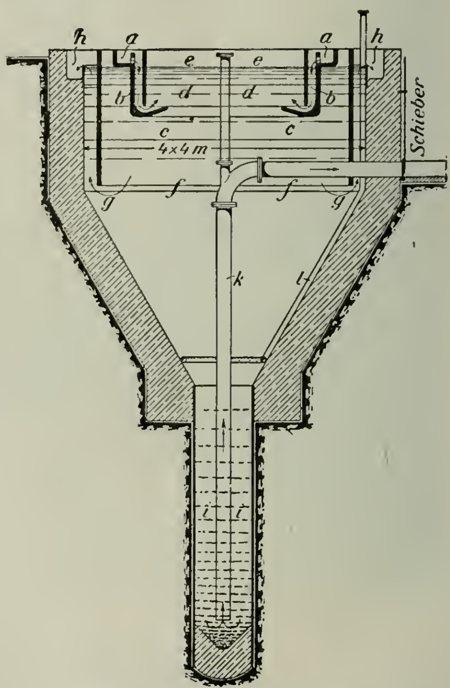
A SEWAGE SEPARATOR.

By Dr. Robert Grimshaw, Dresden, Germany.

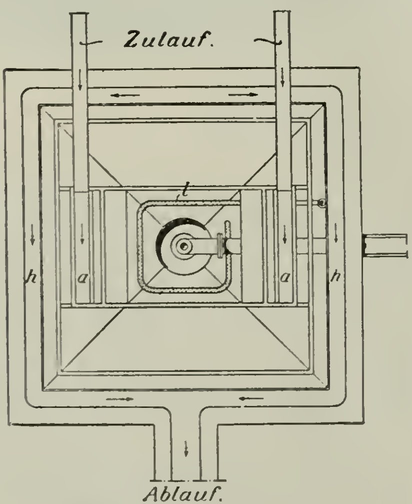
THE illustration shows in plan and vertical section a new mechanically acting sewage separator intended to replace the usual settling tanks, and which has been introduced into several German cities.

With reference to the illustration: *a* are the inlets; *b*, side inlets; *c*, turned-up portions to direct the water upwards; *d*, grease traps; *e*, the upper layer of greasy water; *f*, the clearing chamber; *g*, the edges of the surrounding inner seal wall; *h*, exterior passage for clear sewage; *i*, the mud cylinder; *k*, the mud pipes, from which only thick mud flows, and *l*, the pipe for supplying flushing water.

The principal object is to drive out the mud deposit automatically by water pressure without stopping the general working of the device. The mud deposit being almost free from fat is very suitable for fertilizing purposes. Before being dried, it can be allowed to ferment, which gives it an earthy consistency and deprives it of its disagreeable odor. This fermenting can take place in special reservoirs, either separate or built onto this device.



SEWAGE SEPARATOR. Section.



SEWAGE SEPARATOR. Plan.

The advantages claimed for the arrangement are: That the mechanical separation is effected by clear water instead of by sewage; that the grease is separated from the mud; that the device serves as a preliminary apparatus for plants where the sewage is used for irrigation. It was shown in the Dresden Hygiene Exposition by the Gesellschaft fur Abwasserklarung, Berlin-Schoneberg.

(Zulauf in the plan means inlet, and Ablauf means outlet.)

EDITORIAL COMMENT

STATE CONTROL OF SEWAGE PURIFICATION.

The question of the extent to which the State can carry its control of sewage pollution of streams and of municipalities in requiring them to purify their sewage and levy taxes upon themselves to pay the construction, maintenance and operation expenses, has been an open question until this time, with the presumption in favor of the independence of the city in this regard.

The State of Ohio, in advance of other States, passed an act in 1908 which placed these matters within the control of the State Board of Health, which could require the purification of sewage deemed necessary by it, and the municipality affected was required to levy the necessary taxes to pay the expense necessary to carry out the board's orders. Indiana passed a similar law in 1909.

But little has been done in Ohio and nothing in Indiana toward enforcing the laws, the city of Greenville, O., having attacked the constitutionality of the law. This has now been affirmed by the Supreme Court on appeal from two lower courts. The most difficult question raised was that concerning the discrimination in the law in favor of cities discharging their sewage into the Ohio river, the application of the law in their case being suspended so long as cities in other States bordering on the river discharge their unpurified sewage into the river. The boundary of the State of Ohio is not the center of the Ohio river, but the northerly bank, so that cities discharging sewage into the river are really discharging it into the State of West Virginia or Kentucky. The exception in the law therefore only gives statement of the exception in fact, and is therefore not a discrimination, but merely a recognition of the fact. The States of West Virginia and Kentucky would seem to have some rights in the case which they should be able to enforce.

However, the court took cognizance of the claim made by some that the boundary of the State is the middle of the river, and discussed the case under this supposition, coming to the conclusion that "to compel those persons, corporations, villages and cities bordering upon the Ohio river to refrain from discharging sewage into the Ohio river while the cities on the opposite bank are so doing would serve no purpose and accomplish no good results. * * * The fact that it would be productive of no good results is sufficient reason for the classification and for exempting them from the provisions of this law."

The other points made are that the law provides for compulsory arbitration, places the control of the discretion of city officials in the State Board of Health and delegates the taxing power of the city to the same board.

These are disposed of on the grounds that the powers of a municipality are delegated powers, and the legislature can limit them at its reasonable discretion; that the city has no right to place the burden of pollution upon persons and property below, and that so long as the whole city pays the expense in proportion to its benefit, there is no inequality of taxation such as is contemplated in the provisions of the Constitution of the United States; and that the action of the State Board of Health is to compel the purification of the sewage, the levying of the tax being a ministerial action of the municipality necessary to carry out its orders, so that the State Board has no direct control over the taxing power of the city or the manner of exercising the same by the city officials.

A general allegation was also made that the order of the State Board of Health was not justified by the facts, but no proofs were presented and there was no discussion of this question in the briefs. The remedy for this would not be in a suit for injunction, and therefore no action was taken by the court on this point.

The Ohio State Board of Health can now proceed with much work which has been delayed, waiting for this decision. The authorities in Indiana will also be relieved regarding the status of their statute, but the delay in action in that State has been not on account of the uncertainty regarding the validity of the law, but on account of the lack of appropriations to pay the expenses of investigations, orders, suits and other proceedings.

These laws place the control of stream pollution in the hands of experts, who can make the application of the sanitary principles uniform and without discrimination, producing the best results with a minimum of expense, friction and injustice. Their adoption by other States will doubtless follow as their advantages are demonstrated.

It is necessary for efficiency, however, that the State Board of Health and its activities be kept out of politics. The recent changes in the personnel of the executive and administrative officers and employes of the Ohio board have not yet been explained satisfactorily, and the charge of political manipulation which has been made is therefore not yet refuted. It is to be hoped that, whatever the reason for the changes, they will not cause a lowering of the high standard set by Dr. C. O. Probst, the former efficient secretary of the board. The advanced position of Ohio in legislation on sanitary matters is the result of his constant, thorough work in agitation, education and direction of the progressive forces of the State.

It is also to be hoped that the next legislature of the State of Indiana will see fit to give to its efficient State Board of Health the money needed to make its advanced legislation effective.

OBSOLESCENCE AND DECREPITUDE AS FACTORS IN DEPRECIATION.

In continuation of the discussion of depreciation in public service plants, begun in the editorial on "Theories of the Valuation of Public Service Industries," on page 34 of the July number, some attention may be paid to particular differences in application of the principles there stated under the conditions which arise. Some of these are considered in a paper by William B. Jackson on depreciation and reserve funds, before the Western Society of Engineers, and again the proper understanding of principles and methods of applying them is promoted by his accuracy in determining the differences between the terms used.

Mr. Jackson follows the general custom in including in the term depreciation two elements, decrepitude and obsolescence. Strictly speaking, depreciation should be applied to decrepitude only, and the line of reasoning followed in the preceding editorial is strictly applicable only to the provision for replacing the value of the plant lost through its progressive decrepitude or providing a sinking fund to pay the bonds when this progress in decrepitude extinguishes the plant.

Obsolescence is not decrepitude physically, tho it may be so considered theoretically, and it has been included in depreciation mainly because the physical difference between decrepitude and obsolescence has not been recognized. It really requires different treatment, and most of the difficulties in the practical handling of depreciation charges arise from the attempt to include the two elements in the same charge.

Were there no advancement in invention there would be no new and better methods of performing the service required of the plant. The practical reasons for substituting new machinery for old are either reduction in cost of maintenance or operation, or both, enough to warrant the change, or improvement of the service, or a combination of the two.

If the only result is an improvement of the service, it is evident that the price for the service should be increased enough to pay the cost of the new machinery during the period of its life, in addition to the cost of the old machinery which was discarded. As in one of the cases which Professor Jackson mentions, the depreciation on both old and new machinery should properly be charged off each year, notwithstanding the fact that the value of the plant is actually diminished, at the time the old machinery is abandoned, by its value on the books at that time, less the salvage obtained by its sale.

If the only result is to reduce the cost of operation, the question which arises is one of equation of cost of operation with the old plant and cost of operation plus the new capital charges with the new plant. If the former is the greater, the change will be made. And, if the value of the plant is left as it was before the change was made, there will be a profit to the operators, without taking into account the increase in actual investment in the plant.

Ordinarily both improvement in service and decrease in cost of operation are involved, so that there can be no fixed rule for computing the effect of obsolescence. Each change of this nature must be considered by itself if an exact result is to be obtained. Any rule can be based only on more or less accurate averages of what has happened in the past, and can therefore not be blindly applied to the future, undoubtedly different, conditions, and will never fit exactly the conditions at any one plant.

In valuations of plants for the purpose of fixing rates, if there is a full history of the plant, it should not be exceedingly difficult to make the necessary computations and to make the proper allowances for the replaced machinery and that replacing it.

It is evident that a comparatively stable charge, such as decrepitude, especially when we have the elaborate modern tables of depreciation per annum for so many of the minute details of a plant, should not be combined with one which is so obviously irreducible to rule or formula as obsolescence, and the sooner our valuation experts make the separation the sooner their conclusions will begin to travel toward accuracy and exact equity.

Professor Jackson makes a separate fund of required reconstruction and special insurance, which he calls a reserve fund. But these are largely matters of contract, and while they may be fairly regular for a single plant, will vary greatly for plants in general. The obsolescence charge may be combined with the reserve fund for the purposes of the treasurer, but it should be computed separately and kept separately on the books of the company.

Inadequacy is another factor which Professor Jackson discusses to some extent. He likens it to obsolescence, but shows that it is much more subject to engineering judgment than is obsolescence, and in well-designed plants is therefore fairly negligible. In plants begun small and suddenly outgrown, on account of unexpected increase in population of the city, it is scarcely different from obsolescence. It is likewise a charge which varies in various localities and with little or no relation to any local conditions except the two mentioned, and should therefore receive the same special and individual attention which obsolescence does. Inadequacy is therefore simply a section or variety of obsolescence and may be included in the same fund.

THE QUESTION DEPARTMENT

Patents on Road Construction and on Metal Culverts.

The writer has noticed that you gave a list of patents on road and paving construction and repair in your November, 1911, number. Do you have this list of patents in book form? Also advise us whether you have ever published a list of patents on metal culverts.

G., ———, Ind.

The list of patents on road construction and repair in vol. xli, p. 410, was continued in vol. xlii, p. 68 (Jan., 1912), and is further continued in this number. It will be brought down to date as rapidly as the space available will permit. A short list of patents on culverts and bridges was printed in vol. xxxvii, p. 418. It also will be brought down to date shortly. These lists are compiled from the weekly numbers of the U. S. Patent Office *Gazette* and have appeared nowhere except in MUNCIPAL ENGINEERING.

Resolution for Improvement of Village Street by County Authorities.

Please send a copy of a resolution by board of trustees of a town giving their consent to the improvement of a street as provided in the Acts of 1909, Section 2 of an act concerning highways (page 355).

M., Town Attorney, ———, Ind.

If the board of trustees of the town desires the street included in the line of highway to be improved by the township to have the same character of improvement as the road outside the town limits, it would seem to be sufficient for the resolution to provide "that the Board of Trustees of the Town of ——— concur in the improvement of the road (describing the line) and in the improvement of that portion thereof within the limits of the Town of ——— (describing this section) according to the officially adopted plans and specifications therefor, and consent thereto under the provisions of Sec. 2, of Chapter 148 of the Laws of 1909."

If, however, the town desires the portion within its limits to be improved in some other manner, then the resolution should set forth and, under the provisions of the law may set forth, a full description, including plans and specifications for the kind of improvement desired. The provision that street paving materials shall not be used except upon streets within the corporate limits of cities and towns is evidently intended to give the city or town the right to require such pavement to be laid if it so desires. If the town so prescribes a paving material or a method of laying the material used, or a plan for curbs, gutters or other variations from the road construction adopted for the road outside the town limits, it would be well to include in the resolution a statement that the town assumes the excess in cost of this section over that of the parts of the road outside of city or town limits.

Septic Tank Specialists.

I have a subdivision of some 500 lots I wish to sewer. I will have to use a septic tank system. Can you put me in communication with some company whose specialty is septic tanks?

A., ———, Tenn.

The Cameron Septic Tank Co., 352 Monadnock Bldg., Chicago, Ill.; Russell Sewage Disposal Co., 607 Marquette Bldg., Chicago, Ill.; Merritt & Co., 117 N. Front street, Camden, N. J., make a specialty of septic tank and similar methods of sewage disposal.

Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING for names of specialists in sewage disposal, both manufacturers and engineers, and of apparatus and materials, under the headings, "Air Compressors," "Air Pumps," "Bleaching Powder," "Chemists—Consulting," "Civil Engineers," "Consulting Engineers," "Contractors," "Ejectors," "Flush Tanks," "Powder, Bleaching," "Sanitary Carts," "Septic Tanks," "Sewage Disposal," "Sewage Ejectors," "Sewage Pumps, "Valves, Air."

How to Find a Lost Sewer.

I would like to know if any of the readers of MUNICIPAL ENGINEERING have had any experience in locating a lost sewer. We have about three-fourths mile of out-fall sewer with two manholes and the outlet located. We know it does not run on a straight line between the known points, and we have tried and found that it does not run where the field notes say it should. That part of the city in which the sewer is located has been built up considerably since the construction of the sewer, and most of the ground has been filled from one to three feet, so that all trace of the ditch is lost. I would like to receive suggestions in regard to manner of locating intermediate manholes without going to an excessive expense of digging long trenches either along or across the supposed line of the sewer.

E. W. R., ———, Mo.

Will our readers report their experience in like cases?

No indication is given as to the possible depth of the sewer. If not too deep, a pointed rod can be driven down until it strikes the sewer or has certainly passed it. There must be some idea of the location of the line, and the rod or rods can be driven down in holes close enough together to insure striking the sewer somewhere. If the sewer is small this would necessitate holes close together; for example, if it is 12 inches in diameter, the holes should be not more than 9 nches apart. The line of holes would run across the line of the sewer. If the flow of the sewer is rapid enough or obstructed enough to make a noise, an audiphone held on the rod after it is driven down may detect the proximity of the sewer. If there is rock or hard pan under the surface and above the level of the sewer, the search will be easier, because the sewer will be in the disturbed and softer trench, and the sound of the flowing water may be more easily transmitted.

One engineer reports that he has used a blunt rod which was worked up and down in a hole kept wet with water, and that such a rod can be forced down thru the soil for six feet or so in about ten minutes. Driving the rod would require something to lift the operator up high enough to strike the top of the rod and would require a stiffer rod.

Cost of Electricity for Pumping.

We want to secure some information in regard to what various cities and towns are paying central stations for electricity used as power in their pumping plants.

C. D. P., Boston, Mass.

Can our readers give any information directly to the point?

A few cities buy current for electric street lighting by measurement, the popular price being 10 cents per k. w. Some cities pay as little as 5 cents, and one or two as much as 20 cents. Several cities in California buy current from power companies, mainly for lighting, but Gridley and Lodi seem to pump water by electricity also.

If the pumping can be done in the daytime or at such other times as the demand on the electric plant for other purposes is well below the maximum, undoubtedly better rates can be secured, possibly as low as 2 or 3 cents under favorable circumstances.

There are but few electric pumping plants and they are small or are run under special conditions. Small towns can pump their water supplies by electricity in combined electric light and water plants if there is business enough to keep the plant running all the time, at night making light and in the day pumping water. In such towns there is little or no demand for day current from an electric light plant, but there are doubtless some electric light plants that would be glad to sell current for pumping in the day time at low prices because such use would be practically clear profit.

Terms of Water Works Franchise.

Our small city is considering a new franchise for its water company, and we would like to have some information about what others are doing in this line.

City Attorney, ———, Ind.

Conditions and opinions have changed materially since the expiring franchise was granted, even if its term was limited to the twenty-five years now possible under the Indiana law. The newer franchises recognize these changes. Unfortunately, but few franchises have been changed in the smaller cities and but few of them have embodied the later ideas, because they have not had the necessary expert assistance, and because the city councils could not quite bring themselves to make the material changes necessary. In some cases this reluctance may be due to the fear that an equitable ordinance might raise the rates, in other cases it may be based on influence not definitely located.

Several of the proposed franchises for various public service industries which embody the modern principles have been discussed in MUNICIPAL ENGINEERING. One which applies most directly to this case will be found in "An Outline of a Contract Between a City and a Water Works Company," vol. xxxv, p. 247. Some of the essential points in a franchise for a water company are noted in "Terms of Water Works Franchise," vol. xxxvi, p. 177.

Wilcox's book on "Municipal Franchises" (Vol. I, $5), discusses existing franchises. It gives the terms of what is called a model water franchise, outlined in 1892, which is excellent in its provisions of physical qualifications, but contains no hint of the modern provisions set forth in the first article referred to above. The book gives a general idea of the terms of a water franchise for Ann Arbor, Mich., which is also excellent so far as physical provisions are concerned, and provisions for a board of complaint and for annual reports of receipts and expenditures of the company are also of value. The New Haven franchise is discussed largely as one which contains unsatisfactory provisions. The Indiana law governing the issue of franchises since 1905 is quoted with approval, but the Indianapols water franchise, which is also quoted in part, has not yet been considered as amenable to the regulations of the present law, because of a provision which continues the old contract after its expiration until a new contract, satisfactory to both parties, is made. San Francisco, Los Angeles, New Orleans, Denver, Butte, Birmingham, are quoted mainly to show objectionable features, and Knoxville to show the court decision confirming the city's right to regulate rates.

The report of the National Civic Federation on "Municipal and Private Operation of Public Utilities," three volumes, discusses franchises and conditions of water supplies in Cleveland, Chicago, Syracuse, New Haven, Utica and Indianapolis, which are all materially larger than the city under consideration.

Adrian, Mich., with 11,000 population, has an old contract which expires in 1913. As regards fire protection the present contract as modified from the first one granted provides that the system shall at all times be capable of throwing eight fire streams, each thru 50 feet of hose and 1-inch nozzle, 100 feet in height; that the city rent at least 150 hydrants and one additional for every 600 feet of pipe extension; that hydrants be double nozzle with frost jackets; that the city use hydrants for sewer flushing only at certain hours; that the company test all hydrants twice a month and those in the paved district daily when the temperature is below zero; and that the water company forfeit six months' hydrant rental for failure to furnish water at the required pressure at any fire. This contract is considered inadequate for protection, and it is recommended that the new contract require additional 4,000,000 gallon pump and 150-h.p. boiler, fireproofing of pumping station or its equivalent; metering of all services; strengthening mains so that a flow of 1,500 to 2,000 gallons per minute under fire pressure can be obtained in residence district, 2,500 gallons in manufacturing districts and 3,500 gallons in the principal mercantile district. The improvements in mains recommended to produce this result are stated and in general minimum sizes of mains are recommended; namely, 6 and 8-inch in residence districts, the latter in blocks 600 feet or more in length and on all dead ends; 8 and 12-inch in mercantile and manufacturing districts, the latter for long lines not cross-connected; and that all 4-inch mains be replaced within five years. It is also recommended that gate valves be so placed as to reduce to 800 feet the length of pipe necessary to shut off to repair a break; that there be two hydrants at each street intersection and intermediate hydrants not more than 250 feet apart in principal mercantile districts, one hydrant at street intersection and one intermediate on blocks more than 400 feet long in minor mercantile and closely built residential districts; that hydrants have two hose outlets, 6-inch barrel and 6-inch gated connection to main.

The requirement of capacity in gallons per minute rather than a certain number of fire streams to a certain height is excellent, as it makes the requirement more definite and so more easily tested.

Raleigh, N. C., with a population of 20,000, has the following franchise provisions regarding fire protection:

The company shall maintain a pumping capacity and a supply of water adequate to the needs and demands of the city, with power sufficient to discharge six 1-inch nozzle streams, using 50 feet of 2½-inch rubber hose taken from six separate hydrants located in the business part of the city, to a height of 100 feet, or its equivalent in pressure, say, 60 pounds, from the mouth of said hydrants, and at another time to throw from separate hydrants in other portions of the city four such simultaneous fire streams.

The company shall at all times be prepared to furnish effective hydrant streams without the aid of portable engines, from hydrants having a pressure from water tower of not less than 40 pounds, and from direct pressure not less than 60 pounds per square inch. Such pressure maintained at the hydrants to be the measure of liability of said water company, which shall not be responsible for the proper application of the water.

A water tower of at least 100,000 gallons capacity shall be maintained at an elevation of 110 feet above the street level at Capitol square, which tower shall be connected to the street mains by a pipe of diameter not less than 12 inches, in which pipe there shall be a valve which can be closed and thereby allow an increased pressure to be carried on the street mains.

The city shall rent at least 137 hydrants at the rate of $32.50 per year, may order extensions to street mains not to exceed two miles in length during any one year, provided ten hydrants be set per mile of extension and paid for at the above mentioned rate, and may cause additional hydrants to be set on existing mains by paying for each hydrant an annual rent of $25. The chief of the fire department to have charge and control of hydrants, to cause inspections to be made, and the water company to maintain same in good operative condition. The use of hydrants to be confined to the extinguishment of fires, flushing of gutters and sewers, and sprinkling of streets. The company reserves the right to install meters on all services.

The above contract is considered deficient from the standpoint of fire protection, the size and number of fire streams guaranteed being entirely inadequate for the control of serious fires. It is recommended that the number of hydrants be increased to two at each street intersection and one midway of all blocks of 400 feet or more in mercantile district, hydrants not more than 300 feet apart in manufacturing districts, and not over 350 feet apart in well-built-up residential districts, with mains of size to serve them; hydrants in mercantile and manufacturing districts to have three or four hose outlets, not less than 8-inch barrel and 8-inch gated connection to main and other hydrants two or more hose outlets 6-inch barrel and 6-inch gated connection with mains.

A number of cities somewhat larger than the one under consideration have made new contracts whereby certain portions of the old systems shall be replaced or reinforced each year until the requirements conform to the necessities of the present and the probable necessities of the future, which provisions can be quoted if desired.

The exact wording of these requirements and the method of providing for their modification as conditions change require the assistance of engineers expert in such matters to give the city the service which its conditions require and at the same time give the company the compensation to which it is justly entitled for supplying this service. To render the most efficient service, the engineer must be given an opportunity to study the problem on the ground and to form a reliable opinion of the probable demands of the future.

Best Form for City Charter.

I would like to have your idea as to where I can get the best models for a municipal charter for a city of a hundred and fifty thousand population. In Alabama we have a general municipal charter which supersedes all the former special charters. I would, however, like to have a suggestion as to the names of the two or three states having the best model general municipal codes as well as the two or three cities having the best special charters. I have the Ohio work of Ellis' "Municipal Code" and also the Indiana work of Thornton's "Laws of Cities and Towns." I am inclined to think some good models might be gotten from Minnesota, but this is merely a surmise.

B., City Attorney,
———, Ala.

The charter of the city of Boston seems to the writer to contain the most satisfactory working out of the business principles which should be applied in a city government, and in general to have the best methods as yet developed for reducing to a minimum the influence of politics in the details of the administration of the system. A careful study seems to have been made of all the forms of city government which have been in use. The principles of municipal government which have been most successful have been chosen and the details of the application of these principles have been improved wherever they have been found unsatisfactory.

In many of the attempts which have been made to improve municipal government, defects in details and in applications of principles have been confused with defects in the principles themselves and really good systems with poor working out of details have been discarded for poor systems which work well at the beginning because of the great improvement in some of the more important details of administration. The Boston result bids fair to be the most permanently successful because it has the most efficient combination yet made of correct principles and good detail in their application.

The analogy of a municipal corporation to a business corporation has often been shown in MUNICIPAL ENGINEERING. The principal difference is in the fact that the municipal corporation is essentially a money-spending and not a money-making organization. The methods of measuring the efficiency of its officers must, therefore, be somewhat different. One of the principal difficulties in municipal government is that of securing the best men for administrators of the policies determined upon by the people, which is tied up in very many cases with the difficulty in registering by an independent vote the true desires of the people as to the policy to be adopted. When cities apply the same business principles to the selection and retention of competent elective officials and appointive employes which have been applied in such cases as the Boston charter and the general charter for Indiana cities in providing a business-like plan for the general administration, the results of municipal government will be more satisfactory.

The safeguards which have been thrown about the commission form of government to make its success reasonably certain could be applied to the business form adopted by Indiana more than twenty years ago and would give more satisfactory results than are now obtainable by the commission form. Boston has applied some of these safeguards and is apparently securing the desired results with considerable success. No doubt additional efficiency can be developed after a few years of experience.

The books mentioned in the question give the laws governing municipal corporations in Indiana and Ohio and some of the results of their practical application. Bradford's "Commission Government in American Cities" gives the student's point of view. It needs information from the practical administrator of a city and from one familiar with methods of political manipulation to make it complete.

Some recent articles in MUNICIPAL ENGINEERING give information concerning various forms of charters and sources of information.

In vol. xlii will be found the following: "Municipal Economy and Efficiency," p. 462, outlining the success of methods in use in Boston and elsewhere for checking up and overseeing municipal officials by official and unofficial organizations independent of the municipal administration; "The Election of Administrative Officers of Municipalities," p. 111.

In vol. xli: "Municipal Efficiency Bureaus," p. 309; "Forms of Municipal Government in Europe," p. 256; "Commission Government in Trenton, N. J.," p. 313.

In vol. xl: "Best Form of Municipal Charter," p. 127, giving suggestions as to methods of attacking the problem; "Comparison of Des Moines and Indianapolis Forms of Municipal Government," p. 8, one having the commission form and the other a business form; "Information About the Commission Form of Government," p. 126, giving references to earlier articles on the subject; "Commission and Other Forms of City Government," p. 45, which also has references to earlier articles; "Small Cities with Commission Form of Government," p. 124; "Cities Having Commission Government," p. 431.

The general conclusion of students of municipal government is that almost any form of administration will be successful if the city officials are competent, honest and interested in their work, but that no system is capable of making men honest or competent. The provisions of first importance are those which make it possible for the citizens to overthrow a corrupt administration when they so desire, and which provide for independent watch over the acts of officials so that they must always be ready for investigation. There may be many excellent methods provided for taking care of the details of administration which make the work easy and simple, but they are of little value unless the citizens take enough interest in their government to select the proper men to carry out their wishes. Another very desirable feature of a city charter is one which keeps in employment subordinates who have proved themselves honest and efficient, and removes them from the influence of the politician who wishes to reward his friends by appointing them to office, whether fitted for it or not.

Information About Central Station Heating Plants.

I am advised that you have special information department from which we would like information relative to the subject of municipal central heating plants, as to the desirability of such a plant, also as to which is the most desirable, steam or hot water for a plant of that kind.

C. L. W.,
Chairman Ways and Means Com.,
Commercial Club, ———, Minn.

There has been no book on "Central Station Heating" until very recently. Byron T. Gifford has recently published one on this subject which is now on sale at $4. It sets forth the advantages of central station heating, the sources and amounts of loss in pipe lines, the principles of pipe line design, method of making rates, descriptions of steam and hot water heating stations, methods of operating and maintaining plants, especially hot water plants, and has brief discussions of management and of franchise with outlines of hot water, steam and combined heating franchises. Building equipment is also considered in some detail from radiation to weather records.

Articles in MUNICIPAL ENGINEERING give much of value in this field, some of the more recent being the following:

In vol. xxxix: a review of Baldwin's book on "Heating" ($2.50) on p. 145, which book gives instruction on details of house installation.

In vol. xxxvi: "Central Station Steam Heating," p. 93, a description of the plant at Johnstown, Pa.

In vol. xxxi: "Rates for Heating Service," p. 445, comparing methods of charging for central station heating service; "Central Station Heating Plants, p. 455, giving a full list of cities having such plants, both steam and hot water.

In vol. xxviii: "Central Station Heating Plants," p. 26, giving full statistics and tabular description of many plants. Statistics are also given in vol. xix, p. 412, and vol. xx, pp. 20, 152.

Three articles by Alton D. Adams on "Heating from Central Stations" in vol. xx, pp. 65 and 136, and vol. xviii, p. 351.

A paper on "Central Station Heating" in vol. xxvii, p. 450.

There are several others upon the subject of less importance or of special application.

Books on Plumbing.

We wish to get a bibliography of books on the subject of plumbing for the use of water works engineers. Do you publish such lists or can you tell us where they may be obtained?

MRS. F. E. BRYANT,
Librarian School of Engineering,
Lawrence, Kan.

Following are books on plumbing and pipe fitting, most of which will be of interest to water works men as well as plumbers and pipe fitters:

"American Plumbing Practice" ($2.50).

"American Steam and Hot Water Heating Practice" ($3).

"Plumbing and House Drainage Problems" ($2).

"Practical Gas Fitting" ($1).

"Practical Hints on Joint Wiping" (25 cents).

"Steam Heating Problems" ($3).

Ainge's "Sanitary Sewerage of Buildings."

Allen's "Roughing in House Drains," "Swimming Pools," and "Sanitation in the Modern Home."

Baldwin's "Hot-Water Heating and Fitting" ($4).

Ball's "Plumbing Catechism," Billings's "Details of Water Works Construction" ($2).

Birkmire's "Planning and Construction of High Office Buildings" ($3.50).

Brown's "Water Closets" ($1).

Clow's "Practical Up-to-Date Plumbing" ($1.50).

Cosgrove's "Principles and Practice of Plumbing," "Sewage Purification and Disposal," "Plumbing Plans and Specifications" and "Wrought Pipe Drainage Systems" ($2).

Donaldson's "Hot Water Heating, Steam and Gas Fitting" ($1.50).

Gerhard's "Sanitary Engineering of Buildings" ($5).

Gerhard's "Sanitary Drainage of Buildings" (50 cents).

Gerhard's "American Practice of Gas Piping and Gas Lighting" ($3).

Gerhard's "Guide to Sanitary Inspections" ($1.50).

Gerhard's "Modern Baths and Bath Houses" ($3).

Gerhard's "Sanitation of Public Buildings" ($1.50).

Gerhard's "Water Supply, Sewerage and Plumbing of Modern City Buildings" ($4).

Gray and Ball's "Plumbing" ($1.50).

Jessup's "Contract and Estimate Record Book for Plumbers" ($1.50 and $2.50) and for "Steam and Hot Water Heating" ($1.50).
Kaiser's "Repair Kinks for Plumbers" (50 cents).
Kidder's "Architects' and Builders' Pocket Book" ($5).
Lawler's "American Sanitary Plumbing" ($2).
Lawler's "Modern Plumbing, Steam and Hot Water Heating" ($5.50).
Lawler's "Practical Hot Water Heating, Steam and Gas Fitting" ($2).
Lincoln's "Practical Steam and Hot Water Fitting" ($1).
Maguire's "Domestic Sanitary Drainage and Plumbing Lectures on Practical Sanitation" ($4).
McNeil's "Steam and Hot Water Fitters' Text Book" ($1).
Morris's "Steam Power Plant Piping Systems" ($5).
Richey's Building Mechanics' Ready Reference Series, "Plumbers', Steam Fitters' and Tinners' Edition" ($1.50).
Richey's "Hand Book for Superintendents of Construction," etc. ($4).
Richey's "Building Foreman's Pocketbook" ($5).
Starbuck's "Standard Practical Plumbing" ($3).
Starbuck's "Modern Plumbing Illustrated" ($4).
Starbucks' "Practical Wrinkles for the Plumber" ($1).
Starbuck's "Questions and Answers on the Theory and Practice of Steam and Hot Water Heating" ($1).
Starbuck's "Questions and Answers on the Practice and Theory of Sanitary Plumbing," 2 vols. ($1 each).
Starbuck's "Hot Water Circulation" ($3).
Waring's "How to Drain a House" ($1.25).

Some English books are the following:

"Architectural Hygiene" (5 shillings).
Allsop's "Public Baths and Wash Houses" (6 shillings).
Bjoerling's "Pipes and Tubes: Their Construction and Jointing" (3 shillings 6 pence).
Buchan's "Plumbing" ($1.40).
Coleman's "Sanitary House Drainage" ($2).
Colyer's "Water Supply, Drainage and Sanitary Appliances of Residences" ($1.50).
Cross's "Public Baths and Wash Houses" (21 shillings).
Davies's "Standard Practical Plumbing," Vol. I ($3), Vol. II ($4.50).
Davis's "Plumbing and Sanitation" (30 shillings).
Denton's "Water Supply and Sewerage of Country Mansions and Estates" ($1.25).
Dye's "Hot Water Supply" ($1).
Dye's "Hot Water and Steam Cooking Apparatus" (60 cents).
Eldridge's "Engineers' Practical Guide for Fixing Hot Water Apparatus and Warming Greenhouses and Buildings" (40 cents).
Hart's "Hints to Plumbers" ($3).
Hart's "Sanitary Plumbing and Drainage" ($3).
Hart's "Principles of Hot Water Supply" ($3).
Hellyer's "The Plumber and Sanitary Houses" (12 shillings 6 pence).
Herring-Shaw's "Domestic Sanitation and Plumbing" ($5), 2 vols.
Ingham's "Household Boiler Explosions" (50 cents).
Jensen's "House Drainage and Sanitary Fitments" (5 shillings).
Jensen's "Modern House Drainage Plans and Diagrams" (2 shillings 6 pence).
Jensen's "Drainage Inspection and Sanitary Surveys" (2 shillings 6 pence).
Jones's "Heating by Hot Water" ($1.50).
Latham's "Sanitation of Domestic Buildings" (2 shillings 6 pence).
Maxwell's "Drainage Work and Sanitary Fittings" (1 shilling).
Maxwell and Brown's "Encyclopedia of Municipal and Sanitary Engineering" ($10).
Middleton's "Drainage of Town and Country Houses" ($3).
Munro's "Kitchen Boiler Explosions" ($1.20).
Putnam's "Plumbing and Household Sanitation" ($3.75).
Putnam's "Improved Plumbing Appliances" ($1).
Raynes's "Domestic Sanitary Engineering and Plumbing" ($3).
Reid's "Practical Sanitation" (6 shillings).
Smeaton's "Plumbing, Drainage, Water Supply and Hot Water Fitting" ($3).
Stanger's "Sanitary Engineering" (40 cents).
Sutcliffe's "Modern Plumber and Sanitary Engineer" (6 shillings).
Sutcliffe's "Modern House Construction" (2 pounds 10 shillings).
Sutcliffe's "Sanitary Fittings and Plumbing" (5 shillings).
Taylor's "Water Pipe Discharge Diagrams" (12 shillings 6 pence).

Such books as Moore and Silcock's "Sanitary Engineering" and Vernon-Harcourt's "Sanitary Engineering," in common with other English books on the subject, contain several chapters on the plumbing of houses for drainage and water supply.

Proper Width of Sidewalks.

We are planning to repave the business section of this city, and the question of the proper proportion of the width of sidewalks and roadway has arisen, and as its proper determination is a matter of serious importance, I am writing to ask if you will kindly advise me what the experience of Indianapolis has proven to be the best proportion for width of sidewalks and roadway?

N., ——, Ala.

The question of width of sidewalks is certainly a very important one upon business streets. The tendency has been to make the sidewalks too narrow and the street pavements too wide in both business and residence streets. The pavement should be narrow on a residence street, for economy, width not being necessary for the traffic, and cost, comfort and beauty being favorably affected by reducing the width of the pavement and throwing the space thus saved into a lawn, preferably between the curb and the paved strip of sidewalk. If a street railway should later occupy the street, or business traffic should crowd it, the curbs can be set back and the street pavement widened at the first necessity of repaving. This has been done in Indianapolis, where the ratio of paved street surface on residence streets without street car tracks is 50 per cent. of the total street width in narrow streets, and even less in streets of over 60 feet between property lines. The purpose in Indianapolis where there are street railway tracks in a street has been on residence streets to reduce the street area to the minimum possible for traffic, and some such streets are 37 feet between curbs, leaving sidewalks each 11.5 feet on a 60-foot street. This is rather narrow, but 40 feet makes a comfortable width of pavement, and on residence streets a 10-foot sidewalk and lawn is not bad.

On business streets the experience clearly shows that the sidewalks should be as wide as possible, even at the expense of comfort in the street. Many more people are delayed and inconvenienced by narrow sidewalks than by narrow streets if the street traffic is properly regulated and required to keep always to the right side of the street.

Again, there must be a difference between wholesale and retail streets, and there must be regulation of the use of sidewalks as well as of street area.

On a retail business street the first and most important consideration is the foot passenger traffic. Second is the regularly moving traffic, including the momentary stoppage of vehicles to let off passengers, and third is the standing of vehicles along the curb while the occupants are attending to business in shops, stores and offices. This last becomes a very important consideration about tall office buildings, especially if they are occupied by physicians, real estate men and others who use automobiles or other conveyances constantly. A 40-foot pavement is rather narrow for this use in addition to a double-track street railway and free passage for other vehicles between cars and standing automobiles, but it can be used. Any increase up to 50 feet improves the conditions, but even 40 feet provides fairly reasonable accommodation for all three classes of street use. The traffic being required to move always in the same direction, slow-moving traffic will have no delays except those due to street crossings, and more swiftly moving traffic will have but little more delay than should be enforced upon it by the traffic regulations, being able to pass the slower moving vehicles by taking to the street railway tracks in the intervals between street car passages. Fifteen feet is a narrow sidewalk for a busy retail street, and should be the limit if it is in any way possible to take care of the street traffic on the remainder of the street width. It is possible to make a very satisfactory street on 70 feet between property lines, with 40-foot street pavement and 15-foot sidewalks. Indianapolis has many 15 and 20-foot sidewalks on 90-foot streets, that being the usual width of the business streets aside from the central and main street, which is 120 feet wide, with 20-foot sidewalks, and the diagonal avenues, which are 100 feet wide, with 20-foot sidewalks.

On wholesale streets, street pavement width is somewhat more important if wagons must back up to the curb for loading and unloading; and foot traffic is probably much less. But there must be strict regulation of the use of the sidewalks in handling goods, otherwise the passageway for foot passengers will be reduced enough to cause inconvenience and delay. Indianapolis finds 20-foot alleys in the rear of the principal retail stores of great value in handling the delivery wagon business, and would doubtless plan for the same in the rear of its wholesale houses if it had the opportunity.

Cost of Tunnel in Limestone.

We are considering a power proposition on a small river at this place, and a part of the work would consist of cutting off a twelve-mile bend in the stream by driving a twelve-hundred-foot tunnel thru the bluff at neck of bend. Can you give us any idea what this tunnel should cost? It would be driven through stratified limestone that lies nearly flat. The limestone is not the blue flinty kind, but appears to be moderately hard and contains some sand. The tunnel would be about 6 feet by 12 feet by 1,200 feet. The roof, I think, would be self-supporting. All I ask is a rough estimate of what such work should cost, as the feasibility of the proposition depends on the cost of this tunnel.

Perhaps you can refer me to some books on engineering subjects that would give me the desired information.

I attempted to take this matter up with an engineer and pay him for the information, but he would not give me text-book information or say whether the tunnel would cost $10 or $50 per foot until he had made a survey and personally investigated the situation at $25 per day and expenses. I believe he could have told me what such work usually costs, and then I would have known if it was worth while to investigate further.

P., ——, Mo.

The engineer is right about it, and it would not be possible to make any reasonably accurate figure of the cost of the tunnel from the data given. Figures of cost of excavation in tunneling given in Gillette's "Handbook of Cost Data" ($5) vary from less than $1 to more than $7.50 per cubic yard, according to local conditions, including character of rock, so that "usual cost" is a very indefinite term. It is quite possible that the tunnel must be lined, in which case the cost will be materially increased. Examination of the weathered and fresh rock by an expert would be necessary to judgment on this point, and even then the decision may be wrong. Prelini's "Tunneling" ($3) gives some information which will be of value in making up an opinion on the case.

Books on Street and Sewer Inspection.

Kindly inform as to what books you have covering the subjects of street and sewer inspection. I would like to get full up-to-date information and data concerning the same, and as your journal covers this field of engineering, I feel that you are in a position to advise.

A. L. D., San Francisco, Cal.

Byrne's "Inspection of the Materials and Workmanship Employed in Construction" ($3) is probably the book most nearly meeting the demand. Hill's "Concrete Inspection" ($1) is a good book devoted specially to concrete.

FROM WORKERS IN THE FIELD

The Effect of Creosote Oil on Bituminous Fillers for Creosoted Wood Block.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In my article on page 43 of the July number of MUNICIPAL ENGINEERING the headings of the table are misplaced, which makes the article confusing. I am giving you below the table as it should appear.

TABLE SHOWING THE EFFECT OF ADDING CREOSOTED OIL TO BITUMINOUS FILLERS.

Designation.	Penetration at 77-deg. F.	Point. Melting	5 pct. Creosote added.		10 pct. Creosote added.	
			Melting Point.	Penetration at 77-deg. F.	Melting Point.	Penetration at 77-deg. F.
A	25	142	138	....	122	..
B	20	168	149	34	138	53
C	14	152	136	26.5	126	42
D	28	170	168	42	159	54
E	30	292	292	31	266	33
F	35	167	140	57	122	112
G	30	198	187	38	172	52
H	33	169	150	52	136	98
I	28.5	190	188	38	168	52
J	20	211	204	23	188	32
K	30	273	234	33	210	36

A, B and C are tars. D, E, F, G, H, I, J and K are asphaltic materials.

In the table the second and third columns give the melting points and penetration at 77 of the original substances; the fourth and fifth columns give the melting points and penetrations of the substances plus 5 per cent. creosote, and the sixth and seventh columns give the melting points and penetrations of substances plus 10 per cent. creosote.

HENRY M. MILBURN,
Chemist, Testing Laboratory, Engineering Department, Omaha, Neb.

Bituminous Paving Expert Evidence.

To the Editor of MUNICIPAL ENGINEERING:

Sir—It is generally understood in legal proceedings that "expert evidence" is, in reality, no more than a technical argument made on behalf of his employer and client by one somewhat skilled in the art. For this reason we often hear the statement that "expert evidence must be taken cum grano salis." The best the court can do with "expert evidence" is to endeavor to "separate the wheat from the chaff," and, like the arguments and briefs of opposing counsel, endeavor to arrive at a just decision between the exaggerated claims and plausible arguments of the two sides. The best opposing counsel can safely do with the "expert" is to try by cross-examination and rebuttal to disprove his claims in which the attempted evasion of the "expert" in answering troublesome questions has a very important bearing.

So much for the "expert" in connection with legal evidence. But when we come to the "expert" giving instructions to an engineering class, advising municipal corporations, and writing papers for technical associations or publications, we have the right to expect to find him arguing for the best construction rather than for the interests of his clients, in opposition to the interests of their competitors.

In the June, 1912, issue of MUNICIPAL ENGINEERING is a paper, "Use of Bituminous Materials on Highways in 1911," originally read before Section D of the American Association for the Advancement of Science, which, while mentioning no names, is so clearly an attack on Warren Brothers Company and its patents: so clearly of the nature of arguments of the paid advocate, and so free from impartial "expert advice" as to warrant the writer of this communication in making a somewhat categorical reply thru the pages of the periodical which published the paper referred to.

One would suppose that "expert advice" on this subject would be along the line of "how to construct the best pavements," while the real subject of the paper referred to is an effort to avoid prominent patents which have been favorably adjudicated by the highest courts of the land, almost regardless of how much such avoidance may be derogatory to the success of construction.

Incidentally the paper referred to, which contains approximately 4,500 words, has only about 400 words (say 10 per cent.) even indirectly referring to the subject of the paper—"Use of Bituminous Materials on Highways in 1911."

NOMENCLATURE.

The article "Highways of 1911," etc., opens with definitions of names entirely novel, designed to meet the commercial interests of the clients of the author and quite contrary to the following nomenclature adopted unanimously by the American Society of Municipal Improvements at its 1911 Grand Rapids convention, being the result of two years' deliberation of a committee of engineers of which the author was a member.

Bituminous concrete is a pavement consisting of a combination of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its ingredients mechanically mixed before being laid. To be termed a bituminous concrete it must partake of the well-known characteristics of concrete, that is, there must be stone enough in the composition to form an important part thereof and add to its strength and durability; also there must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles. It is normally a one-layer pavement, all parts of it having equal stability, due both to the structure of stone and the bond of the bituminous cement, and depending on the base for vertical support only. It may or may not be finished with a skim coat and top dressing of sand or stone chips. It is adapted to be laid on either a hydraulic concrete or macadam base, which may or may not have a light coat of bitumen to increase the adhesion.

In the paving mixture, gravel may wholly or in part be substituted for crushed stone, and fine crushed stone for sand. Mineral dust also may be added to increase the density and stability of the mixture.

Bituminous macadam is a pavement consisting principally of crushed stone, retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and protected from surface disturbances by an upper bonding layer of bituminous material. It is a one-layer pavement, and there is no definite distinction to be made between the wearing surface and the base, as in their nature they must be knit together in one structure. Practically all the horizontal stability as well as vertical support is from the macadam base. The pavement may be produced by adding the bituminous top to the macadam base by either the penetration or the mixing method. In the former the bitumen is applied in a liquid state and a top dressing of stone or sand is spread over the surface and thoroly rolled. In the latter the bitumen is mixed with the mineral, consisting of comparatively fine stone or sand, or a mixture of both, and forced into the macadam body of the pavement by rolling. In either case, whether the penetration or mixing method is followed, the macadam base must be specially prepared, with voids in the upper portion into which the bitumen or bituminous mixture penetrates, leaving a coating of the desired thickness over the surface.

Paving nomenclature surely would be in a sad dilemma if every "expert" should adopt a system all his own, designed to meet the commercial interests of his clients, and endeavor, thru engineering papers and societies, to make such definitions appear as "standard." On this basis we would have as many "standard" definitions of names as we have "experts."

BITUMINOUS CONCRETE.

The paper "Highways in 1911," etc., says:

It has been claimed that a bituminous concrete containing as part of its mineral aggregate broken stone passing a ½-inch sieve and retained on a ¼-inch sieve should be classified under sheet asphalt pavements. Fortunately this assertion has not been received with favor by municipal engineers.

As the American Society of Municipal Improvements definition quoted above clearly shows, it is not necessarily the maximum size of mineral aggregate that determines whether a mixture of cement (either bituminous or hydraulic) aggregate is "mortar" or "concrete," but the ratio of proportions the coarser sizes bear to the finer sizes, and when the "mortar" only contains enough coarser particles to "swear by," it is still mortar. That the pavement referred to consisting of sand and "less than 10 per cent." material remaining on a ¼-inch screen opening is in reality an "asphalt sheet pavement" (asphaltic mortar) is best shown by the specifications of the city of Pittsburgh, where it originated, and where it was always specified as "asphalt pavement," and where the ¼-inch material mixed with the sand was merely the very little screened from the "open binder" course, which screenings would otherwise have been a waste, and which added nothing to the value of the sand mixture, and probably practically detracted nothing, altho theoretically, at least, they increase the tendency to shifting of the pavement surface, because the coarser particles of aggregate are not in approximate contact with other coarse particles, but just enveloped in plastic mortar—"a raft of stone in a sea of mortar," or, as otherwise expressed, "like fruit in a poorly fruitized fruit cake," which condition subjects the coarser particles to the greater leverage and rocking tendency of loads bearing on the individual particles.

RHODE ISLAND ROADS.

The writer of "Highways in 1911" refers, in general terms, to bituminous roads laid under his supervision, while connected with the Rhode Island State Highway Department in 1906 to 1909, and quotes, without using names, from a letter written by Warren Brothers Company to the Rhode Island State Highway Department, as follows:

So long as the construction is of the

nearly uniform sizes of stone which you are now using, and you do not get the fine material applied from the surface into the spaces between the particles of bitumen-coated stone more than our observations indicate you are now doing, or we believe it is possible to do, we would not claim this feature of the construction to be an infringement of our basic patent No. 727,-505.

This letter, written in 1910, referred to Rhode Island roads constructed in 1907 to 1909, inclusive, along certain low cost but unscientific lines which, wherever subjected to any considerable traffic, have practically failed and required extensive repairs and in many cases entire new covering.

The author of "Highways in 1911," referring to a pavement made of "one size crusher run stone," says that "during the past year" he "has seen excellent pavements constructed by this method." How can any expert certify to the excellence of any new form of pavement construction in use less than six months, the paper referred to having been written in the early months of 1912 and referred to work of the "past year"?

The writer would like to be shown a single roadway of the type referred to which has been subjected to even moderate traffic for a period of two years which is not very defective. He can show many such, which have utterly failed in one year's use under moderate traffic.

ENGLISH PRACTICE, 1899.

Reference is made to certain English specifications for bituminous pavements laid in layers of varying thickness, but each layer of uniform size, in use in 1899, similar to the Rhode Island practice above referred to. It is generally conceded that this construction has not been a success in England except under the lightest traffic conditions, and it has also failed in Hamilton and Toronto, Ont., Rock Island, Ill., Elmira, N. Y., St. Marys, Pa., and other points where it was thoroughly tried out during the years 1899 to 1902, inclusive.

GRADED AGGREGATES.

"Highways of 1911," etc., refers to "bituminous mixed pavements and combinations of one size crusher run stone and fine material matter, such as sand, stone screenings and fine gravel," and cites certain construction in Washington, D. C. The definition quoted above is indefinite, as heretofore shown under heading "nomenclature," more specifically referring to Pittsburgh; the relation of such construction to the Warren patents depends on the details of specifications or construction in each particular case. In order that the public may not be misled by the references to recently laid Washington, D. C., pavements, which, as "Highways in 1911," etc., says "possess inherent stability," the writer begs to state unequivocally that the Washington construction, although inferior in detail to the best practice, does infringe on the F. J. Warren basic patent 727,505, and has been so proved by decision of the United States Circuit Court of Appeals, Second Circuit, in Warren Brothers Company vs. New York City.

"Highways of 1911" indirectly "throws the gauntlet" as it has been previously and more directly thrown to Warren Brothers Company, with the question, "If Washington infringes, why not bring action for such infringement?" The simple answer is that it costs $40,000 or more to each side to bring such a patent suit to a final decision; that under the division of the Federal Courts a decision of the Court of Appeals of the District of Columbia covers the city of Washington only, and, at the slow rate Washington has been infringing during the past two years, it would take about ten years of the very modest royalty Warren Brothers Company charges for use of its patents to recover the expense of litigation, very little of which, as is well known, can be recovered in direct costs and damages in any specific case.

Warren Brothers Company has neither the financial ability nor the energy to pursue expensive, annoying patent litigation in all Federal Court districts at the same time, nor does it believe either its or the public interest would be best subserved by so doing, and it simply prefers to select its own time and forum for such expenditure in defense of its patents as its competitors desire to force, and to select judicial districts where results of favorable adjudication cover several States and are liable to be sufficient to warrant the expense. As to the city of Washington, as litigation there covers one city, and that one nearly fully paved, we prefer to "bide our time," and, if the accumulated infringement within the six years permitted by the patent laws is sufficient to warrant the expense, we will then, or at such meantime as we think best, bring such action as we may then think best. No amount of "throwing down the gauntlet" by competitors and their hired "experts" and attorneys will swerve us from this proper economic business policy, but in due course we expect to bring action against all municipalities and others which, during the brief time the patent franchise is granted by the government, see fit after due notice to use our patents without securing license for such use.

"ANTICIPATING" PUBLICATIONS.

"Highways in 1911" refers to a number of alleged anticipating patents and other publications, which its author well knows have been "threshed out" before the District Courts of Alabama and Kansas, and the Federal Circuit Courts of Appeals of the Sixth and Second Circuits have decided that the patent referred to is valid and in all such cases to be no anticipation, and broadly defined, and that the United States Supreme Court, with full record and briefs before it, has denied petition of certiorari from the decisions of the Sixth Circuit Court of Appeals.

The author of "Highways in 1911," in an obscure statement fraught with absence of frankness, makes reference to a pavement "description so old as to be covered with the dust of decades," with absolutely nothing even tending toward proof that any pavement was ever constructed in accordance with the "description." When the writer first read the paper "Highways in 1911," etc., about a month ago, he wondered if it could be possible that any library had any such publication which had been overlooked in the most searching scrutiny made by the dozens of attorneys and experts on both sides of the Warren patent litigation, who, during the past ten years, have "raked over" all the old libraries to find any such publications. We did not have long to wait, for on June 28, 1912, at the close of the taking of depositions in protracted patent litigation, the author of "Highways in 1911," as "expert witness" for the defendant infringers, undertook, under oath, to identify as true a typewritten uncertified copy made by his subordinates of a book "the original of which was said to be in a public library," and published in 1871, containing the matter referred to in "Highways in 1911," as "covered with dust of decades," which "book" he claimed to have "discovered" in 1907. It took four hours of most labored cross-examination and the chagrin of witness and his counsel to bring out the following all-important facts, carefully kept back in both "Highways in 1911" and in the "less than half-told" sworn direct deposition of its author:

First—That the publication is not a "book," but a paper circular.

Second—That in the "copy" put in as evidence the order of the matter was distorted so as to give to it the apparent impression desired, which the original does not in fact contain.

Third—That there had been made a copy, certified by a notary, which was withheld from the deposition, and an uncertified copy presented as "evidence," apparently because the certified copy was a true copy and therefore would not serve the purpose of the "expert" and his client.

Fourth—That the only paragraph pertinent to the matter of patent anticipation (quite different in its purport from the balance of the "book"), which paragraph, quoted in "Highways in 1911," is a few lines taken from four pages pasted in the back of the "book," printed on paper different in both quality and size, and never a part of the original publication, and apparently surreptitiously attached thereto during some recent period.

Fifth—That the witness "has reason to believe" that another original copy of the book is in existence, the location of which he refused to divulge, apparently because it does not contain the important attached matter.

Following the cross-examination above referred to, it took an investigation of the original book to divulge that the "book" (paper-covered pamphlet) referred to is listed in the library as "fifteen pages," which is the exact number of pages of the original matter, thus further proving the fair inference that the important matter referred to has been secretly and recently attached to the original publication. The competitors of Warren Brothers Company are surely in a bad way when they have to resort to such means to attempt to tear down its business and patents, the successful development of which has required a decade of time, hundreds of thousands of capital, an immense amount of energy and thought and the untimely death of the inventor in overexertion of energy during its early development.

GEORGE C. WARREN, Boston, Mass.

Want Information About Tests of Sand for Concrete.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The National Association of Cement Users, thru their committee on specifications and methods of tests for concrete materials, are investigating the problem of testing sand and other aggregates for use in Portland cement mortar and concrete to determine their suitability for such use. This committee desires to get into communication with all laboratories that are now testing sand and other aggregates, and to secure their co-operation with the committee in formulating standard tests for these materials. The committee is particularly anxious to secure samples of sand which appear suitable for use in concrete, but in practice prove unsuited. The committee would welcome communications from all interested in the subject who are willing to co-operate in this work to the extent of furnishing data obtained in their laboratory or field practice, or of recommending forms of tests which may be considered by the committee. Communications should be addressed to Cloyd M. Chapman, care of Westinghouse, Church, Kerr & Co., 10 Bridge street, New York.

COMMITTEE ON SPECIFICATIONS AND METHODS OF TESTS FOR CONCRETE MATERIALS.

Sanford E. Thompson, Chairman.
William B. Fuller.
R. S. Greenman.
Arthur N. Talbot.
Cloyd M. Chapman, Secretary.

Information may also be sent to MUNICIPAL ENGINEERING, Indianapolis, Ind.

MUNICIPAL MATTERS IN COURT

A Municipal Officer May Be Put Out of Office for Holding Stock in a Concern Selling to a Municipality.

Quo warranto proceedings were instituted against the burgess of the borough of East Pittsburg, to oust him from his office by reason of his alleged violation of the act of May 28, 1907, relating to borough officers. It was said that the defendant was the duly elected burgess of the borough of East Pittsburg; that he was, at and after the time of his election, interested in the Egan Plumbing and Constructing Company as stockholder and as manager; and that while he was burgess and so interested in the company, that company sold to the borough certain goods.

The answer of the defendant denied that he was financially interested in the Egan Plumbing and Constructing Company at the time of his election and at the time of the purchases alleged to have been made; admitted that the Egan Plumbing and Constructing Company did sell the goods in question, part of them for the use of the lock-up, the goods being purchased by the chief of police and the street commissioner, under circumstances requiring haste in the procurement thereof; and that the sales were made without his knowledge and against his order.

Upon the trial the jury found a special verdict, that at the time the purchases were made from the Egan Plumbing and Constructing Company defendant was president of it; and they further found that when the purchases were made he did not know of them until after the goods had been delivered and the work done, and had knowledge of them only when warrants were issued for the same and of the payment of the warrants, and that if upon this state of facts the court should be of opinion that the plaintiff was entitled to recover, then to find for the plaintiff, and otherwise to find for the defendant.

The act in question makes it unlawful for the burgess or other officers of a borough to be interested, either directly or indirectly, in any contract for supplies to be furnished for the borough, and for any burgess to be a member of any partnership, or stockholder and officer in any corporation, or agent or employe of any individual, partnership or corporation in any way interested in any contract for the sale and furnishing of any supplies for the borough, and provides that any person violating these provisions or any of them, shall forfeit his office.

There were a number of small sales at different times, as admitted by the defendant in his pleadings, and he knew of them when warrants were drawn for their payment, and knew of the payment of the warrants, and altho it is not so found in the special verdict, it appeared from the evidence that he indorsed these warrants himself as president of the company. These facts were held to show, not a repudiation of the contracts when they came to his knowledge, but an adoption of them. It has been frequently held that the amount involved in such cases makes no difference, and that the intention of the party is also immaterial. The act makes certain relations between the officer and the borough unlawful without reference to whether they are knowingly or corruptly entered into, and the legislature has undoubted power to make such a provision, as the deprivation of an office of this kind does not affect the liberty or property of the official.

It was, therefore, ordered that judgment be entered on the verdict for the plaintiff, and that the defendant, Fred W. Egan, be ousted from office of burgess of the borough of East Pittsburg, 234 Pa. S. C. R. 24.

To Prevent Stream Pollution by Pennsylvania Municipalities.

Suits which have been inaugurated by the attorney general's department against the boroughs of Tarentum and Greenville, in western Pennsylvania, for ignoring the decrees of the state that they cease discharging sewage into streams without preliminary purification are but the commencement of a series of actions by the commonwealth for recovery of damages from a number of municipalities. No less than ten cities and towns are said to have been warned to obey the mandates of the authorities or take the consequences.

The act of 1905 provides for penalties of

$500 fine and $50 for each day the decree is disregarded, and at the office of the attorney general it is stated that clear violations of the terms of the decrees signed by the governor, attorney general and commissioner of health have been found against Greenville and its sister borough. The act has been sustained by the appellate courts on appeals from eastern counties, and the suits started against the towns were started only after repeated warnings. It is contended by state officials that vigorous steps must be taken to demonstrate that the commonwealth intends to enforce the purity of streams in view of the increasing population and the demands for pure water supplies.

Electric Company Must Adopt Kind of Pavement Chosen by City.

A second decision has been given by Judge Eschweiler, affirming a former decision by Judge Ludwig, which held that The Electric Company of Milwaukee should be compelled to lay asphalt between its car tracks. The city recently laid asphalt pavements on the streets in question and the street car company wished to retain its wooden blocks.

Decisions of the Higher Courts of Interest to Municipalities.

Contractor Liable for Damage Due to Disregard of Plans Upon Which a City Permit is Issued.—While an employer is liable for the negligence of an independent contractor where the thing contracted for is a nuisance or dangerous per se, the construction of a tunnel excavation across a street according to plans which kept the tunnel eight feet from a water main, which was broken by negligently changing the course of the excavation by the contractor, was not a nuisance or dangerous per se, so as to make the one contracting with the independent contractor liable for the latter's negligence in running the tunnel into it. Von Lengerke et al. v. City of New York et al. (N. Y.) 134 N. Y. S. 832.

Delayed Estimates Not Grounds for Breaking Contract if Previous Estimates Have Been Accepted Even Though Late.—A contract with a city provided for monthly estimates of the work done and materials furnished, and for the payment by the city to the contractor of 95 per cent. of each estimate, but fixed no time for such payment. Payment of May and June estimates was accepted by the contractor in September, and of July and August estimates on a later day in September. Upon the nonpayment of September, October, and November estimates, the contractor after a peremptory demand for payment of all the money due within three days elected to rescind and sue on quantum meruit. Held, the acceptance of payment on former estimates without objection after delay established a course of dealing from which the contractor could not depart without reasonable notice, and the continuance of the custom was not a breach which would entitle him to abandon the contract. Cranford Co. v. City of New York (N. Y.) 134 N. Y. S. 839.

State Supreme Court May Appoint Appraisers to Condemn Public Utility.—A federal District Court will not temporarily enjoin proceedings under an appointment by the state supreme court of appraisers in proceedings by a city to condemn a waterworks plant, on the ground that an act authorizing the appointment is unconstitutional, where the state supreme court has not passed upon the validity of the act, except by acting under it, where there is a conflict in authority on the question involved, and the state supreme court could find ground sustaining the act. Des Moines Water Co. v. City of Des Moines (Ia.) 194 F. R. 557.

Furnishing Gas Outside of City Limits Does Not Provide Grounds for Rescinding Franchise.—In an action by a city to forfeit a gas company's franchise, allegations in the petition that the company had been furnishing gas to persons and corporations outside of the city ever since it acquired its franchise, which provided that no gas should be so furnished, were too vague and indefinite to sustain a forfeiture.—City of Newport v. Municipal Light Co. (Ky.) 145 S. W. R. 1108.

A City Cannot Bring Action Against a Municipal Gas Company for the Benefit of Inhabitants Who Are Overcharged.—A city which granted a municipal gas company a franchise, in consideration that it should furnish gas to the inhabitants at a stipulated rate, cannot maintain an action against the gas company for the benefit of the inhabitants who have been overcharged; for, while the statutes require every action to be prosecuted in the name of the real party in interest, except as provided in a section which allows a person in whose name a contract is made, for the benefit of another, to bring an action without joining him, the person for whose benefit it is prosecuted, the contract in this case is in the name of the city for its own benefit, and for the benefit of the consumer. City of Newport v. Municipal Light Co. (Ky.) 1450 W. R. 1108.

Water Company Must Bear Cost of Service Connections.—Requiring a water company, upon the theory of an implied contract, to bear the cost of making the service connections which it was its duty, under its charter, to make, does not amount to confiscation and the consequent taking of the company's property without due process of law.—Consumers Company Limited plff. in err. v. Albert L. Hatch, 32 Su. Co. R. 465.

A Municipality Has No Authority to Compel a Street Railroad to Light Its Road or Bridges—A municipal corporation has no authority to compel an interurban or street railroad company to light its bridge or railroad within the limits of such corporation. Ohio Electric Ry. Co. v. Village of Ottawa, (O.) 97 N. E. R. 835.

MOTOR VEHICLES

Inquiry Into Fire Engine Trust.

The Department of Justice is reported to be investigating the large manufacturers of fire apparatus in the United States, with the object of ascertaining if a fire engine trust exists.

Many complaints, it is said, have been received in Washington, principally from municipalities over the country, in which it has been declared that there appears to be such a monopoly operating in restraint of trade in defiance of the Sherman law.

The inquiry, it is said, has assumed a nation-wide scope, and a force of special agents has been at work several months gathering data.

Three large concerns dealing in fire-fighting apparatus facilities, it is reported, are especially under the scrutiny of the federal authorities.

The principal organization is said to be the American La France Fire Engine Company, which has its headquarters in Elmira, N. Y., and operates six branch houses throughout the United States. The Chicago branch is located at 815 South Wabash avenue. Other branches are maintained at Cincinnati, Atlanta, Ga., San Francisco, Boston and New York.

A concern in St. Paul and another fire apparatus establishment in New York State are also being investigated in efforts to learn if they are combined in the field to control the market.

Chief Charles F. Seyferlich, of the Chicago fire department, in an interview quoted in the Chicago Evening Post, mentions the remarkable coincidence regarding recent bids received for furnishing the city additional fire engines.

"Last May," said the chief, "the city let a contract for three fire engines. The price quoted by three different companies, the American La France Fire Engine Company, the Ahrens-Fox Company, of Cincinnati, and the Nott Company, of Minneapolis, was precisely the same. The price was $5,975 for each of the engines, and there was not one dollar's variation. Again, the year before we called for bids for engines. The same three companies were bidding. There was a variation in price at that time of only $25. The second bidder's price was $10 higher than the lowest one, and then the third bidder was $15 higher than the middle one.

Motor Apparatus Has Street Rights.

While responding to an alarm, a motor fire truck which had been recently purchased by Richmond, Ind., struck and killed a citizen, Isaac Parry. The car was being driven at about twenty-five miles an hour by a representative of the company which sold the car to the city.

A coroner's inquest which was held during the succeeding week developed the following points. The car was being driven at about twenty-five miles an hour, which is not considered an unreasonable speed for motor fire apparatus. On turning a corner a crowd of sightseers gathered to watch the apparatus pass, and a vehicle in the road caused the driver to turn quickly, resulting in the skidding of the car and the striking and killing of Isaac Parry.

The coroner's investigation was unusually thoro, as possible law suits might require the use of the information developed. The testimony of members of the fire department, the truck driver, Homer Hammond, president of the board of works, and spectators constitute the report, which covers thirty-four pages.

In the coroner's report it was held that no account need be taken of the speed of the truck in answering the call which indirectly led to the death of Parry. "Tho the speed were twice as great as it was," the coroner holds, "no account need be taken of the speed of the truck, it being assumed that the fire department has the right of way and that the streets are cleared, and in this case an attempt had been made by the police to clear the street so that the vehicles of the fire department might pass."

All Motor Apparatus in the Passaic (N. J.) Fire Department.

The city of Passaic, N. J., has set an example for municipal progressiveness which would be a credit to a much larger community.

Recently the last horse in its fire department was sold, and now eleven pieces of motor apparatus comprise the city's fire fighting equipment. The latest purchase was a combination hose and chemical wagon.

Fire Chief R. H. Bowker, in discussing the value of motors compared with horses, stated that the machines will entirely pay for themselves in less than four years, owing to the saving in expense of feed, shoeing and large space required for the horse stalls and equipment.

Other cities in the vicinity of Passaic that will eliminate horses from their fire departments are New Rochelle, Yonkers, Stamford, Newark, Paterson, Mount Vernon and, last New York City.

The Motor Truck for Haulage and Transportation.

A prime factor in bringing about under-production and over-consumption, of which so much is being said at present, is the large number of horses used for haulage and transportation purposes, when the advent and efficient development of the motor truck would seem to indicate no real need for their presence.

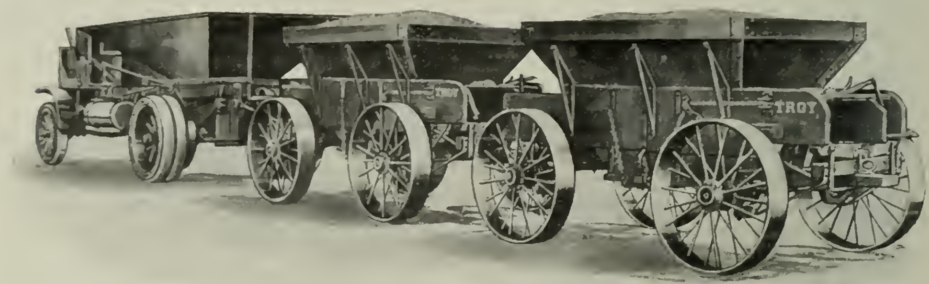
The advent of the motor truck has brought about a new era of transportation. The percentage of shrinkage in horse-drawn vehicles in Chicago during the past year amounted to 15.7 per cent. for one-horse wagons and 13.5 per cent. for two-horse wagons. The aggregate shinkage is 14.6 per cent. for the year. Altogether 6,753 horse-drawn vehicles were discarded in Chicago between May 1, 1911, and May 1, 1912. Since a motor truck handles tonnage equivalent to that of three two-horse wagons the saving in time, money and congestion of traffic becomes very great.

The contractor on all classes of work is coming to understand and appreciate the economy of the motor truck. Particularly is this true in road building where the nature of the work and the length of haul are so well adapted to the economical use of the motor truck. The photograph given herewith shows a 6-ton motor truck pulling two trailers of 3 yards capacity each to haul road material.

Both truck and trailers are fitted with special quick-dumping bodies to facilitate delivery. Two of these road trains hauled by Knox trucks have been in active service in Sioux City, Ia., for the past year and have made a remarkable record in road building, having delivered an average of 44¼ yards of material per day, a distance of 3½ miles, during a busy season.

The contractors who use this method of hauling road material estimate that it would have required over 10 two-horse teams to do this amount of work, while the cost by horses would have been over twice as much.

Grades varying from 3 to 7½ per cent. were negotiated without difficulty, and while the practice of hauling such heavy loads by this method on grades puts an unreasonable strain upon a motor truck and is therefore not sanctioned by truck manufacturers, it nevertheless illustrates the great ability of motor trucks under these circumstances.



MOTOR TRUCK AND CARS ON ROAD WORK.

The Proper Training of Motor Truck Drivers.

As one of the first companies to manufacture motor trucks, the Knox Automobile Company, Springfield, Mass., early appreciated the importance of carefully training the men who were to operate the vehicles, and for this purpose adopted a thorough system which has been productive of excellent results from the standpoint of both the company and its patrons.

The length of the course given depends upon the amount of time permitted the men by their respective companies or cities, as the case may be, but the most satisfactory arrangement is for the men to follow the assembly of their cars right thru the factory, beginning with the motor and ending with driving instruction during the rough test of the chassis.

This course enables the men to become familiar with the various parts of the cars in minute detail, as well as teaching them practically all of the essential adjustments, etc., necessary for satisfactory results, so that they feel a larger measure of confidence and can give intelligent thought to the care and maintenance of the expensive machinery.

No city can afford to spend from $3,000 to $10,000 for a modern motor truck and put it in the hands of an ignorant, half-trained driver to abuse and ruin in a short time, and the systematic method of instruction outlined above is of immeasurable benefit to the purchaser of a motor truck.

Additions to New York City's Motor Fire Equipment.

Four combination chemical and hose cars have recently been added to the New York Fire Department. The accompanying photograph shows one of these cars as ready for service.

The engine is built on a 2-ton chassis of the Mack truck type, which is equipped with a steel body, with a hose reel capacity of 1,000 feet of 2½-in. fire hose. The body is constructed of standard hose body type construction with flared sides and seats for the accommodation of the firemen. The chemical tank has a capacity of 30 to 40 gallons and is equipped with Lally quick opening and self-packing tops. The chemical hose basket is arranged to carry 200 feet of special 4-ply hose. Hand rails are provided running from rear of drivers seat to back step. The fire extinguisher equipment consists of two to three-gallon break-bottle type mounted in polished brass holders on the rear step. Two heavy duck soda bags are also provided.

The lighting is by means of two 8-in. head lights mounted on front springs together with two side oil lamps on each side of the driver's seat. The electric head light is provided with current from 60-hour ampere storage battery. The conventional locomotive bell is mounted on the dash. The usual complement of firemen's axes, acid receptacle holders, etc., are provided, together with tool boxes, a 12-foot roof ladder and a 20-foot extension ladder.

Definitions of Motor Apparatus.

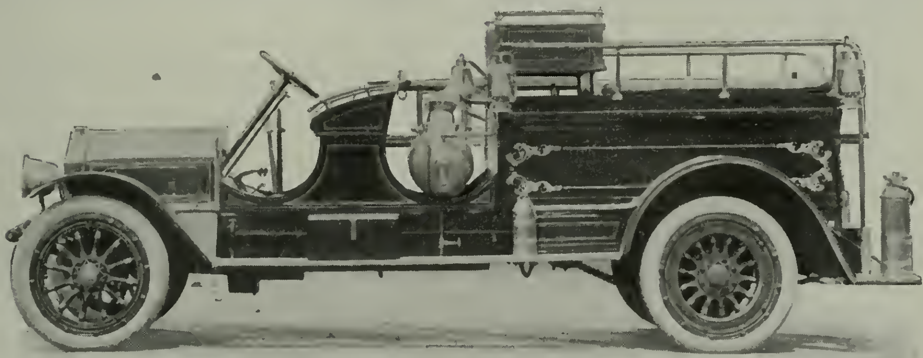
Confusion often arises in descriptions of different types of motor fire apparatus, particularly among newspapers and popular periodicals, which mention specific kinds of automobile apparatus in general and indefinite terms. A number of definitions of the types of apparatus have come into general use, and by this use have become standard. The types defined are:

Motor Fire Engine, a straight pumping engine without any provisions for carrying fire hose.

Motor Chemical Engine, a straight chemical engine with one or more chemical tanks, chemical hose, etc., but with no provision for carrying fire hose.

Motor Hose Car, a motor-driven hose wagon for the carrying of standard fire hose. Often made with a capacity of from 1,000 to 3,000 feet of hose.

Motor Fire Engine and Hose Car, which consists of a straight pumping engine, provided with a body with a capacity to carry 800 to 1,500 feet of fire hose.



COMBINATION CHEMICAL AND HOSE CAR,
New York Fire Department.

Motor Combination Chemical and Hose Car, a combination of such chemical equipment as may be specified, with a body capable of carrying 800 to 1,500 feet of standard fire hose.

Motor Triple Combination Fire Engine, Chemical and Hose Cart, a combination of such chemical pieces of apparatus, viz.: pumping engine, chemical engine and a body carrying whatever amount of fire hose is specified.

Motor Aerial Hook and Ladder Truck, an automatic or manual quick-raising aerial ladder, mounted on a motor-driven chassis.

Motor Service Hook and Ladder Truck, is, as its name implies, the equipment of ladders usually carried on old horse-drawn hook-and-ladder trucks, with fire apparatus usually a part of same, except that this is mounted on a motor-driven chassis.

Motor Chief's Car, a chief's automobile, which may be equipped with one or more chemical tanks and other emergency apparatus.

Motor Squad Wagon, a motor-driven wagon capable of carrying six or more men. May be equipped with one or more chemical tanks and provision made to carry such other equipment as may be required.

A Motor Street Sprinkler.

The city of Pensacola, Fla., is using for sprinkling its streets a motor sprinkling car comprising a cylindrical tank holding 450 gallons, mounted on a commercial chassis of 3,000 pounds capacity. The car is designed to do the work of several horse-drawn sprinkling carts, at a great saving of time and labor. The amount of water spread over the road is regulated by the driver by means of levers, at the driver's seat. One great advantage of the motor sprinkling car is said to be that it does not puddle the roads the way the ordinary slow-moving carts do, but wets the ground thoroly while traversing the route in less time than the horse-drawn vehicle.

The chairman of the Board of Public Works of Pensacola is well pleased with the operation of the car, and comments upon it as follows:

Previously we ran two 500-gallon two-mule team sprinklers, and did not secure the service we required, and we had to be always careful not to overheat the mules. After a very careful investigation I put the matter up before my board, with the result of getting an automobile sprinkler, and after running for several months in a gas car, without any adjusting and with the meager instruction I gave him, we find the service far beyond what we ever expected. It covers all the territory of the other wagons, and a great deal more, and the cost of running is so little in comparison that we feel that it has been a most judicious investment. I would say, also, that besides this regular work it is used many times at night on extra work in sweeping and cleaning the streets.

Scranton Council Reports on Paving Investigation.

In response to agitation started in a local newspaper the city council of Scranton, Pa., instituted an investigation of paving conditions in the city. The inquiry has been in progress since October, 1911, and a report was not prepared until July 12, 1912. The report, as briefly summarized, states the following recommendations:

First: That the contracts and specifications in use at the present time for pavements, which are in many respects old and not in accordance with the best modern practices, be revised. Among other things, by striking out the private brand names of paving materials to be used, and providing for chemical tests and requirements, that all bidders and contractors will know exactly what quality of material may be used and how the same are to be put together. This will also enable the city officials to make definite tests for the purpose of ascertaining whether or not the material being used meets the requirements of the specifications.

Second: That at the time proposals are received from contractors, samples of materials proposed to be used should be submitted with the proposals for the purpose of analysis, and that during the construction of the work, at short intervals, analyses be made of materials being used and the report of such analyses placed on record with the proper city officials.

Third: That inspectors be furnished with details, written or printed instructions, regarding their duties as inspectors of paving constructions, also with simple special forms upon which to make daily reports.

Fourth: That instead of the present method of general repairs twice each year, and a few at irregular intervals hereafter, a system be established for the constant prompt repairs of all kinds of pavement at all times, weather permitting. This, in our opinion, would effect a saving in expense, and the pavements would be substantially in constant good order at all times.

An Original Street Flushing Machine.

To clean the paved streets of Baker, Ore., Anderson Finley, commissioner No. 2, has constructed a machine on the flushing system, with a water pressure of from 60 to 90 pounds.

The machine is composed of sections of 2-inch pipe, 10 or 12 feet long, mounted on 8-inch cast wheels, joined together by pieces of 2½-inch fire hose, about 3 feet long. The axles are made of ¾-inch galvanized pipe, 27 inches long, which are fastened rigidly by means of clamps thru the axles and fifth wheel arrangement to the 2-inch pipe, about 18 inches from the end, the ends of the 2-inch pipe being slightly swelled to prevent the hose from pulling off when slipped over the pipe, and well wrapped with No. 6 wire.

The machine can be made any length desired, the length depending on the distance between the fire plugs.

At the end where the horse is fastened the pipe is clamped to the axle at a right angle to the main line. The front axle is 32 inches long, which makes an offset for the horse to work by the side of the nozzle section. The end of this offset pipe is supplied with an elbow and short nipple, which stands up perpendicularly. This, in turn, is connected with the nozzle section with a 1½-inch Holland flexible joint, which makes it possible to turn the nozzle in any direction.

The nozzle is a piece of ¾-inch pipe, slightly flattened at the end so as to throw the water in a sort of broom-shaped spray, thus avoiding the wearing effect of a solid stream on the pavement.

The connecting end of the machine is supplied with about 9 feet of hose and a 2½-inch coupling.

STREET LIGHTING

Ornamental Street Lighting in Fargo, N. D.

Fargo, N. D., started in 1909 to slowly establish an ornamental lighting system. At the start the property owners along the streets paid for the posts and installation and the tenants paid for the current at the rate of 25 cents per front foot. In 1910 the city took over and paid all the maintenance and current charges.

The posts are of cast iron, and consist of a base and a column supporting four bracket arms, from which ball globes are suspended in an inverted position, and a center ball globe held upright on an ornamental cap.

All lamps burn until midnight, when the four smaller ones are turned off, leaving the upper lamp burning until dawn. The city has ordered the removal of all arc lamps in the district served by these ornamental posts, as it was found that they were not only unnecessary, but by contrast were unsightly.

The Fargo "White Way" is an instance of the value of a good example. From a few ornamental standards established in the downtown section, the spread was rapid into other portions. The possession of the ornamental lights by a few merchants led to a kind of pride in the others, so that they installed the standards in order to "keep up" with their neighbors. Tho installed in this piecemeal manner, the standards adopted were uniform and the effect of the entire system is very pleasing indeed.

Chicago Starts City Beautiful Project.

The first step for the realization of the "city beautiful" project, known as the "Chicago plan," was taken by the city council on July 23, when an ordinance appropriating $1,750,000 to meet the city's share of the expense in widening Twelfth street, from Michigan to Ashland boulevards, was passed by a vote of 49 to 13.

Under the provisions of the ordinance the magnificent boulevard, with an ornamental bascule bridge over the river, to cost in the neighborhood of $500,000, will be the initial link in the Chicago plan, and will form the south quadrangle of this great improvement. The expense of the new bridge will be borne jointly by the city of Chicago and the sanitary district.

The $1,750,000 voted by the city council is estimated to be about 50 per cent. of the total cost of the improvement, exclusive of the new bridge. Property owners whose real estate holdings will be benefitted by the improvement are to pay the balance in special assessments. The city's contribution of 50 per cent. is given because of the public benefits to accrue from the improvement.

Ellsworth, Kans., Rents Its Sewer System.

When Ellsworth was "hard up" several years ago, and needed a sewer system badly, Edward Wellington, a wealthy resident, offered to build a complete sewer system and rent it to the city until the city was able to buy it. A contract was entered into and a fine sewer system was built, the city paying rent on a yard basis. The original contract has now run out, but both sides are so well satisfied that a new contract has been entered into, the city continuing the yard rental system and Mr. Wellington building additions as fast as they are needed. Under the system the city is said to be saving money that would have been paid out in interest on bonds and Mr. Wellington is making a good profit on his investment.

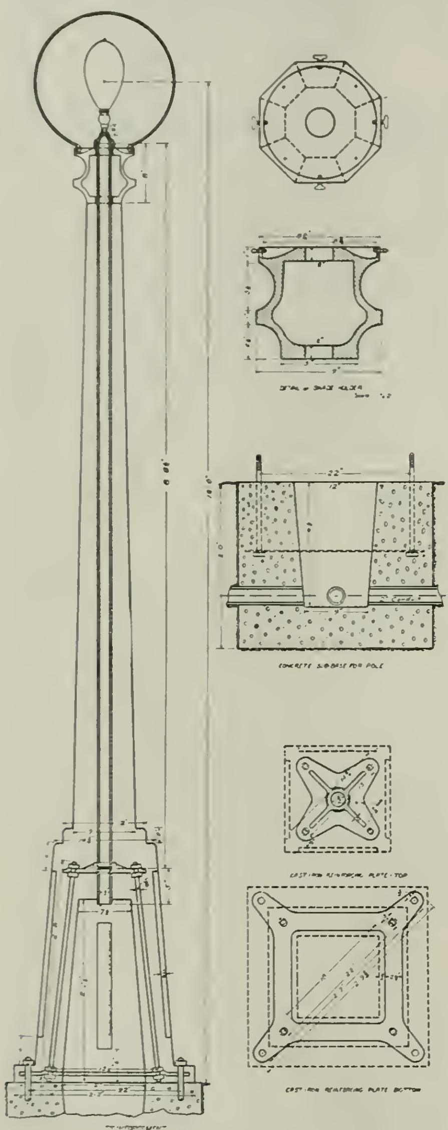
Concrete Lamp Posts in Seattle, Wash.

H. L. Quigley, of Seattle, Wash., describes, in a recent issue of *Pacific Builder and Engineer,* a new type of concrete posts which has been adopted by the University of Washington, at Seattle. Concrete ornamental lighting standards have come into use in a number of cities, among which are Richmond, Ind., Terre Haute, Ind., Oklahoma City, Okla., Rochester, N. Y., Riverside, Cal., and Chicago, Ill.

The last two mentioned are perhaps the more widely known instances. In Riverside a very unique design, which is in character with the city, has been adopted. The post is of reinforced concrete, and consists of an ample base, a shaft and a capital, made in imitation of the bell posts of the old Franciscan monks, and resembling somewhat the

Greek letter Pi, superimposed on a horizontal arm. The posts support three electric incandescent lamps.

The lake shore drive lighting system of Chicago has been described in these pages. It consists of simple standards of artistic



DETAILS OF SEATTLE CONCRETE LAMP POST.

design, supporting single ball globe lights. They are finished, as in the case of the Seattle standards, by the action of acid bath removing the cement from between the particles of bright gravel. The Rochester standard is similar in that it is a simple standard, with an ornamental capital supporting a ball globe lamp.

The description of the University of Washington standards, as given by Mr. Quigley, is briefly as follows:

At present seventy-eight posts cover the most important parts of the campus, or about one-fifth of its total area. The system will be enlarged and completed when possible by a further state appropriation. Throughout the work represented in these concrete posts the idea of "Washington" has been carried out. The design was by a University of Washington instructor, the entire labor was furnished by student engineers during their vacations, and the castings necessary were designed and made at their foundry.

The concrete was hand-mixed in proportion of two parts cement to five parts gravel, without the use of any sand. The pea gravel was hand-screened through a three-to-the-inch mesh, and all of the under size caught on another screen of six meshes to the inch was used. Wooden forms were used, and the posts were poured with the forms set vertically.

After an average time of eighteen hours from the completion of the pouring, the molds were removed and the surface thoroly wire-brushed. After a three days' set, the surface was then given a one-half strength muriatic acid (commercial) bath. When the cement was eaten down sufficiently to make the gravel stand out prominently, the pole was liberally sprinkled with a hose.

Each sub-base and the necessary wiring for each lamp were completed prior to the arrival of the finished pole at its permanent location. By reference to the plan it will be evident that the construction enables easy and quick work on the electrical connections, without detracting from the beauty of design. The erecting frame and wagon were made at the university shops. The trucks support a weight of sufficient magnitude to require special construction.

The university power house generates and transmits current at 2,300 volts to the center of the manholes and subway type transformers, where it is stepped down to 225 volts at the lamp base. On the majority of the poles 100-candle-power Colonial Mazda lamps, with 20-inch sand-blast finish globes, are installed. These lights carry a voltage of 17.9, and in addition a few 200-candle-power lamps carry a voltage of 35.9.

A handhole in the concrete base is located on the opposite side from the passing pedestrian, and the three corresponding or symmetrical panels are of concrete, but painted black for harmony. A rich cement finish containing lamp black was experimentally used for this purpose.

The appended costs have not been completely segregated, and slightly higher costs would prevail if the lamp posts were made under contract, nevertheless the advantages of the concrete pole are prominent.

Bare pole	$14.50
(Pea gravel, $2.80 yard. Cement, $2.65 bbl.)	
Average cost of erection, including horse	.80
Pole foundation and anchors	6.00
Pole trimmings, lamp, globe, transformers, etc.	16.20
Labor, wiring pole, placing lamp, leveling, etc.	1.00
Cost per pole	$38.50

It is likely that the further construction of concrete lamp posts will come into prominence, especially in the high-class residence districts of Seattle.

ORGANIZATIONS & INDIVIDUALS

The Good Roads Year Book.

The official Goods Roads Year Book, which has just been issued by the American Association for Highway Improvement, is the most complete volume of information on he general question of good roads that has been prepared. Starting with a general synopsis of the history of road building, it brings the subject down to the particular needs and conditions in America, and all information extant upon the subject of good roads is either given in this volume or so referenced that it is placed within the reach of the seeker.

A few pages in the fore part of the book are devoted to the American Association for Highway Improvement, together with its aims, its members and it work. This section is followed by a general digest of road legislation thruout the country, each State being taken in turn and complete data being given on its laws relating to roads.

Then follows a full discussion of all of the types of roads known, with the best practice noted in each case. Bridges, culverts and other water crossings are then discussed in their relation to highway construction. The latter portion of the book is devoted to bond issues and funds available for road work in each State, road officials, manufacturers, educational institutions, contractors, patents pertaining to roads, and a complete bibliography of roads.

Viewed from any standpoint, the book is of value as a reference work to anyone interested in any phase of road building. It is the bible of the religion of good roads.

Preparations for the American Road Congress.

The first campaign meeting of Governor Wilson, of New Jersey, and President Taft is to take place at Atlantic City at the American Road Congress, between September 30 and October 5. The respective candidates of the Democratic and Republican parties have both consented to address the American Road Congress, and while the addresses of the two men will be non-political, there is great interest in the manner in which they will greet each other.

The American Road Congress marks the combination of the conventions of the American Association for Highway Improvement, the American Automobile Association and the National Association of Road Machinery and Material Manufacturers. It will be the first time that every faction engaged in the road movement has combined in one general congress. More than a half hundred state, county and local associations which are affiliated with the American Association for Highway Improvement will be represented at the congress, and automobile tours to Atlantic City from all sections of the country are being arranged by the American Automobile Association. Eighty thousand square feet of space have been set aside for the exhibits, nearly one-half of which has already been engaged by leading manufacturers.

The International Road Congress of 1913.

The Third International Road Congress will be held in London from Monday, June 23, to Saturday, June 28, 1913. These congresses will in future be held triennially. The first was held in Paris in 1908 and the second in Brussels in 1910. Their object is to collect, discuss and circulate all the latest practical and scientific knowledge with regard to the construction and maintenance of highways. The congress of 1913 is held on the invitation of the British government, and is under the patronage of his Majesty, King George V. The honorary presidents of the congress are the Right Hon. the Chancellor of the Exchequer and other members of his Majesty's government, and the vice presidents include the Right Hon. the Lord Mayor of London, members of both houses of Parlaiment, chairmen of county councils, mayors of cities and boroughs, presidents of learned societies and of associations of local authorities, engineers, automobilists, cyclists, and of other organizations interested in the improvement of the roads. Over thirty governments have intimated to the British Minister of Foreign Affairs their intention of taking part officially in the congress.

The congress of next year will receive and consider a number of papers and reports by the leading authorities throughout the world on the maintenance of roads, their foundations and proper drainage, the prevention of dust and mud, the laying of light railways and tramways on roads, the choice of surfacing materials, the influence of weight and speed of vehicles on roads and bridges, the conditions that should be filled by horse or mechanically propelled vehicles in order that they may not damage or suffer damage from the roads, etc. Mr. W. Rees Jeffreys, secretary of the British Road Board, is honorary secretary.

Annual Convention of the American Society of Civil Engineers.

The forty-fourth annual convention of the American Society of Civil Engineers was held in Seattle, Wash., on June 25-28, with a registration of about 250. The addresses of welcome were delivered by George A. Lee, of Olympia, representing Governor M. E. Hay; George F. Cotterill, mayor of Seattle, and J. W. Spangler, secretary of the Seattle Clearing House Association.

The forenoons during the convention were devoted to business meetings and pleasure trips were arranged for the afternoons and evenings, during which excursions were made to the Puget Sound navy yard, Brown's Bay logging camp, Mt. Rainier, the Nisqually glacier, and several of the points of engineering interest in and near Seattle.

No reports by committees were made, with the exception of the committee on public utilities, which reported progress.

A paper was read by William Mulholland on the Los Angeles aqueduct; there was an illustrated paper on Pacific coast harbors, presented by Brig.-Gen. H. M. Chittenden, with a discussion of it by Major J. J. Morrow; an illustrated address on irrigation was made by F. W. Newell, director of the Reclamation Service. A paper entitled "Economies in Water and Design of Works Possible by Avoidance of Excessive Seepage Losses" was presented by E. G. Hopson, supervising engineer, U. S. Reclamation Service. A lecture, with lantern slide views of Alaska, was given by Maurice D. Leekey, and one on Mt. Rainier by Asahel Curtis.

The Union of Canadian Municipalities.

The following list of papers has been prepared for the twelfth annual convention of the Union of Canadian Municipalities, to be held at Windsor, August 27-29. Point Grey, B. C., Councillor Richardson, "Point Grey as a Model City; Vancouver, B. C., Alderman Hepburn, "Municipal Taxation;" Lethbridge, Alta., City Engineer A. C. D. Blanchard, subject not given; Edmonton, Alta., Alderman Clarke, "Equable Municipal Taxation;" Calgary, Alta., Mayor Mitchell, subject not given; Medicine Hat, Alta., Mayor Spencer, "Good Roads, and Their Effect on Rural Life and Transportation;" Regina, Sask., J. N. Bayne, deputy municipal commissioner, "Municipal Progress in the West;" Winnipeg, Man., Controller Harvey, "The Price of Cement," Controller Cockburn, "Winnipeg's Hydro-Electric Power Plant;" Detroit, Mich., G. A. Walters, secretary of police department, "Moving Picture Shows;" Toronto, Ont., S. Morley Wickett, Ph. D., "Municipal Government by Commission;" Ottawa, Ont., Mayor Hopewell, "The Georgian Bay Canal, and Its Water Powers;" Montreal, Que., Alderman Boyd, "Metropolitan Parks;" Sherbrooke, Que., Mayor Herbert, "The Operation of Public Utilities in Sherbrooke;" Quebec, Que., Alderman Cannon, LLL., K. C., "Electric Franchises;" Moncton, N. B., ex-Mayor Reilly, "Natural Gas in Moncton and Vicinity;" Halifax, N. S., Alderman Harris, "Capital Cities;" City Engineer F. W. W. Doane, "The Cleaning of Water Mains."

Plans for Cement Shows Changed.

Pittsburgh and Chicago will have the cement shows for the next season, and New York and Kansas City will be omitted. Announcements to this effect have been issued by the Cement Products Exhibition Company, 72 West Adams street, Chicago.

The date set for the first Pittsburgh cement show is December 12 to 18, 1912; the show will be held in Exposition Hall, Duquesne Way, Pittsburgh. The annual Chicago exposition will be held as before in the big Coliseum, where the recent Republican national convention was held. The date for the Chicago show has been set for January 16 to 23, 1913.

With the information as to the cement shows comes also the announcement that the ninth annual convention of the National Association of Cement Users will be held in Pittsburgh in December in connection with the show. The selection of Pittsburgh for a show and the abandonment of New York was based upon the desire of the management to hold a show in a new territory.

Technical Schools.

Jacob Joharn, of Springfield, Ill.,, for many years identified with the Illinois Central railway, and for many years an active member of the American Railway Master Mechanics' Association, has presented to the library of the University of Illinois a complete file of the Proceedings of the American Railway Master Mechanics' Association and a collection of miscellaneous volumes of interest to the Department of Railway Engineering.

George H. Benzenberg, consulting engineer, of Milwaukee, Wis., and past-president of the American Society of Civil Engineers, received the honorary degree of doctor of engineering from the University of Michigan at the annual commencement on June 27. Cornelius Donovan, principal assistant engineer in the U. S. Engineer Office at New Orleans, La., also received the degree of doctor of engineering.

Prof. H. S. Philbrick, M. Am. Soc. M. E., formerly Assistant Professor of Mechanical

Engineering at the University of Missouri, has been appointed Professor of Mechanical Engineering at Northwestern University, Evanston, Ill.

O. H. Landreth, M. Am. Soc. C. E., Professor of Civil Engineering at Union College, Schenectady, N. Y., and a consulting engineer of New York city, has been appointed to prepare plans and specifications for systems of water supply and purification, sewerage and sewage disposal, street and pavement construction, etc., for the Kawasaki plant of the Tokio Electric Co., of Tokio, Japan.

Technical Associations.

At the annual meeting of the American Society for the Promotion of Engineering Education, held in Boston on June 28, Prof. William T. Magruder, of Ohio State University, was elected president; Profs. L. S. Marks, of Harvard University, and F. W. Sperr, of the Michigan College of Mines, vice presidents; Prof. H. H. Norris, of Cornell University, secretary, and W. O. Wiley, of New York, treasurer.

The following officers were elected by the New York State Association of Fire Chiefs, held in Albany, on June 21: President, John Mack, Glens Falls; vice president, William Bridgeford, Albany; secretary-treasurer, Henry R. Yates, Schenectady.

A town-planning congress was held in connection with the Royal Exhibition of Winnipeg during the middle of July. Among the speakers of note were the following: H. R. H., the Duke of Connaught, on "Housing and What It Means to the Community;" F. L. Olmstead, of Brooklyn, N. Y., on "The Four Cardinal Points of Town Planning;" Mrs. Franklin P. Iams, on "The Housing Question;" Guy Wilfrid Hyler, on "The Essential Elements of City Planning;" Dr. Seymour, medical health officer for Regina, with Dr. Hodgetts, medical officer of the committtee of conservation at Ottawa, dealt with the "Tenement House Question and the Prevention and Eradication of Slums;" Mrs. Albion B. Fellows spoke on "The Housing of the Working Classes;" John P. Fox, of New York, an authority on traffic problems, and Charles Browner on "The City Beautiful;" B. Antrim Haldeman, of Philadelphia, on "The Fundamental Principles of Town Planning;" James Ford, of Harvard University, on "The Social Aspects of Town Planning," and C. Whitehall, of Milwaukee, dealt with the financial side of town planning.

The following officers were elected by the Rochester Engineering Society at their annual meeting: President, D. P. Falconer; first vice president, G. S. Dey; second vice president, Ivor Lungard; secretary-treasurer, E. F. Davidson (re-elected).

The thirty-fifth convention of the National Electric Light Association was held at Seattle, Wash., from June 10 to 13, and while it was not equal to the convention of 1911, held in New York City, in point of attendance, it was one of the most important in regard to papers, reports and discussions in the interest of central station policy, operation and maintenance ever held in the history of the association. The following officers were elected for the coming year: President, F. M. Tait, Dayton, O.; first vice president, J. B. McCall, Philadelphia; second vice president, H. H. Scott, New York; treasurer, W. W. Freeman, Brooklyn, N. Y.

The nineteenth annual convention of the International Association of Chiefs of Police was held in Toronto, Ont., Can., on July 9-13, with a registration of about 300. A number of addresses on the cause, handling and prevention of crime were given. Officers were elected as follows: President, Major Sylvester, Washington; first vice president, Michael Regan, Buffalo; second vice president, Col. Percy Sherwood, Ottawa; secretary-treasurer, Harvey O. Carr, Grand Rapids, Mich. The convention of 1913 will be held in Washington, D. C.

The following officers were elected by the Playgrounds and Recreation Association of America at their sixth annual convention, held in Cleveland, O., recently: Joseph Lee, Boston, Mass., president; Harold F. McCormick, Chicago, first vice president; William Kent, California, second vice president; Robert Garrett, Baltimore, Md., third vice president; Gustave T. Kirby, New York, treasurer.

Among the topics for discussion at the convention of the International Association of Fire Engineers, to be held in Denver, Col., on September 18-20, are the following: "Fire Prevention and Building Inspection by Members of Fire Departments," Fred Brodbeck, chief, Salina, Kans., A. M. Schoen, manager Southeastern Underwriters' Association, Atlanta, Ga.; "The Triple Combination Hose Wagon, Chemical and Pumping Engine," F. J. Connery, chief, Newcastle, Pa.; "The Proper Location of Sprinkler Tanks—Should They Be Located on Roofs, Fire Walls or Separate Towers?" J. A. Tremblay, chief, Montreal, Canada; "Tractors for Steam Fire Engines, Aerial Trucks and Water Towers," John Kenlon, chief, New York, R. H. Bowker, chief, Passaic, N. J.; "The Care of Fire Hydrants to Prevent Freezing and the Best Way to Thaw Out Frozen Fire Hydrants," C. W. Ringer, chief, Minneapolis, Minn., John Aiken, chief, London, Ont.; "Direct Connection from City Water Mains to Sprinkler Systems and Standpipes," F. A. Raymond, engineer, National Board of Fire Underwriters, New York; "Motor vs. Horse-drawn Apparatus in Heavy Snows," James Smart, chief, Calgary, Canada; "The Efficiency of the Motor Pumping Engine," Geo. W. Booth, chief engineer, National Board of Fire Underwriters, New York.

The program for the eighteenth annual convention of the Ohio Electric Light Association, held at Cedar Point, O., July 16-19, included the following papers: "Rate Making," Halford Erickson; "The Public vs. the Utility," D. L. Gaskill; "Electrolytic Purification of Sewage," F. C. Caldwell; "Supply of Electric Current to Rural Districts," J. C. Matthieu; "Joint Pole Line Construction," J. L. Spore.

Calendar of Technical Meetings.

Virginia State Firemen's Association—Twenty-sixth annual convention and tournament, Roanoke, Va., August 28-30. L. E. Lookabill, vice president, Roanoke, Va.

International Association of Municipal Electricians—Seventeenth annual convention, Peoria, Ill., August 26-30. Clarence R. George, secretary, Houston, Tex.

International Congress for Testing Materials—Sixth congress at New York City, September 2-7. Secretary of organizing committee, H. F. J. Porter, 29 West Thirty-ninth street, New York.

International Congress of Applied Chemistry—September 4, at Washington; September 6-13, at New York City. Bernhard C. Hesse, secretary, 25 Broad street, New York.

International Association of Fire Engineers—Annual convention, Denver, Col., September 17-20. James McFall, secretary, Roanoke, Va.

New England Water Works Association—Thirty-first annual convention, Washington, D. C., September 18-19. Willard Kent, secretary. Headquarters, Boston, Mass.

Central States Water Works Association—Sixteenth annual convention, Detroit, Mich., September 24-26. R. P. Bricker, secretary, Shelby, O.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment—Seventy-first Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

American Society of Municipal Improvements—Annual convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

Personal Notes.

J. Fred Thomas has been appointed boro engineer for the boro of Farrell, Pa.

C. O. Vandevanter has been appointed assistant city engineer of Baltimore, Md.

Bruno L. Durst has been appointed city engineer of Port Arthur, Tex., succeeding C. E. Dunwoodie.

William L. Vennard has been appointed city engineer of Lynn, Mass., succeeding the late George I. Leland.

W. M. Davis has resigned as city engineer of Prince Rupert, B. C., in which capacity he has served for a number of years.

F. N. Holmquist has been appointed city engineer of Phœnix, Ariz. He has been connected with that department in the city for some time.

Charles F. Uebelacker, Charles N. Black and William von Phul have been admitted to partnership in the engineering firm of Ford, Bacon and Davis, 115 Broadway, N. Y.

John A. Pettigrew, who was formerly superintendent of parks in Boston, Mass., and also at various periods in Brooklyn, N. Y., Milwaukee, Wis., and Chicago, Ill., died July 2 in Boston.

William J. Zartmann, formerly superintendent of parks, boro of Brooklyn, New York city, has been appointed principal assistant engineer of the department of parks of the boro of Queens, in charge of construction.

Dabney H. Maury, consulting engineer, will on August 1 remove his offices from Peoria, Ill., to 1137-38 Monadnock Building, Chicago, Ill., where he will carry on a practice in water works supply and purification, sewerage and sewage purification, lighting and power plants, and the appraisal and adjustment of rates of public utilities. Douglas A. Graham will be Mr. Maury's principal assistant.

Sir Maurice Fitzmaurice has resigned as chief engineer to the County Council of London, England, to take effect in December. He will engage in private practice after that time. He became chief engineer to the London County Council in 1901. Prominent among the works carried out under his direction in this capacity have been the reconstruction of street railways, the new Vauxhall bridge, the Rotherhithe tunnel, subways and the duplication of the main drainage system of the city.

The McGraw Electrical Directory.

The semi-annual edition of the McGraw Electrical Directory, published by the McGraw Publishing Company, of New York, has been received. It contains a complete classified list of manufacturers of central station and general electrical supplies and equipment; a list of all central stations in the United States, together with information regarding each, the officers, capitalization, etc.; an index to lighting companies; a summary of central stations by states, and a complete list of electrical supply dealers and contractors.

The Youngest Mayor.

Joe F. Sullivan, who was recently elected mayor of Imboden, Arkansas, is the youngest mayor of an American city. Mr. Sullivan, who is also the editor of the Imboden Gazette and a writer of short stories won his office by a series of articles on the county political situations which attracted attention to his ability. He is 21 years of age.

MACHINERY AND TRADE

The "Peerless" Pick-Up Hand Sweeper.

The Baker Manufacturing Company, 705 Fisher Building, Chicago, Ill., have taken over the western selling rights for the "Peerless" pick-up hand sweeper.

The machine mentioned has been in use for a number of years in factories, foundries, flour mills, etc., and has recently demonstrated it value in street sweeping. It is said that it cleans sheet asphalt, asphalt block, brick, wood block, bitulithic, bituminous macadam or any other kind of smooth pavement satisfactorily. The universal testimony of those who have used the machine declares it to be sanitary, efficient and economical.

It is very simple in construction and easy to operate, being light and easily pushed along over the pavement, sweeping a path about thirty inches wide. It picks up and deposits in a receptacle which is a part of the machine all the dirt and sweepings in the path of operation. The receptacle will hold, under ordinary conditions, the sweepings from an area of between 750 and 1,000 square yards, which can be dumped wherever the operator pleases by merely pulling a handle which is attached to it.

The sweeping part of the machine consists of a circular brush or broom thirty inches long and thirteen and a half inches in diameter. This revolves within a metal inclosure on the same principle as the revolving brush in a carpet sweeper. This brush is geared to the main axle with a ratio of four to one, so that the brush revolves four times to each revolution of the main axle. By the operation of a simple attachment, the wear of the broom is compensated for at all times, so that without any trouble to the operator it perfectly adjusts itself at the proper angle for sweeping.

When the bag system is used in conjunction with the machine, a tremendous saving is effected, as the bags cost about five or six cents each, while cans to do the same work cost from $2.50 to $3.50 each. The machines are equipped with hooks on the cross rods of the handle, and the men, when provided with bags in the morning, can attach a bag to the handle, in which papers and other materials which the machines do not pick up can be placed.

The material collected in this way is not bulky or heavy, and when the sweepings of a block have been deposited in one pile the operator then uses a short handle shovel to shovel these sweepings into the bag, the mouth of which is held open with the hooks. The same is then unhooked, tied up with a string, and set upon the sidewalk for the pick-up wagon. In this way all of the sweepings which have once accumulated are absolutely taken from the street surface, while where the can system is used, if the sweepings are dry, all of the fine dust and dirt is blown out of the tops of the cans, and in many instances the entire can is knocked over and scattered about the streets. The city of Hartford sells the sweepings accumulated in this way for $1 per cord, so that the bags cost them practically nothing.

With the old method of a push broom 16 inches wide four men sweep a space 44 inches wide in a slow, halting manner. With the Peerless Sweeper two men and two machines clean 60 inches as fast as the men walk, therefore a saving is effected and the dust nuisance is overcome.

The Hotchkiss Steel Forms.

A contractor in New York during the last year laid over a million square feet of sidewalk at a saving of $15,000, and did it because he used steel sidewalk forms and used them intelligently. Every contractor recognizes the waste and expense incident to the old stake and two-by-four method of laying sidewalks.

The Hotchkiss Lock Metal Form Company, Binghamton, N. Y., are manufacturing metal forms for both sidewalk and curb and gutter work, which involve the best modern practice in this work.

The Hotchkiss steel sidewalk form is a jointed section system designed on the most simple principles so as to be easily handled by unskilled labor. The forms consist of straight, rigid side-rails, flexible side-rails, cross-pieces or division-plates of various lengths, and wedge-shaped keys or lugs for fastening these parts together. The rigid side-rails are 10 feet long, 4 inches high, and have slots at one-foot intervals to receive the division-plates. They have a flange at top and bottom to keep them rigid, and in use are joined end to end by a tongue and socket. Rigid side-rails are also made 4 feet and 6 feet in length, slotted at 3-inch and 6-inch intervals.

The flexible side-rails are made 4, 6, 8 and 10 feet long, 4 inches high, and have no flanges. They are made of spring steel and may be bent to any desired curve; for curves of long radius flexibles are made of heavier steel. The cross-pieces or division-plates are simple; all that is required of them is uniformity.

The Hotchkiss steel curb and gutter forms consist of steel templates which conform in shape to the finished curb and gutter. To serve as molds for the back of the curb and front of the gutter are provided steel channels, which are slotted at regular intervals. On the front and back of the templates are tongues which pass through these slots and are locked there by lugs on the outside. When set up in this manner they make a rigid and substantial form that will stand alone and which does not need any stakes or braces.

There is one size and style of curb and gutter so generally specified in cities thruout the country that it has been adopted as a standard. This provides for a curb 12 inches high at the back, 6 inches thick, and having a face of 6½ inches high. The gutter is 18 inches wide and dips toward the curb 1½ inches. The outer edge of the curb and junction of the curb and gutter are rounded on a 1½-inch radius. The back of the curb is made with a batter of 1-inch on 12 inches, both because it is good construction and because it assists in the immediate removal of the forms without waiting for the cement to set.

Probably no invention of recent years has done more to revolutionize any industry than has the system of steel forms. They are now used by hundreds of the leading contractors thruout the country, who are highly pleased with them and find that these forms save them over one cent per square foot on all of their sidewalk work alone, and enable them to lay 25 per cent. more walk per day with the same gang.

A Power Machine for Spraying Trees.

The illustration herewith shows a new power spraying outfit of extra large capacity made for spraying shade trees in city parks and for large commercial orchard service. The outfit is known as the Elm Tree Special and consists of a Triplex Power Pump, made by the Goulds Manufacturing Company, of Seneca Falls, N. Y., driven by a gasoline engine. The engine and pump are mounted together on truck with the tank and tower.

The pressure obtained with this outfit is sufficient to permit thoro work to be done on the tallest trees, and its large capacity makes it possible to spray large numbers of trees in a comparatively short time.

A POWER SPRAYING MACHINE.

Trade Publications.

The Standard Scale and Supply Company, 1345 Wabash avenue, Chicago, Ill., have a very interesting catalog of "The Standard" line of low charging concrete mixers. The mixers are shown in operation on various classes of work, and special designs are noted for particular conditions.

The Universal Portland Cement Company is issuing each month a periodical devoted to the use of concrete on road construction. The publication is broad in its nature, and includes besides the specialized matter for which it is issued a great deal of a general interest relative to good roads.

The Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pa., have published a typical curve of tensile strain of their cement.

The Nelson Valve Company, Chestnut Hill, Philadelphia, Pa., have for distribution their catalog "S," showing steel valves made of acid open hearth steel. The catalog is arranged so that the architect can clearly specify without the usual great amount of trouble, and the engineer will find an asssortment of steel valves that will be quite a "find," for the variety offers gate valves, globe valves, angle valves, vertical valves, cushioned non-return stop valves, cushioned non-return valves, check valves, throttle valves and blow-off valves. Valves are shown for superheated steam, as well as for high-pressure saturated steam and for severe hydraulic work.

The Lead Lined Iron Pipe Company, Wakefield, Mass., have a catalog of their pipe and fittings and of lead-covered coils, tubes and pipe. The lead-lined pipe is formed by a lead lining amalgamated to an iron casing, the two metals being so joined that they cannot be torn apart by bending or rough usage.

The Standard Manufacturing Company, 185 Union street, Worcester, Mass., have a booklet called "The Construction and Maintenance of Roads with Bitumen by the Layer Method." It contains a full description of the methods employed on such construction, together with specifications for gravel, asphaltic oil and refined tars.

The Hersey Manufacturing Company, E street, South Boston, Mass., has a forty-page booklet composed of letters laudatory to the Hersey Detector Meter. The meter mentioned is endorsed in these letters by water departments and underwriters alike.

"The Cleaning of Water Mains" is the title and subject of a publication by the National Water Main Cleaning Company, 61 Park Row, New York city. Numerous photographs are given to illustrate the methods and effects attained in connection with their system of cleaning water mains.

Trade Notes.

Florence, Ariz.—The contract for furnishing a concrete mixer at the penitentiary has been awarded to the Ransome Concrete Machinery Co., of Dunellin, N. J.

Chicago, Ill.—The Keystone Driller Co. announce the establishment of a southern brauch office at 1639 Candler Bldg., Atlanta, Ga. The office is in charge of Mr. McCarthy, who will look after the sale of the Keystone well-drilling machinery and Down-Deep well pumps in the Southern States.

Chicago, Ill.—The Creosoted Wood Paving Block Association has moved its offices to the Otis Building, 10 South LaSalle st., Chicayo, Ill.

New Orleans, La.—Bids will be received Aug. 16, at 12 m., for furnishing one traveling crane of forty tons capacity, electrically operated, and one of ten tons capacity hand operated. Geo. G. Earl, gen. man.; F. S. Shields, secretary.

New York, N. Y.—The MacArthur Concrete Pile and Foundation Co., of 11 Pine st., New York, announce that they have been awarded the contract for placing the pile foundations for a large factory building of John B. Lewis & Bros. Co., of Philadelphia.

Patents Concerning Road Construction and Repair.

979,047. Road Grader and Drag. Thos. I. Swagerty and Arthur L. Lowe, Fontana, Kan.

979,338. Road Scraper. Geo. D. Rhodes, Groton, N. Y.

979,577. Process of and Templet for Use in Laying Pavements. Eugene Geo. Schwendeman, Oak Park, Ill.

979,754. Gutter Bridge. Calvin C. Fouts, Middletown, O.

980,002. Oil Distributing Apparatus. Chas. P. Price, Malden, Mass. (For Roads.)

980,394. Apparatus for Maintaining Crowned Roads. Wm. C. Anderson, San Jose, Cal.

980,513. Means for Laying Dust and the Like on and Making Roads. Robert Hacking, W. Bridgford, Harry Hill, Ollerton, and Henry Walker Hill, Nottingham, England.

980,612. Road Grading Machine. Wm. H. Dawkins and Francis G. Dorough, Royston, Ga.

981,225. Bituminous Paving Cement. Clifford Richardson, New York, N. Y.

981,685. Process of Making Roadways, Railroad Beds, Pavements and the Like. Michael A. Popkess, Kansas City, Mo.

981,710. Road Grader. John T. Starr, Nowata, Okla.

982,247. Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.

982,309. Road Scraper and Grader. Geo. K. Smith and Ralph Russell, Albany, John Anderson, Jr., and Howard Grimes, Newcomb, N. Y.

982,427. Road Grader. David P. Henninger, Redondo Beach, Cal.

982,944. Road Grader. John B. Fender, Kaufman, Tex.

984,543. Compound for Forming Paving. David Crockett, Birmingham, Ala.

984,634. Combined Scraper and Drag. Hiram S. Wood, Oskaloosa, Iowa.

984,801. Method of Making Pavements. Cloyd Davis, Mineola, N. Y.

985,214. Paving Tool. Aaron W. Shroyer, Durham, N. C.

986,113. Road Scarifier. Edward Wright, Brooklyn, N. Y.

986,290. Road Roller. Pliny E. Holt, Stockton, Cal.

986,421. Road Grader. Andrew K. Skow, Newton, Iowa.

987,060. Paving Block. Frank Galgano, New Rochelle, N. Y.

987,726. Process for Making Roads, Pavements, etc. Jules Lassailly, Issy-les-Molineaux, France.

987,803. Road Drag. Edward J. Hickok, Chicago, Ill.

988,818. Garden and Road Roller. Arthur S. F. Robinson, Beceles, England.

990,488. Road Grader. John S. Lord, Ogden, Iowa.

990,846, 990,847. Road Roller. Henry F. Crandall, Racine, Wis.

991,043. Process of Making Roadways. Joseph E. Ward, Long Beach, Cal.

991,172. Culvert. George A. Sagendorph, Newton, Mass.

992,573, 992,574. Armored Paving. Peter P. McMenamin, Jersey City, N. J.

992,649. Concrete Spreader for Ditches, Sidewalks and Other Surfaces. George W. Gale, Greeley, Col.

993,244. Metallic Curb and Gutter. George W. Harrisbrough, San Francisco, Cal.

993,487. Road Scraper. Jacob Williamson, Ava, Ill.

993,618. Apparatus for Treating Roads. Henry K. Porter, Boston, Mass.

994,092. Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.

995,147. Composite Pavement. Harry G. Jennison, Toledo, O.

995,180. Culvert. Marshall A. Quinn and Lyman C. Stewart, Roanoke, Va.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Marion, Ala.—Aug. 12, 12 m. Constructing 4 miles of state aid road, amount to be expended $8,000. Also constructing 5 additional miles of gravel road. Certified check, $400. W. S. Keller, state highway engineer.

Marion, Ala.—Aug. 12, 2 p. m. Clearing, grubbing, grading, draining and surfacing with gravel about 4½ miles of Uniontown-Marion road. Certified check, $1,000. Geo. C. Scales, county highway engineer.

Montgomery, Ala.—Aug. 6, 12 m. Grading draining and macadamizing part of Crow Creek road at Bass, near Stevenson. Expenditure. $4,000. Also constructing road to Tennessee state line. Expenditure, $14,000. Certified check, $400. W. S. Keller, state highway engineer.

Bedford, Ind.—Aug. 6, 1 p. m. Constructing the old Meridian gravel road in Marion township and Woods Ferry road in Indian Creek township. E. W. Edwards, auditor.

Bloomington, Ind.—Aug. 6, 2 p. m. Constructing a stone road in Bloomington township. Horace Blakely, auditor.

Bluffton. Ind.—Aug. 6, 1 p. m. Constructing three gravel and stone roads. L. A. Williamson, auditor.

Brazil, Ind.—Aug. 6, 11:30 a. m. Constructing a macadamized road known as J. P. Acree road. E. A. Skaggs, auditor.

Brookville, Ind.—Aug. 5, 12 a. m. Constructing a road in White River township. Charles G. Reifel, auditor.

Brownstown, Ind.—Aug. 5, 1:30 p. m. Constructing a gravel road known as the Shields road, between Jackson and Redding townships. Constructing a gravel road in Carr township. H. W. Wacker, auditor.

Connersville, Ind.—Aug. 5, 10 a. m. Constructing a macadam road in Orange township, known as Lewis Mathey, et al., free stone road. Constructing a macadam road in Connersville township. Jaspeh I. Kennedy, auditor.

Corydon, Ind.—Aug. 6. Constructing four gravel roads. Wm. Taylor, auditor.

Crawfordsville, Ind.—Aug. 6, 10 a. m. Grading, draining and paving the following roads: S. C. Kennedy road, the Jesse Ward road, the James A. Quick road, the J. B. Cowan road. Bond double the amount of each bid.

Crown Point, Ind.—Aug. 5, 8 p. m. Constructing 11,900 sq. yds. of pavement on N. Main street. H. V. Parry, city clerk.

Crown Point, Ind.—Aug. 6, 12 m. Constructing several gravel roads. Chas. A. Johnson, auditor.

Danville, Ind.—Aug. 5, 10 a. m. Constructing a road known as the John R. Hull, et al., public highway in Brown township. Lewis Borders, auditor.

Decatur, Ind.—Aug. 6, 10 a. m. Constructing a macadamized road in Preble township, known as William Bisck macadam road; also for macadamized road known as Aug. Conrad road in same township. H. S. Michaud, auditor.

Greencastle, Ind.—Aug. 7, 10 a. m. Constructing the John F. Stevenson and D. B. Taylor gravel roads. C. L. Airhart, auditor.

Huntington, Ind.—Aug. 5, 10 a. m. Constructing two roads. Harold Guthrie, auditor.

Jeffersonville, Ind.—Aug. 5, 10 a. m. Constructing 1.28 miles of crushed stone road in Clark county. Commissioners of Clark county. Geo. W. Stoner, auditor.

Kent, Ind.—Aug. 5, 2 p. m. Constructing two macadam roads in Iroquois township. E. R. Bringham, auditor.

Lawrenceburg, Ind.—Aug. 6, 12 m. Constructing roads in Washington and Cæsar townships. William S. Fagaly, auditor.

Logansport, Ind.—Aug. 6, 10 a. m. Constructing six macadam roads. J. E. Wallace, auditor.

Logansport, Ind.—Aug. 7, 12 m. Constructing a gravel road on the county line. J. E. Wallace, auditor of Cass county; M. G. Haun, auditor of Carroll county.

Madison, Ind.—Aug. 6, 2 p. m. Constructing three macadamized roads. A. M. Taff, auditor.

Marion, Ind.—Aug. 6, 2 p. m. Constructing a stone road between Grant and Huntington counties. E. H. Kimball, auditor of Grant county.

Muncie, Ind.—Aug. 12, 10 a. m. Constructing a road in Harrison township. Frances M. Williams, auditor.

Paoli, Ind.—Aug. 6, 2 p. m. Constructing a gravel road. Alvin B. Ham, auditor.

Rensselaer, Ind.—Aug. 5, 2 p. m. Constructing a stone road in Carpenter township. Joseph P. Hammond, auditor.

Shelbyville, Ind.—Aug. 7, 10 a. m. Constructing highway in Union township. Frank W. Fagel, auditor.

Terre Haute, Ind.—Aug. 3, 11 a. m. Constructing a macadam road and bituminous binder covering in Sugar Creek township. Nathan G. Wallace, auditor.

Vincennes, Ind.—Aug. 6, 2 p. m. Constructing 8,575 ft. of gravel roads in Widner township. John T. Scott, auditor of Knox county.

Washington, Ind.—Aug. 6, 2 p. m. Bids will be received by commissioners of Daviess and Greene counties for the construction of pike road between said counties. Lew S. Core, auditor Daviess county.

Williamsport, Ind.—Aug. 5, 1 p. m. Constructing roads in Liberty and Jordan townships. David H. Moffitt, auditor.

Winamac, Ind.—Aug. 6. Improving highway in Pulaski county by draining, grading and graveling. Bond twice the amount of bid. W. E. Munchenburg, auditor of Pulaski county.

Jackson, Miss.—Aug. 6, 12 M. Paving North street and N. Gallatin street with brick, bitulithic, wood block, sheet asphalt, grantoid and Dolarway. Certified check, 5 per cent. J. N. McLeod, street commissioner.

Jackson, Miss.—Aug. 8, 10 a. m. Constructing gravel roadways along the following streets: Hooker avenue, Terry road, N. State street, W. Capitol street, and Bailey avenue. Certified check, $200. George W. Sarlls, engineer.

Macon, Miss.—Aug. 7, 2 p. m. Constructing 24.5 miles of sand-clay road, including 38,000 yds. earth excavation, certified check, 3 per cent.; constructing 16 mi. of sand-clay road, including 39,000 yds. earth excavation, certified check, 3 per cent. N. Scales, L. F. Holberg, S. M. Thomas, road commissioners of District No. 3.

Cincinnati, O.—Aug. 9, 12 m. Resurfacing the Cleves-Warsaw pike for a distance of 18,000 ft. under Specification No. 369. Bond, $1,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cincinnati, O.—Aug. 9, 12 m. Improving the Symmestown road under Specification No. 373. Certified check, $1,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

Columbus, O.—Aug. 9, 10 a. m. Grading and paving with bituminous concrete Section No. 3, the Winchester road. State highway 'D' pet. No. 213. Length, 2.14 miles; width, 14 ft. Estimated cost, $22,044.80. Certified check, $300. Commissioners of Franklin county; James R. Marker, Columbus, O., state highway commissioner.

Portsmouth, O.—Aug. 5, 1 p. m. Grading and paving with brick, the Portsmouth-Columbus Ext. road. State highway 'B' pet. No. 492. Length, 1.02 miles; width, 16 ft. Estimated cost, $14,225.35. Certified check, $300. Commissioners of Scioto county; James R. Marker, Columbus, O., state highway commissioner.

Portsmouth, O.—Aug. 7, 12 m. Grading and improving the Henley and Comstock roads for a distance of 7,500 ft. Certified check, $100. Thos. C. Patteson, county auditor and clerk, board of county commissioners.

South Bethlehem, Pa.—Aug. 5. Paving with Amiesite portions of Second street, Northampton avenue, New street, Elm street, Fourth street, and Third street. R. E. Neumeyer, borough engineer.

St. Clairsville, O.—Aug. 6, 11 a. m. Grading and paving Section No. 1, the Belmont road. State highway 'H' pet. No. 191. Length, 1.42 miles; width 13 ft. Estimated cost, $18,378.24. Certified check, $300. Commissioners of Belmont county; James R. Marker, Columbus, O., state highway commissioner.

Duquesne, Pa.—Aug. 3, 12 m. Grading, curbing and paving Wilmot street. Furnishing 30,000 wire-cut paving bricks. R. T. Dell, city engineer. W. E. Reed, city clerk. L. W. Francis, chairman of street committee.

Racine, Wis.—Aug. 10, 10 a. m. Paving Sixth street with brick, including 1,070 sq. yds. of paving and 480 lin. ft. of curb reset. Bond, amount of bid. Paving Fourth street with brick, including 1,120 sq. yds. of paving and 480 lin. ft. of curb reset. Bond, amount of bid. Paving Eighth street, including 323,322 sq. yds. paving, 480 lin. ft. curb reset, 587 lin. ft. curb, new, 218 lin. ft. curb reset, 1 manhole, 3 catchbasins, 1 catchbasin, rebuilt. Bond, total amount of bid. P. H. Connolly, G. W. Grenier, J. Blessinger, board of public works.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing 10 miles of Cedar Point road, to W. H. Holcombe, $26,090.63.

Montgomery, Ala.—Paving Earle street with bituminous concrete, to the Southern Paving and Construction Co., $1.77 per sq. yd.

Nevada City, Cal.—Constructing the Burkhalter-Iseland road, to John Duffy, $9,475.

San Jose, Cal.—The following contracts have been awarded: Constructing 10 miles of Madera City-Califa road, to Ransome-Crummey Co., $72,091; constructing 5 4-10 miles of S. San Francisco-Burlingame road, to F. R. Ritchie Co., San Francisco, Cal., $89,368; constructing a 13-mile road from county line of Mendocino county to Hopland, to the General Contracting Corporation, San Francisco, Cal., $67,425; constructing 9 miles of road from Morrison's crossing to Marysville, to F. E. Frey, Sacramento, Cal., $67,780.

Decatur, Ill.—Paving W. Forest street and McClellan avenue, to Lisle Hunt, $13,686.50; paving W. Main street, to Lisle Hunt, $11,133.50.

Lewistown, Ill.—Paving several streets, to Mr. Prosser.

Newton, Ill.—Paving a street with cement, to Connor and VonDuesen, $13,073.

Quincy, Ill.—Paving the down-town district with brick, to A. D. Thompson Co., Peoria, Ill., $28,365.57.

Virginia, Ill.—Paving about two miles of streets, to the Illinois Cement Construction Co., Springfield, Ill., $21, 583.

Bloomington, Ind.—Constructing a stone road in Perry county, to McCormick and Rogers, of Smithville, $4,678.

Fort Wayne, Ind.—Paving 9,000 sq. yds. of street, to the Grace Construction Co.; constructing 6,000 sq. ft. of pavement on Pontiac boulevard, to the John Grosjean & Bro. Co., $15,000.

Huntington, Ind.—The following road contracts have been awarded: Geo. S. Fahl road to Beal and Bell, Logansport, Ind., $12,700; John W. Morrow road, to Garrett, Gordon & Brinneman, Bluffton, $9,865.

Jasper, Ind.—Constructing roads in Dubois county, to Me. Eigleman, $9,350.

Kokomo, Ind.—Constructing two gravel roads in Howard county, to O. F. Peterson, $1,717.50.

Lebanon, Ind.—Constructing a gravel road, to John Haffur, of Zionsville, Ind., $5,445.

Madison, Ind.—Constructing roads in Jefferson county, to Jos. Stanley & Co., Madison, Ind., $5,200, and to Jas. E. Miles, Madison, Ind., $412.75.

Newport, Ind.—Constructing state road in Helt township, to Ingram & Co., $7,946.85; constructing the Lewis Runyan road in Clinton township, to Peter Aikman, $7,965; constructing the Clehy road, to Ray G. and Henry C. Jester, $4,180.

Shelbyville, Ind.—Paving four streets, to Breese & Brown, Mattoon, Ill., $55,329.72.

Terre Haute, Ind.—Constructing Ed B. Ferguson gravel road, to Harry B. Carpenter, Cloverland, $8,700.

Tipton, Ind.—The following road contracts have been awarded: The Cor and J. W. Renie gravel roads, to E. L. Hoffman, $1,695 and $745, respectively; the William Pratt gravel road, to W. H. Jarrett, $1, 664.

Valparaiso, Ind.—The following road contracts have been awarded: Westchester township gravel road, to Ray Demass, Chestertown, $13,890; the Morgan township gravel road, to the Crown Point Construction Co., Crown Point, Ind., $4,925.

Washington, Ind.—The following contracts have been awarded: The McCracken road, to L. S. Horrell, Washington, Ind., $9,536; the Ragsdale road, to E. Allen, Washington, Ind., $3,300; the Fornwald and Scholl roads, to Andrew Reister, $8,420.

Bay City, Mich.—Paving several streets, to Rudolph Blome & Sons, Chicago.

Des Moines, Ia.—Paving the Grand avenue bridge floor with creosoted wood blocks, $4.75 per yard.

Des Moines, Ia.—Paving Ingersoll avenue, Tonawanda drive, Polk boulevard, and Forty-third street, to James Horrabin, $1.95 per yard.

Fort Dodge, Ia.—Paving several alleys with brick, to Zitterell & Sullivan, at $1.98 per sq. yd.

Iowa City, Ia.—Constructing 5,000 yards of concrete paving, to William Horribin.

Marshalltown, Ia.—Constructing about 9,000 sq. yds. of concrete paving, to Elzy & Carlson, at $1.08.

Moline, Ill.—Paving Twenty-third avenue with brick, $35,675.60.

Sioux City, Ia.—Paving Fourteenth street and Summit avenue with concrete, to the Flinn Paving Co., at $1.12 per sq. ft.

Atchison, Kas.—The following contracts have been awarded for the improvement of the Catholic Cemetery road: Grading, to Jack Arnold, 35c per yard; removing rock at 75c per yard, and building culverts, to Pete Barnett.

Iola, Kas.—Constructing 1¾ miles of rock road, to Ransom & Cook, Ottawa, Kas.

Louisville, Ky.—Constructing granitoid pavement on Market street, to Frank Sweeny and John Howe, 18½c per ft.

New Iberia, La.—Constructing 6,200 ft. of sand and gravel paving on E. Main street, to the Chatham Construction Co.

New Orleans, La.—Paving Parkerson avenue, to the Creosoting and Wood Paving Co., $75,000.

New Orleans, La.—Paving Frenchman street with asphalt, to the Standard Paving and Construction Co., $35,319.10.

Boston, Mass.—The following paving contracts have been awarded: Improving Ashmont street, to James Doherty, $4,038.28; for a macadam road in Vaughan avenue, to Jas. Doherty, $2,980.30; improving Buttonwood street, to Hugh J. McGuire, $1,958.78; repaving W. Fourth street, to Hugh J. McGuire, $971.25; improving Kilton street, to Hugh J. McGuire, $970.94.

Bay City, Mich.—The following paving contracts have been awarded: Sherman street and Woodside avenue, to Rudolph S. Blome Co., $13,068.50; street railway right of way on Sherman and Woodside avenues, to the same, $4,343.80; Adams street, to the same, $3,348.62; Third street, to the same, $4,762.88; Sherman street, second section, Carpenter & Anderson, $5,463.50; Water street, to the same, $8,368.40; Adams street, second section, $2,229.60.

Grand Rapids, Mich.—Paving East Fulton street with brick, to Carpenter & Anderson, $59,000; paving Fountain and Eastern avenue, to Harry Vanderveen, $2,798.14 for Fountain street and $7,590.96.

Greenville, Mich.—Constructing brick paving, to J. A. McKay, Clare, Mich.

Ishpeming, Mich.—Constructing two roads, one to John Hogan and the other to William Carmody.

Duluth, Minn.—The following contracts have been awarded: Constructing two miles of road, to John Bergman, $5,112.50; constructing 5½ miles of Byrne road, to John A. Johnson & Sons, $5,175; constructing 2¼ miles of the Aurora road, to W. J. Wallace, $2,365; constructing 1 mile of the Judd road, to W. J. Dundas, $900.

Meridian, Miss.—Constructing 7½ miles of Causeyville road, to the Healy Construction Co., $13,000 to $14,000.

St. Joseph, Mo.—Paving Charles street with Hassam, to the Rackliffe & Gibson Construction Co.

Superior, Neb.—Paving the intersection of Tower avenue and North Third street with macadam, to Diffor & Peterson.

Binghamton, N. Y.—The following contracts have been awarded: Road No. 963, to Lane Construction Corp., $53,208.40; road No. 5423, to W. J. Cowhig, Albany, N. Y., $72,381.50; road No. 5241, to W. E. Bennett, Lanesboro, Pa., $27,403; road No. 5215, to Semper Brothers, Watertown, N. Y., $21,391;

Dunkirk, N. Y.—The following contracts have been awarded: Paving East Front street and Courtney street with concrete curb and gutter, to the Dunkirk Construction Co., $16,990.41 for E. Front street and $16,697.41, to W. Courtney; paving Roberts road with asphalt, to McCormick & Son, $21,366.

Ilion, N. Y.—Paving John, West River and Railroad streets, to the Warren Brothers.

Lockport, N. Y.—Paving Locust street, to Henry P. Burgard, $51,525.56.

New York, N. Y.—The following bitulithic macadam paving contracts have been awarded: Locust street, to the Uvalde Contracting Co., $31,075; Third avenue, Fourth and Whitestone avenues, to the Standard Bitulithic Company, $54,486.50; Cooper avenue, to the Uvalde Co., $49,332.50; Union turnpike, to Standard Co.; Laurel Hill boulevard, to the Standard Co., $51,215; Hillside avenue, to the Uvalde Co., $16,580; Rocky Hill road, to the Uvalde Co., $56,742.50; Rockaway plank road, to the Uvalde Co., $90,515; Bell avenue, Willitss road, Fourteenth street and Eleventh avenue, to the Standard Co., $93,888; Jackson avenue, Warren Quinlan Contracting Co., $57,804.75; Trotting Course lane and Woodlawn avenue and Jamaica road, to the Standard C., $58,420; Mott avenue, Central avenue, Washington avenue, Standard Co., $50,865; Little Neck road and Floral Park road, Standard Co., $59,797.50; Springfield road and Lincoln avenue, to the Uvalde Co., $81,225.

Nunda, N. Y.—Constructing the Portage, Nunda-Mt. Morris road, to the following: Part 1, to G. R. March, Philadelphia, Pa., $50,769.08; part 2, to Thomas F. Murray, Le Roy, N. Y.; part 3, to Harradine Bros., Spencerport, $80,245.10.

Cincinnati, O.—Paving Ravine street with bituminous macadam, and Belldare avenue with brick, to the Kirchner Construction Co.

Cincinnati, O.—Paving Mozart avenue with brick, to the Kirschner Construction Co., $11,710.

Dayton, O.—The following contracts have been awarded: Paving Hawthorne street, to the J. E. Conley Co., $7,875.60; paving Dunbar street, to the same, $6,819.30.

Dayton, O.—Repairing the asphalt streets of the city, to the Andrews Asphalt Co.

Elyria, O.—Constructing pavements on E. River street, Harrison street, Seventh street and East Broad street, to the Elyria Construction Co.

Steubenville, O.—The following paving contracts have been awarded: Washington street, to H. M. Bates, $4,814.75; Wilkins street, to John O. Bates, $9,821.55; Wellesley avenue, to H. M. Bates, $18,684.70; Madison avenue, to H. M. Bates, $1,664.20; alley C, to F. H. Patterson, $656.50.

Eugene, Ore.—Paving six blocks, to the Clark & Henery Construction Co., $20,000.

Portland, Ore.—Paving Twentieth street with bitulithic, to the Pacific Bridge Co., $18,516.

Harrisburg, Pa.—Constructing 10,115 ft. of state road, to J. F. Shanley Co., Philadelphia, Pa., $27,331.37; constructing 10,756 ft. of state road, to Baker-Owen Co., Johnstown, $40,791.08; constructing 4 miles of state road, section one, 14,807 ft., to South Shore Construction Co., $53,109.10; section two, 9,632 ft., to the Northwestern Construction Co., $35,819.09.

Lancaster, Pa.—Constructing 10,334 ft. of asphaltic macadam road, to George C. Souder, $31,280.08.

McKeesport, Pa.—Repaving Fawcett avenue, to Daniel Stratton.

Shenandoah, Pa.—Repaving Main street, to John A. Leffler.

Wilkes-Barre, Pa.—Paving Cunyngham avenue and the extension of Bennett street, to John E. James.

Nashville, Tenn.—Constructing concrete sidewalks on Fourteenth avenue, to the Fisher Concrete Co., 13½c per sq. ft.

Marinette, Wis.—Paving several streets, to Magnuson & Lundin.

CONTEMPLATED WORK.

Talladega, Ala.—A $25,000 bond issue for street improvement has been voted.

St. Petersburg, Fla.—A $65,000 bond issue for street paving and a storm sewer has been voted.

Cordele, Ga.—A $40,000 bond issue for paving construction has been voted.

Aurora, Ill.—The construction of a brick pavement on Broadway and Washington streets is contemplated. Roy White, secy.

Effingham, Ill.—A $35,000 bond issue for road improvement has been voted by Douglass township.

Brazil, Ind.—City Engineer F. Kattman has been authorized to prepare plans for the paving of East Cole street, McDonald street and Washington street with vitrified brick.

Pikeville, Ky.—The city is contemplating the construction of about 25,000 sq. yds. of brick paving within the next 12 months. Plans are now being prepared. Amick and Haynes, city engineers.

Bridgeport, Mich.—A $20,000 bond issue for road improvement has been voted.

Ludington, Mich.—A $50,000 bond issue for street improvement has been voted. G. W. Clark, city engineer.

Minneapolis, Minn.—Winona county will construct 16 mi. of concrete road in the near future.

Galena, Mo.—A $10,000 bond issue for road improvement has been voted.

Springfield, Mo.—A $10,000 bond issue for road improvement has been voted.

Natchez, Miss.—A $150,000 bond issue for road construction has been voted. Clerk board of supervisors, Adams county.

Atlantic City, N. J.—A $35,000 bond issue for paving improvement has been voted.

Hoboken, N. J.—A $25,000 bond issue for repaving has been voted.

Woodbridge, N. J.—A $25,000 bond issue for street improvement has been voted.

Forestville, N. Y.—A $12,000 bond issue for paving has been voted.

Mechanicsville, N. Y.—A $46,241 bond issue for paving construction has been voted.

Minster, O.—A $20,000 bond issue for water works improvement and a $25,000 bond issue for street improvement has been voted.

Toledo, O.—The following bond issues have been voted: $25,660.21 for the improvement of Detroit avenue, No. 7; $1,897.50 for the improvement of Mulberry street, No. 3.

Youngstown, O.—A $1,000 bond issue for improving Gladstone street, and a $2,075 bond issue for improving Saranac avenue, have been voted.

Glenolden, Pa.—A $30,000 bond issue for street improvement has been voted.

Rockwood, Pa.—A $5,000 bond issue for street paving and sewering has been voted.

Yeadon, Pa.—The city council has passed an ordinance providing for a $20,000 bond issue for street improvement.

Athens, Tex.—A 35,000 bond issue for road improvement has been voted.

Taylor, Tex.—A $25,000 bond issue for paving improvement has been voted.

Waxahachie, Tex.—A $25,000 bond issue for paving construction has been voted.

Lawrenceville, Va.—A $75,000 bond issue for road construction has been voted.

Waynesboro, Va.—A $250,000 bond issue for road improvement has been voted.

Crandon, Wisc.—A $5,000 bond issue for road improvement has been voted.

SEWERS.

BIDS REQUESTED.

Mobile, Ala.—Aug. 5, 12 m. Laying 22,000 lin. ft. of storm sewers, ranging from 12-in. tile pipe to 5½x8-ft. concrete culvert, with about 30,000 ft. of 6-in. and 10-in. laterals; also laying 18,900 sq. yds. of creosoted wood block, 16,000 yds. of asphalt, 12,700 yds. vitrified brick on concrete foundation, 220 yds. of gravel and 25,000 lin. ft. of granite curbing. Wright Smith, city engineer.

New Orleans, La.—Aug. 24, 12 m. Constructing a reinforced concrete siphon under the New Basins Navigation canal at Broad street. Certified check, $1,000. F. S. Shields, secretary; Geo. G. Earl, general superintendent.

Columbus, O.—Aug. 14, 12 m. Constructing a sewage disposal plant and appurtenances at the State Serum farm. Bond, 50 per cent. The Ohio State Board of Agriculture. A. P. Sandles, secretary; A. Elliott Kimberly, 8 East Long street, sanitary engineer.

Reading, O.—Aug. 5, 12 m. Constructing sanitary sewers in the village. Certified check, $1,000. Daniel S. Hasbrook, village engineer; Wm. F. Klopmeyer, celrk.

Exeter Borough, Pa.—Aug. 6, 8 p. m. Constructing sewers in Wyoming avenue. Certified check, $300. Wm. F. Dougherty, secretary of borough council; James E. Langan, borough engineer.

New Castle, Pa.—Aug. 12, 8 p. m. Constructing a storm sewer in the Second ward. Certified check, $500. Constructing a storm sewer in the Seventh ward. Certified check, $200. Perry Williams, city clerk.

Aberdeen, S. D.—Aug. 19, 10 a. m. Constructing sewers in First avenue and North Lloyd street, including 732 ft. of 8-in. pipe, 366 ft. of 10-in. pipe and 3 manholes. Certified check, $500. F. W. Raymond, city auditor.

CONTRACTS AWARDED.

Danville, Ill.—Constructing a sanitary sewer, to E. R. Harding, of Racine, Wis.

Decatur, Ill.—Constructing several sewers. to Arthur Birt; one, $449.40, and another, $45.60.

Rockford, Ill.—Constructing sewers in Harlem and Daisy avenues, to Mulholland & Kuehn, $2,431.50.

Elkhart, Ind.—The following sewer contracts have been awarded: Indiana avenue, sewer, to the Elkhart Construction Co.; Fulton street and Arcade avenue, to Frank J. Miller.

Goshen, Ind.—Constructing a trunk sewer, to Charles E. Kutz, $6,450.

Julietta, Ind.—Constructing a sewage disposal plant at the insane asylum, to Dennis Bush, $1,744.

Cedar Falls, Ia.—Constructing 4,350 ft. of sanitary sewer, to the Blackhawk Construction Co., Waterloo, Ia.

Des Moines, Ia.—Constructing the Tiffin and Oxford avenues sewer, to O. P. Herrick, at $1.03 per ft.

Keokuk, Ia.—Constructing four blocks of sanitary sewer, to Frank L. Griffey & Co.

Sioux City, Ia.—Constructing a sanitary sewer in West Sixth street, to D. C. Armstrong, 48 cents per ft.; constructing a sanitary sewer in West Twentieth street, to D. C. Armstrong, 48½ cents per ft.

Hutchinson, Kas.—Constructing several small sewer laterals in various parts of the city, to Polly & Welchon.

Boston, Mass.—The following sewer contracts have been awarded: Constructing a pipe sewer in Plymouth court, to Timothy Coughlin, $588.45; constructing pipe surface drains in Deering and Westmore roads, to R. Cartullo, $1,564.95; constructing pipe sewer and drain in Commonwealth avenue, to George J. Regan, $1,262.50.

Sturgis, Mich.—Constructing several sewers, to F. M. Benner & Co., Marion, Ind., $38,793.50; constructing a sewage disposal plant, to Andrew Geek, Owosso, Mich., $8,647; constructing a pumping station, to F. M. Benner & Co., $945.

Lewiston, Mont.—Constructing a sewer for the east side, to R. M. Barsden & Co., $47,800.

Batavia, N. Y.—Constructing sewer in the Second ward, to Frank, George and Arthur J. Shaw, $44,341.

Dunkirk, N. Y.—Constructing a 10-in. sewer on King street, to Ella Colgan, $393.35.

North Tonawanda, N. Y.—Installing several miles of sewer, to the Frontier Contracting Co., Buffalo, N. Y., $5,442.45.

Monroe, N. C.—Constructing a sewer system, to G. Jaeger, Rich Hill, Mo., $24,000.

Columbus, O.—Constructing the Milo extension sewer, to J. C. Beasley, $30,000 or $35,000.

Erie, Pa.—Constructing a 12-in. sewer in Fifteenth street, to Ed Driscoll.

Franklin, Pa.—Constructing sewers on Atlantic avenue and First street, to Burns Bros., New Castle, Pa.

New Castle, Pa.—The following sewer contracts have been awarded: Sanitary sewer in Sankey street, to W. H. Mayberry, $266.26; sanitary sewer in Stanton avenue, to Charles Staph, $317.90; sanitary sewer in Connor street, to W. H. Mayberry, $186.76; sanitary sewer in Moravia street, to Mr. Staph, $393.86.

Philadelphia, Pa.—The following sewer contracts have been awarded: Twelfth street sewer, tô Emilo Pascuzzi, $62,595; constructing sewer in Delaware avenue, to John McMenamy, $29,365; constructing the Rock Run sewer extension in Tenth and Eleventh streets, to the Cantrell Construction Co., $17,495; constructing manholes and inlets, to Vincent Jafalla, $900.

Aberdeen, Wash.—Constructing pavements and sewers, to the Warren Construction Co., $180,890.40.

CONTEMPLATED WORK.

Athens, Ala.—A $38,000 bond issue for sewer extension has been voted.

Bakersfield, Cal.—A $21,000 bond issue for sewer improvement has been voted.

Los Gatos, Cal.—Frank A. Nikirk, town engineer, has prepared plans for improving the sewerage system at an estimated cost of $11,890.

San Diego, Cal.—Councilman A. E. Dodson has authorized to extend $7,000 for new sewers.

Taft, Cal.—A $25,000 bond issue for sewer improvement has been voted.

St. Petersburg, Fla.—A $65,000 bond issue for street paving and a storm sewer and a $20,000 bond issue for sewer extensions and and improvement have been voted.

Cordele, Ga.—A $5,000 bond issue for sewer extensions has been voted.

White Hall, Ill.—An ordinance providing $30,000 for a sewer system has been adopted.

Hobart, Ind.—The city is preparing plans for a $60,000 sewer system.

Lebanon, Ind.—Plans for a sanitary sewer system have been adopted by the city council.

Howell, Mich.—A $48,000 bond issue for sewer construction has been voted.

Marshall, Mich.—The construction of a system of storm sewers, at an estimated cost of $25,000, is contemplated.

Binghamton, N. Y.—A $25,000 bond issue for sewer improvement has been voted.

Mamaroneck, N. Y.—Hering & Gregory, consulting engineers, 170 Broadway, New York City, are preparing plans and specifications for a sewage disposal works. J. M. Duffy, village engineer.

Cleveland, O.—Plans and specifications are being prepared for sewage disposal plants.

Youngstown, O.—The construction of a sewer in Loveless avenue is contemplated.

Pond City, Okla.—Plans and specifications for a sanitary sewer system have been prepared by Benham Engineering Co., 812-14 American National Bank building, Oklahoma City, Okla., at an estimated cost of $20,000.

Darby, Pa.—A $40,000 bond issue for sewer construction has been voted.

New Kingston, Pa.—A $40,000 bond issue for a sewage disposal plant and a $75,000 bond issue for sewer and street improvement have been voted.

Somerset, Pa.—A $5,000 bond issue for street paving and sewers has been voted.

Highmore, S. D.—A $16,000 bond issue for sewer improvement has been voted.

Dallas, Tex.—A $10,000 bond issue for sanitary sewer improvements has been voted.

Paris, Tex.—A $140,000 bond issue for sewer and fire departments has been voted.

Sweetwater, Tex.—A $35,000 bond issue for sewer improvement has been voted.

Princess Anne, Va.—A $10,000 bond issue for water and sewer extensions has been voted.

WATER WORKS.

CONTRACTS AWARDED.

Belleville, Ill.—Laying 1,000 ft. 4-in. water pipe and installing three hydrants, to H. H. Hall Construction Co., East St. Louis, Mo.

Columbus, Ind.—Constructing a mechanical filter, to the Roberts Filter Co., Philadelphia, Pa.

North Attleboro, Mass.—Furnishing a pumping engine to the Epping-Carpenter Co., $7,410.

Fulton, Mo.—Constructing a new water works system, to Thomas Peters, St. Louis, Mo., $25,000.

New Kensington, Pa.—Constructing a filter plant, to Henry S. White, New Kensington, Pa.

CONTEMPLATED WORK.

Haleyville, Ala.—A $20,000 bond issue for water works improvement has been voted.

Pasadena, Cal.—A $1,250,000 bond issue for water works improveemnt has been voted.

Oak Creek, Colo.—A $30,000 bond issue for water works construction has been voted. Allen Cliff, town clerk.

St. Petersburg, Fla.—A $200,000 bond issue for water works improvement has been voted.

Cordele, Ga.—A $40,000 bond issue for water works construction has been voted.

Clarks Fork, Ida.—The construction of a water works system is contemplated.

Logansport, Ind.—Plans and specifications have been prepared for a filtration plant by B. T. Clifford, engineer.

Paoli, Ind.—Constructing extensions to the water works system, to William Hoffman, French Lick, Ind.

Gilman, Ia.—A $12,000 bond issue for municipal water works system has been voted.

Lehigh, Ia.—A $20,000 bond issue has been voted for the erection of a water works and electric light plant.

Clearwater, Kas.—A $23,000 bond issue for water works and light has been voted.

Horton, Kas.—A $38,000 bond issue has been voted for improving the city water works.

Topeka, Kas.—The city will purchase, this fall, a $20,000 pump and will build a pumping station for the city water works plant.

Royal Oak, Mich.—A $33,000 bond issue for a water works system has been voted.

Gibbon, Minn.—A $3,000 bond issue for water works improvement has been voted.

Madison, Minn.—A $50,000 bond issue for water works and electric light improvement has been voted.

Homer, Neb.—A $10,000 bond issue for water works improvement has been voted.

Winnebago, Neb.—A $9,000 bond issue for a water works system has been voted.

Baltimore, Md.—The construction of a filtration plant at a cost of $1,633,000 is contemplated.

Seneca Falls, N. Y.—The Seneca Falls Waterworks Company intends to install a filtration system at their source of supply, at the north end of Cayuga lake. Cost, $30,000.

Lakewood, O.—Mayor J. B. Coflinberry has asked the city council to propose $150,000 of bonds for a filtration plant and a municipal water works system.

Minster, O.—A $20,000 bond issue for water works extension has been voted. A $25,000 bond issue for street improvement was also voted.

Steubenville, O.—The city council has secured an option on a site for a water filtration plant. D. J. Sinclair, chairman of water commission.

Zanesville, O.—Hering and Gregory, consulting engineers, 170 Broadway, New York City, are preparing plans and specifications for a new and improved water supply system.

Cheyenne, Okla.—A $60,000 bond issue for water works construction has been voted.

Hastings, Okla.—A $15,000 bond issue for the completion of the water works system has been voted.

Camden, S. C.—A $10,000 bond issue for water and light improvement has been voted.

Dallas, Tex.—A $1,025,000 bond issue for water works improveemnt has been voted.

Winnesboro, Tex.—A $23,000 bond issue for water works improvement has been voted.

Bridgewater, Va.—A $25,000 bond issue for water works improvement has been voted.

Dublin, Va.—A $10,000 bond issue for water works improvement has been voted.

Princess Anne, Va.—A $10,000 bond issue for water works improvement has been voted.

Oakville, Wash.—A $6,000 bond issue for water works improvement has been voted.

BRIDGES.

BIDS REQUESTED.

Seale, Ala.—Aug. 12, 12 m. Constructing a 90-ft. concrete arch bridge over Little Uchee creek. Certified check, $400. W. S. Keller, state highway engineer.

Brownstown, Ind.—Aug. 5, 1 p. m. Constructing repairs to the Cavanaugh bridge across the Muscatatuck river. Commissioners of Jackson county.

Crown Point, Ind.—Aug. 6, 12 m. Bridge construction as follows: Two bridges in Ross township and one in Cedar township. Chas. A. Johnson, auditor.

Huntington, Ind.—Aug. 7, 10 a. m. Constructing three bridges as follows: One reinforced concrete bridge over Little river at Huntington, the Clark street bridge over the Wabash river, and the Funderburg bridge. H. Guthrie, auditor.

Rensselaer, Ind.—Aug. 5, 2 p. m. Bridge construction as follows: One bridge in Union township; one bridge in Walker township; three bridges in Barkley township and one bridge in Kankakee township. Jos. P. Hammond, auditor.

Marion, Kas.—Aug. 8. Constructing a 40-ft. span reinforced concrete bridge and a 32-ft. span reinforced concrete bridge. R. E. Reimer, county clerk.

Duluth, Minn.—Aug. 5, 10 a. m. Constructing a concrete culvert across the State Line creek. Certified check, 10 per cent. Aug. R. Norman, county auditor.

Cincinnati, O.—Aug. 9. Constructing bridges and culverts on the Batavia road. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cincinnati, O.—Aug. 16. Constructing a concrete bridge on Neeb road. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Columbus, O.—Aug. 9, 12 m. Constructing a reinforced concrete arch bridge over Black Lick creek on East Broad street. Certified check, $500. F. M. Sayre, county auditor.

Lebanon, O.—Aug. 6, 11 a. m. Constructing a high truss steel bridge with creosoted block floor and concrete abutments over Clear creek. Certified check, $500. T. C. Patterson, county auditor.

Wauseon, O.—Aug. 7, 10 a. m. Bridge construction as follows: Sub and superstructure, 130 ft. in length, 14-ft. roadway on bridge No. 214. Commissioners of Fulton county.

Indiana, Pa.—Aug. 7. Constructing a double reinforced concrete bridge over Two Lick creek. J. Bennett, A. M. Ansley, J. M. Wakefield, commissioners of Indiana county.

Washington, Pa.—Aug. 7, 12 m. Constructing a steel pony truss bridge of 35-ft. span, known as Ely bridge over Wheeling creek. Certified check, $300. John H. Moffitt, county controller; Chaney and Armstrong, engineers.

CONTRACTS AWARDED.

Fosterburg, Ill.—Rebuilding the Bartlow bridge, to Miller and Borcherding, St. Louis, Mo.

Hillsboro, Ill.—Constructing the concrete bridge on Wood street, to Driscoll McCallman, Decatur, Ill.

Millbrook, Ill.—Constructing two new bridges between Five Corners and Newark, to E. B. Sleezer.

Quincy, Ill.—The following bridge contracts have been awarded: A steel bridge on North 12th street, to the Michelmann Steel Construction Co., $1,170; a bridge over Pigeon creek, in Section 36, to the Illinois Steel Bridge Company; a small bridge in Section 4, to Emmet Johnson.

Muncie, Ind. — Constructing several bridges across Kilbuck creek, to the Indiana Bridge Company; constructing the Jordon concrete bridge, to S. B. Royse, $648.

Terre Haute, Ind.—Constructing the federal bridge in Riley township, to Osceola Lowe, $537.

Milltown, Ind.—Constructing a steel bridge, to the Vincennes Bridge Co., Vincennes, Ind., $2,998.

Clinton, Ia.—Constructing 16 bridges in three groups, A. B and C: Group A and C, to the Clinton Bridge and Iron Works, Group A, $4,816.85; Group C. $5,064.90; Group B, to J. R. Kane, $10,015.85.

Leavenworth, Kas.—The following bridge contracts have been awarded: Two concrete steel bridges, to G. F. Dillon; the Dick Miller bridge, to John Pierce, $945; repairing the Doege bridge, to the same, $134; Ward road bridge, to the same, $790; the Opliger bridge, $884, and the Bush creek bridge, $590, to Goldberg and Son; the Ryan bridge, to Missouri Valley Bridge and Iron Works, $627; repairing the Little Stranger bridge, to the Leavenworth Bridge Company, $285; the Salt Creek bridge, to J. F. Mottin; repairing the Plum creek bridge, to the same, $118; repairing the Zimmerman bridge, to the same, $193.

Topeka, Kan.—Constructing a bridge over Kaw river, to the Leavenworth Bridge Co., $29,500.

Saginaw, Mich.—Constructing the substructure of the Johnson street bridge, to W. N. Sager, $28,477.77, and the superstructure to the Detroit Bridge and Steel Co., $44,200.

Kansas City, Mo.—Constructing concrete work on the Broadway viaduct, to the Concrete Foundation Company, $50,000.

Palmyra, Mo.—Constructing 17 iron bridges, to the Dildine Bridge and Construction Company, Hannibal, Mo.

Salamanca, N. Y.—Constructing the Main

street bridge, to the Owego Bridge Company.

New York, N. Y.—Constructing an underground passage to the Brooklyn bridge, to the North Eastern Construction Co., $408,-883.

Hicksville, O.—Constructing a bridge over the St. Joe river at Nashville, to George Japp, Ft. Wayne.

Allentown, Pa.—Constructing the 8th street bridge, to the McArthur Bros., New York City, $512,000.

Hazelton, Pa.—Constructing a concrete bridge, to the McArthur Bros., New York City, $500,000.

Lockhaven, Pa.—Constructing substructure of the McElhattan river bridge, to Robert Myers.

Norristown, Pa.—Constructing steel superstructure over Tacony creek, to G. W. Ensign, Camp Hill.

Phoenixville, Pa.—Constructing an arch bridge over Bridge street, to Enos L. Seeds, Philadelphia, Pa.

Reading, Pa.—Repairing the Conners' Crossing bridge, to R. A. Simmons, Pottsville, Pa. Erecting a bridge over Manatawny creek, to Bland and Company, Philadelphia, Pa.

Washington, Pa.—Rebuilding bridge over the Monongahela river, to the Capital Construction Co., Columbus, O., $31,091.50.

Columbus, S. C.—Constructing a bridge over Hampton creek, to M. Goode Homes, $2,131.

Rock Hill, S. C.—Constructing a bridge over King's creek, to the Roanoke Bridge Company.

Greenville, Tex.—Constructing a concrete bridge over Sabine river, to the El Paso Bridge Company.

De Pere, Wis.—Constructing a reinforced concrete bridge, to Martin Pink, of Woodville.

London, Wis.—Constructing the Shawano-Door street bridge, to the Worden Allen Co., Milwaukee, Wis., $15,885.

CONTEMPLATED WORK.

Quincy, Ill.—The board of supervisors have appropriated $14,939 for bridge construction.

Jackson, Miss.—Bids will be asked soon for a steel bridge over Pearl river, near Jackson. Board of supervisors of Hinds and Rankin counties.

Springfield, Mo.—The construction of a steel bridge over Wilson creek is contemplated.

San Angelo, Tex.—A $70,000 bond issue for bridge construction has been voted.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTRACTS AWARDED.

Pasadena, Cal.—Constructing an incinerator plant, to William C. Crowell, $46,000.

CONTEMPLATED WORK.

Kansas City, Mo.—The construction of a garbage incinerator is contemplated. The estimated cost is $100,000.

Kenmore, O.—The construction of a garbage and sewage disposal plant is contemplated.

Morgantown, W. Va.—A site for the proposed garbage disposal plant has been obtained and bids will be asked immediately by the mayor and three members of the council.

STREET LIGHTING.

BIDS REQUESTED.

Fremont, O.—Lighting the city for a period of 10 years, to the Yarman Company, $57.50 per lamp, per year.

CONTRACTS AWARDED.

Olivet, Mich.—Lighting the streets of the village, to the Commonwealth Power Co.

Rochester, N. Y.—Lighting the streets of the city, for 5 years to the Rochester Railway and Light Co., $350,941 per year.

CONTEMPLATED WORK.

Port Byron, Ill.—The construction of a street lighting system is contemplated by the village. W. D. Hall, president of village board; F. B. Skelton and G. B. Tolman, light committee.

Lehigh, Ia.—A $20,000 bond issue for the erection of a water works and electric light plant has been voted.

Clearwater, Kas.—A $32,000 bond issue for water works and light improvement has been voted.

Norton, Kas.—A $20,000 bond issue for the construction of an electric light plant has been voted. R. M. Hemphill, city clerk.

Grand Rapids, Mich.—The installation of an ornamental lighting system on North Division avenue is contemplated.

Ellwood, Neb.—A $5,000 bond issue for electric light improvements has been voted.

Bellevue, O.—An ordinance providing $35,-000 for an electric light plant has been voted

Olmstead Falls, O.—A $5,000 bond issue for electric light improvements has been voted. A. E. Atkinson, village cuerk.

Sharon, O.—The city council has voted to build a municipal electric light plant at an estimated cost of $85,000.

Wellsville, O.—A $60,000 bond issue for a municipal lighting plant has been voted. A. S. Campbell, clerk of council.

Oklahoma City, Okla.—The Oklahoma Gas & Electric Co. will install street lights for the city.

Norristown, Pa.—The city has purchased a site for an electric light plant.

Camden, S. C.—A $100,000 bond issue for water and light improvement has been voted.

Garretson, S. D.—A $6,000 bond issue for electric light improvements has been voted. C. O. Berdahl, mayor.

FIRE APPARATUS.

BIDS REQUESTED.

Sharon, Pa.—Aug. 6, 12 m. Furnishing an automobile fire engine. Oscar J. Denny, borough secretary.

CONTEMPLATED WORK.

Bakersfield, Cal.—A $60,000 bond issue for the fire department has been voted.

St. Petersburg, Fla.— A $10,000 bond issue for fire department improvement has been voted.

Quitman, Ga.—A committee has been authorized to purchase an automobile fire truck, similar to those used in Macon, Augusta and Savannah.

Council Bluffs, Ia.—The purchase of a new auto fire truck and a street flusher and the building of a new fire station is contemplated by the city council.

Waterloo, Ia.—The purchase of a motor combination chemical and hose truck is contemplated by the city. City clerk.

Lynn, Mass.—A $28,500 bond issue has been voted for motor fire apparatus.

Albany, N. Y.—The purchase of several tractors is contemplated by the city.

Pittsburgh, Pa.—Director Morin, of the Department of Public Safety, has asked for a $700,000 bond issue for motor fire and police apparatus.

Dallas, Tex.—A $125,000 bond issue for fire department improvement has been voted.

Paris, Tex.—A $140,000 bond issue for sewer and fire department has been voted.

Municipal Engineering.

VOLUME XLIII SEPTEMBER, NINETEEN HUNDRED TWELVE NUMBER THREE

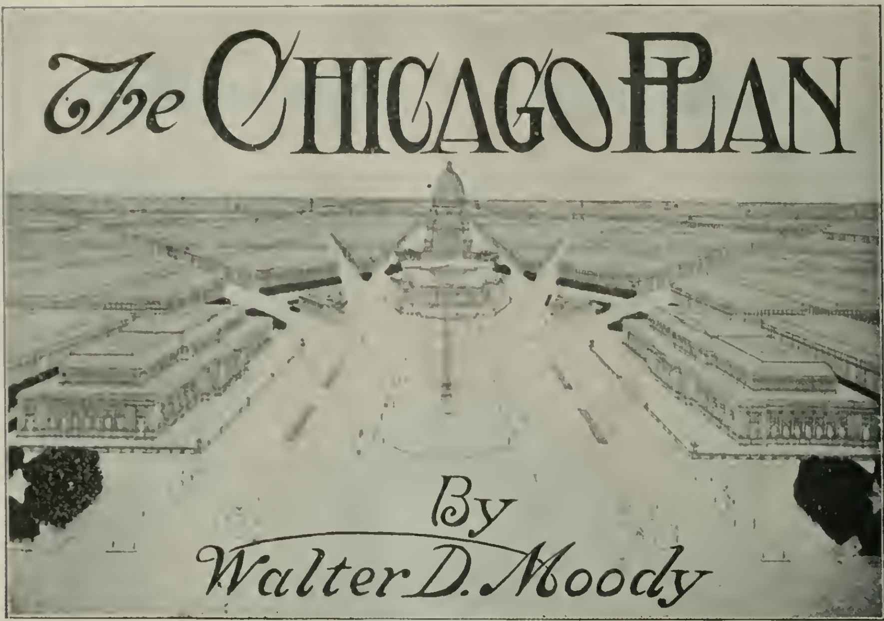
THE CHICAGO PLAN COMMISSION.

IN this issue we publish an article by Walter D. Moody, managing director of the Chicago Plan Commission, and written by him especially for MUNICIPAL ENGINEERING.

WALTER D. MOODY.

In 1907 the first Chicago Plan Committee of the Commercial Club was organized, with Charles D. Norton as chairman and Charles H. Wacker as vice-chairman. These leaders retained their respective offices until 1909, when Mr. Norton resigned to take up his residence in Washington, and Charles H. Wacker succeeded him as chairman of the committee. On July 6, 1909, Fred A. Busse, mayor of Chicago, sent a message to the city council requesting authority to appoint members of a permanent organization to be known as the Chicago Plan Commission. This authority was immediately granted, and on November 1, 1909, the mayor announced the appointment of three hundred twenty-eight citizens to form the first Chicago Plan Commission, and designated Mr. Wacker, who was the chairman of the Commercial Club Committee, to be permanent chairman of the new commission. At the first meeting of the commission Frank I. Bennett was elected vice-chairman, and Harry Bennett Chamberlain was chosen secretary pro tem., an office which he held until his resignation late in 1910. On January 13, 1911, the executive committee appointed Walter D. Moody, formerly general manager of the Chicago Association of Commerce, to be managing director of the Chicago Plan Commission. The plan of the commission, which is outlined by Mr. Moody in the following article, has been brought to the point of realization during the past year, due to the force of the personal efforts of the men behind the movement. The constant idea has been to adopt such a plan that all development and improvement should be along certain definite and prearranged lines, to the end that the necessary expenditures for public improvements from year to year may serve not only the purpose of the movement, but also the needs of the future. To assure the more intimate acquaintance of the city officials with the details of the plan, it was decided that members of the council and the heads of the various departments related to the work should be ex officio members of the commission.

The spirit that is making Chicago's Plan Commission a great factor in the city's progress is but the expression of the enthusiastic faith, self-confidence and fixity of purpose of its leaders, and to Mr. Moody is due no small amount of the credit for its success.—THE EDITORS.



ALL over the world there is, at this period, an astounding and unparalleled movement of people toward cities. The tendency of people to gather in close contact has always existed, but today is operating more strongly than ever in the history of man. Naturally this movement is creating new problems in municipal government. It is bringing up new tasks in social science, or the science of maintaining health and good order among people of different families and different races when brought closely in contact.

In the past the problem confronting the people of the cities was to provide gas, electric light, pure water, adequate schools and properly equipped public institutions for the sick and improvident. Today the problem in great cities is to provide light, air, ample means for healthful recreation, relief from congestion, facilitation of traffic, housing of the poor, scientific organization of charities, better public improvements and attractive surroundings for the multitudes swarming to the cities.

The great issue confronting American municipalities today is right citizenship in relation to City Planning. Right city planning is basic. A proper city plan, officially adopted and realized, for the direction of the growth of a city in an orderly and systematic way, practically affords a solution of the problem confronting our constantly expanding municipalities.

European cities have a distinct advantage over American cities in city planning. In Germany, France and England, where vast city planning projects are being carried out, the advantage lies in the fact that the work originates with the municipality and is usually aided financially by the government, and its direction, to some extent, is under government supervision. In American cities the reverse is true. Here city planning originates, as in the case of the Chicago Plan, with a small group of public-spirited citizens. Then follows a long and arduous campaign of education with the people to arouse civic interest in the city's welfare. When that is accomplished, usually an expression in the form of a popular demand follows. Plans are then submitted to city authorities, and the long and tedious process of administrative machiner, necessitated by legal procedure, ensues, and finally something tangible is accomplished. Achievements are made only in proportion as the people have gained knowledge of city interests.

Citizenship all right—the city will be all right. The cities all right—the nation will be all right, for our cities today control our country. The old order—national control by rural influence—has passed. The conservation of natural resources as a national asset of prime importance, is occupying the serious attention of the government, but what is more important than the conservation of public health in our large cities? Every human life is a national asset and should be carefully preserved.

THE CHICAGO PLAN.

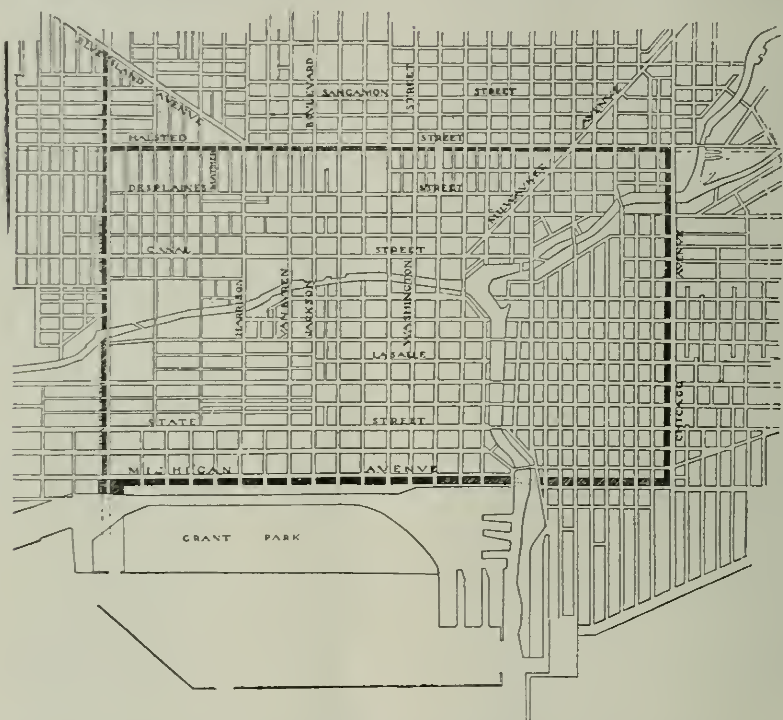
Front Elevation of the Proposed John Crerar Library Building, Chicago. This Structure Is to Be Erected in Grant Park. The Late John Crerar Endowed the Library. The Trustees Have a Building Fund of $1,000,000.

THE CHICAGO PLAN.

Field Museum of Natural History, Chicago. This Structure Is to Be Erected in Grant Park at a Cost of $4,000,000, Provided in the Will of Marshall Field.

Forty-three per cent. of the people of the United States now live in cities. Twelve per cent. live in three cities alone, Chicago, New York, and Philadelphia. It is a matter of government record, in countries where conscription to army service is compulsory, that the physique of the city dweller is degenerating. Only a relatively small percentage in congested cities are able to measure up to the strict requirements for military service. Germany is alarmed on account of this condition, and has undertaken a wide movement intelligently and systematically to direct proper city plans for bettering present city conditions, and for future growth.* England, during the Boer War, and the United States, during the Spanish-American War, found the conditions described existing to a very alarming extent.

The city of Chicago has been quick to appreciate the necessities arising from modern day municipal problems—which the experience of European cities has proven can be solved only thro the adoption and realization of an official plan designed to direct the future growth of the city in an orderly and systematic way. Such is the Chicago Plan which the city has placed in the hands of the Chicago Plan Commission for study and execution. The Plan in its inception gained nation-wide prominence as the "Chicago Beautiful" plan. It has since become internationally known as the Plan of Chicago. A more appropriate title than Chicago Beautiful is Chicago Practical, since the Plan deals directly with the three greatest problems confronting every metropolitan community—relief of congestion, facilitation of traffic and the conservation of public health.



THE CHICAGO PLAN.

Plan of the Quadrangle. Bounded by Twelfth Street on the South, Halstead Street on the West, Chicago Avenue on the North and Michigan Avenue on the East. It is the Purpose of the Commission to Complete This Square as the First Great Necessary Step in Carrying Out the Plan.

The origin of the Chicago Plan dates back to the World's Columbian Exposition in 1893. A few of Chicago's leading men, who were members of the Commercial Club of Chicago, and directors of the exposition, perceiving the splendid and convenient arrangement of the streets, the practical grouping of the buildings, and the general beautification and magnifi-

*Dr. Grimshaw's article on page 161 of this issue explains the city planning situation in Germany.

cence of the entire scheme, decided that if some of the more practical and main essentials of the plan of the exposition could be embodied in a plan for Chicago, the undertaking would be worthy of their efforts and fraught with the greatest possible significance to the city.

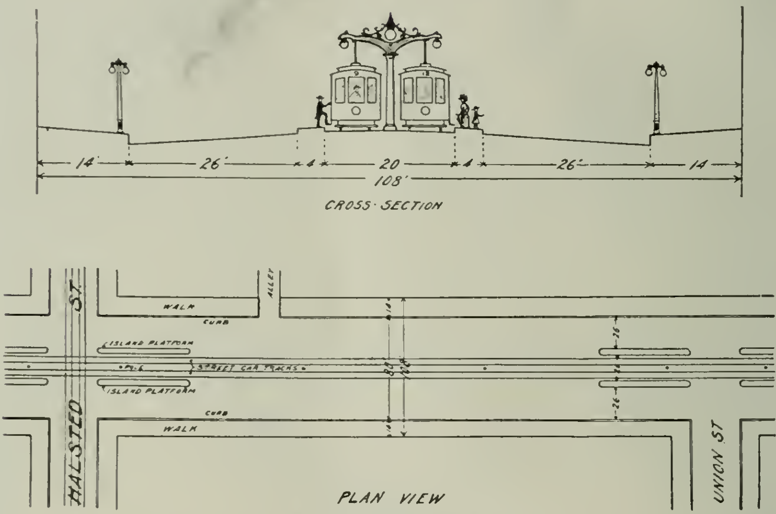
At almost the same time the Merchants' Club of Chicago became interested, and work on a plan was formally undertaken by this club in 1903, and was well under way when that club was merged with the Commercial Club in 1907, under the name of the latter. In producing the Plan of Chicago the Commercial Club spared neither time, money nor effort. Daniel H. Burnham, world-renowned architect and city planner, took charge of the details of the plan, and gave his genius to the task without charge. The World's Fair—the work of Daniel H. Burnham—was designed upon Athenian lines. So also was the great Haussmann plan for the rebuilding of the city of Paris. The people of Athens were the greatest city planners of any time. Athenian lines of architecture and grouping of buildings and arrangement of streets have since been made the basis of every city plan of any magnitude. Pericles found Athens a city of mud and left it a city of marble. In 1908 the charts, maps and drawings necessary for carrying out the plans were completed, and these, together with subject-matter

THE CHICAGO PLAN.
Proposed Boulevard to Connect the North and South Sides of the River. Looking North from Washington Street. (Painting by Jules Guerin.)

relating thereto, were arranged in a magnificent volume published by the Commercity Club.

Thus, after years of study and hard work by the Commercial Club members, the plan was completed and ready for submission to the citizens in the early fall of 1909. Then it was evident to the leaders of the movement that the time had come to engage the interests of the public and to put the plan into the hands of the representatives of the people. After conferring with the city authorities, it was decided to create a permanent organization to be known as the Chicago Plan Commission. This body, it was decided, should be composed of a large number of of the following boards—education, library, park boards and sanitary district—should be ex-officio members of the Commission, and that the membership of persons appointed because of official position should cease when they retired from office, the membership to be assumed by their successors.

The central idea out of which the Chicago Plan has grown is: If Chicago is to become, as we believe, the greatest and most attractive city of this continent, its development and improvement should be guided along certain definite and pre-arrange lines, to the end that the necessary expenditures for public improvements from year to year may serve not only the



THE CHICAGO PLAN.
Plan of the New Twelfth Street. Plan Below Shows "Islands" on Both Sides of the Car Track for Safety in Entering and Leaving Street Cars.

men of influence to be representatives of the business and social interests of the city.

On July 6, 1909, the Hon. Fred A. Busse, (mayor of Chicago,) sent a message to the city council requesting authority to appoint this commission, which authority the council granted. On November 1, 1909, the Mayor sent a second message to the city council announcing the appointment of three hundred twenty-eight citizens of Chicago as members of the Chicago Plan Commission. To secure at all times adequate representation on the Chicago Plan Commission of the city government and all other locally interested governmental agencies, it was decreed that members of the city council, the corporation counsel, commissioner of public works, city engineer, health commissioner, and the presidents purpcse of the moment, but also the needs of the future.

The Chicago Plan is not a scheme for spending untold millions of dollars, now or in the future. On the contrary, it is a comprehensive suggestion of what may be accomplished in the course of years by spending, in conformity with a well-defined plan, the money which must be spent from time to time on permanent public improvements. The Chicago Plan is in conflict with no other plan or project for the industrial or commercial development of Chicago.

Looking west from the lake front, the city, when developed in accordance with the Chicago Plan, will present wonderful harmony of detail—continuity of design typifying scientific arrangement. It will be seen from this brief description that the Chicago Plan will direct the fu-

THE CHICAGO PLAN.
Field Museum as Shown in the Model of Grant Park, Chicago.

ture growth of the city in a systematic and orderly way, and it has to do primarily with the relief of congestion, the facilitation of traffic and the safety and preservation of the public health of our citizens. In the interests of the latter, the Plan demands more and larger parks and playgrounds, and better and wider streets.

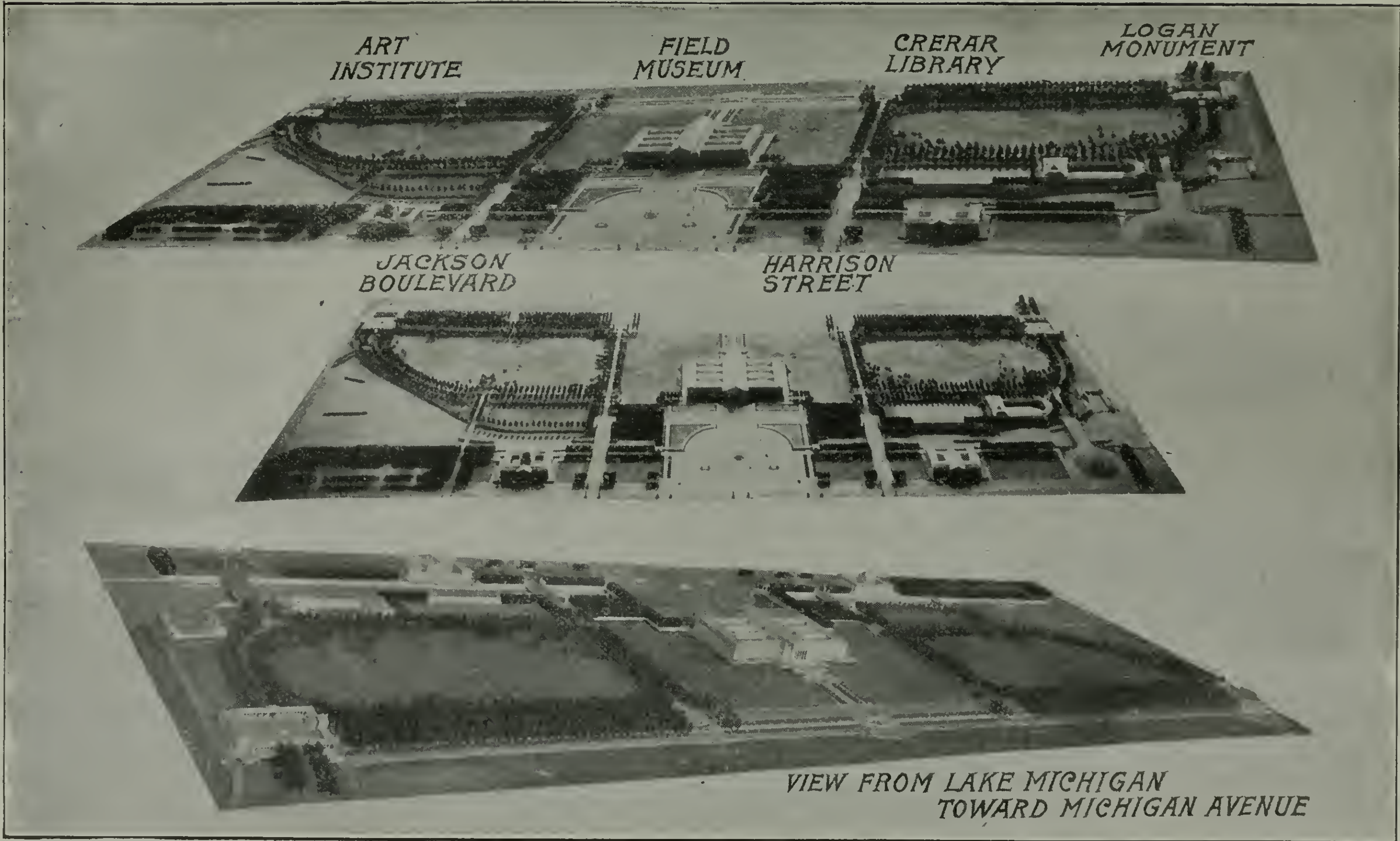
The Commission has delivered lectures on the Chicago Plan illustrated with stereopticon views, in every part of the city of Chicago, to a variety of audiences, all of which were highly interested in, and in sympathy with the plans of the Commission. The Commission compiled and distributed 165,000 copies of a booklet entitled "Chicago's Greatest Issue—an Official Plan," intended to popularize the Chicago Plan and to familiarize all our citizens with its provisions and the necessity for its adoption. The Commission also prepared a text-book entitled "Wacker's Manual of the Plan of Chicago," which was adopted as a regularly accredited study in the eighth grade of the Chicago public schools. Fifteen thousand copies were distributed to the school children, in the belief that right citienship in relation to city planning is one of the greatest issues confronting any growing American municipality today. The book is intended to accomplish two objects—first drawing the sympathy of the parents to the Plan, and, second and greater, the training of our future citizens to become responsible heads of government control.

Initial attention has been devoted to the three major phases of the Chicago Plan, all of which are in a fair way to early realization. The first step taken was the widening of West Twelfth street, one section of the quadrangle which it is proposed to establish surrounding the heart of the city, to provide free and easy access between the various sections of the city without the necessity of traffic going thro the congested downtown section. This widening case has made most satisfactory progress. An ordinance was passed on July 23, appropriating $1,750,000 to pay the city's share of this work. It is expected condemnation proceedings for property to be taken will be commenced in the near future. Another section of the quadrangle, and the street which is destined to bear the heaviest traffic of any street in the world, is Michigan Avenue. This is to be widened and projected a mile north, to form a boulevard connection between the North and South sides of the city, on a two-level plan, to allow the free circulation of east and west traffic underneath the boulevard level, without interfering with north and south traffic.

THE CHICAGO PLAN.

Looking North of the South Branch of the Chicago River. Showing the Suggested Arrangement of Streets and Ways for Teaming and Reception of Freight at Different Levels. (Painting by Jules Guerin.)

Next to convenience and orderliness in its street arrangements, the most essential thing in a great city is a park area



THE CHICAGO PLAN.
Model of Grant Park, Chicago, Used as a Basis of Study.

THE CHICAGO PLAN.
Additional Views of the Model of Grant Park, Chicago.

sufficient for the preservation of the public health of the citizens. Parks of a city have been aptly compared with the lungs of a person, as means by which the city and its people get the stimulus of fresh air so necessary to normal well-being. Three great elements make up the park plans of the future city under the Chicago Plan. First, there is the lake front to be improved, beautified and put at the service of the city's thousands for the creation and preservation of public health. Second, there is provision to be made for extending the park areas within the city, that wholesome and necessary recreation may be close at hand for all the people in all parts of the great future city. Third, there are the wide areas of forest and stream outside of the corporate limits, but upon the borders of the city, to be acquired and held in their natural state as places where the city-worn worker and his family may rest and wander freely in holiday and vacation time.

First attention has been given to the lake front, which forms at once one of the greatest and spectacular features of the plan and one easiest to be carried out. Grant Park, at the very heart of the city on the lake front, has been created out of the lake shore built up of the city's waste material and refuse. The area of this park is over two hundred acres, and it is proposed to create, by the same method, a shore line park extending five miles along the water's edge south to Jackson Park. There are annually over four million cubic yards of waste and excavated material produced in Chicago. This amount would create over one hundred acres a year—without any expense to the taxpayers of the city—and would add over 1,500 acres to the park system of Chicago. Under the plan, there would be created an island park and boulevard paralleling the shore line park the entire distance, with a lagoon between, always calm and safe, for rowing, sailing, motorboating and swimming. When this park has been completed, Chicago will have the most magnificent waterfront in the world, with a continuous shore line of parks approximately twelve miles in length, the inner park 300 feet wide. the outer park half a mile wide, and the lagoon between the two, 700 feet wide. The Chicago Plan also contemplates carrying similar park developments north along the shore for about eight miles.

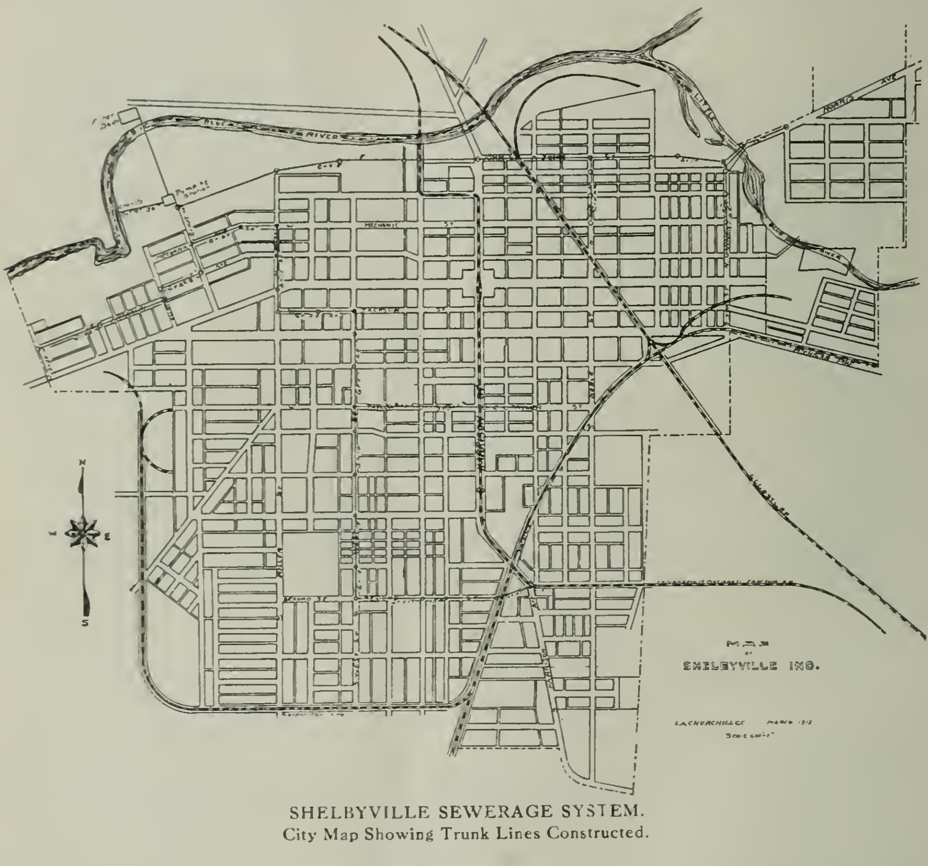
THE CHICAGO PLAN.
Birdseye View of Grant Park, Chicago. The Harbor and the Lagoons of the Proposed Park on the South Shore. (Painting by Jules Guerin.)

Great dangers to mankind lurk in the existence of cities. City life is intense, many times more wearing upon the nerves than that of the country. It is this strain of city life which increases insanity and brings weaknesses of many kinds to shorten life and deprive the people of their vigor. These ills may best be coped with by the realization of a proper plan to direct the growth and development of a city along scientific lines, such as is provided in the Plan of Chicago.

SEWERAGE OF SHELBYVILLE, IND.

SHELBYVILLE, Ind., is a city of about 10,000 population, located within a bend of the Big Blue river in the eastern part of Indiana. By reason of its location, topography and the character of the soils encountered, the construction of the sewers contains many interesting features.

Plans for the sewers were prepared in 1908, and the main trunk lines laid out were substantially as shown in the accompanying plan. A great many difficulties were experienced in laying the grades on account of the topographical features of the city. The elevation of the outlets is 93, and a rather abrupt rise brings the ground level at Miller and Mechanic streets to 108. Then continuing on south along the line of the "South Branch A," as that extension on West street was called, the ground level becomes 116 at Jackson street and then drops away to 111 at the point where the line turns east on Second street. Thus, even tho the outlet is taken far below highwater mark, a minimum grade is obtained only at the expense of what proved to be a 22-foot cut at the summit of the bill in the vicinity of Jackson and West streets. As completed, the sewer is fully effective only during low or mean water level at the river. A slight rise of the river sends water back along the sewers for a distance of from 1,000 to 1,600 feet from the outlet, and the manholes, which on the "River Branch A" are brought high above the level of the ground, contain from six to eight feet of water, and at times during floods water has forced out thru the manholes all along this line. The pumping station, the location of which is shown on the map, will be constructed in the near future, and at that time the sewers will become effective under all conditions.



SHELBYVILLE SEWERAGE SYSTEM.
City Map Showing Trunk Lines Constructed.

At present the sewers drain into a receiving well, whence the sewage drains by gravity, as the water level permits, into the river. A check valve, operated under supervision of the street superintendent, is provided as a protection against excessive back flow. The sewage disposal plant, the location of which is indicated by the "filter beds" on the map, will probably not be constructed until such time as the state shall legislate against the emptying of raw sewage into its streams.

The sewer presented many construction difficulties, which, however, were surmounted by the contractors, and the completed pipe lines are true to grade and as tight at the joints as it is possible to make them. One contracting firm took the entire contract, including about 22,000 feet of pipe sewers, ranging from 12 to 30 inches in size, with all manholes and appurtenances. Whether from a mistaken estimate or natural difficulties, this contractor was obliged to give up the contract after completing only a portion of the "River Branch" and a small portion of another branch. This contractor was paid about $37,000 for that portion which he had completed, and was released. The Julius Keller Construction Company, of Indianapolis, then undertook and completed the remaining portion, about 14,000 feet of 20-inch to 12-inch sewers, at a price of $45,794.

The greater portion of the sewer was laid in gravel which, tho it provided easy digging, yet required sheeting for practically the entire distance. The worst trouble was caused by water which, along practically the entire job, filtered in thru the gravel so fast as to rise three or four feet into the trench during a night. The first portion of the work was laid with a jointing compound which required that water should be excluded from the joint before it was poured, otherwise the material "sputtered" and was thrown out of the joint like hot lead under similar conditions. The pumping cost about $25 a day. This made necessary the continuous use of two 37,000-gal.-per-hour pumps and the digging of "sump holes" on both sides of the pipe joint, in order that the water might be entirely drained off.

After the work was about one-half completed, permission was secured from the city authorities, and G-K compound, a jointing material which could be poured in water, was substituted. From that time the pumps were used only occasionally as an excessive depth of water in the trench demanded. The remaining portion of the first mentioned compound was used up in joints poured on the bank. One interesting example of the tightness and elasticity of the second compound is shown by an incident which occurred

SHELBYVILLE SEWERAGE SYSTEM.
Pouring Patent Joints on the Bank.

when laying the 20-inch pipe. About 70 feet had been laid in the morning with one end in a bulkhead where a manhole was to be located, and the other end was held down by the back fill on the preceding section. Water and sand entered the open trench and raised the 70-foot section so that it was 12 to 15 inches above grade at the center. At this time the situation was discovered by the contractor. A jack placed at the highest point and working against a timber placed across the trench above failed to cause the pipe to go back into place. The water was pumped out, and after the sand had been removed from beneath the line, the jack forced the whole line back to grade. After this a pressure test showed the joints to be tight, tho they had been forced to bend in two directions, when the pipe was raised and when it was returned to grade.

One section of extremely difficult construction was a short stretch of gravel underlaid by quicksand. The cut along this portion was about 22 feet, and of this about 8 feet was quicksand. The water which bubbled up thru this quicksand bed caused it to "work and move" as if it were alive. Sheeting was driven to about three feet below the bottom line of the tile, and the sand was removed. Piling was then driven in on both sides at intervals and "saddles" were placed across, upon which pipes were laid. Concrete was then placed around, under and above the pipes to anchor them in place, and the sheeting was left when the trench was back filled. Only about 380 feet of 20-inch pipe line was constructed during the month in which this quicksand was encountered as compared to 1,500 to 2,000 feet under favorable conditions.

Another interesting condition was encountered where the extension of the "River Branch A" crosses the river. It was necessary to construct an inverted siphon, using about 120 feet of 12-inch cast iron pipe, which was laid 5 to 6 feet deep under the river. In making this crossing, a dam was constructed across one-half of the stream and a "sump hole" was dug, into which the water was drained and pumped out. The trench was thus left perfectly dry while the pipe was laid and jointed. The same procedure was then repeated with a dam across the other half of the stream.

SHELBYVILLE SEWERAGE SYSTEM.
Showing Flow of Water from Sewer Trench.

The straight ditch was cut, principally by means of ditching machines. The Moore machine and the Parsons machine were both used on the work. The former is a simple trestle and trackway, along which the dirt is removed to make the back fill. The Parsons machine is a chain and bucket device capable of digging a trench as deep as 20 feet and up to 5 feet in width. It has a cross belt conveyor attachment which empties the earth on a longitudinal belt conveyor which carries it back into the trench at about 50 feet distance from the digging. Except for a short stretch of hard-pan where dynamite was used, not even picks were required to loosen the soil.

The tile were joined two together on the bank, as shown in the photograph. They were then lifted by means of a tripod and tackle and swung into place in the trench.

The plans for the sewer were prepared by Riggs & Sherman, of Toledo, Ohio, with J. H. Phillipi, of Shelbyville, city engineer. Some modifications were made by Charles C. Brown, of Indianapolis, before the second letting of the contract. The work was completed under W. H. Isley, city engineer. L. A. Churchill was superintendent in charge of the work.

THE COVERING OF JONES' FALLS, BALTIMORE, MD.

By Stuart Stevens Scott.

ONE of the most far-reaching and best paying improvements the city of Baltimore will ever undertake is the work of inclosing Jones' Falls in reinforced concrete conduits and building a roadway over them. What has for more than a century been a nuisance, an expense and an eyesore thro the heart of the city, will not only be removed, but the city will have reclaimed a strip of land 75 feet wide and more than a mile long which will become a broad, smooth roadway affording a much-needed relief in a North and South thoroughfare connecting the docks and the business section of the city with the railroad depots in the Northern section. This roadway will be on an easy grade, enabling one horsee to accomplish what now requires two, thus effecting a great saving in money and time to merchants.

The improvement will transform back lots abutting an open stream into valuable land facing a broad boulevard. It will not only improve the property to the extent of securing for the city sufficient revenue from increased taxes to pay the interest on the bonds and create a sinking fund to redeem the loan, but it will eliminate the dozen expensive bridges and do away with the annual appropriation for bridge repair, which runs into thousands of dollars.

Aside from the esthetic features, and to say nothing of having an open sewer inclosed, the most important part will be the prevention of the flooding of property along the low-lying sections of the stream. Jones' Falls, altho normally a somewhat sluggish stream, is, when accentuated by heavy rains, very turbulent, and has caused much damage by overflowing. The most notable instances were on July 24, 1868, and July 5, 1904. In 1868 the flood not only did damage to the extent of several hundred thousand dollars, but caused the loss of a number of lives. In 1904 the damage was confined to property, altho many persons had narrow escapes.

Following this last flood, and with the construction of the new sewerage and storm water drainage system, changes were made which have since kept the stream within its bounds, altho there have been numerous periods of excessive rainfall.

Notwithstanding the general belief that the Falls would never again leave its banks, the city authorities deemed it expedient to close the stream and thus make it absolutely safe.

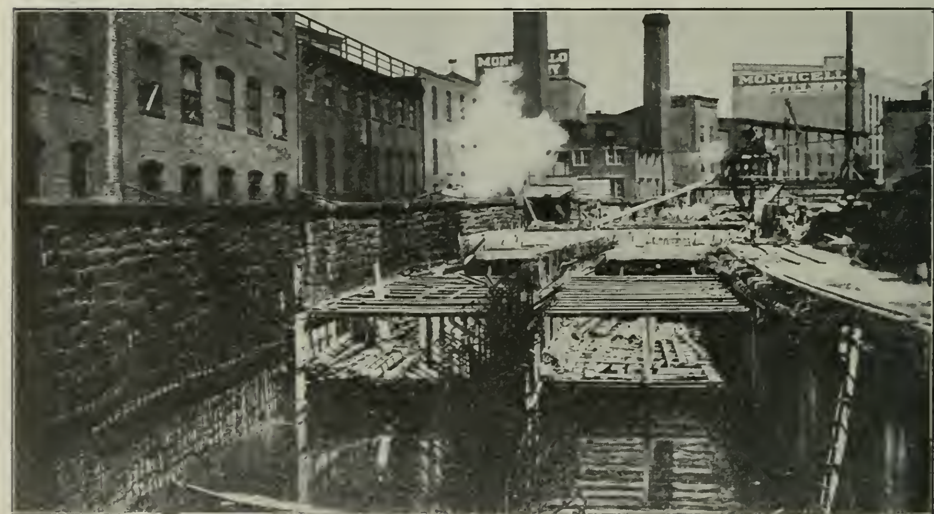
From an economical point of view, the city could not have taken a better step. About thirty years ago, the city spent more than $1,000,000 upon retaining walls, and since that period has spent fully another million in building and maintaining bridges. The inclosing of the Falls and the construction of the roadway will cost approximately $1,300,000, and it has been estimated that the revenue from the increased taxation of property in the vicinity will pay back every cent of this expenditure.

The total length of the sewer is 1,764 feet. It begins at the northern edge of the city, with a basin approach a little more than 100 feet long, from which point the water flows into a tunnel 28 feet by 29 feet, 1,080 feet long, to a junction chamber where begins a series of three ducts, the east duct being 8 feet by 14½ feet, and the others each 17 feet by 17 feet. These ducts lead 1,400 feet to where the east duct is enlarged to 15½ feet by 16 feet and the others to 15½ feet by 20 feet each.

At a point 1,300 feet farther down stream the east duct is enlarged to 18½ feet by 15 feet and the others each to 20 feet by 15½ feet. Thence these sizes are carried 2,800 feet to the outlet apron in the harbor.

The object in having the east duct

COVERING JONES FALLS.
The Start of the Work, Constructing Cofferdams.



COVERING JONES FALLS.
Showing Side Reinforcement and Centering in Place.

smaller, is to use it for the ordinary discharge of the stream and to keep the water so closely confined that it will rush thro with a force sufficient to prevent sediment and to keep the duct clean. As the water increases in volume in the junction chamber and overcrowds the east duct, it finds its way into the central duct. Should even this duct be overcrowded, there is the third one, and it is believed that these three ducts will take care of even the worst storms.

Altho not as spectacular as many other engineering feats, the covering of the Falls is no child's play, and the contractors have had their hands full all the time. All of the work has had to be done by constructing coffer dams, but even tho these dams have been high and steam pumps have been employed, the Falls has contested every inch. During the winter and this spring the contractors have had innumerable delays because of high water, and on several occasions much of their timber has been washd down stream.

For convenience, and with the idea of better controlling the stream, the east duct was built first, and after it had been carried down stream several hundred feet work on the other ducts began, all of the water being sent thro the east duct. This method has been pursued as much as possible, altho, at certain points, it was necessary to shift the stream from one side to the other. That there is but 75 feet of space in which to work and that it is necessary to have dry bottom to lay the bottoms of the ducts has greatly hampered the contractors.

While the granite retaining walls of the stream are solid the ducts are being built independent, with the retaining walls more as frames than as supports. The side walls of the ducts are each 2 feet thick and the top varies from 27 inches to 35 inches. Reinforcing is liberally used, the steel being in square bars and varying from ¼ inch to 1¼ inch. In the walls the vertical bars are ⅝ inch, spaced 7¾ inches, while the longitudinal bars are ¼ inch, spaced 2 feet to 3 feet. The bars in the top are 1¼ inch, spaced 7¾ inches, and there are also ¼ inch longitudinal bars, spaced 2 feet. The bars in the bottom are ¾ inch, spaced 15½ inches, and the longitudinal bars are ½ inch, spaced 12 inches.

COVERING JONES FALLS.
Head of Completed Portion, Showing the Ducts.

The east duct has a brick invert, one brick deep, but the bottoms of the other ducts are of concrete.

The construction of the conduits is being carried on by the Elkan-Tuft Construction Co. and by Fisher & Carozza. The contract for section No. 1 was awarded to the first named contractor for $503,990, and Section No. 2 to the other contractor for $703,989.50. The contract for the construction of the first section of paving has been awarded to the David M. Andrew Contracting Co. This contract covers about 13,000 square yards of pavement, or approximately one-fourth of the total amount to be laid. The pavement will be of granite blocks throughout and will be 50 feet wide between curbs. There will be 12½ feet concrete sidewalks on both sides. It is expected that the entire work will be completed by January, 1913.

PRACTICAL ROAD BUILDING.*

By John N. Edy, Jun. Am. Soc. C. E., Assistant City Engineer, Billings, Mont.

Bridges.

In selecting a location and span for a bridge, the drainage area is not alone to be considered. It is absolutely essential that a substantial foundation for the piers and abutments be secured. The banks should be well defined and the channel straight. While it is not always possible to find an ideal site for a bridge, a good location should be secured as local conditions fix the span. High-water marks are to be observed, so that the lowest point of the span may be high enough to clear all drift. This caution applies to all bridges. In the following paragraphs spans of 10 feet and over will be designated as bridges, spans of less than 10 feet being considered culverts, having been treated in the preceding paragraphs. For short spans, say up to 50 feet, reinforced concrete is now being used to a great extent; steel bridges on stone or concrete abutments are most common, while timber is being used less each year for this purpose.

PRELIMINARY.

The following points should be noted in choosing a site and preparing for the construction of a highway bridge:

1. If the road as established does not approach what appears to be a good bridge site, consider the advisability of changing the location of the road.

2. Note the direction of stream flow, observing the general condition of the water course, and if there is any apparent likelihood of the channel changing or washing out piers or abutments.

3. Ascertain the nature of the material composing the stream bed; also the foundation material in the banks, whether hard or soft, or of sand, clay or gravel or rock. If possible, ascertain the depth to solid rock.

4. Get a cross-section of the stream at the proposed crossing, noting low and high-water marks, and mean stage of water.

5. Ascertain the causes of high water, and if there is likelihood of log or ice gorge.

6. Note particularly the channel at the proposed site, observing the condition of the banks, whether high and steep, sloping or flat.

7. Note if provision must be made for a cattle or wagon pass under the bridge or approach.

8. If piles are to be used, see if they can be obtained in the vicinity.

9. In case earth fill approaches are to be built, state if the material for the fill can be had on the road right-of-way, or if borrow pits must be opened on adjacent land. From the height and width of approaches ascertain if present width of road right-of-way is sufficient.

10. Ascertain the location of, and carefully examine, deposits of stone, sand and gravel that may be used in the construction of stone or concrete abutments, etc.

11. State whether the stream is ever "dry," and if so, during what months.

12. Select location for storing piling, stone, gravel, steel and cement.

13. If the proposed structure involves the purchase of land, note carefully and report on conditions.

14. Inquire as to accommodations for boarding and lodging; also advise how the men may get to and from work.

15. Note the volume and nature of traffic, and advise as to the possibility of diverting same during construction. (This applies especially to renewals.)

16. Advise whether rip-rapping or other bank protection is necessary.

17. Advise if bridge will cross the stream at right angle, and if not, why, and give angle of skew.

18. Ascertain the location and probable cost of piles and lumber.

19. Note the condition of the road between the bridge site and nearest shipping point with reference to the maximum load that can be hauled. Advise if road is ever in an impassable condition.

20. Ascertain the wages paid in the vicinity for labor and teams.

21. Note carefully the labor conditions in the vicinity.

22. Advise as to the best season of the year to build the bridge.

2v. Ascertain if local contractor has pile-driving plant in the vicinity, and if can be obtained, inquire charge for same.

24. Examine several possible sites for the bridge in an effort to locate the most desirable crossing, regardless of the location of the road leading to the stream. Report fully on this matter.

25. Take elevations for a distance of at least 500 feet on each side of the stream, and leave a permanent B. M. on each side.

26. State alignment of road approaching the stream.

27. Note all sloughs and creeks in the vicinity and ascertain their effect on the stream in times of high water.

28. Investigate other bridges crossing the same stream, and determine whether extraordinary conditions will attend the construction of the proposed bridge.

29. Remember that earth approaches are better than timber trestles; also that the bridge is being placed for the accommodation of future, as well as present, conditions of traffic.

Each bridge is a problem in itself; and while the commissioner and supervisor are not required to build them, they have to buy them, so that the following suggestions are pertinent:

Do not advertise for bridge bids, permitting each contractor to bid on his own design. Have the bridge designed by a competent bridge engineer (the State Highway Commission, if there is one in the State) and receive bids on this one plan. Inasmuch as very heavy traction engines and road rollers are being placed on the market, provision must be made for their safe transportation, and all bridges and culverts should be safer under a live load of at least 15 tons. Do not permit the use of wooden joist in the floor system of a steel bridge. Steel beams should be used for this purpose; they do not cost a great deal more than timber stringers, and they make the bridge more safe and permanent.

The bridge should rest on abutments of stone or concrete. The top of the abutment should never be less than 2 feet 6 inches, the bottom width being not less than one-fourth the height. In all cases abutments and piers must extend below the bed of the stream. Steel tubes filled with concrete form a very satisfactory substructure, if correctly designed and placed. Tubes should be filled with a good quality of concrete mixed in the proportions 1:2½:5.

CONSTRUCTION.

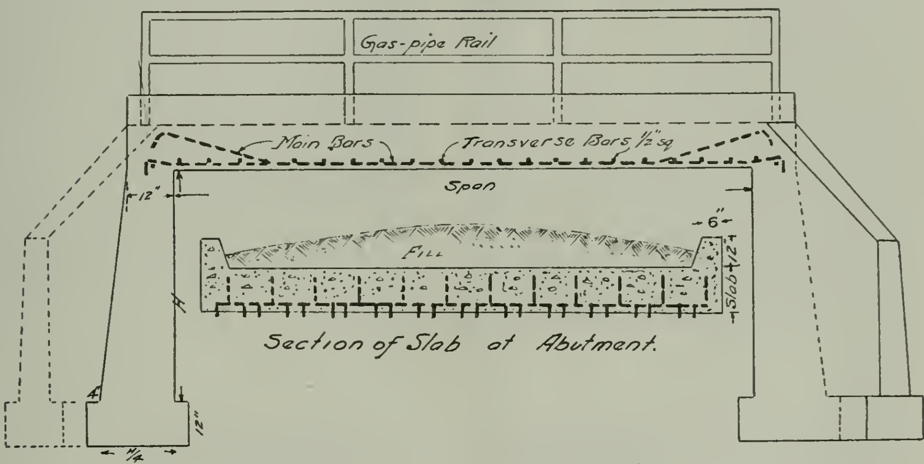
During construction engage an inspector who will see that the plans and specifications are fulfilled. All material and dimensions should be inspected on the ground, and if not in conformity with the plans, should be rejected. Particular attention must be given the riveting and bolting, to see that no rivets or bolts are omitted; and to the concrete, to see that it is properly mixed and placed.

Concrete floors are preferable to plank for the same reason that permanent culverts are preferable to flimsy wooden boxes; and while a concrete floor increases the dead weight on the bridge, it also better distributes the live load.

SHORT SPAN BRIDGES.

By far the greater number of bridges with which the supervisor has to contend are those of short span, say 50 feet and under. There are always small creeks, sloughs, ditches, etc., that must be bridged in this manner. Furthermore, it is often possible to use a number of short spans in place of one long one. This is true in crossing streams of no appreciable current, as in the case of wide "dry creeks," sloughs, etc. These small bridges can often be erected by the supervisor with local labor. The writer has found that the men usually take an active interest in this work, feeling that they are performing a valuable service for the community.

Plain concrete may be substituted for stone in any structure. Reinforced concrete is the accepted material for permanent spans under 50 feet. For spans less than 20 feet such bridges are built as a flat slab resting on concrete abutments. The accompanying sketch shows the design of reinforced concrete slab bridges, which are readily erected. The form work is simple, and the whole structure, excepting perhaps the steel, may be built of local material. It will be observed that



REINFORCED SLAB CONCRETE BRIDGE.

TABLE OF REINFORCED CONCRETE SLABS.

SQUARE BAR REINFORCEMENT

Clear Span	Depth of Slab	Main Bars Size	Main Bars Length	Main Bars Space	Transverse Bars Size	Transverse Bars Length	Transverse Bars Space
Culvert Roadway 20 Feet Wide.							
2 ft.	5 in.	½ in.	3 ft.	6 in.	½ in.	20½ ft.	12 in.
3 ft.	6 in.	½ in.	4 ft.	5½ in.	½ in.	20½ ft.	12 in.
4 ft.	6½ in.	⅝ in.	5 ft.	7 in.	½ in.	20½ ft.	12 in.
5 ft.	7½ in.	⅝ in.	6 ft.	6½ in.	½ in.	20½ ft.	12 in.
6 ft.	8 in.	⅝ in.	7 ft.	6 in.	½ in.	20½ ft.	12 in.
7 ft.	9 in.	⅝ in.	8 ft.	5½ in.	½ in.	20½ ft.	12 in.
8 ft.	9½ ft.	¾ in.	9 ft.	7 in.	½ in.	20½ ft.	12 in.
Bridge Roadway 16 Feet Wide.							
10 ft.	11 in.	¾ in.	12 ft.	6 in.	½ in.	17 ft.	12 in.
12 ft.	12 in.	⅞ in.	14 ft.	7 in.	½ in.	17 ft.	12 in.
14 ft.	13 in.	⅞ in.	16 ft.	6½ in.	½ in.	17 ft.	12 in.
16 ft.	15 in.	⅞ in.	18 ft.	6 in.	½ in.	17 ft.	12 in.
18 ft.	16 in.	⅞ in.	20 ft.	5½ in.	½ in.	17 ft.	12 in.
20 ft.	17 in.	1 in.	22 ft.	6½ in.	½ in.	17 ft.	12 in.

either bars or expanded metal may be used for reinforcement, the bars being preferable on the longer spans, inasmuch as they may be bent up to provide for diagonal tension.

The concrete must be placed with care so as not to disturb the reinforcement. The strength of any reinforced concrete bridge depends upon the position of the steel, which must be placed in the bottom of the slab, as shown. A rail of pipe or concrete may be used on such a bridge, as desired. Very rarely do these bridges cost more than if built entirely of steel on the same abutments. Whenever a fill is to be placed against the ends of a structure, as is usually the case, the abutment must serve as a permanent retaining wall. It is for this reason that the bottom width should never be less than one-fourth the height. Concrete for bridge construction should be rich, and the forms left in place for one to two weeks, as previously noted; the forms and false work supporting the bottom of the slab to be left for a longer time. No reinforced concrete bridge work should be started so late in the fall that there is danger of freezing weather before completion. While the designs given above are in accordance with good practice, the inexperienced supervisor is cautioned not to undertake the building of so important a structure without engineering advice as to the particular conditions.

MINOR PROBLEMS OF TARRED ROADS.

By Francis G. Wickware, New York City.

THE first decade of surface tarring for the suppression of dust on macadam roads ends with the treatment formally admitted to the list of practical processes by the International Road Congress. First applied on a practical scale in 1901, the process very soon attained to wide popularity, and in recent years its extension has been remarkable in both distribution and degree. The complete demonstration of the efficiency of tar treatment as a dust preventive followed close upon the earliest experiments; it remained for prolonged trial to prove an economy comparable with that of competitive processes. The experience of the last few years has established beyond question that under all conditions tarring diminishes wear, increases drurability, and reduces the cost of road cleaning. Whether these economies are sufficient to offset the admittedly high cost of the process, depends, in any case, on the nature and frequency of the traffic the tarred road is called upon to bear. The reputation of tar treatment has suffered, to a certain extent, from the dissatisfaction of municipalities who have demanded of tarred macadam roads a service which could be successfully performed only by some type of permanent pavement; but when applied with judgment and care, in localities where the traffic conditions guarantee a fair degree of permanence to macadam roads, it is the almost universal experience of highway engineers that surface tarring is an efficient and economical process, and, except under very unusual conditions, the best available solution of the problem of adapting ordinary highways to motor-vehicle traffic.

Like all other processes, however, tar treatment is not wholly free from defects. Tarred roads are accused of an injurious effect on the eyes of users, and of a pernicious influence on neighboring vegetation. Compared with the positive merits of surface tarring, its inconveniences are of minor importance; but the extent of the literature in which the defects of the process are canvassed, to which not only highway experts but also physicians, chemists, physicists, and horticulturists of considerable eminence have contributed, indicates that they are by no means without significance.

Eye troubles first made their appearance in France in 1906, among drivers of automobiles on the Sarthe circuit, which had been freshly tarred for almost the whole of its length. The fact that ocular injuries had been observed, was frankly communicated to the first International Road Congress, held at Paris in 1908, by Dr. Guglielminetti, whose experiments with tar treatment at Mentone in 1901 laid the foundation for the subsequent success of the process. M. Forestier, of the Paris department of parks, reported at the same congress the production by heavy traffic of large quantities of black dust with an inflammatory effect on the eye, on a Paris street treated with westrumite, an ammoniacal solution of tar. Dr. Guglielminetti admitted the possibility that the vapors given off by freshly treated road surfaces, and the particles of tarry dust which it is impossible entirely to eliminate, may cause more or less pronounced cases of conjunctivitis. It has been pointed out more recently by M. Vasseur, one of the engineers of the French department of public works, that, while the proof of eye trouble is conclusive, it seems to be limited to automobile races over freshly tarred roads, and may be attributed, therefore, to the exceptionally intense conditions of traffic. Hence, he suggests that a means of prevention may be found in the use of suitable goggles. L. Philibert, on the other hand, is doubtful that eye troubles can be avoided in this way. Goggles may give effective prevention against dust, but it is neither safe nor practicable to make them absolutely air-tight, and thus impervious to tarry vapors. On freshly tarred roads, and during warm weather—and it may be noted that cases of conjunctivitis are much more frequent during the summer months—the vapors given off by the tar are responsible for the greater part of the injuries observed.

The classical investigation of ocular lesions of this character is that concluded last year by H. Truc and Charles Fleig, two physicians of Montpellier. Their exhaustive report, printed in the *Revue d'Hygiene* for February and March, 1911, presents the results of their own experiments in great detail, and summarizes the whole of the existing body of information relating to the eye troubles attributable to the action of tarry dusts and vapors. MM. Truc and Fleig set out to determine the mechanism of the injurious action of tar. To this end they made an extended series of experiments on the eyes of dogs and rabbits, designed to yield comparative data of the effects of dusts from treated and untreated roads. Repeated application of dusts from untarred roads, surfaced with either silicieous or calcareous metal, they found produce only slight or temporary inflammation, which is readily cured by natural processes. Only slightly more marked are the effects produced by dusts from old tarred surfaces. Dusts from well-preserved tarred surfaces, on the other hand, even if the treatment is of long standing, cause serious conjunctivitis, often assuming a purulent form, frequently resulting in chronic inflammation of the lacrymal gland. Finally, artificial dusts obtained by pulverizing a portion of a recently treated surface, which naturally contains a larger proportion of tar than ordinary dusts, produce extremely acute conjunctivitis, accompanied by eversion of the eyelid, first with an abundant mucous discharge and later with purulence. The results in the latter case are much more marked than those obtained with mixtures of tar with powdered chalk, pumice, or talc, or even with applications of raw tar, because of the absence from these substances of the noxious germs ordinarily found in road dusts.

Three factors, MM. Truc and Fleig conclude, enter into the injurious effect of the dust of tarred roads on the eye: First—and initially, at any rate, this is the most important—the caustic and toxic action on the mucous membrane of the eye of the constituents of the tar; second, the mechanical irritation of the dust; and third, infection by germs contained in the dust, which is greatly accelerated by the lesions produced by chemical and mechanical means. The validity of these conclusions has been widely assailed, largely on the ground that the methods of experiment employed by MM. Truc and Fleig bear no resemblance to the actual conditions of automobile driving. The experimenters justify their methods by comparing the human ocular apparatus with the more highly protected eyes of the dog or rabbit; still, their critics assert that the production of conjunctivitis was unavoidable under the treatment adopted by MM. Truc and Fleig, and that the results are of no value as proof that tar produces ocular injuries. M. Philibert, however, in the paper already referred to, finds it impossible to accept the theory that mechanical irritation alone is responsible for the effects observed in these experiments. The prime cause, he says, exists in the complex constituents of the tar, and of these carbides and hydrocarbons of the phenol group would appear to be essentially the most active. M. Philibert bases his opinion, in part, on clinical observations among pitch workers, communicated by a number of Belgian physicians to the International Diseases Congress held at Brussels last year. Two industrial varieties of pitch are produced in the distillation of coal tar—ordinary black pitch, which is rich in phenols, and dry pitch, which contains only an insignificant amount. The eyes of pitch workers are constantly exposed to the action of pitch dust, and it is very common to find among them cases of conjunctivitis. The action of phenols in producing these injuries seems to be established by the fact that serious cases are wholly confined to workers in black pitch. The dry pitches, which contain no phenols, involve no specific danger.

Further evidence of the chemical action of the dust of tarred roads is afforded by the fact that the dust of ordinary roads is very rich in micro-organisms, which are materially reduced in number by tar treatment, and are sometimes expelled completely, at least while the tar is still fresh, the period when tarred dust has most serious effects on the eye. In 1904, two Swiss bacteriologists, H. Cristiani and G. de Michelis, reported the results of an investigation of the bactericidal effects of tar treatment. They reached the conclusion that, "from the bacteriological point of view, the air of tarred or oiled roads is infinitely better than that of untreated highways." Collaterally with their ocular experiments, MM. Truc and Fleig have determined the nature and number of bacteria in a large number of dust samples. In general, they find tar treatment diminishes the number of bacteria in road dust, but does not effect their complete expulsion. Tetanus, or lock-jaw, for example, has been produced in guinea pigs by inoculation with tarred dust.

Such is the evidence upon which tarred roads are accused of injurious action on the eyes of users. No one has yet had the temerity to suggest that it is sufficient to warrant the abandonment of tar treatment, and a great many advocates of surface tarring resolutely deny that any part of the evidence is credible. Assuming, however, that MM. Truc and Fleig have established their case, their final conclusion may well remain the last word in the dispute: "The ocular lesions produced experimentally, and the few cases of similar injuries observed in human eyes, do not appear to us to constitute any argument against the tarring of roads, a treatment in every other respect entirely satisfactory, and which, when properly carried out, is capable of diminishing by the suppression of dust, the chances of injury to the eye."

We may pause, before passing to the consideration of the effects of tarred roads on neighboring vegetation, to draw attention to three reports of injuries to fish life by storm waters washed from freshly tarred surfaces, which appeared last year in the columns of *The Surveyor*. R. B. Marston, editor of *The Fishing Gazette*, complained to a London newspaper early in May that trout and other fish had been killed in various English streams by the run-off from tarred roads. Col. R. E. Crompton replied in a later issue of the same paper that these damages were limited wholly to cases where roads had been treated with raw gas-works tar. They cannot occur if reasonable care is taken in selecting a tar which has no constituents, such as ammoniacal liquor, soluble in water. The proper material is distilled tar, which cannot possibly find its way into a stream. A subsequent correspondent, in reporting a case of wholesale slaughter of fish by the run-off of a freshly tarred surface, suggests that such destruction can be largely prevented by applying the treatment only in fine weather. When the tar has once set, the chances of any of its constituents reaching a stream are very much reduced.

Turning now to the effects of road tarring on vegetation, evidence of deleterious action is here both copious and credible; but it is a curious fact that it is supplied wholly by France, and almost exclusively by the avenue du Bois de Boulogne, in Paris, and the Bois itself. Dr. Guglielminetti, the founder and present secretary of the French anti-dust league, states that in the south of France, where tar treatment has been employed on an increasing scale ever since its earliest application, the owners of gardens bordering tarred roads have offered no complaints of injury, and are, in fact, among the largest subscribers to the league. When the first reports of injurious effects reached England in September, 1908, *The Surveyor* issued a circular letter to the municipal and county engineers of all localities where tar treatment was practiced. Not a single complaint of any seriousness was elicited. Of the large number of replies received, only one admitted the possibility of injurious action on vegetation not in immediate contact with the tarred surface. The majority of engineers who did not entirely flout the ieda of any possibility of damage suggested that the reported injuries might be due to the action of tar in actual contact with the roots of plants, combined with the exclusion of air and moisture from the soil. A similar inquiry instited in Germany produced like negative replies, and the reports from Belgium are of the same nature.

But in Paris the effects are well marked, and have attracted the attention, not only of engineers and scientists, but of the press and public. The avenue du Bois de Boulogne was first treated in May, 1907, and subsequently in the spring and autumn of each year. Immediately after the spring tarring in 1908, signs of its destructive influence on vegetation appeared, and by late summer the condition of the plants and shrubs bordering the avenue was the subject of a good deal of newspaper comment. Dr. Guglielminetti persisted in denying that the tar treatment had produced any ill effects, but the question was settled beyond dispute by M. Forestier, curator of the Bois de Boulogne, who reported to the International Road Congress held in Paris in October, 1908, that surface tarring had indeed induced a disturbing condition in the trees, shrubs, and flowering plants under his care. The nature of the effects has been described by M. Honore, a prominent Parisian horticulturist. When M. Forestier made his report, the trees of the avenue were practically unaffected, with the exception of a few trees, the foliage of which was seriously injured within a few hours of the spreading of hot tar. Syringa and other shrubs, however, were seriously affected, their foliage dried, shrivelled, and spotted with brown and white patches. The lower part of a hedge withered within a few hours of the spreading of the tar, and did not recover during the remainder of the season. The leaves of geranium and begonia plants showed gray or brown patches, and the plants were clearly stunted in growth. Subsequently the effect on trees became progressively more marked. With each succeeding year they plainly suffered a decrease of vitality and of power of resistance to the destructive influence. Before the publication of M. Honore's article, several American walnuts and maples had been killed outright and removed, while alders were fast losing their vitality, and catalpa and chestnut trees were beginning to show unmistakable signs of infection.

So much for the evidence of destructive effects. The disclosure of the manner in which they are produced has been one of the results of recent researches on the effect of vapors on vegetable organisms, notably those of Marcel Mirande, whose papers on the subject give a very clear and complete exposition of the mode of action of tar on vegetation. The phenomenon of osmosis, the ability of gases to traverse thin membranes, is familiar to every student of chemistry. By virtue of this property, the vapors exhaled at ordinary temperatures by various liquid and solid substances penetrate vegetable tissues, and produce in plant cells the well-known phenomenon of the contraction of the protoplasmic mass and its separation from the cellulose membrane. If plasmolytic action is continued long enough, the life of the cell is destroyed, and, in this event, the plasmic tissues having lost their osmotic properties, water is forced into the cellular spaces and also to the exterior of the plant. This water contains in solution various substances, some of which often crystallize out on the surface of the outer skin. Within the tissues, substances formerly localized in the living plant are permitted to become freely diffused. Among them, chemical reactions, in the majority of cases, produce new substances, of which some, frequently colored, remain in the cells, while others, of a volatile nature, are exhaled into the atmosphere.

Under the influence of a large number of vapors, plants exhibit the phenomenon of discoloration, of gas liberation, or both phenomena together. Exposure to a mixture of different vapors produces an effect which is the summation of the individual effects of the various constituents. And it is important to note that before the action of vapors has progressed far enough to cause the destruction of the cells, even while the plant is still green, there occurs arrest of the function of the chlorophyl. The assimilation of carbon is suspended. In short, the plant is anesthetized, an almost complete suppression of the respiratory function succeeding a short period of very pronounced activity.

Leaves of the laurel-cherry exposed in a confined space to the vapors exhaled by tar at ordinary temperatures show both blackening and gas liberation at the end of about two days. Leaves with very thick skin—syringa, chestnut, and the like—are covered with yellow or brown spots in less than twenty-four hours. When heated, even very slighty, tar exhales vapors extremely rapid in action, producing discoloration in a few minutes, not only in a confined space, but also in the open air. M. Mirande has made experiments in the open with plants suspended over a raised platform about forty feet square in area, exposed to the direct action of both sun and wind. Tar was spread on this platform at a temperature of 70 to 80 degrees C., the usual temperature in road-tarring practice. Leaves attacked by the vapors rising from the hot tar were killed with great rapidity. When cooled, and even solidified, the tar continued to exhale vapors which produced effects more or less rapid and severe according to the temperature, the itensity of the sun's rays, and the wind conditions. Specimens of the castor oil and tobacco plants, suspended at a height of twenty inches above the tar, suffered a gradual blight. Plants hung at a height of forty inches suffered less, some not at all, but the results were quite sufficient to prove that the effects produced by tarry vapors in the open air differ not in kind but only in degree from those observable in the laboratory.

Not all the injuries to vegetation observed in Paris are to be ascribed to the action of vapors arising from the the tar on the road. It is generally conceded that the vapors exhaled from particles of tarred dust are responsible for some part of the deleterious effects; but the relative intensity of the action of tarred dust and that of the vapors given off by the road itself is still a matter of controversy. An experimental investigation reported by M. Mirande has shown the action of tarred dust in some cases to be surprisingly small. M. Mirande was prepared to find that the dust of tarred roads, if applied to plants in sufficient quantity, would produce effects comparable in intensity with those of tarry vapors. Leaves in closed vessels, copiously sprinkled with a mixture of tar dust and sand obtained from a freshly treated road, showed signs of discoloration only after five or six days. Under similar conditions dusts of fresh asphalt or bitumen produce blackening very rapidly. M. Mirande's experiments in the open gave purely negative results; plants sprinkled with dust of tar, asphalt or bitumen over several successive days of high temperature and bright sunlight showed no visible sign of alteration. Hence, M. Mirande concludes that, except in very rare instances, the vapors exhaled by tarred dust in the open air are too small in amount and too rapidly disseminated to have an injurious effect on vegetation.

On the other hand, M. Griffon, of the Paris Institute of Vegetable Pathology, who has been investigating the effects of road tarring on vegetation for the Paris municipal authorities ever since the first signs of injury appeared, has published results which prove beyond a doubt that, on certain classes of plants at least, the action of tarred dust is decidedly injurious. The results of M. Griffon's laboratory experiments on the effect of tarry vapors confirm those obtained by M. Mirande; his experiments in the open air, however, have yielded no positive evidence of deleterious action. Indeed, his observations in the Bois de Boulogne lead to the belief that during the process of spreading and up to the opening of the road to vehicular traffic, the effect of the vapors rising from tar is practically nothing. M. Grigon's numerous experiments with tarred dust, spread on the leaves of many varieties of plants under natural conditions, show, on the other hand, that plants of aqueous and delicate tissues are susceptible to pronounced injury, although many species of ornamental trees and shrubs are apparently immune. On the basis of the results of direct experiment, M. Grigon is at a loss to explain the withering of the foliage of chestnut and other trees in various parts of the Bois. It may be, he suggests, that the period of exposure, the fineness of the dust, the direct action of the sun on the tarry particles, have an important, tho indeterminate, influence; while it is unquestionable that the age of a tree, its condition, and, above all, the environment of its roots, will go far to determine its susceptibility to injury.

To the last point M. Mirande also adverts, in summing up the conditions under which injurious action may be expected to occur. In urban streets, he says, the exclusion of air and moisture from the soil by a coating of tar may be a most important adjunct to the direct action of tarry vapors on trees. Direct action will begin when the air is sufficiently charged with tarry vapors, a condition promoted by hot and dry weather and absence of wind. The tarring of confined streets, bordered with high houses, may, therefore, result in injury to shade trees; and the same is true of avenues, wide and open, yet bordered with a dense vegetation. The first stage of the action is anesthesis. Agitation of the air may dissipate the vapors and arrest their action at this point. But if anesthesis is too frequent the result is the same as if the tarry vapors had been permitted to continue their action. Leaves, and even whole trees, gradually lose their power of resistance, and finally perish.

M. Honore recommends that where the safety of plants is the prime consideration, tar treatment of roads should be entirely avoided. Before condemning for park purposes a process which offers so many and so important advantages, M. Mirande and Griffon prefer to await the results of practical experiments on a large scale. To M. Gatin, the latest investigator to communicate his observations, however, the Bois de Boulogne supplies all the data which can be obtained from practical experiment. Certain of the drives in the Bois are tarred for only part of their length, and offer abundant opportunities for comparing the condition of the vegetation on the tarred and untarred portions. Taking two very popular drives, M. Gatin calls to witness that the trees of the tarred portions are distinguished by less abundant, less luxuriant and less healthy foliage, by premature falls of leaves and by a less thriving condition of the young branches. The effects are less marked in the upper than in the lower branches. M. Gatin presents the proof in quantitative form, having made innumerable comparative measurements of leaves on the tarred and untarred portions of these two drives, which, in addition to being much traveled, are exposed to the direct action of the sun.

Comparing the condition of the vegetation bordering these drives with that of trees along other tarred roads little frequented and heavily shaded, M. Gatlin reaches the conclusion that only in certain cases, and particularly when a road is open to the direct action of the sun and subjected to very heavy traffic, is surface tarring able to exercise an injurious effect on neighboring vegetation.

The Prefect of the Seine has recently appointed a commission of twenty-six members, including Dr. Guglielminetti and MM. Gatin, Forestier, Honore and Griffon among other highway, chemical and horticultural experts, to investigate means of preventing the injurious effects of surface tarring. Comparative observations in the open, and further laboratory investigation will yield, it is hoped, precise data of the action of the tars now in use. Another line of inquiry which promises useful results is the investigation of methods of eliminating from tar the injurious constituents, which has been taken up by a number of French chemists.

We cannot conclude better than by quotation from the conclusions of Dr. Guglielminett's recent paper: "It is to be hoped that tar treatment, the best solution hitherto discovered of the problem of adapting roads to automobile traffic, will not be found to present disadvantages great enough to dictate its abandonment. If, however, the observed injuries to vegetation are actually as great as reported, it would seem impossible to use along tarred roads ornamental plants highly resistant to deleterious action, and, at the same time, to eliminate from tar its dangerous elements.

"For the present, the important matter is to suppress tarred dusts. It is a grave error to suppose that tar treatment alone guarantees dustlessness. Tarring does, indeed, suppress almost entirely dust produced by the wear of the road surface, but it is of no avail against dust carried by the wind or by vehicles. This imported dust it is necessary to combat by watering more or less frequently, according to the weather conditions and the intensity of traffic. In any event, if the proximity of vegetation forbid the application of surface tarring to streets bordered by delicate trees and flowers, there remain to be tarred enough roads with neither trees nor flowrs, or bordered with a vegetation sufficiently hardy successfully to withstand its destructive influence."

PURIFICATION OF BATH WATER.

By Frank C. Perkins, Buffalo, N. Y.

THE accompanying drawing shows a section of a unique English equipment for the sanitary purification of the water for swimming baths, as developed at Darlaston.

Swimming baths are usually emptied and refilled with fresh water twice a week, and sometimes three times. As a matter of fact, even three times a week is not really sufficient, from a sanitary point of view, as it gives results far below those which are easily attainable by the modern method of continuous purification and re-use.

Assuming that the water is changed twice a week, and fresh water has to be paid for at the rate of 12 cents per thousand gallons, then the interest on the first cost of a purification plant would be less than half the amount paid for fresh water on the assumption that the swimming baths are in use six months in the year. In case the water is changed three times a week, then the interest on capital outlay would represent less than one-third the cost of the water. It is claimed that the working costs are low, as these only entail running a pump and the slight attention for washing the filters, no increase in the present bath's staff being necessary, and consequently this item is practically nil. The depreciation charges may be taken on the basis that the life of the tanks and filter drums is equal to that of a steel bridge, or fully fifty years.

But a much more important matter than mere cost is the aspect of the whole question from a public health point of view. The modern method of purifying swimming bath water for re-use over and over again by aeration and filtration has met, in some quarters, with a good deal of opposition, chiefly because the idea of using water over and over again for bathing purposes has been disliked. This state of affairs results almost entirely from want of adequate explanation of the whole subject.

In providing a mechanical filtration plant for the purification of bathwater, one is imitating nature's own process of aeration and filtration. Bath water is continually liable to contamination from germs of disease derived from the human body. One of the most important conditions then that a filter for bath water should fulfill, is that its efficiency as a means of intercepting disease germs should be high.

There are, however, other difficulties with which the bath superintendent has to contend, such as the growth of green algae, which takes place rapidly in sunlight, and the production of a slimy deposit on the bottom and sides of the bath. Usually this latter can only be removed by the use of muriatic acid. The use of alumino ferric introduced directly into the bath is objectionable, as it increases the deposit at the bottom of the bath and has the further disadvantage of making the bathers' hair sticky.

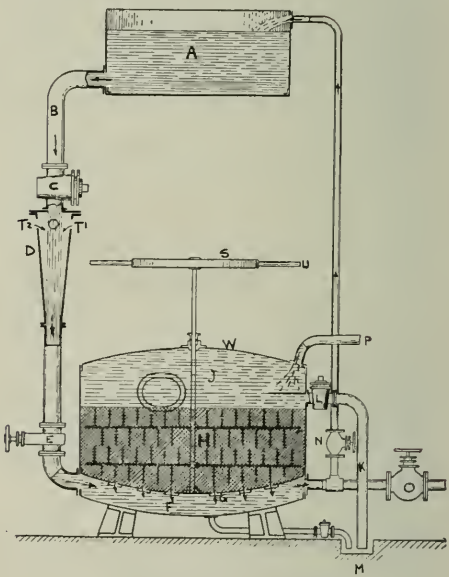
It is maintained that these difficulties are avoided as follows: The alumino ferric is used in an insoluble form e. g., as hydrate of alumina, which is then introduced into water on its way to the filter, on the surface of which it forms a film, which has the power of intercepting green algae, diatoms, and other organisms giving rise to slime on the bottom and sides of the bath.

This filter was tested on canal water in a very populous district and in which there is a great deal of bathing in the summer months. The water is stagnant and very impure from a bacteriological point of view, i. e., it swarms with microorganisms or germs, but actual counts of the germ colonies before and after filtration show as high a degree of purification as is effected by nature's own filters, such as geological strata permeable to water, such as chalk. This canal water is further contaminated by sewage, and abounds in green algae and diatoms, the purification from all of which was thoroly efficient.

It may be of interest to consider the actual condition of swimming bath water under the old system and the new. By the old system is meant the system of changing the bath water for fresh water twice, and sometimes, tho rarely, three times per week, and it is assumed for the sake of argument that it is actually changed three times a week.

If changed at the end of 48 hours the bath authorities must, at the end of six hours, consider it quite fresh; but it has been proved by actual analysis that bath water, which has been continuously purified by aeration and filtration and used over and over again, is as pure continuously as the water periodically changed for fresh is at the end of 6 hours, a time when the latter is considered quite fresh. No continuous purification apparatus has ever given a worse result than this. Better results have been attained, in some cases the continuously purified water being actually equal in purity to tap water for drinking purposes. Clearly, then, if the periodically changed water is to compete in purity with the continuously purified water, the former will have to be changed every 6 hours, which is practically impossible.

What then must be its condition when the water is allowed to remain in the bath for from 2 to 3 days without change. As a matter of actual analysis, it is exceedingly impure, and swarms with germs or bacilli derived from the human body. Surely this is the unsanitary system against which prejudice ought to exist. The method of continuous purification does, it is true, use the water over and over again, but it uses water which both from a chemical and from a bacteriological point of view, is in a reasonable state of purity, attained as before pointed out, by an artificial imitation of nature's own process.



FILTER FOR BATH WATER.

Considering again the pathogenic bacilli, or the germs of disease. When introduced into the blood of man or animals, they produce by their activities certain poisonous products called toxins. These microbes of disease derive the necessary food for their own sustenance from the human blood, and throw off into the blood products which may be regarded as excrement. It is this excrement, then, which is the toxin or poison which produces the disease. The truth of this theory has been proved in the case of diphtheria. tetanus (lock-jaw) and others, and is probably generally true. Serums or antitoxins are introduced into the blood as antidotes for these poisons, or destroyers of the poison-producers.

Diseases produced in this way are termed zymotic because their course bears a resemblance to the process of fermentation. The following are some of the diseases now known to be attributable to the activities of specific micro-organisms or bacilli: Plague, cholera, typhoid fever, dysentery, tuberculosis, anthrax, tetanus (lock-jaw), erysipelas and influenza. In fact, it is now pretty generally recognized by the medical profession that every disease to which man is subject may be directly due to a bacillus special to the particular disease, altho the micro-organism in question has not, in the case of every disease, been isolated, identified, and proved to be the cause of the disease.

During the ordinary course of working the English mechanical filter of the Rubery-Owen type, seen in the illustration, the valves C, E and L are closed, but when it is necessary to cleanse the filtering material, the supply of unfiltered water, which usually enters the filter at P, is stopped. The valve L is then opened, and the water in the space J flows to the drain M via K and L. L is then closed, and the valves E and C are opened. Clean water now passes via B and C thru the cone D. It will be noted that this falling stream of water induces a current of air which is drawn in through the aperatures T1 and T2 in the top of the cone. This air is then carried forward by the falling stream thru the valve E into the space F underneath the filtering material H. Thence the water and air passes upwards through the perforated plate G, which is fitted with specially constructed screens, and the filtering material H, the air finally escaping by an air pipe not shown.

While the water and air are flowing thru the filter bed, the agitator is rotated with the aid of the horizontal wheel S and the levers U. This can be done by hand, but in large installations, mechanical gearing for power is provided. The impurities are now floating about in suspension in the space J, and by opening the cock L they flow away to the drain.

The application of aeration to swimming baths is novel. A much larger volume of atmospheric oxygen can be dissolved in a given volume of water in this way than can be done in any other manner and the loss of heat on circuit is much less than when any form of apparatus for the production of a shower is employed.

GERMAN DWELLING REGULATIONS.

By Dr. Robert Grimshaw, Dresden, Germany.

THE necessity of having a general German law concerning dwellings is coming to the fore. As an example, I may say that in Berlin proper there are 600,000 persons so closely housed that there are five persons or more in each room; and 335,000 school children are entirely without a room in which to play, by reason of the fact that everywhere one sees the sign, "Playing in the courts and corridors is forbidden."

These figures show the boundless misery in these crowded quarters. The example noted as to children playing shows what a wretched childhood so many young beings have, hedged about at every turn by "forbidden," "not permitted," "not allowed," "prohibited," and every variety of prevention, caution and threat. In some towns and cities steps have been taken to give the youngsters a chance, in order that they may grow and thrive; but these steps have been and are still voluntary on the part of the municipalities.

At present there are many in the Imperial Parliament who think that it is time for the general government to step in and regulate the housing question, as it has that of workmen's insurance, by a law for the entire empire. A good many resolutions have been brought before Parliament, some from very altruistic motives, some from the standpoint of national defense, and others by politicians, in order to curry favor with the proletariat. The result of all this is that there has been appointed a commission to study the dwelling question and frame a law which will be brought before the Parliament for discussion. This commission held its first sitting April 18, this year.

It is remarkable that at the very first there was a paper from a commissary of the general government (that is, of the "allied governments") in which the government stated that it did not consider it its duty to mix directly in the affairs of the various governments (Prussia, Bavaria, Saxony, etc.), but greeted with pleasure all steps tending to the improvement in the condition of the people, and would work in harmony with all suggestions tending thereto. This might be said to be a bucket of cold water in the face of the commission, which put itself on record as saying that the standpoint of the general government was entirely false. The empire, as such, is just as competent to act and justifiable in acting in this as it is in the matter of the care of the public health. The action of the general government is absolutely necessary, because the various states composing the empire, with the exception of Hessen and Bavaria, have taken no action in the matter.

From the initiative of the various municipal bodies one cannot expect very much. In solving the dwelling problem there must be a limit drawn against the heavy capitalists, just as was drawn in the matter of protection of the workmen. The general government must take the initiative in compelling the municipalities to act. It is less a question of police power than one of general welfare.

The new commission will, despite the unfriendly attitude of the allied governments, be able to work with advantage, and finally to compel the Ministry of the Interior to take action. For this reason the result of its work will be the outline of a general law which will serve to animate the general government to definite action.

PAPERS BEFORE THE AMERICAN WATER WORKS ASSOCIATION.

LAYING WATER MAINS UNDER STREAMS.

By M. L. Worrell, Meridian, Miss.

THE first work of this nature, in my own experience, was accomplished while Superintendent of Public Works at Rome, Ga., having in charge the waterworks, streets and sewers of that city, during the three years beginning January 1, 1908. There were three crossings constructed, one thru Silver creek and two thru the Etowah river at different points.

The creek was to be crossed under near a highway or county bridge, and it was deemed advisable to lay the pipe on the bottom of the creek, properly secured, rather than to suspend it from the bridge or to lay it on the floor thereof, on account of the sudden rises and terrific floods the stream is forced to carry at times, it being the drainage outlet of a large area of mountainous country.

At the point to be crossed the creek was sixty feet wide between banks at street level, forty feet wide at low water, and at ordinary low-water stage twelve feet deep. Material used was cast iron, made with Ward's flexible joint, sixteen inches in diameter, weight about 67 lbs. per foot or 1,034 lbs. per joint of 12 feet, costing 2 cents per lb. delivered in Rome. The limit of deflection of this joint was said to be fifteen degrees, tho we did not find it safe to use the limit, twelve degrees being, in our experience, safer. The pipe line of five joints, twelve feet each, was made up or constructed on a platform spanning the creek at the level of the street, then lowered by means of proper tackle into the stream, the two ends being kept clear of the water for later joining to the water mains on each side of the creek, and the submerged part being gradually lowered, thus allowing deflection, until it rested on the bottom. The pattern of the pipe bell and spigot that laid under the stream being different in design to the ordinary cast-iron pipe, the two were connected by short pieces designed by the consulting engineer, J. N. Hazelhurst, who was in responsible charge of both engineering and construction. After the Ward pipe was attached to the street main a test, hereinafter described, was made for leakage, this test revealing a loss of 28,000 gallons per day of twenty-four hours. This being excessive, a diver was sent into the water to ascertain the cause and exactly locate same, the examination revealing that the limit of safe deflection had been exceeded, causing three lead joints to leak very badly. We then detached the creek line from the main on each side of the creek, raised the entire line, recaulked all joints, partially filled the bottom of the creek with small boulders, using several cubic yards in securing a good foundation and in reducing the deflection to about twelve degrees, again lowered the pipe line into creek, joining to regular main, when the next test showed only small leakage of about 380 gallons per day. Later this joint was again caulked and the leakage reduced to quite a small quantity, about 150 gallons per day. The foundation made by the loose boulders was added to, the pipe being covered and otherwise made secure, since which time no trouble has been noted, tho many heavy rains have caused large floods to be thrown against it. This work was done in the month of September, 1908. The last test made by the writer was in the month of December, 1910, and was made both for leakage and to ascertain if the pipe had moved, even slightly, down stream No movement was noted, and the leakage had not increased. The cost of this work approximated $300, everything included, or $5 per lineal foot.

The first river crossing was at Second avenue, north of the East Rome highway bridge spanning the Etowah river, the height of the banks being about forty feet above low water. We prepared for this by providing the necessary wire cable, stretched from bank to bank, to which the trolleys for carrying the supply boat and pontoon raft were attached. The pontoon raft or boat, from which we were to lay the pipe in the river, was constructed as follows:

The flotation was provided by twenty-five empty oil barrels lashed together with ½-inch manilla rope, the barrels being laid in three rows, head to head, row No. 1 having ten barrels, row No. 2 five, and row No. 2 ten, the three rows being laid parallel thus leaving a "slot" in the middle row, same being to the stern of the raft. The barrels having been so arranged, a deck was built upon them, the material used being pine lumber, 2x12, of the necessary length to cover the barrels as laid out, the barrels being secured under the deck by drop pieces or retaining "sleepers" enclosing the outfit, making a strong raft, extremely buoyant, and practically impossible to sink or capsize. The carpenter work, when completed, left the "slot" ready for the purpose for which it was designed—that of laying the pipe thru it. The woodwork was so left as to make it easy to transfer the "slot" from the rear to the front for purpose later described. Two trolleys, with the necessary tackle for operating the raft, were attached to the wire cable and secured to the raft; a supply boat, utilized from a river flat or ferry boat, was provided and attached to the wire cable and almost immediately beneath it, this boat carrying extra lengths of pipe, pigs of lead, yarn, melting pot, etc. The pontoon boat carried nothing but a tripod made of 2-inch wrought-iron pipe, attached to flattened ends by a suitable bolt, supporting a triplex chain-block, this being for handling the pipe in process of laying in bed of river. The completed outfit was propelled across the river by means of a lead or hand rope. The first joint was secured to a "dead-man" on the bank, by means of a heavy chain, the outfit pushed off, the bell of the pipe forward, the second joint fitted therein, the joint poured and caulked, outfit moved forward again with the next and each succeeding pipe until the shore had been reached. The "slot" was then moved forward, or to the front end of the boat by removing a part of the deck, which had been constructed for the purpose, removing the short row of five barrels to the stern, placing the movable portion of decking to the rear, thus leaving the last joint of pipe ready for attachment to the forward shore of the river and to the ordinary 10-inch cast-iron pipe. The short joints or pipe for joining the Ward with the ordinary cast-iron pipe were three feet in length, or made to lay three feet, one having the standard bell on one end and the flexible joint bell on the other, and one with the standard bell and the flexible joint spigot. After the operation of laying the river crossing was completed, security was insured by anchoring or attaching two joints on each

LAYING PIPE UNDER WATER, ROME, GA.

end of the river pipe to "dead-men" permanently constructed in the banks, heavy hog chains being used for the purpose. Before the work of laying the pipe was begun the river bottom was sounded, it being found to consist of solid rock, slaty limestone, with three ledges running longitudinally, each ledge having practically the same elevation. Those ledges were cut or notched, and the pipe, while being laid, was fitted therein, the notches being made by blowing away a portion of the ledge with dynamite. These notches secured the pipe from deflection down stream, and provided safe anchorage for the pipe without the necessity of providing a channel in which to lay it. The length of this river crossing was 216 feet, and the time required for preparation and actual laying was about six days. The photograph shows how the pipe-laying outfit was operated.

We used a construction superintendent, who also performed the duties of foreman; a straw boss or gang foreman, and five able-bodied negro laborers and one water boy, the pipe laying cost being about 35 cents per foot. This particular job cost about $700.

We crossed under the same river at Broad street with 12-inch pipe, the river being somewhat wider and deeper, no notches in the rock having to be cut and no channel to be prepared, the cost of this job approximated $900.

On each side of the stream thru which the pipes were laid we placed valves for cutting off the crossings in case of emergency, and it was by means of by-passing these valves that we were enabled to make the tests heretofore mentioned. One of the valves at each crossing was enclosed in a telephone or coffin-shaped manhole, in which manhole we tapped the main on each side of the valve, the inlet tap being ¾-inch and the outlet tap being 1-inch. Lead connections, properly equipped for the purpose, were attached to the taps and the other ends connected to a 1-inch meter of great sensitiveness, thus by-passing the valve, which, along with the other across the stream, was shut off, the water turned on at the ¾-inch inlet tap slowly, and as slowly let out at the outlet 1-inch tap. As soon as the meter and outlet connection had filled, the meter ceased to operate, apparently showing that we had no leaks in first river crossing. Not entirely satisfied with this, we removed the meter, blew thru it to show whether it was "struck" or not, replaced it, repeated the operation of by-passing, and experienced the same effect. Both river crossings showed the same results at the first and all subsequent trials, made at quarterly periods during term of my engagement at Rome, three years. The creek crossing did not show any deterioration. I prepared for and made similar tests of the crossings already laid, two in number, at other points, but they were not quite so satisfactory, tho the leakage observed would not justify reconstruction of the old lines.

CONTINUOUS SETTLING BASINS.

By Alexander Potter, Consulting Engineer, New York City.

THE city of Muskogee, Okla., has under construction a number of improvements to its water supply and sewerage system together with a garbage incinerator plant, with which improvements the author has been identified as designing and supervising engineer. The water improvements consist of construction of an intake tower in the Grand river, some two thousand feet above its junction with the Arkansas river, a 54-inch concrete-lined intake constructed in rock tunnel under the Arkansas river, and 2,500 feet long, the installation of additional pumping units, both high and low lift, of a water purification plant, the reinforcement of the water distribution system, and the construction of a six million gallon equalizing reservoir, consisting of a 50-sided polygon, whose walls are built entirely above the ground, each side consisting of an Ambursen dam section.

That portion of the water purification plant now under construction is designed to apply sedimentation assisted by coagulation with ferrous sulphate and lime. Provision is made so that ultimately mechanical filters can be introduced if they should be found necessary. In this article, the settling basin only will be discussed.

The new settling basin for the Muskogee water works is a reinforced concrete structure, 212 feet square on the inside. When filled to a depth of 18 feet, this basin holds over six million gallons of water. A curtain wall of reinforced concrete divides the basin into two compartments. The first or smaller of these compartments, 212 feet long and 52½ feet wide, has the bottom perforated and underdrained. A distributing trough, 3 feet 6 inches wide and 5 feet deep, extends the entire width of the first compartment. The water enters the first compartment from the distributing trough, supported on the counterforts through a series of 8-inch round openings spaced two in each panel formed by the counterforts. A 4-inch concrete baffle or stilling wall in front of the distributing trough extends the entire length of the basin. The water passes thru the first compartment over the curtain wall into the larger compartment. Balanced valves in the bottom of the curtain wall equalize the pressure on the wall during filling. A collecting channel of the same size as the distributing channel is located at the far end of the basin, extending the entire width of the basin. The water enters the collecting channel thru a series of 2-foot weirs located one in each panel. The basin is designed to operate continuously.

A settling basin operating continuously possesses a number of advantages over a basin which is operated intermittently. There is first a considerable saving in the size of the settling basin when the settling is carried on continuously. This saving may amount to as much as 50 per cent. over an intermittent installation in which two basins are used, decreasing, of course, somewhat the number of basins. When a settling basin is operated continuously, the capacity of the basin, except for the sludge displacement, is always available, which is not the case with the intermittent type. There is no reason whatever why in a properly designed basin the settling efficiency should be impaired by the disturbance at the inlets and outlets.

The author wishes to call attention at this point to the method to be used in the Muskogee settling basin for removing the settled sludge from the first or smaller compartment without interfering with the efficient continuous operation of the plant. The small compartment is underdrained. These underdrains consist of 3-inch vitrified pipe drains, each perforated with a hole 19/32 inch in diameter. The underdrains are laid with asphalt joints, and are arranged in five zones. The collecting channel for each zone is 8 inches deep and 14 inches wide. Each channel is covered with a 24-inch square reinforced concrete slab, 3 inches thick, perforated with a 19/32-inch hole in the center. A 12-inch cast iron pipe is carried from the collecting channel to the sludge chamber.

The sludge valves are 12-inch hydraulically operated valves of the Renssalaer make. Each valve controls a zone approximately 212 feet long and 10½ feet wide. In each zone are 405 holes or perforations, each 19/32 inch in diameter, spaced 2 feet on centers in rows 27½ inches apart. As the amount of sludge deposit depends principally upon the distance from the distributing trough, the arrangement of the zones is such that the sludge will be fairly uniformly deposited over the area of any one zone.

The intervals between openings of the valves and the length of time they remain open at the outlet end of the sludge drains will vary with the condition of the raw water. The precipitated solids should not be allowed to accumulate long enough to pack over the openings. The sludge valve should be closed at once when the discharge, which is visible at all times, begins to show up clear. If we could go down and examine the bottom immediately after the sludge is drawn off, we would find a cone-shaped depression in the sludge at each of the perforations. Between the perforations, some of the sludge would be left standing in the form of wedges and pyramids. The angle assumed by the side slopes of the sludge depends somewhat upon its character, and also the frequency with which it is being drawn off. Assuming a side slope of 45 degrees for the sludge, which is considerably steeper than most sludges stand in water, the amount of sludge that is out of reach of the underdrains in this particular case would cover the bottom. If considered uniformly distributed, a depth of 6 inches. This means a decrease in the capacity of the first compartment of approximately 2.8 per cent.

Great care should be exercised in the design of a system of underdrains such as has been outlined, to insure its successful operation. The underdrains and perforations must be designed so as to give the same amount of suction for all of the perforations or holes in any one zone. Otherwise, clean water will be drawn in at those points where the suction is greatest, and while sludge is still covering a large part of the opening. Such a condition not only leads to a great waste of water, but results sooner or later in the partial clogging of the perforations, and ultimately in the permanent break-down of the underdrain system. To be efficient, the water must enter the perforations at as high a velocity as it is practicable to obtain. This means that, especially in a shallow tank, the frictional losses in the underdrains and effluent pipes, and the velocity head at the discharge end, must be kept down as much as possible. In the average plant, the area of each valve should approximate the total area of the perforations tributary to the valves, preferably less, altho this proportioning is claimed to be protected by patents. Ample provision should be made to prevent excessive pressures developing in the effluent pipe from water hammer. Valves 8 inches or smaller, can be readily operated by hand; larger valves should be either hydraulically or electrically operated.

The author has used this system of sludge removal with great success. It is in use in the settling basin of the water purification and softening plant for the city of McKeesport, Pa., put in operation in 1908; and in the settling basin of the municipal water purification plant in the city of Georgetown, Ky., in operation since May, 1911. Both of these plants were designed and constructed by the author, and to the best of his knowledge there has been no break-down at any time in the underdrain system.

The larger compartment of the settling basin, comprises three-quarters of the total capacity of the basin. It has a sloping bottom draining to a sump. A 12-inch cast iron sludge pipe is carried from this sump to a 24-inch vitrified pipe drain located outside of the basin. It is expected that fully 85 per cent. of the suspended solids will settle out in the first compartment. For this reason it was considered necessary to underdrain the larger compartment. Whenever the sludge reaches a depth of several feet in the larger compartment, the operation of the basin will have to be suspended and the basin cleaned. The turbidity of the river water, however, is normally low, and it is not expected that this will happen more than once in several years.

The cost of constructing the underdrain system for the removal of the sludge, is not great when compared with the economy resulting in the cost of operation. By removing the sludge daily, the capacity of the basin is not impaired, as is the case when the deposits are allowed to accumulate. In the former case, the efficiency of the basin is maintained, whereas in the latter the accumulated deposits of settled solids displace more and more of the water content of the basin, often to an extent which seriously impairs its efficiency. The full capacity of the basins is most sorely needed when the river is turbid, but it is then that so much space is occupied by accumulated solids which cannot be removed because every inch of space is needed to assist in settling. The emptying and cleaning of a basin is a costly operation, especially in winter time, and is to a very great extent avoided, even if only a portion of the basin is properly underdrained.

The amount of water that passes off with the sludge in the system just described is not excessive. It is estimated that in the Muskogee plant this amount of water will not exceed one-sixth of 1 per cent. of the water treated.

The basin is being constructed of reinforced concrete. The value of reinforced concrete construction for water works purposes is perhaps not so fully appreciated as it should be. The advantages of a reinforced concrete structure over one constructed of plain concrete, together with the resultant economy in the cost of construction, are far greater than the profession has been ready to admit. The structure in question may safely be said to bear out this statement. Our knowledge of reinforced concrete is comparatively recent. It is only in the last decade that we have been able to produce in the field a product whose physical properties are sufficiently uniform and well understood to enable us to construct the wonderful structures now possible. It is but a question of time, and that only a very short one, when reinforced concrete will entirely displace the heavy masonry and plain concrete structures so common in the last decade.

Reinforced concrete differs materially in many respects from plain concrete. The physical properties of plain concrete can be best understood by comparing it with one of the natural stones, such as sandstone, which is very closely resembles. Reinforced concrete, on the other hand, is an entirely different material. Un-reinforced, the material is brittle, possesses very little ductility and tensile strength; reinforced, the material is tough, possesses considerable ductility and great tensile strength. In many ways, the properties of reinforced concrete are very similar to those of structural steel, and it also is adapted to many of the uses to which structural steel is put.

It is possible to construct a monolith of plain concrete of considerable proportions. However, it is but a question of time when the unequal settlement of the foundation, always present except when the foundation is solid rock, the shrinkage and temperature stresses set up in the mass, destroy the continuity of the structure. On the other hand, it is possible to construct and maintain as such a reinforced concrete monolith of very large proportions.

There appears to be some doubt that thin sections of reinforced concrete are suitable for water-tight structures. There need be no fear whatever that trouble will occur if the work is carried out as it should be. The water-tightness of concrete depends principally upon the amount of cement present, provided the sand and stones or gravel are properly proportioned. Six bags of cement per cubic yard of concrete is ordinarily sufficient to produce a water-tight mixture. This amount, however, should be increased when the hydrostatic head is considerable.

The author is opposed to the use of waterproofing ingredients or water-proofing applications. Both increase the cost of the concrete work considerably. It is far better to put the value of the waterproofing materials into the concrete itself by adding more cement. The use of a waterproofing ingredient or application tends to poor construction work, the contractor counting upon the waterproofing to help out materially careless construction.

The author, from his study and experience in the construction of tanks and reservoirs, has reached the conclusion that leakage may be due to any one of the following causes:

1. Faulty construction.

(a) Lean and porous concrete work.

(b) Inexperience and carelessness in carrying out the design.

2. Faulty design.

(a) Weak details at the connections.

(b) Excessive secondary stresses at connections.

(c) The use of too high unit stresses in steel and concrete.

Faulty construction can be rectified to some extent, but often only at a considerable cost, by waterproofing the structure from the inside. Leaks developing through faulty design are, on the other hand, always difficult to master, and in many cases very little can be done to remedy the unsatisfactory condition of the completed structure. To guard against the production of lean concrete work, the author's specifications provide that all cement used in the work should be paid for separately.

As 10 feet of the basin is constructed below the original surface of the ground, it was decided to use counterforts instead of buttresses to save excavation. The counterforts are 15 inches thick, spaced 13 feet 4 inches on centers. The side walls of the basin are 12 inches thick on the top, widening out to 18 inches at the bottom. The floor of the basin is 6 inches thick in the larger compartment, and in the smaller and underdrained one 9 inches. The basin, including the floor, is constructed and reinforced as a monolith. No expansion joints whatever are provided. There will, however, be an expansion joint between the present basin and future extension.

Horizontal construction joints are used freely. The unfinished surface is always left in as rough a condition as possible, but never roughened up after the concrete has partially set. The author has found that this roughening often loosens the stone in the concrete, but not sufficiently so that they can be removed, a condition which is apt to impair the water-tightness of the structure. To start a day's work, the surface is thoroly cleaned with wire brushes and water, and a cement liquid mortar mixed in the same proportions as the mortar in the concrete, is poured over the old work to a depth of ½ inch. This method always gives a good water-tight horizontal construction joint.

Vertical joints are permitted only in certain places, as these joints are very difficult to make water-tight.

The specifications call for two coats of neat cement wash to be applied with a white-wash brush on the inside of the basin. Both of these coats are to be applied to the concrete when damp but not wet, and the second coat must be applied before the first one has had time to get very hard. Any leakage that may develop in the basin previous to its final acceptance, must be repaired by the contractor, at his own expense, no additional compensation whatever being permitted for this work under the specifications. The work is being done so thoroly that very little leakage, if any, is expected when the basin is filled for the first time.

The contract for the construction of the basin was let to W. W. Fuller, of Muskogee, Okla. The following is an approximate estimate of the quantities of material required, together with the contract unit prices:

18,000	cu. yds. of earth excavation	@ $ 0.40	$7,200.00
1,930	cu. yds. 1:2:4 concrete	@ 6.25	12,062.50
820	cu. yds. 1:3:6 concrete	@ 5.40	4,428.00
4,000	bbls. of cement	@ 1.40	5,600.00
220,000	lbs. of steel	@ 0.035	7,700.00
3,520	ft. 3-inch vitrified sewer pipe	@ 0.20	704.00
800	ft. 6-inch vitrified sewer pipe	@ 0.20	160.00
220	ft. 24-inch vitrified sewer pipe	@ 3.50	770.00
1	manhole complete		50.00
160	ft. 12-inch cast iron pipe	@ 2.25	360.00
40	ft. 18-inch cast iron pipe	@ 4.00	160.00
380	ft. 36-inch cast iron pipe	@ 8.00	3,040.00
28,000	lbs. cast iron specials	@ 0.05	1,400.00
5	12-inch valves (gate valves)	@ 10.00	150.00
6	18-inch pressure equalizing valves	@ 12.00	72.00
1	24-inch tidal valve	@ 18.00	18.00
485	ft. 1½-inch pipe railing	@ 0.60	291.00
Superstructure for valve chamber			500.00
1,000	lbs. wrought iron and steel	@ 0.05	50.00
300	ft. ¾-inch galv. wrought iron pipe	@ 0.v0	90.00
Total			$44,805.50

EDITORIAL COMMENT

THE AUTOMOBILE IN MUNICIPAL SERVICE.

Within the past three or four years there has been an enormous advance in the application of the gasoline engine to the service of municipal departments in moving vehicles and in supplying power for other purposes.

Perhaps the earliest use of the automobile was in the police department, where speed is an important factor in keeping the department abreast with the law-breakers, and stock cars and patrol wagons have been used for several years.

Then the fire departments recognized the value of speed and control, and, not much more than three years ago, began to supply automobile hose and chemical wagons, followed by squad wagons and engines, the latter being equipped with gasoline engines for pumping, or using the same engines for motive power for both machine and pump. The development has been rapid and some wonderful results have been obtained, but the best has not yet been reached, and the improvement in the next few years will be still more marked than in the last three.

The park departments are just beginning to use gasoline power for running park engines, for spraying trees, for cutting grass and rolling lawns and for the numerous other special operations peculiar to their work.

We have in this number, by courtesy of City Engineer R. H. McCormick, of Detroit, Mich., a photograph of what is said to be the first automobile designed and purchased for the special work of a city engineer's department, which has been in use since 1907. This shows very nearly the limit of the use of the automobile in special city use, altho, doubtless, stock machines of various sorts have been in use for a longer period of time in this and other cities in one or more of the departments. It would be of interest to record the first purchase of an automobile for use in any city department, and our readers are invited to give the details of any such purchase and use coming under their observation or experience prior to 1907.

Mr. McCormick's department now has four automobiles in use, the department of public works has a few more, the police department has seventeen automobile vehicles and sixteen motorcycles, all purchased since 1909; the fire department has about twenty-five automobiles of all sorts, from the runabouts to fire pumping engines, all purchased since 1909, and most of them in 1911 and 1912, and the park department is supplying itself, including a number of new park wagons for making the rounds of Belle Isle park. And all this seems to the investigator to be but a small beginning of the development which is now imperatively demanded.

If this is true of a first-class city, like Detroit, it is still more true of the cities of the United States in general. This fact has so impressed itself upon Municipal Engineering, that this magazine has decided to pay such special attention to the subject as its growing importance demands. This has been shown by the articles in recent numbers, and will be shown still more strongly by the October number, in which a special effort will be made to record the present state of the use of the automobile for municipal purposes and to show the basis upon which future growth must rest. It is the intention to continue in future numbers the practical treatment of the automobile in city use in the same way that this magazine is accustomed to treat municipal problems. The question department is open to all our readers for their use for all problems from carbureter troubles to design of machines for special purposes, and the questions will be answered by experts in the practical use and construction and design of machines. Practical articles on subjects all along the line will also appear at frequent intervals and will cover all the subjects touched upon by our correspondents, and such others as seem desirable.

We trust that our readers will make the same use of the department for these purposes that we are glad to see them make for others in the municipal field, and that they will also report their own experiences and ideas in articles for the department, "From Workers in the Field."

MAKING AND CORRECTING CITY PLANS.

Much of the earlier work in "City Planning" and on the "City Beautiful" was in the way of civic centers and connecting boulevards, which necessarily concentrated the effort upon certain points or lines in the city, leaving the improvement of the rest of the city to local effort or neglecting it altogether. There has been a commendable tendency on the part of the landscape architects and engineers and advisers upon municipal beauty to extend the work over larger areas, and many of the reports of such men as Robinson and Nolen upon the improvement of the smaller cities have recommended plans which would leave no part of the city out of consideration.

One of the principal difficulties in the way of control of city development has been the power which the individual land owner has in most states of laying out his land according to his own ideas and without reference to the conditions in the surrounding territory, the convenience of travel along the streets or the appearance of streets or buildings. This difficulty with reference to Boston and its environs was discussed in a paper by Arthur A. Shurtleff, a landscape architect in Boston, before the last conference on city planning.

Mr. Shurtleff shows clearly that, so far as main lines of communication are concerned, the demands of the surrounding country and of communication with other towns in the days before railroads produced a system of roads which is almost ideal so far as radial roads are concerned, and that all sections of the city and its suburban towns can be reached with the utmost ease from the center of the city. This will be found true of many towns and cities which have developed in accordance with the demands of the times, but is not true of that large number of cities which have been laid out with large ideas of their probable future growth. Nor is it true of cities in the western districts laid off in square miles under the system of the U. S. Land Survey, which system has been followed in the details of alleys and streets in cities laid out upon those square miles, even to the extent of showing the jogs upon township lines which were provided for in the original system to correct the errors which crept unavoidably into the surveying work in the wilderness in which it was originally done.

In the states, especially the level states, under the U. S. Land Survey system, the section and half-section lines are adopted as lines of roads and there are few roads in any other locations, and a city laid out complete or allowed to develop follows the rectangular system unless some interested person forces a modification. The rectangular system is therefore the natural outgrowth of the conditions in all states from Ohio west, with a few exceptions, owing to early settlement by French or Spanish, such as Detroit, New Orleans, parts of St. Louis, and the older parts of some Pacific coast cities.

Mr. Shurtleff next points out the tendency in Boston and its suburbs toward circular roads across town, with the center of the city as a common center, and shows the nature of this tendency by a plat showing only these cross-town roads or main streets. He suggests that, so far as the suburban towns are concerned, and therefore the foci in the outer districts of the city as the suburban towns are absorbed into it, this tendency toward circular cross-town roads is due to the development of main roads with some reference to topography between contiguous towns, thus making lines of communication between these towns, which are independent of the lines to the center of the city.

These, again, developed in the days of horse-drawn vehicles, and cities which have developed since the railroad era do not have, nor have they heretofore required, many of these main cross-town routes. Indeed, the modern suburban town or neighborhood center develops as a residence and correlative small-business center for those doing business in the city, and there has been, comparatively, but little necessary communication between these suburban towns or neighborhood centers, and cross-town traffic is therefore small and unimportant. Where the rectangular system prevails, and it has developed mainly within the same period of time as the railroads, this unimportance of cross-town communication is still more pronounced, and there are many cities of several hundred thousand population in which it is necessary to take a car to the center of the city and then out on another line to reach centers just out of walking distance across town. These are developments of the railroad and street-railroad era and are natural. No city planning campaign could have had more than a superficial effect upon them.

Mr. Shurtleff then shows that these cross-town streets are not continuous, and shows that the reason for the numerous breaks in them is to be found in the fact that each part of such a street is the line of communication between two such centers, without reference to any other one. Therefore, in many of these centers there is a failure of direct connection which amounts to anything from a few feet to several blocks. He finds that many of the breaks in cross-town streets are due to the private control of the platting of land to the extent that streets in one plat are laid out with no reference to streets in another, and as the ideas of one man as to the way of getting the most out of the sale of lots do not agree with those of another, there are as many sizes of lots and widths of streets as these ideas and the irregular boundaries of the properties of their possessors can produce. The only limits to such a wilderness are the old-time roads between these centers, located when the area was farming land and there was no idea of making it into city lots.

The same objectionable effect of control of plats by the private owners is seen in the cities laid out on the rectangular plan, but the controlling lines are more regular, the plat having a road in each rectangular direction at least every mile, and probably every half mile, so that there are roads of reasonable regularity and continuity each half mile.

Mr. Shurtleff complains of this, and thinks control of these plats should be assumed by the city. This same complaint was made in Indianapolis some thirty years ago, and the legislature passed a law requiring the approval of plats within three miles of the city limits by the board of public works before they could be recorded. This law has been in effect for more than twenty years, and is having a good effect. But before it was passed much damage was done, and one can now see the boundaries between the original square mile, laid out on a liberal scale, an area of smaller lots and narrower streets, presumably because cheaper lots were demanded, areas laid out on much more liberal plans, a second strip of small lots with interpolated streets, each band being broken up into sections of each sort, and each band being a half mile in width.

If these rectangular cities had developed at the same time that Boston did, it is probable that the diagonal streets would have developed also, but they did not come to any considerable size until street railroads had reduced the difficulty of getting down town and the time required. As a consequence, the desirability of lines leading more directly to the center was not so strongly emphasized and the natural tendencies based on the controlling influences of the rectangular property lines have continued to have their full effect.

A new factor has entered the problem and it remains to be seen what its effect will be. The automobile has entirely changed, for a time at least, the character of travel, much of it being for pleasure rather than direct business. While the use of the automobile for business purposes is increasing rapidly, it is probable that its use for purposes of pleasure riding will always be great in proportion to its use for other purposes. This means a material increase in cross-town travel at certain times of day in particular, and emphasizes the need of continuous cross-town streets. The Boston case can hardly be made satisfactory without considerable reconstruction, but the case in the rectangular city is different. The occurrence of fairly continuous cross-town streets every mile, if not every half mile, makes it possible to get across at almost any desired point. The greater speed of the automobile and its capacity for continuous motion without "cruelty to animals" makes the few yards greater travel to get round the rectangular blocks unimportant, so that the need of secondary diagonal streets between the secondary centers, such as contiguous suburban towns, is not very serious, so that even the much heavier travel is not likely to demand great expenditures for easier methods of communication, except possibly under such circumstances as Mr. Shurtleff describes, or such as exist in Memphis, Tenn. That city is located with its front on the Mississippi river, and is well provided with streets running back from the river in continuous and approximately straight lines to the city limits, but it has practically but one street, and that very near the river bank, which extends across town in a continuous line, straight or otherwise. This is a city laid out on the parallel rather than the rectangular or the radial plan, and so has problems of its own, of which this suggestion is sufficient at this time.

One of the principal developments of the agitation for improvement of civic beauty is the planning of boulevards to connect parks with each other and with the various civic centers. So far as pleasure traffic is concerned, and this will include much business travel in automobiles, these connecting boulevards would serve very well as cross-town means of communication, and it is probable that the desired results upon this line can be obtained more quickly and easily by promoting these boulevards, and perhaps extending them to some extent, than in any other way.

The writer is heartily in favor of such civic center developments as are foreshadowed in the leading article this month for Chicago, and as are under construction in Cleveland, but much of the practical value of civic improvements, so far as the individual citizen is concerned, is to be obtained by the less expensive and more readily constructed works of less extent, such as small parks and connecting boulevards, and his only desire is that these less striking, but more generally useful improvements, shall not be forgotten, but shall be promoted at the same time, that they may be secured and enjoyed during the long years necessary for the development of the grander plans.

INCOME FROM MUNICIPAL AND COMMERCIAL SERVICES BY PUBLIC SERVICE PLANTS.

One of the difficulties in making appraisals of public service plants for purposes of making rates is in distributing the total of charges against income between municipal and commercial services, so that the charges for municipal lighting may be equitable as compared with the service rendered and with the charges for service to other customers, whether large or small consumers. This consideration is of particular value in municipally owned plants, although it is almost wholly neglected in most of them.

So far as capital charges are concerned, engineers are coming to a fairly general agreement as to the methods of determining the value of municipal service from water works plants, which have been principally in mind in writing the preceding articles in this series, but there is much less uniformity in opinions regarding the relative value of municipal and commercial services in the case of electric lighting. This is exemplified in the recent Worcester, Mass., case, in which the rate for magnetite street lamps was fixed by the State Board of Gas and Electric Light Commissioners.

Confining the discussion to the capital charges as nearly as may be, leaving those depending on operating conditions to another time, the following comparisons of the contentions of the two parties to the case and the decision of the board may be made:

The city's expert estimates the investment of the company for its street arc lamps at $300,000 and allows 5 per cent. interest and 7 per cent. depreciation upon this amount.

The company proposes to make up the investment for street lamp service of the following items: (1) The investment in both old and new generating stations and their connecting lines is to be divided in the ratio of the municipal arc connected load to the generating capacity of the new station; (2) the station equipment used exclusively for the municipal arc lighting system; (3) the municipal arc lamps, posts, wires and fixtures; (4) underground cable for municipal arc circuits; (5) ducts used in municipal arc circuits; amounting, in all, to $403,976. On this amount the company proposes to allow 6 per cent. interest, and 5 per cent. depreciation on $397,515, which omits value of land.

The commission refused to accept either method as conclusive, since it is impossible to separate the municipal arc system absolutely from the plant as a whole. Thus it considers that all of the $48,000 added to the share of the municipal arc system in the investment in the new power house, according to the company's method of computation, is not properly chargeable to that system. The reason given for this position is that the city's service was well taken care of in the old station and the new station was demanded by the material increase in the demands for commercial service, particularly for power service, and that service should carry the additional investment charge. This is decided notwithstanding the fact that the municipal arc system's proportion of the value of the power plants amounts to less than the estimated cost of a new independent plant for that system alone. This would seem to be a good place to apply the principle discussed in the article on "Obsolescence and Decrepitude as Factors in Depreciation," on page 100 of the August number. The board has arrived at a similar result, though very indefinitely stated, but if proper consideration were given to the influence of the improved station upon net returns and the increase in investment allowed were fixed in relation thereto, with due attention to the municipal and commercial branches of the business, a definite figure could have been fixed.

The second, third and fourth items of the company's inventory of the municipal arc system are readily determined, and there is little or no opportunity for difference of opinion concerning them.

The company makes a larger claim regarding the proportion of the value of the underground conduit system than the board is willing to allow. The contract requiring the construction of the conduits provided for one duct for free city use in each circuit. The company made a complicated augmentation and correction of the estimated value of the ducts occupied by municipal arc cables by means of the ratios of the municipal arc ducts to all ducts except the free city ducts, of the vacant ducts to all ducts except the free city ducts, and of municipal arc ducts to all ducts actually occupied, but the board limits the computation as nearly as the circumstances permit to the ratio of ducts occupied by municipal arc cables to the total number of fully occupied ducts, the unoccupied ducts having been laid to provide for the expansion of commercial business, with little expectation of the necessity for future additional ducts for municipal arc service, but rather an expectation that some of the space in ducts carrying municipal arc cables would be occupied also by commercial cables as business developed.

This last computation is getting deeper into detail of distribution than these articles were intended to reach, but it serves to show the desirability of discussion of such matters that standards may be developed intelligently and applied with some uniformity.

The board decides that it is impracticable under present conditions to make an analysis and apportionment of the company's property and operations so accurate and conclusive as to be a controlling factor in fixing the price for municipal arcs, and proceeds to fix the price largely upon other considerations at $80.30 per lamp per year, which is $11 less than the previously prevailing price and $15 more than the city fixed as an equitable charge. More than half the price is required to meet interest and depreciation charges, so that the value of accuracy in determining the investment is clearly shown.

The general agreement upon methods of taking care of such special technical questions in the water field as hydrant rental has been brought about by discussion and careful study of details. This question of price of municipal arc lights is one which is analogous in the electric lighting field, and, while somewhat more complicated, is capable of almost as complete formulation and consequently of approach to general agreement upon methods.

CIVIC BEAUTY.

Attention is called to the department, "Civic Beauty," on following pages of this number, which is a concentration under one heading of the efforts of Municipal Engineering in this direction. American cities are rapidly passing the strictly utilitarian stage; in fact, many of them have passed it, in the sense that they now fully recognize the value of civic beauty. That beauty and utility can go hand in hand and that a city can be built in a pleasing way at as little cost as otherwise has been demonstrated many times. That heavy cost is a profitable investment has been proved by a few prominent examples. Between them they cover almost the entire field of city building.

For many years this magazine has been identified with movements tending towards the uplift of municipalities in America, and has by means of its efforts had much to do with the upward trend of city management, which has been so markedly shown by the improvement in the personnel of city administrators, the increased interest which is being continually shown by the average citizen, in the more systematic and business-like methods pertaining to city government and a general approach toward producing better, cleaner, more healthy and more useful cities.

City embellishment is generally conceded to be necessarily an after thought, a luxury only to be afforded by a city after its utilitarian departments have been fully provided for. American people have been prone to suffer their cities to grow in a hap-hazard fashion, providing no general plan for their development and paying scarcely any heed to the aesthetic problems which have been so carefully considered by city builders of other countries.

That the American municipality, especially the smaller, growing city, may be greatly benefited by considering matters of civic beauty and especially by securing, as early in its history as possible, a comprehensive, well-balanced and dignified plan or program of development, is one of the objects for which this department will strive.

We feel that municipal officials will read with interest the articles which will appear in the department from time to time. They will be written by well-known authorities and upon the most practical and timely subjects in this field. A well-known park builder, Mr. Myron H. West, of Chicago, will pay special attention to this department, which will be a guaranty of its quality and efficiency.

OUR NEW COVER.

The most striking improvement thus far made by the new management of Municipal Engineering is undoubtedly the new cover which is first used this month. It illustrates the new department, "Civic Beauty," and we believe it meets the demands of the artist as well as being a good photograph. It is the intention to illustrate, each month on the cover, one of the most prominent features in the issue, and experience will undoubtedly enable us to improve upon the high standard set by this first design.

THE QUESTION DEPARTMENT

Oxidation, Sterilization and Disinfection of Sewage.

Please explain the difference between oxidation, sterilization and disinfection, as applied to sewage and sewer effluents.

S. E., ——, Okla.

Oxidation in a sewage effluent means the same as elsewhere, viz., the combination of oxygen from whatever source with the carbon, hydrogen, nitrogen, sulphur, etc., in the organic matter suspended or dissolved in the water. Oxidation is a chemical process which may be the result of the action of chemical or of biological forces.

Sterilization and disinfection are terms which mean the same thing, so far as the removal of the danger of infection is concerned. Disinfection is the older term as applied to sewage and other possible sources of infectious diseases, and the term is still applied to the application of chemicals by the older methods, in the attempt to remove the danger. Sterilization is the newer term and means, as ordinarily used, the destruction of all life in the liquid, whatever method may be used. The bacteria causing disease being less hardy than many others present in the sewage, disinfection should mean the destruction of such dangerous bacteria and may mean simply the stoppage or the delaying of the action of the other bacteria, whereas sterilization, if as complete as the term indicates, means the destruction of all life, and no new organic action can take place until inoculation with bacteria or other life from the air or other sources thereof. The distinction between the two terms is not definite, and this explanation is an attempt to express the common opinion regarding their difference in use. The distinction made in the dictionaries between the words for general use is on the same line, disinfection meaning the removal of infectious organisms and sterilization meaning complete removal of power of reproduction in any form.

Size of Water Mains and Leakage Therefrom.

Can you tell us where we could get the following information?

What size cast iron water pipe would it be advisable to use for a main line for a water works to supply 40,000 to 50,000 gallons per day, raising the water 500 feet in pumping from 8,000 to 9,000 feet?

What power gas engine pump would be necessary to handle the above requirements, and how many thousand feet of gas per day would it require?

Also, could you mention two or three manufacturers of gas engine pumps who are in position to furnish such machinery?

Could you give any information as to how a water company should proceed to locate leaks on the main line, where there seems to be large waste but the water does not rise to the surface anywhere near the line?

T., ——, Pa.

All the factors required to be known in order to answer the first question properly are not given. They are all fully discussed in Turneaure and Russell's "Public Water Supplies" ($5). A diagram given in the book indicates that under the ordinary conditions of domestic water supply without fire service a three-inch pipe will be sufficient to carry the amount required. An engine of 20 brake horsepower capacity would lift the water readily.

There are a number of books on the gas engine which will give more or less information regarding the kind of engine to choose for pumping, such as Audel's "Gas Engine Manual" ($2); Donkin's "Gas, Oil and Air Engines" ($4); Hutton's "The Gas Engine" ($5); Jones' "The Gas Engine" ($4).

Manufacturers of gas engines and pumps are the Quincy Engine Co., Quincy, Pa.; Harold L. Bond Co., 383 M Atlantic avenue, Boston, Mass.; Goulds Mfg. Co., 131 W. Fall street, Seneca Falls, N. Y.; Harris Air Pump Co., Indianapolis, Ind.; Keystone Pump and Drill Co., Beaver Falls, Pa.; Leiman Bros., 62 A1 John street, New York City; Merritt & Co., 117 N. Front street, Camden, N. J.; Practical Gas Engine and Machine Works, North Chicago, Ill. Reference may be made to the "Business Directory" published in each number of Municipal Engineering under the headings, "Engines," "Gasoline Engines," "Pumping Engines," "Pumps," "Sewage Pumps," "Sewage Lifts."

Several articles on methods of finding leaks in water mains have been published in Municipal Engineering. Among those of interest in this connection, some giving references to other sources of information, also, are the following:

In vol. xliii: "Testing Water Pipes by Compressed Air," p. 42; "The Cost of Leaks in Water Works Distribution Systems," p. 20; "Methods and Cost of a Leakage Survey for Lancaster (Pa.) Water Works, p. 31.

"Apparatus for Finding Leaks in Water Pipes," vol. xi, p. 429. "How to Find Leaks in Water Mains," vol. xxxix, p. 390. "What Is an Aquaphone," vol xxxvii, p. 329; "Measuring Water Waste," p. 257. "How to Find Leakage in Water Mains," vol. xxxvi, p. 319. "Location of Leaks in Water Mains," vol. xxxvi, p. 108.

Can City Plant Supply Water Outside.

Can you inform me whether or not a city, owning its own water works, can enter into contract and supply water to an association outside its corporation limits? What jurisdiction has it over the pipes and meters laid outside of its corporate limits?

F., City Attorney,
———, Iowa.

This is a question which must be answered according to the constitution and laws of the state in which it arises. Following are some decisions quoted in MUNICIPAL ENGINEERING and articles containing other information bearing on the subject:

The discussion in vol. xlii, p. 391, may be of interest.

According to the case of Steitenroth v. City of Jackson, a Mississippi city cannot supply water to citizens living outside the municipality, vol. xli, p. 140. By Edwards v. City of Cheyenne, Wyoming cities can condemn land outside city limits for water works purposes, and this is universally true, and carries with it control of the pipes and appurtenances laid in connection therewith, vol. xli, p. 141. According to Childs v. City of Columbia, that South Carolina city can supply water, under ordinances governing the case, to persons living outside the city limits and can terminate its agreements thereunder on thirty days' notice, vol. xli, p. 141. According to a case stated in some detail in vol. xli, p. 142, Reading, Pa., was adjudged unable to sell water to consumers outside its own boundaries, the matter having been so decided after presentation to the courts in several different forms.

According to Somerville Water Co. v. Borough of Somerville, a New Jersey water company can serve consumers outside the city from which it receives its powers, but this decision does not cover the case of a municipally owned plant; vol. xl, p. 440.

One of the questions in the Omaha water works case was as to the transfer to the city of Omaha of the portion of the plant serving South Omaha, but it seems to have been decided that the city must take the whole plant and operate it for the city of South Omaha as well as for itself; vol. xxxix, pp. 48, 300; vol. xxxvi, p. 45.

Texas has a law prohibiting cities from selling water to consumers outside the city limits, unless they are factories, which is declared valid in Sturgeon v. City of Paris, vol. xxxviii, p. 353.

The method of testing the right of a water company to sell water for use outside the municipality is stated in Bland v. Tipton Water Co., a Pennsylvania case, reported in vol. xxxvi, p. 322.

A decision that a private water company, operating outside of Rochester, N. Y., but with a pipe line in the city, could not sell water in the city, which has a municipal plant, is quoted in vol. xxxi, p. 29.

Other decisions quoted in earlier numbers are equally irregular, owing mainly to the local legislative and constitutional peculiarities. The writer knows of no Iowa decision on the subject. Can our readers give any additional information?

Waterproofing Concrete Pit.

We wish you would advise us whether you can suggest any method of waterproofing from the inside a concrete pit, 22 feet square on the inside, about 17 feet deep, where the outside water level is about 15 feet above the bottom.

There is a seepage of approximately ½ foot per day in this pit, and apparently the water comes in from the sides for a distance of about 2 feet above the bottom. It appears that the bottom of the pit is practically watertight.

The ground conditions are such that the method of tarring or otherwise waterproofing from the outside is not warranted because of the prohibitive expense.

C., ———, N. Y.

Will our readers report any methods which they have found efficacious?

Perfect success seems to be dependent almost entirely upon good workmanship. The pressure per square inch on the bottom of the pit on the outside is about 6½ pounds and, while this is not sufficient to force water through the concrete at a rapid rate, the attempt to stop the seepage of water will cause this pressure to develop sufficiently to make it difficult to force any waterproofing material into the pores through which the water is seeping or to keep intact any waterproof coating which may be put on the inner surface of the pit. One practical waterproofing expert says:

The only possibility of opposing a reasonably effective stop to the water by an inside application lies in making it of ample thickness and bonding it effectually to the existing concrete. Waterproofing cement in various forms has been tried under these conditions. In one of the most successful forms it combines with the good qualities of a first class Portland cement the power of expelling water. It is usually applied in a coating about ⅝ inch thick, but requires a special sand for its mixing and especially skilled labor in its manipulation. Its success depends primarily upon its adherence to the wall.

Shrinkage cracks, if they occur, reduce its value by the leakage which may occur thru them.

One manufacturer of a special waterproofing compound recommends the following specification:

Water-tightness shall be secured by plastering the inner surface of damp walls and floor with an unbroken continuous coat of cement mortar to which Trus-Con waterproofing paste has been added.

The waterproofing cement mortar shall be prepared by thoroughly tempering, to required consistency, a dry mixture of one (1) part of cement and two (2) parts of sand with water to which Trus-Con waterproofing paste has been added in the proportion of one (1) part of paste to twelve (12) parts of water. The sand shall be clean and spherical and well graded from coarse to fine.

Before plastering cement mortar on old concrete, the surface of same shall be treated as indicated in the following:

(a) The old surface shall be cleaned very thoroly with a heavy wire broom so as to remove all dust and dirt. A jet of steam shall be employed to clean the wall, if available.

(b) To the mechanically cleaned surface, apply with a large brush a liberal coat of 1:10 solution of hydrochloric acid. Allow the acid to remain until it has exhausted itself, which will require at least ten minutes. A second liberal coat of acid solution shall be applied before removing the first. A third coat shall be applied if the two applications have not satisfactorily exposed the aggregate and entirely removed the skin of hardened cement.

(c) With a hose under good pressure, slush the surface in one direction so as to remove the salts resulting from the action of the acid. Continue the slushing until the salts and all loose particles are removed and the old concrete is thoroly soaked to its full hygrometric capacity.

(d) To the cleaned and saturated surface, apply with a strong fibre brush a coating of pure cement, mixed to the consistency of thick cream, with water to which Trus-Con waterproofing paste has been added in the proportion of one (1) of paste to twelve (12) of water. Rub in vigorously so as to fill all the crevices and cavities produced by the action of the acid.

Immediately after applying the above slush coat, the first coating of waterproof cement mortar shall be applied (thickness ⅜ inch) directly upon the slush coating and well trowelled into every void or crevice of the surface. Before this first coat has reached its final set a second and final coat shall be applied to an equal thickness, so as to make the full average thickness ¾ of an inch. The finish coat shall be floated to an even surface and subsequently trowelled free from any porous imperfections. If the conditions of the work make it impracticable to apply finishing coat before scratch coat has set, the latter must be dampened and slush coated before finishing coat is applied.

The floors shall be treated and prepared exactly as indicated above and finished with the waterproofed mortar to a thickness of two (2) inches. Special care shall be exercised to bond the wall coating to the floor coating, so as to make the waterproof coat absolutely continuous.

Another method, for use where the water pressure is great and the seepage is considerable, is recommended by a manufacturer of a special waterproofing material, as follows:

Where there is pressure the first object should be to temporarily relieve the pressure on the surface to be treated, if possible. If the surface to be treated is a floor, one or several small wells should be made, reaching from one to two feet below the surface of the floor, and provision should be made for keeping the water pumped or bailed out of these wells constantly until the treatment of the floor is finished. Where the surface to be treated is a wall, holes should be drilled into the wall at convenient intervals. In each of these holes should be inserted a collapsible tin tube, such as may be bought at most confection or school stores under the name of "bean blower." The seams of these tubes are not soldered and when firmly inserted into the wall may be caused to collapse by twisting them in the proper direction. After such a tube is inserted into a hole (which should be ordinarily from one and a half to two inches deep) dry cement should be placed around the tube and tightly packed into the hole so as to hold the tube in an inclined position, with the free end pointing slightly downward so that the water will run thru the tube and drip off at the end. The seam of the tube should always be on the upper side, as otherwise the water is liable to work thru the seam and wash the underlying cement away before it has had time to set. The number of bleeders to be inserted into a given wall depends entirely on the amount of water to be drained off and the condition of the wall. Quite often it may be necessary to place tubes less than a foot apart. After drainage has thus been provided the wall should be proceeded with under proper Ironite process according to condition. The drains and wells should be left undisturbed until the Ironite has sufficiently developed to make the surface substantially waterproof. After this is accomplished (which ordinarily will take a couple of days) the wells should be filled with a good concrete up to within three inches of the surface and the remainder finished with a rich mixture of pure cement and torpedo sand, to which should be added about 15 to 20 per cent of Ironite. A better bond for topping of "well" may be obtained by coating upper edges of well with Ironite. This mixture should be tamped down hard and thoroly bound to the surrounding edges, and where there is considerable pressure a smooth board with a heavy weight should be placed on top of it at least two or three days and left in that condition undisturbed. After this period, if there should be any leaks, they should be filled with cement mixed with Ironite, which should be thoroly tamped down and driven into all cavities, and rubbed into the leaking surface. The wall drains require a similar treatment. When the surrounding surfaces appear to be waterproof, the tubes should be withdrawn by twisting them around their own axis so as to collapse them; then a piece of cork or similar substance should be driven to a depth of an inch and a half into the hole left by the tube, and immediately after that the remainder of the hole should be filled with a mixture of pure cement and Ironite in equal parts. This mixture should be put into the hole in a dry form in case there is leakage around the cork; otherwise it may be used in the form of a very thick paste. In case the Ironite is applied in a dry form, it should be thoroly packed and tamped in. This can be done without displacing the cork, on account of the peculiar packing qualities of dry Ironite, which will set as fast as it takes up the moisture and will not permit itself to be displaced. Wet Ironite will slip and will be much more readily washed away than dry Ironite working in this manner. After the holes are filled, they should be trowelled smooth so as to correspond with the surrounding surface, and thereafter the surface should be watched for several days for any leaks which might appear. Any such leaks should be treated with dry Ironite substantially as above described in reference to floor leaks. Not infrequently a persistent leakage will occur in certain places tho they have been treated properly. In such cases a careful investigation and sounding will usually reveal a rotten and partially hollow place in the wall. A pointed instrument should be driven into the wall in such case and all loose particles should be thoroly removed and the resulting cavity, if small, should be filled with dry

Ironite to be driven in and tamped hard as above described. In case the cavity discovered is large, the rear portion of it may be filled with a mixture similar to that used in the case of a well in the floor (described above).

Where water pressure, in a basement for example, is stopped, it has been found that an increased pressure is thrown on the angles (especially those between the floors and walls). It is often advisable to reinforce these angles by trowelling in a "filler," composed of cement, torpedo sand and about 10 per cent of Ironite; thereby slightly rounding said angles.

Other materials of like nature or even portland cement without the special waterproofing can be used in either of these specifications, with probability of success if the workmanship is of the best. None of them will be successful if the work is carelessly done.

How to Raise Money for Public Improvements.

We contemplate installing electric lighting and water works for our city. We will have to issue bonds to the amount of thirty or thirty-five thousand dollars, and our assessed valuation is $660,000. What is the best way to proceed? We are out of debt, and have seven thousand dollars on hand.

S., Mayor, ———, Ind.

The first step should be to have complete plans and detailed estimates of the cost of the lighting and water works prepared by a competent engineer. This will show how much money must be raised, and will save the city money in many ways besides giving a definite sum to discuss in deciding whether the city shall build the works or not.

The mayor and council can then estimate the amount of money which will be available from the funds of the city, including that on hand and the probable surplus for the following year or two. They can then decide how much of the remainder of the cost of the works shall be raised by increasing the tax rate and how much must be raised by selling bonds. It is probable that some money must be raised in each way, the bonding limit being possibly not high enough to build the works entirely from the proceeds of the bonds.

An ordinance can then be passed authorizing the issue and sale of the bonds. Ordinances should be passed from time to time appropriating the money raised in the ways mentioned to pay for the works as needed, or a single appropriation ordinance can be passed after the bond issue has been made and all the money is on hand.

Ordinances Governing Building Construction and Storage of Explosives and Combustibles.

If you have anything modern and up to date on building regulations, and the sale and storage of high explosives, gasolene, etc., I would be pleased to see them.

S., City Attorney, ———, Pa.

The most modern form of building ordinance is probably that passed by the city of Cleveland, O., which fills a good-sized book. Chapter XVIII of the ordinances providing governmental and general regulations covers the subjects of combustibles, explosives and fire arms very completely, occupying 15 pages and divided into 36 sections. The building code is printed separately and doubtless the city attorney would supply a full copy of the ordinances on request from the city attorney of a sister city.

Ordinances concerning fireworks and the like will be found in MUNICIPAL ENGINEERING, vol. xl, p. 209.

Form of Gas Franchise.

We now have an application for a gas franchise, and if you would be so kind as to send me what you consider a good franchise I will greatly appreciate it. If you are in a position to give me the information I would like you to state whether it is possible for the city to insert a clause in the franchise requiring the deposit of a certified check to be forfeited in case the system is not built. S., City Attorney, ———, Wis.

A modern franchise for a gas company in a small city will be found in vol. xlii, p. 185.

Some German franchise provisions are given in "Gas Lighting Franchise in Hanover, Germany," vol. xlii, p. 471.

Some of the provisions quoted in the article "Bill to Control Gas Companies in the District of Columbia," vol. xxxix, p. 51, will be found of value. The article on "Determining Minimum Charge for Gas," in vol. xxxix, p. 222, may give some suggestions that can be used. Some of the information given in "Information About Gas Manufacture," vol. xxxix, p. 389, will be of interest in the consideration. A list of books and articles giving "Information About Franchises for Public Utility Corporations" will be found in vol. xxxix, p. 473. The "Influence of Indeterminate Franchises on the Value of Bonds of Public Service Corporations" is discussed in vol. xl, p. 46. A decision affirming the right to tax gas mains is quoted in vol. xl, p. 138. A series of articles giving brief description of gas processes and tables of rates in many small cities will be found in vol. xl, pp. 38, 125, 220, 347.

Some articles on franchises for other public utilities will be of interest in this connection, such as "Street Railway Franchises," vol. xlii, p. 188; Specifications for Electric Lighting Contract," and Electric Light Franchise," vol. xl, p. 37; "Best Form of Water Works Franchise," vol. xxxix, p. 35.

As to the question of the deposit of a certified check as guaranty that the works will be built, it would seem to be quite as proper and legal as the filing of a bond to the same effect. A bond to secure the completion and beginning of operation of a gas works within a definite period of time is, if properly made, liquidated damages for the failure to carry out the contract and the same can be collected by suit against the bondsmen in case of failure. The certified check is similar in effect and the contract could be worded in such a way that the check could be collected in case of failure to fulfill the requirements, subject, of course to suit for injunction or recovery in case the company wished to test the correctness of the city's decision that the contract had not been fulfilled. There may be some Wisconsin statute which governs the matter. See MUNICIPAL ENGINEERING, vol. xliii, p. 49, for statement of decision in Grayson v. City of Marshall, Tex., on the point mentioned above.

Ordinance Providing for Municipal Court Juries.

Have you any ordinances or charter amendments providing for city or municipal ordinances for courts with juries to try cases therein? J. L. M., City Attorney, ———, Ga.

The writer knows of no such provisions in city charters or city ordinances. Under the principle that a city can do only what its charter permits, no city could establish jury trials in its city court unless they were provided for expressly in its charter. The writer knows of no city which has such an institution unless it is coextensive with the county in which it is located. If our readers know of any such will they refer our correspondent to them through this department?

Ordinances Regulating Peddling and Taxing Amusement Resorts.

Please give an ordinance for peddling in boroughs; also taxing places of amusement. S., City Attorney, ———, Pa.

An ordinance governing peddling in a Pennsylvania boro is not at hand. The following are the provisions of an ordinance which has been in successful operation for some years:

Sec. 1. Makes its unlawful to peddle without license, provides for more than one license to the same individual, and requires as many licenses as he has persons employed in peddling. Defines peddling as follows:

Every person who goes from house to house or from one part of the public streets to another in a vehicle, on foot or with a push cart, offering for sale any goods, wares, merchandise, fruit, candies, poultry, produce or other article, shall be deemed a peddler within the meaning of this ordinance, and the word peddler shall include hucksters, "hawkers" and "intinerant dealers" as commonly used, and shall include also any person going about said city on foot or otherwise, taking orders for or selling any kind of goods, wares or merchandise, by sample, to be afterward delivered. Provided, however, that nothing herein shall be construed to apply to drummers selling goods by sample to resident merchants. Provided, further, that non-residents peddling linen, laces, rugs or dry goods, by sample or otherwise, shall pay a license of 50 cents a day.

Sec. 2. Provides for 6 months and one year licenses at the rate per year of $20 for peddlers using any wagon, cart or other vehicle, and $6 for all others, licenses to date from January 1 and July 1 with no reduction for parts of the half year.

Sec. 3. Exempts from the provisions of the ordinance persons selling produce of their own raising or newspapers and children under 15 selling fruit, matches or stationery.

The city clerk is authorized to charge $1 for issuing each license.

Violators of the ordinance may be fined not exceeding $25 and licenses may also be forfeited.

Another ordinance prohibits peddling between 7 a. m. and 6 p. m. on penalty of $5 fine.

Following are provisions for license taxes for general revenue purposes on places of amusement, which are selected from a general ordinance covering all licenses in a Pennsylvania city:

1. There shall be levied, collected and paid within the city of —— for general revenue purposes, a license tax; and every person, firm or corporation hereinafter mentioned, shall, on or before the first day of June of each and every year, apply to the city treasurer for a license, which shall expire on the 31st day of March following, and the license year shall begin on the first day of April of each year, and include 12 calendar months, and the city treasurer shall issue such license upon payment to him of the respective sums for the same, as provided for in this ordinance: Provided, that all persons, firms or corporations commencing business after the first day of June shall pay a pro rata of the whole year, and that all licenses shall begin on the first day of the month.

2. The amount to be paid to the city treasurer shall be as follows:

xxvii. Every company, firm or individual owners of an opera house or other hall open for public amusement with a capacity to seat 1,000 persons or upwards, shall pay annually the sum of $100.

xxviii. Having a capacity to seat 500 or upwards, not exceeding 1,000, shall pay annually the sum of $75.

xxix. Owners of all other places of amusement shall pay annually the sum of $50.

xxx. Theatrical companies, minstrel shows or variety troupes giving public entertainments in the city shall pay for each entertainment $5; Provided, that if the entertainment is given by a company organized for encouragement of home talent, or in any hall paying the license tax described in Clauses 27, 28 and 29, they shall be exempt from the payment of license.

xxxi. For every single show under canvas the sum of $100.

xxxii. For every combined show under canvas the sum of $100.

3. And all shows, games or devices for public amusement or instruction for which a fee or charge is made or collected, on inclosed or open space, or under canvas, occupying not more than 200 square feet, shall pay $10 per day, and the same occupying not more than 700 square feet shall pay $25 per day, and the same occupying more than 700 square feet and not exceeding 7,000 square feet shall pay $35 per day, and the same occupying 7,000 square feet or more shall pay $75 per day: Provided, the same shall not be construed to apply to athletic sports.

7. It shall be the duty of every person beginning business in the city of ——, for which license tax is payable, to apply forthwith to the city treasurer and procure such license, which they shall exhibit to any officer of the city whenever thereto requested, and it is hereto made the duty of the mayor and aldermen and all constables and police

officers of the city to be vigilant in requiring this ordinance to be complied with and enforced.

16. To all delinquents of the license tax after the 1st day of June of each year, there shall be sent a printed notice by the city clerk, that if said tax is not paid to the city treasurer within 30 days a penalty of 5 per cent. will be added and the same can be returned to the mayor or to any alderman of the city for collection and on all of said delinquents to whom said notices are sent the city clerk shall receive 5 per cent. commission for his compensation.

17. That any person failing to take out a license or refusing to pay the license tax required by this ordinance or who shall violate any of the provisions thereof, shall, on conviction, be fined not less than $10 nor more than $50, and in default of payment thereof, together with costs, be imprisoned in the county jail not exceeding 30 days.

Another class of ordinances provides for regulation of various classes of places of amusement and for license fees intended mainly to pay the expenses of such regulation. These differ according to the local demands, and samples of such ordinances can be given if desired and the special class of amusement places to be regulated is named.

Charges Against An Engineer.

A civil engineer, who claims he is an expert in the water works business, makes a contract with a city to furnish plans and specifications to enlarge its water works. Advertisement for bids follows, contract is let, the city soon learns that he is "working" them by inferior material. Some of the well points are a dead loss for, on account of carelessness in making tests, they ran into mud instead of water-bearing gravel. He is discharged and the city puts its own engineer at work, under whom the plant is completed. On account of the inadequate supply of water due to the loss of two well points the city is put to the expense of $4,500. Before they learned the civil engineer was crooked and incompetent they paid $500, and he claims $360 balance due.

H., City Attorney, ——, Kan.

The above statement asks no question, but presumably what is wanted is an opinion as to the liability of the engineer. The statement is not complete enough to make this evident. The terms of the contract would govern and they are not given. It is not customary in this country for engineers to guarantee their work and the contract probably does not cover this, so that the engineer could not be held responsible for his errors. Whether he could recover the balance due on his fees or salary would depend almost entirely upon the terms of the contract with him. Whether he could be held criminally liable for his acts could be determined only by a suit, which would prove or disprove the allegations of fraud.

This question is an example of the indefinite charges which are too frequently made against public officials upon insufficient grounds and garbled reports of the opinions of persons unfavorable to the work under construction. City officials, especially the city attorney should take pains to get at the facts as nearly as possible before lending themselves to a movement which may be wholly unwarranted, or before making charges, the evidence supporting which might be suppressed or destroyed in case such public notice is given that the matter may be investigated.

The necessity of choosing an engineer with care and only after investigation of his record is also demonstrated. City councils are too apt to take a man on his own statement and personality because they are not all well informed in the engineering field and do not know just how to inform themselves as to the qualifications of an engineer. Any competent engineer can give references as to quality of work and integrity of character, and they should be investigated no matter what his reputation may be with some citizen, who is too often interested in one way or another in the success of the particular candidate in securing the job. The most dangerous advocate of an appointment is the man who has no particular interest aside from the desire to do a favor to a friend or a business connection in another city or a relative more less distant, for he assumes no responsibility, and shows that he can reap no personal advantage and so can talk loudly for a man concerning whom he really knows nothing.

Grades and Storage Batteries on Interurban Lines.

Kindly advise me what is the general practice as to ruling grades on interurban traction lines. Are the grades kept down to a few tenths of 1 per cent. (as on steam lines), or are 1 per cent. and 2 per cent. considered allowable? Are storage battery cars in successful use either in urban or interurban service? If so, where?

——, Okla.

Will our readers report their observations? On most of the earlier interurban electric lines little attention was paid to grades, and the surface of the roads was followed very closely, and 4 or 5 per cent. was not considered very excessive. Short grades of 10 or 12 per cent. were used in some cases. When the roads began to use their own rights of way the grades were reduced, but even then a line with a maximum grade of 2 per cent. was called a "nearly level" road.

The writer knows of no system of cars run by storage batteries which may be termed successful in all repects. They have been used only where special conditions required them.

Books on Land Drainage.

Have you any publication which treats of surface drainage for private places, telling the size of pipe to be used for mains and laterals in connection with catch basins and under drainage of grounds?

E. F. R., New York City.

Elliott's "Engineering for Land Drainage" ($1.50) and Elliott's "Practical Farm Drainage" ($1) will probably give the desired information.

FROM WORKERS IN THE FIELD

Price of Electricity for Pumping City Water Supply.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In reply to C. D. P. inquiry in August number of the MUNICIPAL ENGINEERING, in reference to price paid to electric companies per kilowatt hour for pumping water in various municipal water works:

Electricity in the water works has now been used for more than fifteen years, and the electrically driven pump has taken a permanent place among the steam driven machinery.

Like all other machinery in water works or elsewhere, the electric pump has its limitations. There are situations, however, and they are very numerous in water works pumping, where the electric pump is not only a great convenience but a profitable investment. In any power or pumping device, the use of electricity is a question of service, cost of power and investment charge. Conditions in different localities differ, and no two installations are likely to be the same, viz: pressure (fire and domestic), hours of pumping (day or night), capacity of stand pipes or reservoirs, number of water consumers (flat rate or metered), total head, including suction, discharge, friction, etc.

Here are a few towns that purchase electricity for pumping water, also the price paid per kilowatt hour:

Lincoln, Ill., population 8,000, rate 5 cents to 2 cents per k.w.hr.

Dover, N. H., population 13,000, rate 2 cents per k.w.hr.

Norwood, Mass., population 9,000, rate 1.6 cents per k.w.hr.

Cheboygan, Mich., population 6,000, rate $26.50 per h.p. per year.

Other towns pumping water with electrically driven pumps are as follows:

Lima, Ohio; DeKalb, Ill.; Maywood, Ill.; Grand Haven, Mich.; Rockford, Ill.; East Douglass, Mass.; Dudley, Mass.; Harvey, Ill.; Lagrange, Ill.; Blue Island, Ill.; Holland, Mich.; North Chelmsford, Mass.; Uxbridge, Mass.; Webster, Mass.

A comparison as to cost of pumping water, electricity vs. steam, follows: This is for a town of 4,500 people in New England. 200,000 gallons of water pumped per day or 73,000,000 gallons per year. Water is pumped to reservoir from driven wells, pressure 62 pounds.

BY ELECTRIC POWER.

Cost of Plant.

Brick pumping station, 20x20 ft....	$800.00
Grading, road, fences, etc..........	150.00
One 5½x8-inch double acting, triplex pump, capacity 220 gallons per minute, in place on foundations, with all measuring appurtenances, including sand and air chamber, and independent pump for renewing the latter, connected with one 20 h.p. electric motor............	1,835.00
	$2,785.00

Annual Expenses.

Interest on $2,785.00 at 4 per cent..	$111.40
Depreciation on pumping station, $800.00, at 2½ per cent.........	20.00
Depreciation on pumping plant, $1,835.00 at 5 per cent..........	91.75
Electric current purchased, 60,833 k.w.hrs. at 3 cents..............	1,824.99
Oil, waste, repairs................	50.00
Attendance, one-eighth of one man's time	105.00
	$2,203.14

BY STEAM POWER.

Cost of Plant.

Brick pumping station, chimney, coal room......................	$6,300.00
Grading, road, fences, etc..........	250.00
One 9x18x18½x12 duplex compound condensing pumping engine, capacity 220 gallons per minute, set in place, with all necessary appurtenances, connected with one 90 h.p. horizontal return tubular boiler complete in brick setting...	4,750.00
	$11,300.00

Annual Expenses.

Interest on $11,300.00 at 4 per cent.	$452.00
Depreciation on pumping station, $6,300.00, at 2½ per cent........	157.50
Depreciation on pumping plant, $4,750.00, at 3 1-3 per cent......	158.33
Boiler insurance	21.00
342 tons coal at $4.75 per net ton..	1,624.00
Oil, waste, repairs, etc............	75.00
Attendance, one-half of one man's time	420.00
	$2,908.33

WILLIAM PLATTNER, Consulting Engineer, North Attleboro, Mass.

Back Filling Trenches.

To the Editor of MUNICIPAL ENGINEERING:

Sir—At the convention of the American Society of Municipal Improvements, held at Detroit in October, 1907, the writer read a paper on "Back Filling Trenches," in which, among other things, he referred to the fact that when trenches are back filled by what is still the most common method by just puttng back what earth will get in the trench by handling with shovels, scrapers, tip carts or excavatng machines without any pretense of tamping the result is sure to, sooner or later, be serious settlement and damage to the pavement if not serious accident.

A recent example of this occurred in Boston. In July, 1902, we laid a bitulithic pavement on Hancock street, Boston (alongside the State House) incidentally having a 9 per cent. grade. The pavement has stood perfectly for ten years, but on May 25, 1912, a hole was discovered in the center of the street and examination developed a cavity about four feet deep and five feet wide. This is the final result (or perhaps is not yet the final result) of an old, loosely back-filled excavation made years before the laying of pavement ten years ago, during which early period the street was macadamized, and when the street was graded for laying the bitulithic years later no weakness developed. Fortunately, when the pavement finally "caved in" no other damage was done, but horses or people might easily have been passing at the time and a serious accident occurred.

It is of interest to note that, altho the bitulithic was laid on a bituminous foundation (crushed stone poured with bitumen), and, altho most of the foundation stone had fallen into the cavity, the pavement was still carrying traffic when the surface on a section about two feet in diameter of the "caved in" area broke thru.

With such facts as these before public officials (and almost every one has seen similar instances in his home city), it is really surprising what a lack of care is exercised by and enforced on contractors.

In this connection, about a year ago, in Wilmington, Del., the writer for the first time saw in operation a Staley tamping machine, which was doing such excellent and evidently economical work that it is surprising that so few cities have adopted this simple, effective and inexpensive machine.

WARREN BROTHERS COMPANY,
George C. Warren, Pres.,
Boston, Mass.

Cost of Making Cement Drain Tile.

H. H. Mussselman, of Michigan Agricultural College, makes some estimates of the cost of making drain tile which are of much interest. In places where sand is difficult to obtain or where clay tile is extensively manufactured, the making of cement tile may not be advisable, but in sections where clay tile is not easily obtained and where sand is convenient, their cost will usually be found less than for the clay product.

In the following figures, which are furnished for estimating the cost of making cement tile, it must be kept in mind that they will be affected by local conditions in almost every case. The cost of labor, sand and gravel, kind of machine used, convenience of arrangement for manufacturing and number to be made will all affect this item. The factors which will affect the cost to the greatest degree are labor and the cost of sand laid down at the place of manufacture. The element of labor required is often neglected in making estimates of this kind, since it is assumed that at certain seasons of the year it cannot be used for other purposes.

The following figures are based on some rather short tests made by the farm mechanics department of the Michigan Agricultural College. Thes tile were made on a machine adaptable to both hand and power operating, the mixing being done by hand. Two men were required to operate the machine to the best advantage. On this machine from 400 to 500 tile could be made per day of ten hours by hand power and from 500 to 750 per day using small gasoline engine for power. Not more than one-half to one horse power was required to run the machine. In any case it would be of decided advantage to use power, and if a large number are to be made a mixer could be used which could be operated by power and thereby materially reduce the work connected with their manufacture. Making at the rate given above, the cement and sand have to be mixed in comparatively small batches, since no more should be mixed than can be used in a half hour.

All the figures given are for a 4-inch tile having a 9-16-inch wall. The cost of the size given should give a fair notion of the cost of the other common sizes. The proportions used were one to four of cement and sand, screened thru a ⅜-inch screen.

Cost of material and labor per thousand by hand power:

4.30 bbls. cement at $1.50	$6.45
2.43 yards sand at $1.25	3.04
4.4 days' labor at $1.50	6.60
Total	$16.09

Cost of material and labor per thousand by engine power:

4.20 bbls. cement at $1.50	$6.30
2.34 yards sand at $1.25	2.93
3.3 days' labor at $1.50	5.00
1 gallon gasoline at 15 cents	.15
Total	$14.38

The rate of making in the above figures is computed at 450 per day by hand power and at 600 per day using an engine for power. It will be seen that the cost of making by engine power will run from $1.50 to $2 less per thousand than by hand. It will also be noted that the items of cement and sand might each be much lower in some localities.

CIVIC BEAUTY

South Parks and Boulevards of Chicago.

BY LINN WHITE, ENGINEER SOUTH PARK DISTRICT.

By acts of the legislature of the state of Illinois, approved February 24 and April 16, 1869, the South Park district was created.

The acts rererred to authorized the organization of a board of park commissioners consisting of five members, the term of one member expiring each year, the commissioners to be appointed by the circuit judges of Cook county.

The acts defined the limits of the park district and also the lands which were to be taken for park and boulevard purposes, and provided for the levying of a special assessment upon all property within the park district for the purchase of the lands, and also provided for the levying of taxes for the maintenance and improvement of the parks and boulevards.

The South Park commissioners have under their control about 60 miles of drives, including various boulevards and park drives, all drives varying from a maximum of 17,000 vehicles per twenty-four hours, of which 4,000 are heavily loaded traffic teams, which extreme condition occurs on the northern end of Michigan avenue, down to a minimum of a few hundred vehicles on the more remote boulevards situated so as to carry no other traffic. The comparatively few miles of boulevards in the downtown district carrying the heavy downtown traffic, such as the northern end of Michigan avenue and Jackson street, have long been paved in a substantial way.

Ninety per cent. of the sixty miles of drives in the system are paved with either plain or water-bound macadam. The straight away or thru traffic on the principal park drives and various boulevards thru the residence district at an average distance of six or seven miles from the center of the city amounts to from 3,000 to 5,000 vehicles per twenty-four hours in average fair weather, but may be greatly decreased during bad weather conditions or greatly increased on Sundays and holidays during fine weather. As traffic teams are excluded, at least 75 per cent. of the vehicles are automobiles, but on the numerous intersecting streets the general traffic moves unrestricted across boulevards, and must be added to the figures given above and must be reckoned with in considering effects of traffic on the pavement surfaces.

In 1908 the first surfacing was done by mixing method, amounting to about 10,000 square yards. At the beginning of the season of 1909 there was on the market a portable plant manufactured by the Link Belt Company, which embodied all the essential parts of an asphalt paving plant mounted on one truck. The South Park commissioners purchased two of these plants, which have been kept in use during the seasons of 1909-10-11-12, and, up to date, about 435,000 square yards of mixed bituminous wearing surface have been laid with them, principally over the old macadam. A comparatively small amount has been laid on new macadam base, but as no questions are involved differing from old macadam base, no special mention need be made of it. The method of doing the work has progressed from experiment to experience and from experience to what may be considered established practice in a somewhat similar process of evolution as that previously described for the pouring and penetration methods. More attention is now given to the preparation of the base with a coarse, open and grainy top, into which the surfacing mixture may be forced. In the earlier work done, the macadam surface was left comparatively smooth, and dependence was placed upon the composition of the mixtures and stability of binder to prevent shifting on surface.

One of the main attractions of the South Park system is the uniformity of the paving, which is kept up in first-class condition constantly. Winding and circulatory drives add to the beauty of a park system, but they must be kept as good as new or they will become an eyesore and a peril. All Chicagoans, and particularly all members of the South Park commission, point with pride to our drives.

Our method of paving is simple and effective. While we probably have more paving to do in the South Park than many cities of 600,000 population, we do not have a stationary paving plant. We have in operation a number of Twentieth Century portable asphalt paving machines, because the cost is less in proportion to the capacity than for the permanent or stationary plant. By means of these portable machines, conditions are favorable to maximum economy of working, as all operations of the paving work are concentrated at one spot, on the street, under the eye of one man. Expensive losses and delays due to distant location of mixing plant are avoided. There are no long hauls of prepared material to entail delays and irregular deliveries. No broken harness or wagons, nor any traffic blockades can keep the paving men waiting in idleness. No loss of working time by wagons waiting in turn at the plant, or quitting before time because unable to complete another trip.

Raw materials can be hauled more economically than the prepared mixture, as regularity and speed of delivery are of less importance. Batches of prepared material can be more advantageously delivered on the street, and more evenly and economically spread in place, in small quantities wheeled in carts or barrows than in large loads brought in wagons.

The closeness of the plant to the work removes completely the cause and possibility of the familiar irregularities in asphalt paving, due to chilling of material and separation, however slight, of the stone from the asphalt, as occur unavoidably during long hauls.

Our machines are not at all complicated. To illustrate: One furnace and one fireman to do the heating of both aggregate and asphalt. One lever measures by automatic devices both aggregate and asphalt. The total number normally required to operate the plant, producing upwards to 800 square yards of 2-inch pavement per day, is as follows: Three men feeding dryer, one man tending asphalt tank, one fireman, one machine tender and oiler, one lever man measuring for mixer, one mixer man discharging finished material. When two machines are operated together, one asphalt tank man, one fireman and one machine tender serve them both.

The manner in which the forced draft is handled—suction on the firebox and blast thru the dryer—makes the most effective drying combination possible. The hot gases follow the dried material up the elevator shaft, utilizing the last practical unit of heat.

The asphalt melting tank is placed above the dryer, where it can receive heat directly from the furnace gases after they pass around the dryer. but means are provided, in suitable dampers and baffle plates, for regulating or cutting off the heat completely. The storage hopper and measuring box for the aggregate, the measuring valve for the asphalt and the mixer for the two are all housed in and protected, so there is no waste heat. The measuring devices for materials are exact, and when proportions are determined, each batch must come out exactly as wanted. The operator cannot vary the proportions by carelessness or intent.

The division of asphalt paving work into two distinct operations—the preparation of the material at a semi-portable plant located some distance away and the laying of the pavement on the street—has various disadvantages. These are entirely overcome by the use of such machines as we use, which makes one job of the entire work and places the whole proposition on a basis of maximum economy and satisfaction.

The larger amount of bituminous surfacing done has been made 2 inches thick; a lesser quantity, 1½ inches, and a considerably small quantity about 1 inch. The later conclusions are that a comparatively thin, completely waterproof wearing surface, with a strong, coarse layer of stone keying it to the macadam base and giving lateral stability, is the most logical, economical and successful construction, the layer of coarse stone corresponding somewhat to binder course in sheet asphalt pavements.

All of the surfacing done by the mixing method during the past four years, beginning with 1908, is giving good service, with less than one-half of 1 per cent. of repairs up to date. Some weaknesses of construction have developed at certain points where the stress of traffic has been the greatest and has occasioned the small amount of repairs referred to. On some of the earlier pieces of work, surface cracks or checks have appeared, but it is believed better methods of construction, particularly the use of a coarse, open stone base, has, to a large extent, overcome this tendency.

The two other park commissions in Chicago, the West Park commission and the Lincoln Park commission, have both adopted the same method for surfacing and are using the same machinery for mixing and preparing the material. Altogether, there have been laid, and are in service in Chicago, by the three park boards close to 1,000,000 square yards by the mixing method.

In conclusion, it may be said that the additional cost of surfacing by the mixing method over first-class construcion by the penetration method is so slight and the advantages obtained of uniform results and longer service are so considerable that every municipality should look carefully into it before deciding on the inferior method. It is probably true that it should not supersede the penetration method in all cases, but where there is growing traffic, urban, suburban or interurban, it will be a better proposition.

City Planning Congress at Duesseldorf, Germany.

Duesseldorf, the most beautiful and modern city in western Germany, known as the "Park City," and the center of the industrial empire with its extraordinary commercial and political developments, probably without a rival thruout Europe, is at present holding an exhibition on city planning, city operation and city administrative functions.

The exhibition will last from June 29th to October 31st, while the International Congress will be from the 23rd to the 28th of September.

The first group of exhibitions consists of general ground plans, traffic systems, such as railways, local and express facilities, elevated, subway, suspension and street railways, aviation stations, city embellishments, bridges, docks, parks, lawns, forests and real estate politics.

Under City Operation are grouped: Gas works, water works, electric central stations, sewerage systems, street cleaning, refuse disposal, cemeteries and crematories.

Under the third group, Administrative Functions, are exhibited plans and models of hospitals, rescue homes, poor houses, lodging houses, orphan asylums, homes for widows and the aged and infirm, schools, churches, museums, art galleries, libraries, concert halls, etc.

It will be noticed from the foregoing items that this exhibition is planned with the well-known German thoroness so that hardly any subject is omitted that is of importance in city planning, city operation and administration.

The addresses and papers will be read in the principal languages, German, English, French, etc.

Duesseldorf is one of the most progressive of all European cities. The eminent writer, Frederick C. Howe, after a careful study of the city, says: "I have often dreamed of a city whose ideals rose above mere business, a city that was built like a home, that had a communal bigness of vision, that was planned by city builders, and that serves its people as a father might serve his children, and I have seen such cities in Germany, the nation which has alone recognized the portentous significance of the change which has taken place in the distribution of population. Of all German cities, I think Duesseldorf is easily the first. It is not an old residence city like Dresden or Munich. It is a comparatively new city like Cleveland, Milwaukee, Indianapolis, or Kansas City. Its population was about 69,000 people in 1871. In 1910 it was 300,000. Duesseldorf, too, is an industrial city of mills, factories and workshops. It is one of the best governed cities in the world. It has dreamed dreams and dared to carry them into execution. It is almost as beautiful as Washington, as full of joy of living as Paris and is managed with more scrupulous honesty, more scientific efficiency and more devoted pride than almost any American business corporation. The city is built for the comfort and convenience of its people. It is designed as master architects might design a world's fair to which all mankind was invited for education, recreation and art. But the thing that most distinguishes Duesseldorf is this—her people and her officials seem to appreciate that congestion of population has made it necessary for the city to own many things and do many things. Duesseldorf was not a natural harbor. The waterfront, which extends for miles along the Rhine, was low-lying land. The bank opposite the city was covered with shacks and huts, which were torn down and the land developed into a beautiful parkway several miles in extent. The city side was reclaimed from the river and confined with stone embankments. A wide esplanade was constructed upon which several public buildings as well as a splendid exhibition building have been erected. In the latter annual exhibits of art are held. Further up the river a system of docks was constructed with powerful cranes and devices which handle all kinds of freight at an insignificant cost. Crossing the river is a beautiful bridge upon which hundreds of thousands of dollars were spent merely to make it beautiful. The remarkable thing about this undertaking is the way business is made to harmonize with art and beauty. The use of the river front for recreation is not impaired by the docks and railroad tracks. Duesseldorf is laid out like a great park. Everywhere are parks and playgrounds as artistic and varied as the landscape architect can make them. The entire river bank is a promenade and driveway. The parks run into the heart of the business district. Thru the center of the town is a broad mall with the moat of the old city in the center."

A Practical Glass Street Sign.

BY. L. A. DUMOND, ENGINEER OF COMMITTEE ON DOWNTOWN STREETS, CHICAGO ASSOCIATION OF COMMERCE.

The Committee on Downtown Streets of the Chicago Association of Commerce was organized something over a year ago for the purpose of promoting improved conditions in Chicago's downtown district.

The need of a uniform and adequate system of street signs in the downtown district was one of the first matters to attract their attention. A study has since been made of the different street signs used in the large cities of America and Europe. One of the first conclusions reached by the committee was that the most beautiful streets, other things being equal, were those that were the least obstructed, and that it would be one of their objects to do away as far as possible with existing obstructions and prevent any further obstructions.

The first problem which presented itself was the selection of a street sign which could be mounted upon all buildings regardless of age, color or style of architecture, which would not be affected by the elements, which would require no maintenance expense, and which would be legible both day and night.

It was evident after some study that no enamel sign could meet all the above conditions. The cost of metal signs was prohibitive and they require almost daily attention to prevent them becoming illegible.

About this time reports were received from the chairman of the committee in London concerning the success of a glass sign recently introduced there and in several other cities of England.

The sign consists of a heavy opalized glass plate, one-half inch in thickness, mounted in a heavy zinc framework and is given added stability by a backing of portland cement grout from one-eighth to one-fourth of an inch in thickness. The letters are large and of simple design. They are put on the plate by means of a sand blast, the black enamel is applied and the plate is baked at a high temperature until the enamel becomes permanently vitrified into the glass.

The manufacturer in London made sample signs marked "Dearborn Street" and one of these signs was mounted for a time on the Marquette Building, at the corner of Dearborn and Adams streets. This sign could easily be read at a distance of three hundred feet in the daytime, while a blue enameled sign at the same corner upon a post could scarcely be distinguished at half the distance.

It was decided as an experiment to make up enough of these signs to equip Dearborn and LaSalle streets from Madison to Jackson boulevard, and to obtain the consent of the property owners to put them on their buildings. It was found that the signs could be made in Chicago for about the same money as the signs, duty and transportation charges if they were made in London.

Specifications were drawn and bids asked from Chicago manufacturers.

The job was given to the Rawson & Evans Company, of Chicago, to whom we are indebted for the accompanying photograph of a sign, and has just been satisfactorily completed. The attempt will be made to interview all of the property owners concerned and get the signs mounted within the next few weeks.

The glass street sign, which we believe is being introduced for the first time in America, is not claimed to be the ideal sign, but does seem to possess the following advantages to a greater degree than signs of other materials:

(1) It is cheap.

(2) There is practically no maintenance expense.

(3) It is not affected by the elements.

(4) It does not detract from the appearance of the building upon which it is mounted.

(5) Rain falling upon the sign washes the surface.

(6) The surface does not readily collect dust.

(7) It is legible for a great distance.

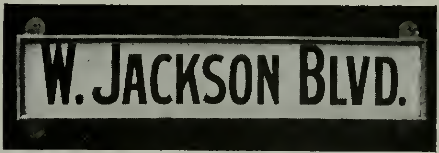
The specifications for the signs read as follows, omitting the general clauses in the contract:

Glass Plate—The plate shall consist of a white glazed slag material (trade name opalized glass) one-half inch in thickness, six inches in width, and of a length such that when the plate is mounted in the frame there shall always be a blank space at either end of the name of one and one-fourth inches.

Metal Frame—The metal frame shall be made of zinc in weight and form similar to the sample submitted, except that the lugs for mounting shall be fastened to the framework by copper set screws three-sixteenths inch in diameter, and holes for fastening the lugs provided on the top and bottom of the frame. All holes for mounting lugs to the frame shall be bored one inch from the corners of the same.

Note—It was originally intended to make the lugs interchangeable as indicated above but it was found to be impractical to make satisfactory threads in a zinc framework one-eighth of an inch in thickness. The lugs were "sweated" to the framework upon the top and bottom of the same at the ends.

Mounting of Glass Plate—The glass plate shall be mounted as follows: A surplus of soft putty shall be placed in the curved recess at the inner edge of the framework and the glass plate forced into the frame until it rests evenly upon the framework. Enough putty shall be provided so that when the glass plate is placed in the framework the surplus shall be forced up between the edge



of the glass plate and the framework for a distance of at least one-eighth inch. The glass plate shall be held in the framework by four copper clips in a manner similar to the sample submitted. The concrete backing shall be a one to one mixture of portland cement and sand mixed wet. The sand to be used shall be clean, sharp, and coarse. The concrete shall be firmly pressed into the framework and the surface smoothed with a trowel. The concrete shall be allowed to set at least seven days before the sign is moved. If the concrete backing is applied in a heated room then the sign must be kept covered and sprinkled with water at least once a day after the first day.

Lettering—The lettering shall be in form similar to the sample submitted. The first letter of each name or abbreviation shall be four and one-half inches in height. The remaining letters shall be three and three-fourths inches in height. The letters shall be eroded one thirty-second inch deep by some sand blast process. They shall be colored in black enamel and permanently vitrified into the glass.

The contract called for 78 signs distributed on Dearborn, LaSalle, Madison, Monroe, Adams, Jackson, Sherman and Quincy streets and they cost $3.25 each ready to be set.

MOTOR VEHICLES

Direction Signal for Fire Apparatus.

Ever since the introduction of the silent alarm system in Baltimore the problem that has confronted the police of the traffic squad has been to determine, on sighting the fire engines, whether the engines would go straight on a street or turn out at any particular intersection. In the congested section of the city the keeping of a clear way for the fire apparatus was thus rendered more difficult until one of the engineers of the Baltimore fire department invented the signal apparatus which is shown in the accompanying picture.

This signal, which is being tried out on one of the high pressure automobile hose wagons, consists of a large red and white striped paddle and is operated by the man who sits beside the driver of the machine and who also sounds the alarm bell. If the machine is going straight across any intersecting streets then the paddle remains upright, but if it is proposed to turn either to left or right, the paddle is lowered to the side to which the turn will be made.

DIRECTION SIGNAL ON BALTIMORE FIRE APPARATUS.

As it is possible for a policeman to see the paddle at a distance of a city block he has ample time to clear the way in the necessary direction. Although the signal system has been in use but a few weeks, it has proven so satisfactory that all of the apparatus of the department will be equipped with it.

As this is the only signal apparatus of its kind in the country it is probable that other cities will investigate its worth with a view to adopting something of a similar nature.

Municipal Automobiles of Louisville, Ky.

The motor machine is in high favor with the heads of all the departments of the Louisville city government, as well as with the subordinates. The fact that old Dobbin was not long ago entirely eliminated in the city service in favor of motor power in the street cleaning, police, fire and other departments, is because of of the lack of appropriations sufficient to bring this about. As it is, Louisville has made a good start along this line, and the executives hope to see additional automobiles purchased each year, until practically every city department is served by them.

The first substitution of the motor machine for horse power was in the police department, where a motor patrol was put into use. At that time but one was purchased, but it was quickly followed by others, in addition to a touring car for the use of the chief of police and his aides on official business. The next purchase was a machine for the chief of the fire department. It has been in use for two years, the first one in the police department having been in use three years. The board of works was next to authorize the purchase of motor machines, supplying one for the superintendent of streets, one for the use of the board members and one for the city engineer.

The motor equipment of the various departments of the city of Louisville consists of the following:

Police department, three Oldsmobile auto patrols, one Cadillac auto patrol, three Cadillac passenger or touring cars for the use of the officers of the department, and one Autocar touring car for the use of the detective force. The board of public safety, Col. E. T. Tierney, chairman, which has charge of the police and fire departments, the city hospital, alsmhouse and workhouse, has adopted a plan in connection with the purchase of motor cars for the various departments which has proven very successful. This plan is to purchase a chassis of a given make and have the rest of the machine built in Louisville to plans drawn by the engineer of the department. In this way the board has not only economized, but it has secured cars, or patrols, exactly suited to the purposes desired.

Most of the officials in charge of departments using autos indorse motor power for the city departments with which they are connected.

Col. H. Watson Lindsey, chief of police, says: "I consider the motor machines in use in mv department one of the very best assets. The advantages of motor-driven cars over horse power are so numerous that I would have to go to great lengths to enumerate them. Suffice it to say that a modern police department without motor cars is sadly handicapped. I only wish we had more."

Major Timothy Lehan, chief of the fire department, states: "I am strong for the motor-driven fire apparatus. It helps in many instances to save thousands of dollars worth of property by enabling the firemen to reach the scene of a conflagration in the shortest space of time. I have found the use of the machine provided for me of great assistance. In addition to my car, which is an American Traveler, and which has been in use for three years, the master mechanic of the department has one. Not only do motor-driven machines aid in reaching the scene of a fire in record time, but they are cheaper to maintain than horse-drawn apparatus."

The board of public works uses a sixty-horsepower Stearns; the city engineer uses a thirty-horsepower Chalmers; the superintendent of streets, William McFarland, a forty-horsepower Hudson, and Superintendent of Sewer Construction Andrew Kast uses a car which has been turned over to him by the sewer commission, that body having gone out of existence.

The board of public safety is now having built a sixty-horsepower ambulance for the use of the city hospital, an Oldsmobile chassis having been purchased and the rest of the car built in Louisville, as in the case of the auto patrols.

MUNICIPAL AUTOMOBILES OF LOUISVILLE, KY.
Chief's Car With Chief Timothy Lehan and Assistant Chiefs.

None of the city officers are more enthusiastic over motor-driven apparatus for city work than Mayor W. O. Head. Mayor Head, in discussing the innovation, said:

It is impossible for the heads of the various departments of a municipal government to keep their forces up to a high state of efficiency without the use, to an extent at least, of modern equipment, such as the motor-driven machines. This naturally applies especially to the police and fire departments, altho in the street work, the hospital work and other ways they are just as important. I find that motor-driven cars or apparatus not only increase the efficiency of the different departments, but they are more economical than the horse-drawn, power-propelled apparatus.

The handling of problems which confront the executives of a city administration calls for modern equipment, and, as I suggested before, the motor machine stands at the front in this connection. I am in sympathy with the substitution of motor equipment for horse-drawn equipment as rapidly as it can be done without the sacrifice of any property which we now have.

Automobiles for the City Engineer.

The first automobile purchased for the use of the city engineer's department in Detroit was put in service in 1907. It is a "Northern" five passenger car with body designed for the carriage of the field instruments of an engineering party and is shown in the accompanying photograph. Mr. R. H. McCormick, the city engineer, states that this was the first automobile purchased and used in a city engineer's department in this country. It is still in use by his sewer department and is now in its fifth year of service.

Three other automobiles have since been purchased on definite specifications prepared by Mr. McCormick. They are Warren cars and cost $1,325 each, complete, including top, wind shield and all essential appurtenances.

A comparison of cost of horse service and automobile service is hardly fair to the automobile, for the present outfit of automobiles enables the department to take care of the present work, which is nearly double that required in the days of horse vehicles, with no increase in the number of men. Some indication of the saving in using automobiles is given, however, by the statement of facts:

When horse vehicles were in use the department owned five wagons and two buggies. No horses were owned and they were hired, without drivers, at a rate of $3.50 a day for each team. An inspection of his record showed average livery bills of about $62 a month. The four automobiles, three five passenger cars and one run-about, are kept in the garage of the department of public works and rent and attendance are not charged to the cars. Gasoline, oil, other supplies and repairs average very near $25 a month.

The horse vehicles and automobile accounts are very closely upon the same basis, each including expense for motive power, supplies and repairs, altho neither includes all the expense connected with them. Depreciation also is not included. A complete comparison would require consideration of this item, but, judging from the present condition of the cars in use and their first cost, the probably higher charge against the automobiles for depreciation will not offset the saving in operating expenses, not to mention the saving in salaries of men on account of the larger amount of work the force can take care of in a day.

The cost of operating automobiles is also comparable with that of the ordinary citizen who takes care of his own machine and pays no garage rent. The department cost is extremely low, on this basis, and some may question the completeness of the account. It is stated as shown by Mr. McCormick's records and he would doubtless be willing to go into greater detail of items included if our readers are interested.

THE FIRST CITY ENGINEER'S CAR.

ORGANIZATIONS & INDIVIDUALS

American Road Congress.

Of special interest to engineers, highway officials and manufacturers of road material and machinery, is the construction and maintenance section of the American Road Congress to be held at Atlantic City, September 30 to October 5. Col. E. A. Stevens, State Commissioner of Roads of New Jersey, is the chairman of the Construction and Maintenance Section of the Congress. This section will deal with streets, roads, park drives, bridges, and culverts. The subjects discussed will be sub-divided in a manner unusual to road conventions. Instead of subdividing the subject under the headings of diffferent types of roads, the division will be made on the different problems of road construction.

In one sub-section for instances, there will be discussed location and grades. Question 1, will deal with surveys, discussion lasting twenty minutes; Question 22, with new location, while under another subdivision there will be a discussion of rights of way; Question 3, of sub-section A, will deal with grades, tractive resistance of various surfaces, relation to traffic, etc.

Civil service will be thoroughly considered in its application to road management. Gen. John C. Black, chairman of the United States Civil Service Commission, will make one of the addresses on this subject. He will explain the importance of putting the civil service, or merit test, to every man having anything to do with the supervision of the roads.

Every other phase of the roads subject will be handled in the same scientific manner. The most eminent bankers will discuss methods for safe-guarding a proper accounting of taxes and assuring business methods in obtaining loans or making bond issues to build good roads. There is to be a legislative section which will endeavor to point the way to needed reforms in road legislation. The president of the American Bar Association is lending his assistance in preparing the program for this particular section of the Congress.

In conjunction with the Congress, there will be a conference of educators with a view to having highway engineering introduced in colleges on a scale that will meet modern requirements. Engineers experienced in road building are not plentiful and if the colleges could be induced to introduce the right kind of .courses one of the greatest needs of the road movement would be supplied.

Logan Waller Page, director of the Office of Public Roads, and active president of the congress, believes that the gathering in Atlantic City will put the road movement on such a basis that the time will not be long distant when twenty per cent of the public highways will have been improved. Mr. Page estimates that the improvement of twenty per cent of the roads will bring this nation's road system to a high point of efficiency, almost equal to that of France.

American Road Builders' Association.

The invitation extended by the Mayor and the Commercial Association of the City of Cincinnati to the American Road Builders' Association to hold its ninth annual convention in that city has been accepted. The convention and the American Good Roads Congress which is held in connection with the convention, will, therefore, be held in Music Hall, Cincinnati, December 3, 4, 5 and 6.

In connection with the annual convention of the association, there will be held, as usual, an exhibition of machinery, materials and methods of road construction in Music Hall in space which has been set aside for the purpose. The building has a floor space of over 50,000 square feet and it is expected that all this space will be required for the exhibits. Not only will the manufacturers of material and machinery be represented in this exhibition, but the several states will have booths set aside for them in which they will exhibit, models of roads, photographs, drawings and road materials.

The president of the Association is Nelson P. Lewis, chief engineer Board of Estimate and Apportionment of New York City; first vice-president, Harold Parker, ex-chairman of the Massachusetts State Highway Commission; treasurer, Maj. W. W. Crosby, consulting engineer of the Maryland State Highway Commission; secretary, E. L. Powers, New York City.

Technical Associations.

At the annual meeting of the Colorado Association of the American Society of Civil Engineers the following officers were elected: President, Prof. M. S. Ketchum; vice president, A. O. Ridgway; secretary and treasurer, G. N. Houston.

At the sixth annual convention of the Illuminating Engineering Society to be held at the Hotel Clifton, Niagara Falls, Ont., September 16-19, the following papers will be given, "High Pressure Gas Lighting," F. W. Goodenough; "Indirect and Semi-Indirect Illumination," T. W. Rolph; "Recent Developments in Series Street Lighting," Dr. C. P. Steinmetz; "Reflection from Colored Surfaces," C. W. Jordan; "Determination of Illumination Efficiency," E. L. Elliott.

The organizing committee of the sixth congress of the International Association for Testing Materials has just issued an advance bulletin of the congress to be held in New York, September 2-7, 1912. In addition to the eight technical sessions, six of which will be in three simultaneous meetings, there will be numerous receptions and excursions in and around New York, and an official tour, September 8-15, from New York, thru Washington, Pittsburgh, Buffalo, Niagara Falls and back to New York.

The August meeting of the American Society of Engineer Draftsmen was held in the Engineering Societies' Building, New York City, on Thursday, the 15th inst. A paper by W. T. Walters, a Chicago member, on Safety Devices, their Application and Design, was read, followed by Prof. Chas. Wm. Weick, of Columbia University, who gave a lecture on Practical Perspective.

Calendar of Technical Meetings.

International Congress for Testing Materials—Sixth congress at New York City, September 2-7. Secretary of organizing committee, H. F. J. Porter, 29 West Thirty-ninth street, New York.

International Congress of Applied Chemistry—September 4, at Washington; September 6-13, at New York City. Bernard C. Hesse, secretary, 25 Broad street, New York.

International Association of Fire Engineers—Annual convention, Denver Col., September 17-20. James McFall, secretary, Roanoke, Va.

New England Water Works Association—Thirty-first annual convention, Washington, D. C., September 18-19. Willard Kent, secretary, Headquarters, Boston, Mass.

American Public Health Association.—Washington, D. C., September 18-20. Seldcar N. Gunn, secretary, 289 Fourth avenue, New York, N. Y.

Fifteenth Congress on Hygiene and Demography.—Meeting, Washington, D. C., September 23-28.—Dr. John S. Fulton, Secretary, Army Medical Museum, Washington, D. C.

Central States Water Works Association—Sixteenth annual convention, Detroit, Mich., September 24-26. R. P. Bricker, secretary, Shelby, O.

American Road Congress—Annual Meeting, Atlantic City, N. J., September 30 to October 5. Logan Waller Page, president, Washington, D. C.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment — Seventy-first Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

American Society of Municipal Improvements—Annual convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

American Road Builders' Association.—Ninth Annual Convention, Music Hall, Cincinnati, O., December 3-6. E. L. Powers, secretary, 150 Nassau street, New York City.

National Association of Cement Users.—Annual Convention, Pittsburgh, Pa., December 12-18. R. L. Humphrey, president, Harrison Building, Philadelphia, Pa.

Personal Notes.

T. H. Mandell has been elected city engineer of Lake Charles, La.

Harry P. Willis, Assoc. M. Am. Soc. C. E., chief engineer of the New York State Department of Highways, has resigned.

Melvin C. Hazen has been reappointed surveyor of the District of Columbia, which position he has held since 1908.

Henry W. E. Rabe has been appointed superintendent of the water works and sewerage departments of Galveston, Texas.

B. H. Klyce, Assoc. M. Am. Soc. C. E., formerly city engineer of Jackson, Miss., has been made city engineer of Waycross, Ga., succeeding H. H. Pafford, resigned.

Prof. William J. Carrell, associate professor of civil engineering at the State University of Kentucky, has been appointed bridge engineer in the Highway Department of that State.

Joseph W. Shirley, Baltimore, Md., chief engineer of the Topographical Survey Commission, has been appointed a member of the Baltimore City Planning Commission, succeeding W. H. Fehsenfeld.

Irving W. Barbour, Portland, Ore., has resigned his position as field engineer of the water department, to become a highway engineer with the United States Office of Public Roads, Washington, D. C.

F. F. Longley, Assoc. M. Am. Soc. C. E., resident engineer of the Toronto, Ont., water filtration plant, has resigned, to become a member of the firm of Hazen & Whipple, consulting engineers, New York City.

James E. Barlow, Assoc. M. Am. Soc. C. E., engineer with the Bureau of Municipal Research, Cincinnati, Ohio, has been appointed principal assistant city engineer of Cincinnati, succeeding G. D. Baker, resigned.

Ewing & Stone Co., civil and consulting engineers, 1742-43 Monadnock Block, Chicago, Ill., announce the change of their firm name to Central Engineering Bureau, at the same address. This firm specializes in municipal and public works.

Prof. James F. Kemp, of the department of geology, Columbia University, has gone to the Panama Canal Zone to make a special study of the geological conditions in the Culebra cut for the Isthmian Canal Commission.

E. W. Robinson has been appointed city engineer of Webb City, Mo., after having served as assistant engineer for three years. The former engineer, A. J. McKenzie, Assoc. Mem. Am. Soc. C. E., has resigned to enter construction work.

Adolph O. Krieger has resigned as publicity manager of the Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, to open an office at 916 Victoria Building, St. Louis, for the sale of the Tacchella oil burning device. Waller Edwards has been appointed publicity manager of the Busch-Sulzer Bros.-Diesel Engine Co.

MACHINERY AND TRADE

The "Roturbo" Centrifugal Pump.

The modern and successful development of rotary machinery in the form of electric motors and steam turbines has reacted on the centrifugal pump and created a demand for a design to meet all pumping problems and the highest efficiency, avoiding gearing and reducing cost, weight and expense. Until about ten years ago it was generally agreed that centrifugal pumps were only suitable for low lifts and large volume of water—such as occur in irrigation, sewage and salvage work and for circulating water for condensers.

The efforts of the early designers that the centrifugal type should not be limited to a few of the pumping problems of the world is shown by the patents taken out in the attempt to overcome the well-known difficulties, and to make the centrifugal pump suitable for high lifts by using a number of impellers in series.

The delayed development was largely due to the fact that to get the best results from a centrifugal pump, impellers should be of small diameters running at high speed, rather than of large diameters running at low speed, but until the advent of the electric motor and steam turbine there was no means of driving centrifugal pumps at the necessary speed except thru belting or gearing with their inseparable difficulties and losses in transmission, which neutralized the advantages aimed at in the pumps.

Perhaps the defect which has been the most difficult to overcome and which has decided the buyer in many cases against this type of pump, has been the fact that it would only work at its best at the exact head for which it was designed. The reason of this being that the blades of the impeller were shaped so as to pass a certain amount of water with the minimum friction of loss, due to cavitation; but if the head against which the centrifugal pump is working is reduced, a greatly increased volume of water passes and the impeller then becomes unsuitable for the increased speed of the water thru it and begins to act as a water brake, thus creating an overload on the driving machine. Large numbers of motor driven centrifugal pumps have given trouble or been burnt out by reason of this inherent defect (if they have not had a large margin of power). Since the variation of head either in the suction or delivery is one of the commonest conditions met with in pumping problems, it has been a large handicap to the wider introduction of centrifugal pumps.

The problem of varying heads has been met by the invention known as the Rees pressure-chamber impeller, which was placed on the market in Europe in 1907 by the Rees Roturbo Manufacturing Company, of Wolverhampton, England. The invention has been protected by patents in every country in the world by the parent company, the Rees Roturbo Development Syndicate, Ltd., Wolverhampton, England. The sole right to manufacture and sell Roturbo pumps in this country and Canada has recently been obtained from the Rees Roturbo Development Syndicate, Ltd., by the Manistee Iron Works, of Manistee, Michigan.

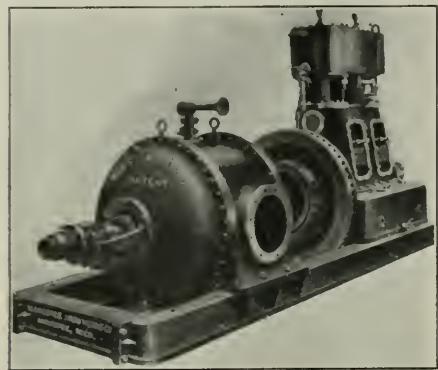
The characteristic feature of this pump is that it is a true turbine pump, the "rotor" has a strong "turbine" effect, due to the water passing. The turbine effect is secured by making the rotor of large capacity for storing water which is maintained by rotation at a constant maximum internal pressure with the minimum amount of loss, consequently, instead of throwing away the surplus speed energy of the water discharged when the head of delivery is reduced, the energy is extracted from the water before it leaves the pump casing.

In the Roturbo pump the design differs from the ordinary impeller or flat disc runner, which is formed with the main object of securing velocity of the water in the expanding channels of the fixed casing.

With the Roturbo pressure-chamber, the water, after being picked up at the eye, becomes practically stationary, relatively to the pressure-chamber itself, thus eliminating friction and losses, and generating a pressure by centrifugal force.

The inner portion of the impeller between the eye and the largest section of the pressure-chamber may be looked upon as a centrifugal pump proper and the blades of this portion are designed similarly to those of an ordinary centrifugal pump. The rim portion, beyond pressure-chamber, is designed as a reaction turbine, having rearwardly directed nozzles, discharging from the pressure-chamber.

The pump is therefore always discharging with a constant pressure, which is the ideal condition for a centrifugal pump, and the turbine is always discharging from a constant pressure which is the ideal condition for a turbine. The result of a combination of a pump and turbine, with a pressure-chamber between them, is that the self-regulation is perfect, and at any heads lower than normal duty the power taken from the motor is prevented from rising. As the speed of the water passing through the pressure-chamber is reduced, internal friction is reduced to a minimum and a high efficiency



THE ROTURDO CENTRIFUGAL PUMP.

is secured without the necessity of machining or polishing blades or surfaces. The internal wear is also minimized.

The Roturbo pumps are operating for pumping sewage, mines, coal mines, boiler feeds, pressure augmentors for city service, fire protection, dock pumping, cooling towers and condensing plants, etc.

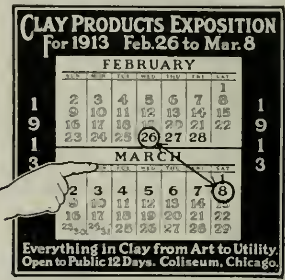
Due to the self-regulating characteristics of this pump, the streams can be delivered through any number of hosepipes without overloading the engine when the head is reduced. Consequently the maximum power of the engine can be utilized at all times no matter what the head may be, since it runs at constant speed.

The Clay Products Exposition.

The second annual show of the Clay Products Exposition Company in Chicago this coming winter, will extend over a period of twelve days instead if six days. Secretary Hopley and his assistants are beginning to put into effect the preliminary plans for the event.

In addition to many new features, which will not only interest the visitors, but assist in creating a demand for clay products, the lines represented will be extended and, where other branches of the industry were merely represented last season, full displays will be presented. This is true, particularly of the pottery interests.

A feature that is to be added to this year's show will be the prizes offered the exhibitors. One prize is to be given for the



most novel display; another for the most beautiful display; another for the largest single display, and still another for the most practical display. Allotment of space to exhibitors will be made September 20.

Progress of the Wire-Cut-Lug Brick.

During the month of July three more large brick manufacturing companies have contracted for the production of the Dunn wire-cut-lug brick. They were the Foster Paving Block Co., Bradford, Pa.; the Bessemer Limestone Co., Youngstown, O., with two plants, and the Metropolitan Paving Brick Co., Canton, O., with six plants.

The advance of the wire-cut-lug brick has been remarkable. Starting with only two plants equipped in 1910, in less than two years, fifteen manufacturers, with twenty-four plants, have been licensed to make brick under the Dunn patents. In that time four hundred and fifty cities have admitted this type of brick under the specifications.

A Squeegee Street Washing Machine.

The Kindling street washing machine is a German invention, which has for some years been in successful operation. It has become more popular, until now it is in general use in the municipalities of the continent, and is universally recognized as one of the most thoro and economical of all machines for the cleaning of smooth pavements—asphalt, bitulithic, tar macadam, wooden block and brick. It is manufactured by the Kindling Machinery Co., Milwaukee, Wis.

The operation of the Kindling street washing machine is very simple. The tank feeds four sprinklers, between the front and rear wheels, all operated with valves by the driver on the seat. One or more of these sprinklers can be used at the same time, according to the amount of water required to remove the accumulation on the pavement, or the water supply can be shut off entirely, when the pavement is already wet enough, as after a heavy rain.

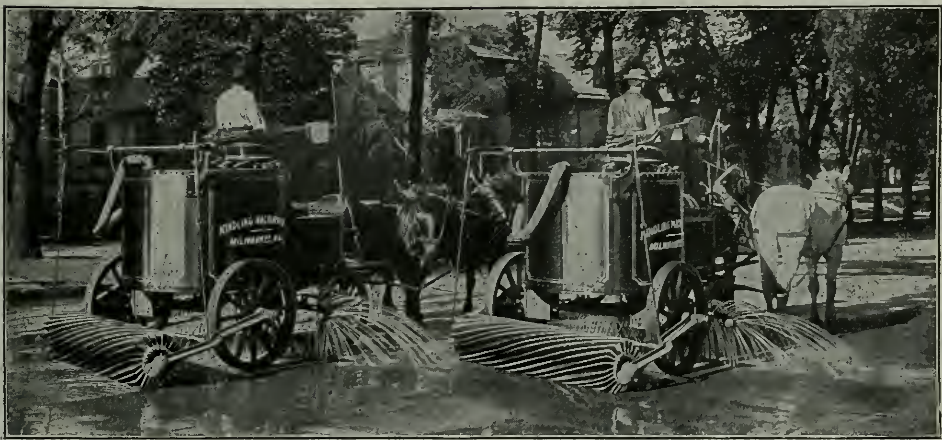
Geared to the left hind wheel is the cleaning roller, or squeegee. This is a heavy steel cylinder, with twenty-four rubber fins, each seven feet long, five and one-fourth inches wide, and five-sixteenths of an inch thick. As the cylinder revolves, the rubber removes the mud, dust and slime from the pavement.

To the right of the driver's seat is a lever, by which the cleaning roller can be raised or lowered. Should the roller be too high, the counterweight may be set back a few inches; if too low, set it forward. On the counterweight are two iron plates which can be removed as required. The rubber blades should merely touch the pavement and should not be bent very much; the latter position not only causes the rubber to break and wear faster, but has a tendency to smear the accumulation instead of removing it.

Many of these machines have been placed in operation by the city of New York. Foster Crowell, former commissioner of street cleaning, New York City, states: "Experiments have shown that in the residential districts the squeegee uses only an average of 0.11 to 0.12 gallon of water to each square yard of surface cleaned, while in the more congested districts, the rate runs from 0.125 to 0.250 gallon to the yard, as a greater quantity of water must be used there to loosen the accumulated dirt.

By a recent series of interesting experiments the sanitary efficiency of the squeegee has been pretty well demonstrated, as well as its economy. Bacteria culture plates were exposed in the streets in different localities, and the number of bacteria colonies which developed on them during exposures at the same localities as before and after street cleaning by means of the squeegees was some measure of the sanitary effectiveness of the machines.

In Fifth avenue, for instance, between Seventh and Eighth streets, a plate exposure before the street was cleansed developed 200 colonies but after the street had been cleansed a new exposure showed their number had been reduced to only 29."



SQUEEGEE STREET WASHERS.
The Street Washing Machines in Operation.

The Matthews Interlocking Signs.

There is one very important point in road and street improvement that has been neglected, namely, the proper and effective marking of the streets with permanent and serviceable signs. Few cities and villages have given this subject the attention it so much deserves and few realize the importance and necessity of an effective and uniform system of street markings or the very great convenience which is thereby given to the public.

Cities which have placed signs on their streets in the old way of nailing them up on convenient buildings, poles, fences or trees, are beginning to realize that this method is inadequate and ineffective because of the rapid growth of the cities and villages, the changes in mode of travel, the greatly increased number of strangers being daily brought into the city by the improved facilities offered by electric power, and also that they are undesirable from an artistic point of view. The old style and manner of installing street signs is not found satisfactory because it is necessary to place the signs parallel to the street which allows of their being read from but one direction; they are not permanent because, generally placed on private property, they are soon destroyed by one means or another, they are not uniform as to location and therefore not readily found during the day and never at night.

The driver of an automobile does not know where to look for the sign put up in this manner and in order to find it must take his attention from his machine and this at a time when he is about to cross an intersecting street, a time when his whole and undivided attention should be given to the handling of the automobile. If he finds the sign at all, the chances are that he has by that time gone so far across the intersecting street that it is impossible to make the turn and it is necessary to stop, reverse and back up to a point from which the turn can be made.

The street sign manufactured by the Mathews Interlocking Sign Company, White Plains, N. Y., is a device by means of which a uniform system of street markings is possible; the sign at each intersection is the same. It can be seen and read from all four directions. It is durable, being composed entirely of metals not subject to the action of the elements. The sign plates are bright and do not require painting.

The Mathews signs have been adopted by the state highway departments of New Jersey and New York and by over forty cities, villages and towns during the first year of their manufacture.

Motor Grass Mower.

The larger the city, the more serious the problem is for keeping the grass in good order. The ordinary horse lawn mower in its most efficient condition in a day's operatiin can only take care of one and a half or two acres, according to the nature of the ground, and when our parks run into anything from one hundred to eight hundred acres, the simple operation of mowing the grass becomes a great problem.

Grass growing experts state that after the winter frosts the upper turf has been raised up and there is an air space between it and the lower soil thru the action of the frost. The only way to insure a strong, healthy growth of grass is to get these two layers in touch with each other early in the season, otherwise the roots of the grass become impoverished as the spring advances, because they have not thoroly reached the nourishing soil below. This is where the motor lawn mower can do more good in the early spring than fertilizers can do later in the season. A strong, healthy growth of grass gets a start which the summer heat can not burn, with ordinary care. A close, velvety surface of grass is the surest way of keeping out weeds.

The latest model of motor lawn mower built by the Austin Manufacturing Company, Chicago, is designed to take care of large tracts of grass in the most efficient manner. This machine has a 16-horse power engine on it with self-oiling system, magneto ignition and mechanically operated valves. Their double speed transmission gear is made of vanadium steel, case hardened, running on steel roller bearings enclosed in a dust-proof, oil-tight gear box. No chains or sprocket wheels with their loose sliding bearings are permissible in a machine built for durability and easy maintenance. Every gear is enclosed and runs in oil.

MOTOR LAWN MOWER.
Machine in Use in South Park District, Chicago.

Motor-Driven Concrete Mixer.

The accompanying illustration shows a gasoline concrete mixing outfit with discharging trough or chute for street work. The chute will distribute the concrete over a considerable area avoiding shoveling and wheeling. This mixer is built low and is so designed that it can be charged direct from barrows, requiring only slightly inclined runways, instead of being high above the ground necessitating the use of some form of mechanical charging device, or the putting up and taking down of expensive high charging platforms.

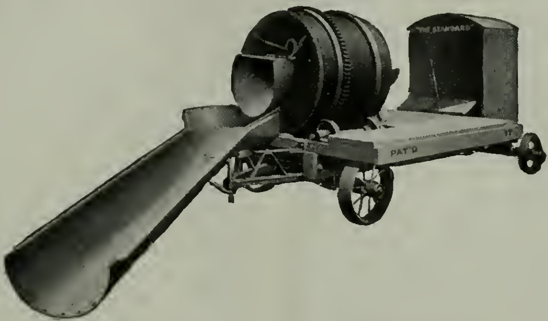
The discharge is a patented invention and is so designed that it discharges high enough above the ground to afford ample clearance. The batch may be discharged in wheelbarrow loads or as a unit.

The discharging arrangement is semi-automatic and the discharge door is opened from either end of the drum, dispensing with the services of a man to operate the discharging device. The charging platform is attached to the truck and this, together with the inclined runways, is portable as a unit with the machine.

The drum of "The Standard" concrete mixer is made with flanged steel heads, riveted to surrounding shell of rolled plate steel which is reinforced with two heavy rings or bands with flare for rollers and one or both of the bands are provided with gear for driving.

The drum is supported by trunnion rollers which tread against the flare of the track bands. It is rotated by pinions meshing into gear bands, the power being transmitted thru the shaft on which these pinions are placed.

At the charging end there are a large circular opening in the flanged head and diagonal overlapping charging blades which carry the material into the drum. These charging blades extend within the plane of opening and are attached to the flanged head and also to the interior of the shell. The charging end of the drum is open, allowing the entire batch of concrete to be seen while being mixed.



THE STANDARD CONCRETE MIXER.

Hendricks' Commercial Register.

The twenty-first annual revised edition of Hendricks' Commercial Register of the United States for buyers and sellers has just been issued. Established in 1891, it has been published annually since that time and is the most complete work of its kind in existence. Its aim is to furnish complete classified lists of manufacturers for the benefit of those who want to buy as well as for those who have something to sell. It covers very completely the architectural, engineering, electrical, mechanical, railroad, mining, manufacturing and kindred trades and professions.

The present is by far the most complete edition of this work so far published. The twentieth edition required 108 pages to index its contents, while the twenty-first edition requires 122 pages, or 14 additional pages. As there are upwards of four hundred classifications on each page, the fourteen additional pages represent the manufacturers of over 5,000 articles, none of which have appeared in any previous edition. The twentieth edition numbered 1,419 pages, while the twenty-first edition numbers 1,574 or 155 additional pages.

Trade Notes.

Philadelphia, Pa.—The Civil Service Corporation has been formed to take over and prosecute the public utility and general engineering businesses which have formerly been conducted individually by T. Wilson Battin and by A. L. Osgood. These gentlemen have been in the business for a number of years in an advisory capacity for others and are turning over and consolidating several going concerns. The officers of the new corporation are G. Henry Stetson, president; T. Wilson Battin, vice president; J. Lee Patton, treasurer, and A. L. Osgood, secretary.

Chicago, Ill.—The Jeffrey Mfg. Co. have moved their Chicago headquarters and offices from the Fisher Building to the McCormick Building, recently completed. S. S. Shive, sales engineer, is the district manager. The Jeffrey Mfg. Co. maintain fourteen branch offices in the United States and over one hundred agents in the leading commercial centers all over the world.

Patchogue, L. I.—Dayton Hodges has purchased a second portable drying and mixing outfit for road work from the Ruggles-Coles Engineering Co., 50 Church street, New York.

The Foreign Commercial Bureau Co., 50 Church street, New York City, has received the privilege from the United States government of placing in every American consulate a completely briefed and indexed resume of the catalogs of American manufacturers in every branch of industry. Such catalogs are arranged in card form, are printed in Spanish, German, Portugese, French and English, or such other language as may be necessary, are arranged under the names of the manufacturer and also under the title of his product, and are shipped in complete and compact form. MUNICIPAL ENGINEERING will be found on file in the London and Paris offices of this company.

Patents Concerning Reinforced Concrete.

889,820. Reinforced Wall. Antoine Z. Chiodo, Cairo, Egypt.

890,032, 890,033, 890,034, 890,035, 890,036. Unit Bars, Frames and Reinforcement for Concrete Construction. Julian O Ellinger. New York, N. Y.

890,428. Reinforced Concrete Construction. John W. Lingee, Jr., Boston, Mass.

890,545. Reinforcement. John J. Whitacre, Canton, O.

891,234. Reinforcing Bar for Cementitious Bodies. Edward F. Crane, Newark, N. J.

891,929. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

893,272. Concrete Structure (reinforced). Chas. E. Springer, Chicago, Ill.

893,640. Reinforced Girder. Ernest A. Moccetti, Paris, France.

893,792. Reinforcement for Concrete or Cement Construction. Wm. C. Gabriel, Auburn, Ind.

894.997. Reinforced Concrete Construction Member. Robert Anderson, Cincinnati, Ohio.

896,589. Bar for Concrete Construction. Julius H. Schlafly, Canton, O.

896,679. Reinforced Concrete Beam. Hiram B. Andrews, Melrose, Mass.

900,379. Reinforcing Bar. Alfred C. R. Janni, St. Louis, Mo.

901,551. Reinforced Structure. Daniel W. Norton, Vincennes, Ind.

902,027. Reinforced Cement Culvert. Clifford D. Voris, Crawfordsville, Ind.

902,335. Reinforce for Concrete Structures. John M. Sherwood, Bridgeport, Conn.

903,903. Reinforcing Device for Concrete Structures. John T. Simpson, Newark, N. J.

903,909. Reinforced Concrete Construction. Chas. R. Steiner, Gridley Colony No. 8, Cal.

904,283. Reinforcing Device for Concrete Structures. John T. Simpson, Newark, N. J.

904,785. Reinforcing Bar for Concrete Construction. John V. Jenkins, Wichita, Kan.

904,977, 904,978. Tension Bars and Devices for Concrete Constructions. Geo. S. Miles, New York, N. Y.

905,056. Armored Concrete Construction. Edmond Coignet, Paris, France.

905,480 Reinforcing Bar for Concrete Structures. Avila Thomas, Detroit, Mich.

906,479. Concrete Reinforcement. John J. Whitacre, Canton, O.

908,783. Reinforced Concrete Construction for Piers and Docks. Englebrit C. Lawrence and Oscar F. Lackey, Baltimore, Md.

908,805. Reinforced Concrete Manhole Cover. John P. Rogers, Topeka, Kan.

909.850. Metal Reinforce for Concrete. Gordon F. Dodge, Chicago, Ill.

910,124. Girder for Reinforcing Concrete Structures. Geo. M. Graham, Chicago, Ill.

910,469, 910,470. Reinforcing Frame for Concrete Structures. Geo. M. Graham, Chicago, Ill.

910,837. Girder (reinforced concrete). Ernest A. Moccetti, Paris, France.

910,947. Reinforced Concrete Supporting Beam. Jas. Needs, Takenham, Eng.

911,062. Deformed Bar. Frank V. McMullins, Edgewood, Pa.

913,083. Reinforced Concrete Construction. Elbert F. Wilcox, Kansas City, Mo.

913,603. Reinforcing Bar for Concrete Work. Edward C. Woodward, Raleigh, N. C.

915,590. Reinforced Concrete Retaining Wall. Edward Godfrey, Pittsburg, Pa.

917,304. Metal Reinforce. Albert L. Johnson, St. Louis, Mo.

917,822. Metal Reinforce for Concrete Structures. Eli White, New York, N. Y.

917,787. Bar for Reinforcing Concrete. Alfred L. Lindau, St. Louis, Mo.

918,019. Strengthening Member for Composite Cement and Metal Constructions. Oliver M. Davis, Detroit, Mich.

918,231. Reinforced Concrete Construction. Wm. J. Warren, Yuba City, Cal.

918,366. Reinforced Concrete. Hamell J. Quireau, Baldwinsville, N. Y.

918,715, 918,716. Metallic Reinforcements for Concrete Construction. Daniel A. Wedmore, Philadelphia,, Pa.

919,100. Metallic Reinforce for Concrete Construction. Daniel A. Wedmore, Philadelphia, Pa.

919,273. Reinforcing Truss for Concrete Structures. Herbert E. White, Youngstown, O.

919,714. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

921,626. Reinforced Concrete Construction. Walther Raster, Chicago, Ill.

922,305. Means for Reinforcing Concrete. Edmond G. du Mazuel, New York, N. Y.

924,090. Reinforced Concrete Construction. Egbert J Moore, Yonkers, N. Y.

925,643. Shear-Bar for Reinforced Concrete Construction. Chas. T. Lindsay, Pittsburg, Pa.

925,750. Concrete Reinforcing Bar. Elie Cannes, New York, N. Y.

925,989. Reinforcing Means for Concrete Structures.—Eldridge R. Boyle and Wm. H. Upton, Washington, D. C.

926,005, 926,006. Reinforcing Devices Wm. T. Kerlin, Rockfield and Edward W. Bowen, Delphi, Ind.

927,194. Reinforced Concrete Beam. C. A. P. Turner, Minneapolis, Minn.

928,192. Reinforced Concrete Cattle Guard. John H. Hammill, Cedar Rapids, Iowa.

928,430. Reinforcing Bar for Concrete Construction. Jas. M. Dudley,, Bessemer, Ala.

928,475. Means for Reinforcing Concrete Constructions. John T. Simpson, Newark, N. J.

929,728. Reinforced Revetment. John H. Taylor, Waterloo, Neb.

931,049. Reinforced Concrete Construction. Ralph de Lacaire Foster and Gustav Schulz, San Diego, Cal.

931,185. Reinforcing Bar for Concrete. Jas. M. Dudley, Bessemer, Ala.

931,320. Reinforcing Bar for Concrete Construction. Preston T. Large, North Tonawanda, N. Y.

931.322. Reinforcing Bar. Alfred E. Lindau, St. Louis, Mo.

933,261. Reinforced Construction of Walls (Tunnel.) John T. Flynn, San Francisco, Cal.

934,089. Reinforced Concrete Structure. Ernest McCullough, Chicago, Ill.

934,378. Concrete Reinforce. Herbert E. White, Youngstown, O.

937,178. Method of Manufacturing Reinforced Tubular or Hollow Bodies. Louis H. Reutzsch, Meissen, Germany.

938,660, 938,661. Reinforcing Framer for Concrete Structures and Method of Erecting. Geo. M. Graham, Chicago, Ill.

938,662. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

939,403. Reinforcing Bar for Concrete. Jas. M. Dudley, Bessemer, Ala.

939,962. Reinforcing Bar. Thos. W. Jenks, Avalon, Pa.

940,399. Concrete Steel Construction (reinforcing bar.) Wm. Mueser, New York, N. Y.

941,078. Reinforced Concrete Pile for Pier and Foundation Construction. Cassius E. Lamburth, San Francisco, Cal.

942,142. Reinforced Concrete Piling. Jas. P. Holmes, Ocean City, N. J.

942,202. Metallic Reinforcing Bar for Concrete Construction. Richard J. Grace, Portland, Ore.

942.625. Reinforced Concrete Structure. Maurice Dumas, Brussels, Belgium.

943,310. Reinforcing Construction for Concrete. John W. Linzee, Jr., Boston, Mass.
943,402. Metal Reinforcement for Metal Reinforced Concrete Construction. Wm. S. Ferguson, Cleveland, O.
943,878. Reinforcement Bar. Wm. G. Hughes, Pittsburg, Pa.
944,110. Reinforced Concrete Construction. Samuel H. Summerscales, Winnipeg, Man., Can.
944,589. Reinforcing Bar for Concrete Structures. Daniel Baum, Jr., Omaha, Neb.
946,890. Reinforced Concrete Construction. Chas. D. Watson, Ben Avon, Pa., and Albert W. Buel, New York, N. Y.
947,044. Reinforcing Structure. Geo. J. Schade, Sandusky, O.
947,199. Reinforcing Bar for Concrete Structures. Albert C. Kuester, Philadelphia, Pa.
947,746. Concrete Reinforcement. Herbert E. White, Youngstown, O.
947,750. Reinforced Concrete Structure. Eugene N. Hunting, Youngstown, O.
949,262. Reinforced Concrete Construction. Percy W. Cook, Lidcup, Eng.
950,401. Reinforced Concrete Construction. Chas. W. Peckham, Haven, Kan.
952,891. Reinforcement for Concrete Construction. Julian O. Ellinger, New York, N. Y.
953,368. Reinforced Concrete Construction. Sydney Burrowes, Niagara Falls Center, Ontario, Can.
954,128. Reinforced Concrete. Robert McLaughlin, Baltimore, Md.
954,750. Reinforced Concrete Bridge. John E. Mandeville, Hawley, Pa.
954,900. Trussed Bar for Reinforced Concrete Construction. Pietro Stragiotto, Hurley, Wis.
954,925. Reinforcement for Concrete Structures. Chas. Brossmann, Indianapolis, Ind.
955,236. Reinforced Concrete Construction. Edmund P. Wells, Clapham, London, Eng.
956,194. Reinforced Concrete. Wm. F. Scott, Toronto, Ontario, Can.
957,244. Reinforced Concrete. Pierrepont B. Noyer, Oneida, N. Y.
960,382. Reinforcement for Concrete Structures. Ralph E. Newton, Milwaukee, Wis.
960,666. Reinforced Concrete Tower. Louis F. H. Mifforus, Aylmer, Que.
961,619. Reinforced Concrete Construction. Jas. Hanner Knight, Westtown, Pa.
962,488. Concrete Reinforcement. Robert S. Allyn, New York, N. Y.
963,218. Reinforced Concrete Structure. John Gilmore, Montrose, S. D.
965,070. Unit Reforcing Frame for Concrete Construction. Eugene L. Brown, Jr., St. Louis, Mo.
965,729. Reinforcing Structure for Concrete. Eliott E. Nickson, Philadelphia, Pa.
966,291. Reinforced Concrete. Glenn Allen, San Francisco, Cal.
967,390. Reinforcing Bar. Albert L. Johnson, St. Louis, Mo.
967,427. Reinforced Concrete Pipe. John M. Phelan, Jackson, Mich.
967,505. Reinforcing Element for Concrete Structures. John A. Ettler, San Francisco, Cal.
968,125. Machine for Making Reinforced Concrete Piles, Columns and the Like. Alex Crawford Chenoweth, New York, N. Y.
968,982, Concrete Reinforcement. Geo. V. Rhines, Toledo, O.
969,039. Reinforced Concrete Structure. Wm. Pierce Cowles, Minneapolis, Minn.
969,408. Composite Wall Construction. Roy Henry Robinson, Chicago, Ill.
981,353. Reinforcement for Concrete Structures. Geo. A. Brayton, Martin's Ferry and Edwin C. Roberts, Bridgeport, O.
972,961. Metallic Reinforce for Concrete Construction. Daniel A. Wedmore, Philadelphia, Pa.
974,656, 974,657, 974,658, 974,659. Reinforced Concrete Structures. Geo. M. Graham, Chicago, Ill.
975,307. Reinforced Concrete Structure. Herbert E. White, Youngstown, O., and Wm. H. Ham, New York.
975,381. Retaining Wall. Frank A. Bone, Cincinnati, O.
978,361. Reinforced Arch, Bridge or Viaduct. Robert A. Cummins, Beaver, Pa.
979,285. Reinforced Concrete Construction. John Gilligan, Nebraska City, Neb.
979,564. Reinforced Concrete Construction. Frank S. Robinson, Detroit, Mich.
979,776. Reinforced Structure. Daniel B. Luten, Indianapolis, Ind.
980,414. Reinforcing Device for Concrete. Chas. A. Hanson, Chicago, Ill.
981,516. Reinforcing Means for Concrete Structures. Robert Anderson, Cincinnati, O.
982,080, 982,081. Concrete Water Tanks. John H. McCoy, Harnsville, Pa.
982,682. Corrugated Bar. Albert L. Johnson, St. Louis, Mo.
982,697, 982,698. Bulkhead and Retaining Wall. Maxwell M. Upson, Englewood, N. J.
983,274. Reinforced Concrete. Geo. M. Graham, Chicago, Ill.
984,494. Reinforcing Structure. Joseph F. Russell, Battle Creek, Mich.
984,747. Machine for Making Reinforced Concrete Piles, Columns and the Like. Alex. C. Chenoweth, New York, N. Y.
984,775. Reinforcement for Concrete. Christopher J. Morgan, Glassport, Pa.
985,640. Reinforced Concrete Structure. Wm. J. Stewart, Belfast, Ireland.
985,734. Concrete Reinforcement. Raymond W. Dull, Aurora, Ill.
986,143. Cistern or Tank (Reinforced Concrete). Arthur B. Crawford, Hastings, Neb.
986,474. Reinforced Concrete Construction. Henry L. Lewen, New York, N. Y.
988,951. Reinforced Concrete Structure. Wm. C. Sauer, Pearlbrach, Mich.
989,120. Reinforcement for Structures of Concrete. Herbert F. Cobb., Cleveland, O.
989,830. Reinforced Concrete Construction. Frederick A. Berne, Birmingham, Ala.
990,963. Reinforced Concrete Structure. Denis Wm. Daley, Parkersburg, W. Va.
991,439. Reinforcing Rod or Bar for Cement, Concrete or Similar Material. Newton L. Hall, Denver, Col.
991,971. Reinforced Concrete Construction. Secondo Giletti, San Francisco, Cal.
992,970. Concrete Reinforcement. Edward McClure, Chicago, Ill.
994,091. Reinforcement for Concrete Constructions. Hugues Brussel, St. Louis, Mo.
994,325. Truss Bar for Concrete Construction. David Maxwell, Detroit, Mich.
995,009. Reinforced Concrete Wall and Like Structure. Geo. W. Jackson, Chicago, Ill.
995,069. Reinforced Concrete Construction. Henry L. Lewen, San Francisco, Cal.
996,288. Reinforced Concrete. Thos. H. Skinner, Oneida, N. Y.
996,843. Sea Wall or Wharf Construction. (Reinforced Concrete). Chas. F. Francisco, San Diego, Cal.
997,493. Reinforcing Concrete. Geo. S. Gallegher, New York, N. Y.
999,663. Reinforced Concrete Construction. Daniel B. Luten, Indianapolis, Ind.
1,001,682. Reinforced Concrete Conduit. Mason D. Pratt, Harrisburg, Pa.
1,002,565. Reinforcing Bar for Concrete and Similar Structures. Wm. C. Congell, Youngstown, O.
1,007,187. Form for Molding Reinforced Concrete Conduits. Geo. W. Cross, Ft. Smith, Ark.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED

Anderson, Ind.—Sept. 7, 10 a. m. Constructing the Jas. G. Clark, Geo. E. Adams, aand No. 4 free gravel roads. Joel B. Benefiiel, auditor of Madison county.

Beech Grove, Ind.—Sept. 3, 9 p. m. Paving Fifth avenue with crushed stone and constructing sidewalks and curbing. Merrill Johnson, town clerk.

Bloomington, Ind.—Sept. 3. Constructing the Nathan Cooter gravel road in Monroe county. Horace Blakely, auditor.

Bloomington, Ind.—Sept 3. Constructing a gravel road known as the J. T. Acuff road. Horace Blakely, auditor.

Brazil, Ind.—Sept. 6, 11:30 a. m. Constructing the Alex Medesitt and Wm. Francis gravel roads. E. A. Staggs, auditor of Clay county.

Corydon, Ind.—Sept. 3. Constructing seven gravel roads in Harrison county. Wm. Taylor, auditor.

Crown Point, Ind.—Sept. 4, 12 m. Constructing the L. J. Rhodes road, the Geo. Hess road, and the E. H. Gehrke road in Lake county. Chas. A. Johnson, auditor.

Decatur, Ind.—Sept. 4, 10 a. m. Constructing a macadamized road in Adams county, known as Julius Haugh road. H. S. Michaud, auditor.

Franklin, Ind.—Sept. 3, 10 a. m. Constructing gravel roads known as E. E. Trisler and J. T. Applegate gravel roads. H. L. Knox, auditor of Johnson county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Constructing a stone road on the line between Hendricks and Marion counties. H. T. Patten, auditor of Marion county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Constructing cement sidewalks on both sides of Maple road. Dr. Henry Jameson, president Board of Park Commissioners.

Lawrenceburg, Ind.—Sept. 3, 2 p. m. Constructing three gravel roads known as the Grubbs, Haley, and Geo. W. Sawdon roads. Wm. S. Fagaley, auditor of Dearborn county.

Marion, Ind.—Sept. 3, 2 p. m. Constructing gravel roads in Washington and Center townships. E. H. Kimball, auditor of Grant county.

Marion, Ind.—Sept. 5, 10:30 a. m. Constructing a gravel road on the line between Grant, Wabash and Miami counties. E. H. Kimball, auditor of Grant county.

Monticello, Ind.—Sept. 3, 10 a. m. Constructing a gravel road known as Wm. H. Parks road, in White county. A. G. Fisher, auditor.

Monticello, Ind.—Sept. 3, 10 a. m. Constructing the C. E. Gay gravel road in White county. A. G. Fisher, auditor.

Mt. Vernon, Ind.—Sept. 7, 2 p. m. Constructing two gravel roads in Posey county. Joseph R. Haines, auditor.

Plymouth, Ind.—Sept. 5, 1 p. m. Constructing the J. H. Matchett stone road in Marshall county. Geo. F. McCoy, auditor.

Rensselaer, Ind.—Sept. 3, 4 p. m. Constructing the George Naninger and Chas. E. Kersey gravel roads. J. P. Hammond, auditor.

Shelbyville, Ind.—Sept. 4, 10 a. m. Constructing a gravel road in Shelby county. Frank W. Fogel, auditor.

Sullivan, Ind.—Sept, 3, 12 m. Constructing a gravel road, known as E. M. Purcell road. W. S. Bicknell, auditor.

Washington, Ind.—Sept. 3, 2 p. m. Constructing the E. E. Ritterskamp and the James F. Thompson roads. Lew S. Gore, auditor of Daviess county.

Williamsport, Ind.—Sept. 6, 1 p. m. Constructing the Jacob Troxell gravel road in Warren county. David H. Moffitt, auditor.

Cincinnati, O.—Sept. 13, 12 m. Improving Clough Creek pike under specifications No. 385. Certified check, $2,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

East Youngstown, O.—Sept. 9, 12 m. Paving Wilson avenue with brick. Certified check 2 per cent. P. J. Carney, clerk.

Lisbon, O.—Sept. 9, 1 p. m. Grading and paving a mile of road with brick at Wellsville, O. Certified check, $500. H. C. McCamon, president; P. R. Walker, chief clerk, board of commissioners of Columbia county.

Huntington, W. Va.—Sept. 9, 1:30 p. m. Paving a number of alleys. Certified check, $500. L. A. Pollock, commissioner of streets; A. B. Maupin, city engineer.

CONTRACTS AWARDED.

Greenville, Ala.—Constructing the Forest Home road, to Andrew E. Perry.

Little Rock, Ark.—Paving East Third street with creosoted wood blocks, to E. J. Weterstrom.

San Diego, Cal.—Constructing sidewalks and street improvement at Normal Heights, to George H. Oswald, $292,983.

Wilmington, Del.—Constructing the Ashland-Yorklyn road to B. L. Wickersham, $24,639.

Belvidere, Ill. — Constructing macadam paving on West Locust and Buchanan streets, to Fair & Taylor.

Galesburg, Ill.—Paving North street, to J. B. McAuley, $20,384.75.

Moline, Ill.—Paving Seventh street, to the Western Improvement Co., Racine, Wis., $37,625; paving Thirteenth street, to I. D. Lain, $4,800.

Monmouth, Ill.—Paving West Boston, avenue, district including 18 blocks, to the Burlington Construction Co., Burlington, Ill.

Paris, Ill.—Paving two miles of brick roads, to Alan J. Parish, $27,400.

Paxton, Ill.—Paving Market, Spruce and State streets, to Edward Patton, Veedersburg, Ind.

Peoria, Ill.—Paving Spring street with brick, to John McAllister, and resurfacing Bigelow street with asphalt, to J. H. Bushel & Co.

Peoria, Ill.—Paving Spring street with brick, to Douglass A. Myers, $5,664.20.

Peoria, Ill.—Paving Chambers street with brick and constructing a 12-inch pipe sewer in the same street, also curbs, to the Canterbury Bros., $19,554.80.

Quincy, Ill.—Constructing creosoted wood block pavement on streets near Washington Park, to Henry Rees, $24,417.

Rock Island, Ill.—Paving Twenty-seventh street, to the Independent Construction Co., Davenport, Iowa, $1.95 per square yard for brick paving and 65 cents for concrete gutters.

Waukegan, Ill.—Paving Steel Court and Cory avenues, to the Boyne Construction Co.

Brazil, Ind.—Paving National avenue with Tarvia X, to Hawkins Bros., $28,848.20.

Connersville, Ind.—Constructing a macadam road, to Amos U. Stevens.

Logansport, Ind.—The following road contracts have been awarded: Constructing the Browning road, to Shaffer & Browning, $6,965; the McDonald road, to Martin McHale, $15,982; Clingenpeel road, to Walter Girton, $5,843.

Seymour, Ind.—The following paving contracts have been awarded: Constructing the Jackson-Redding Township road with stone, to Chris Moritz, $3,894; constructing roads in Carr township, to Hague & Massena, $7,384.

South Bend, Ind.—Paving several streets in the Merrifield additions, to Rankert & Eggleston, $1.40 per square yard for asphaltic concrete.

Centerville, Iowa—Paving Fifth and West Van Buren street, to B. S. Staley, at $1.41 per yard for paving and 30 cents per foot for curbing.

Charles City, Ia.—Paving Wisconsin street, including 12,000 yds, to the Bryant Asphalt Paving Co., Waterloo, Ia., $1.70 per sq. yd.

Council Bluffs, Ia.—The following paving contracts have been awarded: Paving Pine street, to the Independent Construction Co.; paving an alley, to the Hydraulic Construction Co.

Glenwood, Ia.—Repaving Vine street, to Dunagan & Hamlinton, Shenandoah, Ia., about $11,000.

Oelwein, Ia.—Constructing 40,000 ft. of sarcolithic paving, to Wm. Horribin & Co., Iowa City, Ia.

Perry, Ia.—Paving Otley avenue, to W. G. Birdsall.

Vinton, Ia.—Paving nine blocks of city street, to F. H. Hann, Cedar Rapids, Ia.

Atchison, Kas.—Paving three blocks of alleys, to the Land Construction Co., $2,164.59.

Baltimore, Md.—Paving several streets, to the United States Asphalt Co.

Springfield, Mass.—Paving Elm street, to Laniel O'Connel's Sons, Holyoke, Mass., $12,300.

Grand Rapids, Mich. — Paving several streets, to Carpenter & Anderson, $33,000.

Iron Mountain, Mich.—Grading the Granite Bluff and Foster City roads, to J. E. Blomgren, Norway, Mich.

Monroe, Mich.—Paving Elm street, to the Fidelity Construction Co., Ann Arbor, Mich., $18,331; paving Second street, to the Toledo Asphalt Block Co., $35,811.

Duluth, Minn.—Paving Parkside avenue, to P. McDonnell, $28,000; constructing concrete curb and gutters, to August Bodin, $1,500.

Meridian, Miss.—Constructing sidewalks on several streets, to P. C. Powers & Sons, $26,668.50.

Carrollton, Mo.—The following paving contracts have been awarded the Columbia Paving Co.: Lincoln avenue, $16,703.40; West Washington avenue, $2,788.30; West Fourth street, $615.

Fulton, Mo.—Grading a road, to Mulville Bros., $28,700. The contract includes about 28 miles of highway.

St. Joseph, Mo.—Paving Sylvanie street with mineral rubber, to the Metropolitan Paving Co.

Rochester, N. Y.—Improving the East Side Boulevard, to Whitmore, Rauber & Vicinus, $50,781.

Troy, N. Y.—Paving Eighth street, to Warren Bros., Boston Mass., about $20,000.

Belmont, O.—Paving the Belmont National road, to Petris & Turner, $17,600.

Bryan, O.—Paving South Main, East and West Wilson and East Hights street with Metropolitan paving blocks, to E. A. Freshwater & Sons, $55,000.

Bucyrus, O.—Constructing five miles of pike road, to Christ Reiff and Dave Shumaker, $22,000.

Cincinnati, O.—Paving Moore street to the Kirchner Construction Co.

Columbus, O.—The following street improvement contracts have been awarded: Cleveland avenue with brick, to George Garnes & Co., $15,321; Terrace avenue with asphalt, to Andrews Paving Co., $5,673; Indianola avenue with asphalt, to Andrews Paving Co., $8,492; Eighteenth avenue with asphalt, to Andrew Paving Co.; Parkwood avenue with asphalt to A. G. Pugh & Co., $8,000.

Findlay, O.—Constructing brick paving on South Main street, to C. B. Hall & Son, $8,538.

Fostoria, O.—Paving Maple and Poplar streets, to the Modern Construction Co., Fremont, O.

Fostoria, O.—The following road contracts have been awarded: The Buckley road, to J. J. Peters, $2,400; the Sandusky road, to the Bluffton Stone Co., $4,400.

Hamilton, O.—Paving Walnut street with sheet asphalt, to the Andrews Asphalt Paving Co.

Lancaster, O.—Paving Pearl avenue with Nelsonville block, to Charles Justus, $5,177.04.

Lima, O.—Paving Walnut and Baker alleys, to H. S. Enck.

Lisbon, O.—Constructing one mile of the Lisbon-Hanoverton road, to Patterson & Grafton, East Liverpool, O., $15,458.

Lisbon, O.—Paving the Minerva-Lisbon road, to George Patterson and N. F. Grafton, $15,458.74.

Marion, O.—Paving South Seffner and Blaine avenues, to the Cleveland Trinidad Paving Co., Cleveland, O.

Perrysburg, O.—Paving Main street with Wassall brick, to T. J. Mulligan, Lima, O.

Portsmouth, O.—Paving one mile of the Chillicothe pike, to Henry P. Kaps, $12,537.

Steubenville, O.—The following paving contracts have been awarded: West Adams street, to H. M. Bates; Alley D, to the same; Alley B, to the same; Ohio street, to J. O. Bates.

Uhrichsville, O.—Paving the Trenton avenue bridge with creosoted wood blocks, to Capital Construction Co.

Youngstown, O.—The following grading have been awarded; Grading and sewering Ohio avenue, to the Youngstown Construction Co., $1,347.70; grading Valley street, to John McVean, $2,113; grading Augusta street, to William Hynes, $299.40; paving Wellendorf avenue, to Turner & Olson, $11,822.75; paving Albert street, to Patrick Mylott, $16,248.10; paving Oxford avenue, to R. C. Shook, $2,295.05; paving Murdock street, to Joseph Hannon, $3,442; paving Martin street, E. J. Kane, $7,456.30; grading Manhattan avenue, to R. C. Shook, $1,101.60.

Youngstown, O.—Paving Struthers road, to Martin & Fleming.

Youngstown, O.—The following grading contracts have been awarded: Oneta street, to R. C. Shook, $2,324; Jones street, to Joseph Morrison, $3,212.74.

Zanesville, O.—The following paving contracts have been awarded: To Adams Bros, Woodlawn avenue, $1.53 per sq. yd;

Spurk street, $1.22 per sq. yd; Harrison street, $1.53, and Elborn avenue, $1.55.

Durant, Okla.—Paving Third avenue, to the Cleveland-Trinidad Co., of Oklahoma City, Okla.

Nowata, Okla.—Constructing paving in district No. 4, to the Davis Construction Co.

Altoona, Pa.—Resurfacing Seventh avenue and other streets, to the Union Paving Co., Schenectady, N. Y., 96 cents per sq. yd.

Beaver Falls, Pa.—Grading and paving Beaver street, to A. V. Purnell, Pittsburgh, Pa.

Camden, Pa.—Paving Second street, including 23,000 sq. yds., to Aaron Ward, $2.55 per sq. yd.

Franklin, Pa.—Paving Liberty and Thirteenth streets, to the Northwestern Construction Co.

Franklin, Pa.—Constructing a highway in Mercer county, to the Northwestern Construction Co., $35,817.09.

Monongahela, Pa. — Improving Fourth street, to Reed, Liggett & Britt, Washington, Pa. $20,219.50.

Philadelphia, Pa.—Paving South Bethlehem street, including 18,000 sq. yds., to Richard P. Bennis, $31,990.50.

Roscoe, Pa.—Paving 8,000 ft. of Railroad street, to Frank Manella, Pittsburgh, Pa., $16,000.

Sayre, Pa.—Paving Elmer avenue, to the Lake Shore Construction Co., $34,745.

Wilkes-Barre, Pa.—The following paving contracts have been awarded: Paving Hickory street with Metropolitan brick, to John E. James, $2.26 per sq. yd., and red stone curb at 75 cents per ft.; paving Hancock street with asphalt, to Warner-Quinlan Co., $2.09 per sq. yd. and 75 cents per ft. for red stone curb; paving Washington street with brick, to John E. James, $2.12 per sq. yd.

Williamsport, Pa.—The following paving contracts have been awarded: West Edwin street, Government Place, North street, Court street, first and second sections, to Busch and Stewart, $2.10 per sq. yd.

Providence, R. I.—The following road contracts have been awarded: North Smithfield and Smithfield, 9 miles, to Amos D. Bridges & Sons, Inc., Hazardville, Conn., $52,714.90; Bristol, 1 mile, L. H. Callan, Bristol, $6,760.75; Burrillville, 1 mile, Amos D. Bridges, $7,139.03; Cranston, ½ mile, Chas. E. Horne, Millbury, Mass., $3,573.22; Coventry, 1 mile, Bristow Bros. & Knowles, Narragansett Pier, $7,528.72.

Fort Worth, Tex.—Påving Twenty-fifth street, to Rudolph S. Blome Co.

San Angelo, Tex.—Constructing 23,000 sq. yds. of creosoted pavement, to M. A. Moon, $2.56 per sq. yds.

Norfolk, Va.—Constructing asphalt paving on Tenth, Thirteenth, Fourteenth and Fifteenth streets and Colley avenue, to the Continental Public Works Co.

Olympia, Wash.—Paving Water and Fifth streets, to the Independent Asphalt Paving Co., Tacoma, Wash., $15,137.58.

Huntington, W. Va.—Constructing the Westmoreland road, to George Hunt, between $3,000 and $4,000.

Milwaukee, Wis.—The following paving contracts have been awarded to the Badger Construction Co.: Galena street, $1.59 per sq. yd.; Cleveland avenue, $1.62 per sq. yd; Forest Home avenue, $1.62 per sq. yd.

Superior, Wis.—Paving Becker avenue, to Sid Riches.

CONTEMPLATED WORK.

Rock Falls, Ill.—A $6,000 bond issue for paving First street has been voted.

Baltimore, Md.—The city will pave Smallwood street and Monroe street with vitrified brick.

Greensboro, N. C.—A $130,000 bond issue for street improvement, sewerage extension, market and opera house improvement has been voted.

Bartlesville, Okla.—The paving of several streets is contemplated by City Engineer Kirkpatrick.

Houston, Tex.—A $300,000 bond issue for paving construction has been voted.

SEWERS.

CONTRACTS AWARDED.

Russellville, Ark.—Constructing a sewerage system, to the Tonkawa Construction Co., Kansas City, Mo., $23,000.

Galesburg, Ill.—Constructing the Mulberry street sewer, to the O'Connor Trading and Contracting Co.

Peoria, Ill.—Paving Chambers street with brick, and constructing a 12-inch pipe sewer in the same street, also curbs, to the Canterbury Bros., $19,554.80.

Woodriver, Ill.—Installing water pipes and sewer mains for the water and sewer system, to Bash & Gray, Joplin, Mo.

Evansville, Ind.—Constructing a sewer in West Delaware street, to the West Side Construction Co.

Council Bluffs, Ia.—Constructing a sewer in Pine street, to the Independent Construction Co.

Ida Grove, Ia.—Constructing a new sanitary sewer system at Galva, to H. Cathroe Company, Omaha, Neb.

Waterloo, Ia.—Constructing sewers on Wellington, West Sixth and other streets, to the Black Hawk Construction Co., $8,700.

McPherson, Kans.—Constructing a sewer, to Elvain & Ramsey, Topeka, Kans.

Fenton, Mich.—Constructing the Fifth street drain, to Bergin & McFadden.

Flint, Mich.—Constructing the Parkland storm water sewer, to William Finley, $22,756.32.

Holland, Mich.—Furnishing materials for the sewer extension on West Tenth and Nineteenth streets, to Tyler Van Landegend, $1,091.68.

Howell, Mich.—Constructing a sewer system, to Hamilton Bros., Bellevue, Mich., $38,900.

Pontiac, Mich.—Constructing a sewerage extension in Ferry addition, to Bergin & McFadden, Flint, Mich.

Duluth, Minn.—Constructing a sanitary sewer on Victoria street, to Johnson & Erickson, $1,500.

St. Joseph, Mo.—Constructing a sewer in district No. 57, to the Kelley Construction Co.

Great Falls, Mont.—Constructing a sewer in Second Alley, to F. E. Evans.

Newark, N. J.—Sept. 10. Constructing the Sixteenth section of the Passaic Valley sewer, including one and a half miles.

Binghamton, N. Y.—The following sewer contracts have been awarded to George Serifina: Riverside Drive sewer, $1,799.95; Hanchett avenue sewer, $216.40. Constructing the Mulberry street extension sewer, to Frank Matthews, $750.

Elmira, N. Y.—Constructing the Mt. Zoar and Herrick street sewers, to John C. Costello.

Guernsey, O.—The following sewer contracts have been awarded: Constructing the Taylor avenue sewer, to Port E. Gibson, $803; constructing the Fourth street sewer, to Stanley & Moorehead, $576.20.

Reading, O.—Constructing a sanitary sewer system, to Thomas P. Strack, $41,774.10.

Youngstown, O.—Grading and sewering Ohio avenue, to the Youngstown Construction Co., $1,347.70.

Erie, Pa.—Constructing a drainage sewer

in the Sixth ward, to Joseph McCormick & Brother, $8,900.

Franklin, Pa.—Constructing sewers in the First and Tihrd wards, to Burns Bros., Newcastle, Pa.

McKeesport, Pa.—Constructing a 15-inch terra cotta sewer on Wayne and Archer streets, to P. F. Rhode & Son.

Philadelphia, Pa.—The following sewer contracts have been awarded: Fifty-seventh street sewer, to Donato Deliso, $4,930; Gunners Run relief sewer in Indiana avenue, to Joseph Lombardi, $70,819.10; Hartwell Lane sewer, to David McMahon, $20,947; Rock Run sewer, to Patrick Durkin, $1,350; Shunk street, to Joseph Lombardi, $50,940; Wissahickon sewer in Stokley street, Robert Higgins, $23,181.86; reconstructing several sewers, to Davis Peoples, $55,000.

Greenville, S. C.—Laying 12,200 feet of sanitary sewerage, to Porter & Boyd, Charlotte, N. C.

Milwaukee, Wis.—The following sewer contracts have been awarded to George E. Zimmerman: Elm street sewer, $3,341.52; Fifteenth street, $1,087.68; Hi-Mount boulevard sewer, $1,799.27; Fourteenth street, $1,900.71; Fifteenth street, $773.90; Forty-ninth street, $1,369.76; also constructing sewer on Twenty-sixth avenue and Arthur avenue, to T. Szukalski, $427.68, and constructing a sewer in Island avenue, to M. Synowitz, $433.20.

CONTEMPLATED WORK.

Nashville, Ga.—A $12,000 bond issue for a sewerage system has been voted.

Mattoon, Ill.—City Engineer C. L. James has prepared plans for a system of storm aand sanitary drains to cost $250,000.

Escanaba, Mich.—An $80,000 bond issue for the construction of a trunk sewer has been voted.

Leonia, N. J.—A $23,000 bond issue for sewer improvement has been voted.

Oneida, N. Y.—Joseph Kemper, engineer, Utica, N. Y., is preparing plans for a sewage disposal plant.

Greensboro, N. C.—A $130,000 bond issue for street improvement, sewerage extension, market and opera house improvement has been voted.

Bend, Ore—A $60,000 bond issue for the construction of a sewerage system has been voted.

Houston, Tex.—A $750,000 bond issue for drainage and a $500,000 bond issue for a sewerage system have been voted.

Kewaunee, Wis.—W. W. Reed, engineer, is preparing plans for a complete sewer system.

WATER WORKS.

BIDS REQUESTED.

Oakley, O.—Sept. 3, 12 m. Furnishing and laying a 6-in. water pipe in 32nd avenue. Certified check, $50. Oscar Kosche, clerk.

Polk, Pa.—Sept. 4, 12 m. Constructing an electrically operated pumping station and filter plant, with 500,000-gallon capacity. Certified check, $500. Marvin F. Scaife, secretary; Dr. J. M. Murdock, superintendent, board of trustees of the State Institution for Feeble Minded of Western Pennsylvania.

CONTRACTS AWARDED.

Los Angeles, Cal.—Furnishing lights for the Annandale district for a period of five years at $1.60 per lamp.

Alton, Ill.—Installing water pipes and sewer mains in the village of Wood River, to Bash & Gray, Joplin, Mo.

Coffeyville, Kas.—The following water works contracts have been awarded: Furnishing pipe, to the American Cast Iron Pipe Co.; laying the pipe, to McGuire & Stanton; construction work, to F. W. Yale.

Shreveport, La.—Constructing a 100,000-gallon tank and tower for the water supply and distributing system at the fair ground, to the Memphis Steel Construction Co., $2,900; contract for the pipe line, to the American Cast Iron Pipe Co., $27.40 per ton.

Grand Rapids, Mich.—Furnishing water mains and hydrants for South Front avenue, to Fitzpatrick and Mulvihill.

Mankato, Minn.—Laying water mains on Fourth street, to McLaurin & Northrop.

Hyannis, Neb.—Constructing a new water works system, to C. C. Empfield, $9,000.

CONTEMPLATED WORK.

Kimballton, Ia.—A $6,500 bond issue for water works improvement has been voted.

Lincoln, Neb.—The city will enlarge the municipal water works at a cost of about $45,000.

Honeoye Falls, N. Y.—A $42,000 bond issue for water works improvement has been voted.

Alliance, O.—A $140,000 bond issue for water works improvement has been voted.

Pittsburgh, Pa.—An appropriation of $50,000 for the construction of a pumping station has been voted. The plant will cost about $230,000.

Winnsboro, Tex.—A $23,000 bond issue for water works improvement has been voted.

Fond du Lac, Wis.—A $25,000 bond issue for water works improvement has been voted.

Rawlins, Wyo.—A $30,000 bond issue for water works improvement has been voted.

BRIDGES.

BIDS REQUESTED.

Anderson, Ind.—Sept. 7, 10 a. m. Constructing and repairing a number of bridges. Joel B. Benefiel, auditor of Madison county.

Petersburg, Ind.—Sept. 3, 2 p. m. Constructing and repairing bridges. John D. Gray, auditor of Pike county.

Jackson, Miss.—Sept. 5. Constructing the following steel and concrete bridges: New Town bridge, Terry bridge. George W. Sarlls, engineer highway commission.

Cleveland, O.—Sept. 4, 11 a. m. Constructing bridge work under Report No. 2906, including railing, wall, grading, etc. Certified check, 10 per cent. John F. Goldenbogen, clerk, board of Cuyahoga county commissioners.

De Smet, S. D.—Sept. 3. Constructing a slab reinforced concrete bridge. W. M. Look, auditor of Kingsbury county.

CONTRACTS AWARDED.

Oroville, Cal.—Constructing a reinforced concrete and steel bridge, to the Chico Construction Co., at about $12,894.

Morgan Hill, Cal.—Constructing a concrete bridge over the Llagas on Sycamore avenue, to John Doyle, $1,627; also constructing a concrete bridge over the same on Llagas avenue, to William Radtka, $1,590.

San Francisco, Cal.—Constructing the Niles Canyon bridge, to the Locks Construction Co., $71,460.

Montrose, Col.—Constructing two bridges, to the Pueblo Bridge Co., at $3,700 and $2,950.

Champaign, Ill.—Constructing a two-span bridge over the Sangamon river at Mahomet, to the Decatur Bridge Co., $7,990.

Livingston, Ill.—Constructing a new steel and concrete bridge, to the Continental Bridge Co., $1,385.

Pekin, Ill.—Constructing a bridge in Peoria county, to Edward Cooney.

Peoria, Ill.—Constructing a steel bridge across Henry creek, near North Hampton, to Martin Malone, $4,500.

Muncie, Ind.—Constructing five bridges, to the Indiana Bridge Co., and one bridge, to the Fulhart Bridge Co.

South Bend, Ind. — Constructing two bridges, to the Elkhart Iron & Bridge Co., $4,779 and $3,499.

Sullivan, Ind. — Constructing seven bridges, to the Sullivan Bridge and Supply Co., $3,079.

Owensboro, Ky.—Constructing the iron work of a bridge near Hurricane pond, to the Champion Bridge Co.

Baltimore, Md.—The county commissioners have ordered that concrete culverts shall be erected on the following county roads: Hillide, Melvala, Third district; Parsonage, Spook, Eagle Mill, Sixth district; Mays, Belfast, Pot Spring, Eighth district; Worthington, Tupton Church, Fourth district; Wise, Willow Spring, Twelfth district; Beckleysville, Trenton, Benson Mill, Fifth district.

Duluth, Minn.—Constructing two steel bridges, to the Mead Morrison Co., $250,000.

Duluth, Minn.—Constructing a culvert and fill at Eighty-first avenue, West, to C. R. McLean, $13,012.50.

International Falls, Minn.—Constructing the Big Fork bridge over Big Fork river, to Fred Smith, Laurel, Minn., $4,015.

Albany, N. Y.—Constructing the Three Rivers bridge, north of Syracuse, to Barrally & Ingersoll, Rochester, N. Y., $40,639.

Auburn, N. Y.—Constructing the new North street bridge, to the Groton Bridge Co.

Greensboro, N. C.—Constructing a reinforced concrete bridge across Buffalo creek, to the Carolina Concrete Company.

Lima, O.—Constructing the Suthoff street bridge in Delphos, to Jos. Mueller, Landeck, $1,018.

Sandusky, O.—Constructing a bridge in New London, to the Modern Construction Co., Fremont.

Toledo, O.—Repairing thirteen bridges, to R. W. Johnson, and two bridges, to W. J. Demuth, of Whitehouse.

Wooster, O.—The following bridge contracts have been awarded: Emanuel Fair bridge, to Wm. Rockenfeller; Highland Park bridge, to the Central Construction Co.; R. A. Dague bridge, to S. Levers & Son.

East Allentown, Pa.—Constructing the East Mauch Chunk bridge, to the Nelson-Meredith Bridge Co., Chambersburg, Pa., $46,369.

Hazleton, Pa.—The following bridge contracts have been awarded: Butler township bridge No. 2, to G. H. Hartman, $324; No. 3, to the same, $401; Sugarloaf township, Bridge No. 1, to the same, $359; No. 2, to the same, $489.

Pittsburgh, Pa.—The following bridge contracts have been awarded: Rebuilding bridge in Douglass Hollow, to C. M. Driver, $5,047.09; rebuilding bridge in Lovedale Hollow, to J. A. Householder, $3,509.75.

Uniontown, Pa.—Constructing bridges at Stony Fork and Meadow Run and constructing a pier across Big Sandy, near Elliottsville, to W. A. Nelson and Clarence Meyer.

Providence, R. I.—The following bridges were awarded to T. J. Hynes & Son, Wales Mass.: Smithfield bridge, $1,360; Kenyon bridge, $3,560; North Smithfield bridge, $1,150; Noose Neck, $1,750; Millville bridge, $830; Beaver river, $1,960; Foster bridge, $710; Cranberry bridge, $375; Clayville brook bridge, $630; Buck's Horn bridge, $1,125; Portsmouth bridge, $530.

Brownsville, Tex.—Constructing a bridge, to the F. H. Alsbury Co., Houston, Tex., $4,650.

Dallas, Tex.—Constructing a 100-ft. steel bridge across Denton creek, to the Midland Bridge Co., $2,147; constructing three small bridges, to Austin Bros.

Huntington, W. Va. — Constructing a bridge across Big Cabell creek, to the Brackett Bridge Co.

Forest, Wis. — Constructing a bridge across the Sheboygan river, to Joseph Mertes, $1,607.

CONTEMPLATED WORK.

Manhattan, Kas.—The state highway engineer, at the Kansas Agricultural College, is preparing plans for thirty-five concrete bridges, twenty-four of which will be in Jewell county.

Northfield, Mich.—The construction of two new bridges is contemplated.

Bethlehem, Pa.—The construction of a bridge to cost about $525,000, over the Lehigh river, is contemplated.

Easton, Pa.—The county engineer has been instructed to advertise for bids for rebuilding County Bridge No. 32, over Oughoughton creek, in Lower Mt.

Houston, Tex.—A $200,000 bond issue for bridge construction has been voted.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Sharon, Pa.—The councils of Sharon and Farrell decided to construct a sewage disposal plant at a cost of about $100,000 to $125,000. C. E. Miller, Pittsburgh, Pa., engineer, has prepared the plans.

STREET LIGHTING.

CONTRACTS AWARDED.

Camden, N. J.—Constructing the municipal electric light plant, to Runyan and Carey, Newark, N. J., $1,000.

Cooperstown, N. Y.—Installing a new electric lighting system, to the General Electric Co., Schenectady, N. Y., $25,000 to $30,000.

Cleveland, O.—Installing the electrical equipment for the new municipal electric lighting plant, to W. D. Cook, $18,000.

CONTEMPLATED WORK.

Duluth, Minn.—Plans have been completed for the wiring of the Aerial bridge for ornamental lights, about 721 lights to each side.

St. Clou[illegible] Minn.—The installation of a "White W[illegible]" ornamental lighting system is contempl[illegible]ted.

Johnstown, N. Y.—The city is contemplating the construction of a municipal electric light plant.

FIRE APPARATUS.

CONTRACTS AWARDED.

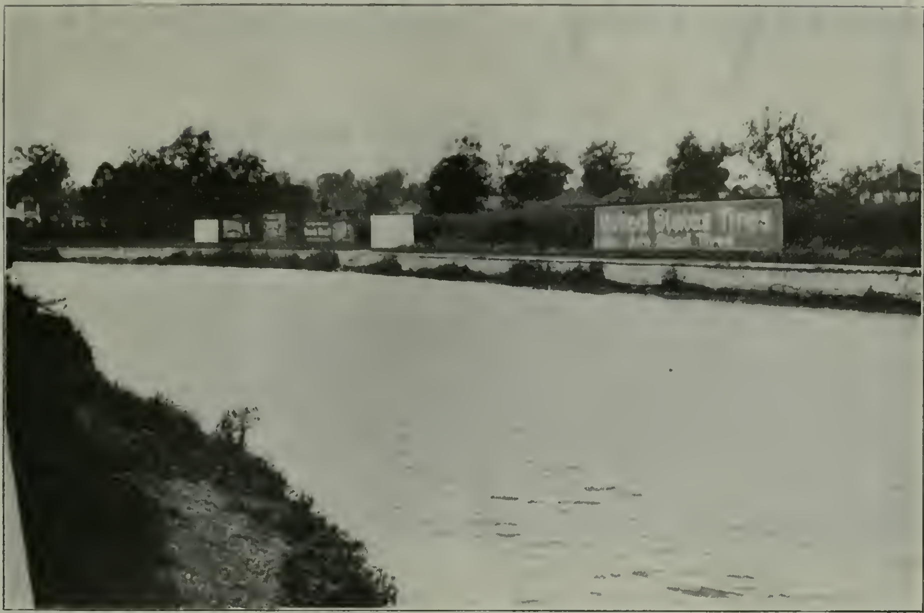
Grand Rapids, Mich. — Furnishing a chassis for the fire department, to the Harder Auto Truck Company, Chicago, Ill.

CONTEMPLATED WORK.

Champaign, Ill.—The city will purchase near future. Would advise immediate attention. combination motor fire apparatus in the Wm. Coughlin, mayor.

Peoria, Ill.—The city will purchase an auto for one of the assistant fire chiefs. The city clerk will advise for bids at once.

IMPROVEMENT OF STREAM BANKS.



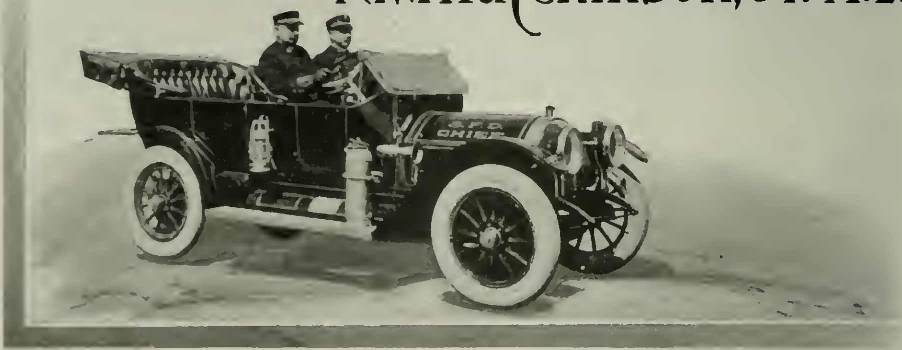
STREAM BANK BEAUTIFICATION.
Showing Billboards and Weeds Along North Side of Fall Creek, Indianapolis.

STREAM BANK BEAUTIFICATION.
Opposite Side of Fall Creek After the Improvement by the Park Department.

The Automobile in

By

R. W. Hutchinson, Jr. M.E.



THE reason for the great movement now going on in American municipalities for the superannuation of the noble horse is due to conditions which have been created within a decade or two by increase of cities' populations, expansion of their areas, architectural changes, enhancement of realty values, extension of distances, congestion of traffic and a variety of lesser causes, which, combined, are making the horse anachronistic in urban communities.

The coming of the motor vehicle into municipal development is already well under way, and its progress in a period of five years has greatly outstripped the ratio of utilization of the motor business wagon in commerce. Day by day the motor-driven fire engine is growing in popularity with municipal authorities; the motor police patrol, the motor ambulance, the motor road sprinkler and road oiler, even in relatively small cities, have grown so familiar as to have lost their novelty. And yet the surface has been barely scratched, when one inspects the statistics for 1912 of municipalities having motor vehicles in operation or contracted for. For every service in which the horse is now employed, the motor, when of the right kind and properly utilized, is more efficient, is cheaper to operate and maintain, and enables centralization to become more perfect, eliminating small sub-stations. In the opinion of the 1911 International Association of Fire Engineers, the horse should no longer be considered by any modern municipality for fire service. The ultimate motorization of fire departments is the ambition of every far-seeing fire expert, and rarely does a fire engineer, without the prompting of ulterior motives, recommend horse-drawn equipment. Enormous monetary losses must surely fall on the municipalities who are buying horse equipment, which, in a few years, can hardly be given away.

The municipal motor vehicle art is so young that naturally mistakes will be made by both manufacturer and user, and only experience and the closest co-operation between city officials and the manufacturers will prevent costly errors to both. The certain future of motor municipal apparatus, particularly the fire engine branch, has attracted a considerable number of builders, some of whom have neither the facilities, the equipment or the experience to turn out apparatus that is thoroughly dependable. On the other hand, the number of manufacturers

Municipal Service

who have been builders of horse equipment for years and are thoroughly versed in the practical requirements of the apparatus, is large, and their number is increasing.

It is not the purpose here to discuss the design of municipal motor vehicles. Results of the experiences of cities with motor apparatus are the most interesting to municipal authorities, as they reflect the strong or weak points in design and construction better than generalized discussions.

Fire Apparatus

The motor fire engine is to-day the largest application of power vehicle equipment in use, and, as its field is larger, it is with motor protective and safety apparatus that this article will be chiefly concerned. During the month of May, 1912, contracts for one million dollars' worth of motor fire apparatus were made in the United States by 125 cities and towns. If the motor engine possessed no other advantage than greater dispatch in reaching the conflagration, it would be superior to horses, for saving time is absolutely essential to the effectiveness of a fire department. Seconds and minutes stand for human lives, not to mention the thousands and ofttimes millions of dollars' property loss. It decreases the cost of the department, as when it is not working t[illegible] is absolutely no expense for kee[illegible] it. The centralization of the fire department due to the 50 to 300 per cent. greater radius of motorized apparatus enables the municipality to dispense with numerous sub-stations now situated in sections where property values are increasing and to sell the sites for prices sufficient to motorize the entire department, incidentally complying with their own laws against the establishment of stables in residential sections. For example, the fire chief at Springfield, O., states that the city was enabled to dispense with a building by adding a motor fire engine, a structure which, with site occupied, would have cost twice as much as the new apparatus. Many cities are saving two dollars per day in upkeep cost with motor fire engines.

The following concrete examples of saving verified by the fire commissioners of the municipalities mentioned above proves this statement.

DAILY COST OF MOTOR-DRAWN APPARATUS.

Richmond, Va............	13 cents per day
Springfield, Mass.........	14 cents per day
Decatur, Ill..............	22 cents per day

DAILY COST OF HORSE-DRAWN EQUIPMENT.

Richmond, Va.	$2.18 per day
Springfield, Mass.	1.90 per day
Average daily cost from records of various cities	$2.04 per day

This saving is expressed in dollars and cents, our measuring rule for the efficiency of everything, but one cannot express the utility saving, the protective value of a motorized fire department, in dollars and cents. One needs only to watch the comparative efficiency of horse-drawn equipment and motorized fire apparatus in extremes of weather, particularly in deep snow and sleety pavements, when the horse's drawbar pull is lowered frm 50 to 75 per cent., to appreciate the factor of safety is 100 per cent. greater with the motor engine. Motor fire engines at such times may be the means of saving property worth millions.

Economy of Motor Fire Engines

As the boilers of steam fire engines become condemned and must be replaced with new ones, fire departments can effect in nearly every case great economies by discarding their steam engines for motor engines. A concrete example will clearly show this. The city of Springfield, Mass., recently had to either overhaul its old steam-driven engines or put in a motor-driven engine. Careful estimates by the city engineer showed that replacement of boilers would mean an outlay of $2,000. To this would have been added a driver's and stoker's wages, aggregating $2,200 per year, and also the upkeep of horses, totaling $500 per year. Thus the cost of a steam engine amounted to $4,700 the first year. A motor engine, by eliminating boilers and horses, stoker and driver (the latter place being taken by an engineer serving in a dual capacity), knocked off $2,200 from the first year's cost.

The city of Minneapolis has a motor-driven fire engine in use which has been put on a scientific cost basis for the past year, in comparison with horse equipment, with the astonishing result that the total expense for the auto engine was $749.58, as against $2,461.50 for the horse equipment, a saving of over 300 per cent. per year in favor of the former.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
"Mack" Hook and Ladder Truck of Morristown, N. J. Extreme Length, 34 feet. Wheel Base, 18 feet.

The small city of Norwich, Conn., has found that the average cost of maintaining a combination auto chemical and hose wagon is $50 per year, against $500 per year for the maintenance of two horses. In one month, which is a fair average, this auto-chemical consumed fifteen gallons of gasoline, costing $2.25, one gallon of engine oil, costing 50 cents, a total expense of $2.75. The number of alarms responded to was 7; miles traveled in practice runs, 25.1; in responding to alarms, 15; total, 40.1.

In Richmond, Va., an auto combination pumping engine, chemical and hose wagon made fifty runs in a period of five months, covering seventy-five miles and pumping at fires for fifteen hours. This service, including gasoline, maintenance, oils and repairs during the five months, amounted to $20.54. The horse equipment which the motor supplanted cost in a similar period $337.50, or a saving of $317.06 in favor of the motor. In addition, the motor outfit covers 40 per cent. more territory, and is ready to respond to the next alarm immediately it returns from the former, which is not true of the horse steam engine, as the fires within the engine have to be withdrawn, charge relaid and the engine put in serviceable condition.

Cost data of this kind could be multiplied to fill an entire issue of this magazine, but space prevents, and the figures would merely make more emphatic the voluminous evidence presented of the economy of the mechanical fire vehicle. A press item which the writer recently saw from Salina, Kans., is so typical of the efficiency of the auto fire engine that I will give it in full: "An alarm was recorded at 8:59½ a. m. At 9:02 a. m., 150 seconds later, the machine had covered the distance, more than a mile, 100 feet of hose had been laid, the water turned on and a stream playing."

Police Patrols

The first motor police patrols used in America began to appear in 1905. During the past seven years the employment of patrol automobiles has multiplied to such an extent that there is hardly a city of 100,000 population that does not own at least two much machines. The advantages of motor over horse patrols are in the main the same as apply to motor fire apparatus, the elimination of enormous maintenance expense incident to horse-propelled patrols. The economies are most strikingly shown when combination auto ambulance patrols can be used. For example, the commissioner of public safety of a certain city informs the writer that the cost of each of two separate horse-drawn vehicles is as follows:

Salaries of three policemen per month (patrol and ambulance drivers)	$225.00
3 horses (feeding, shoeing, etc.) per month	97.50
Repairs on 2 wagons from Jan. 1 to July 1, 1912..............	194.62
Total expense for 6 months.....	2,129.62

In addition, this commissioner says he has two worn-out wagons left at the end

THE AUTOMOBILE IN MUNICIPAL SERVICE.
Motor Trucks on Road Construction.

of this period. Contrast these figures with the operating expense of a combination auto ambulance-patrol (for one year):

Tires	$378.00
Gasoline	262.00
Oil	23.50
Driver and ambulance attendant	1,800.00
Repairs	125.00
	$2,588.50

Assuming that the expense of the horse patrol and ambulance (two vehicles) was double the above figure ($2,129.62) in one year, or $4,259.24, the combination auto apparatus is saving the city $1,671 per year, a sum that will more than pay for the machine in two years. Motor police patrols are saving cities from $250 to $1,500 per year each (on an average) over horse patrols, from carefully computed figures which the writer has verified.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
A Seven-Ton "Mack" Truck Distributing Asphalt for City Paving in Seattle, Wash. The Body Is Lined with Fire-proof Material.

Road Repair

Those who have made a careful study of economic road maintenance have generally conceded that the neglect on the part of cities, towns and townships to repair their roads promptly has brought about a very excessive cost for this maintenance work. It is generally accepted as a truism that $50,000,000 is being spent for road building in the United States every year and $100,000,000 is expended for their maintenance.

If two men with the proper equipment were kept constantly employed going over the roads in their territory, equipped with material and tools with which to properly repair trifling defects, the annual expense of such repair work would be considerably less than if the plan of periodical work were employed. From all information obtainable, it appears that a new piece of road is generally allowed to take care of itself for the first year or two, at the end of which time the neglect to repair properly what were originally trifling defects has allowed the road to get in frightful disrepair, requiring a very considerable sum to restore it to its former condition.

Very many miles of road could be taken care of by a motor truck operating daily and covering all of the roads in the care of the city where it is to work. This truck could be provided with changeable bodies, one of these bodies to be of box construction to carry sand, gravel, crushed stone and top dressing, as might be required; at other times, tar kettle and material for building roadside fires. The other body could be for water for sprinkling during the summer months.

The former equipment could be generally used during the winter months and the sprinkling body placed on the chassis for summer use. A small hole or rut worn in a road, if neglected, will have its sides gradually torn down by continuous traffic, and develop into a large hole, requiring the expenditure of a considerable sum to effect proper repairs.

With the advent of the motor truck we believe that the business men in every community have come to realize the importance and economy in maintaining good roads.

Motor Dump Truck

The economy and great utility of the motor dump truck to municipalities for street construction and maintenance has been proved in every city where it has been given a fair trial. Motor dumping trucks are made with either side or end discharge bodies, the latter being the most practicable type, as it permits broken stone, sand, asphalt or dirt to be spread to a uniform depth through the tailboard, the extent of the opening of which is governed (see illustration) by a chain about the bottom of the tailboard fastening it to the platform of the body. The operation of this type of dump truck is entirely automatic and under the control of the truck driver. As the truck moves forward it leaves in its wake a spread of even depth and width. This element of labor saving cannot but appeal strongly to the street and highway commissioner, who sees with considerable satisfaction the truck perform gratis, and in a few seconds, the same labor that heretofore has taken hours to accomplish by hand, with the attendant expenses.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
Motor Road Oilers Used in Kansas City, Mo.

One of the most noteworthy examples of the economy of the motor dump truck for municipal service is shown by the experience of Rutland, Vt., of which Mayor Clement says: "On one piece of road we moved and spread with the truck (a 7-ton Mack machine) over 2,000 tons of broken stone in 17½ days, a distance on an average of 1½ miles—an average of about 114 tons a day at a daily cost of $5. If the same work were done by teams it would require at least twelve teams, costing in this city $4 each." In other words, this truck is saving the city of Rutland $43 per day in road building. Reflect for a moment the saving which could be made in a thousand towns and cities in the United States on the same basis as this truck has done.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
A 5-Ton Truck Carrying a 50-Foot Girder for the New York Municipal Building.

Road Building

The city of Mount Washington, Md. (suburb of Baltimore), has recently completed a stretch of macadam road which was built with a 5-ton automatic motor dump truck and a four-mule team. The operating report of motor vs. mule equipment shows the following interesting figures:

4 mules at $325 each	$1,300.00
Harness	75.00
Wagon	250.00
	$1,625.00

MULES.

Interest on half investment at 6 per cent.	$48.75
Insurance on truck, 2½ per cent. on 80 per cent. of half value....	2.50
Insurance on team...............	32.50
Depreciation, 20 per cent.........	325.00
Fixed charges per day............	1.85
(Assuming 225 working days per year.)	
Wages per day..................	$1.84
Feeding at 60c per head..........	2.40
Stable man	.25
Veterinary's service	.20
Shoeing	.30
140 days' feeding at 40c per head, $224	.99
Total daily operating cost......	$6.18
Fixed charges per day............	1.85
	$8.03
Truck	$5,300.00

TRUCK.

Interest on half investment at 6 per cent.	$159.00
Insurance on truck, 2½ per cent. on 80 per cent. of half value....	53.00
Depreciation on truck (not including tires)	480.00
Fixed charges per year.........	$692.00
Fixed charges per day............	3.07
Maintenance, .04½c per mile......	$2.50
Tires, 6c	2.70
Gasoline, 4c	3.60
Oil	2.40
	.60
Total daily operating cost.......	$11.80
Fixed charges per day...........	3.07
	$14.87

Four-mule team hauls 13½x4½, or 57.37 ton-miles per day: 13.9c per ton-mile. (The discrepancy in ton-miles is due to the mules not working, quarry being shut down owing to cold weather.)

Five-ton truck hauls 5x30, or 150 ton-miles per day: 9.9c per ton-mile, or a saving of 4c per ton-mile, or $6 per day.

The truck had to make ten miles to a round trip, as against nine for the team, on account of having to go a mile out of the way on the trip from the quarry in order to avoid a bridge, which was too weak to carry it loaded. One mile of the trip loaded was up a 14 per cent. grade. The average amount of gasoline consumed was twenty-one gallons. Average amount of oil consumed was two gallons. Average working hours was ten. Average time loading, 3 minutes; average time unloading, 10 minutes. Total load carried, 60,000 pounds; number of trips, 6; total mileage, 60. There were three rainy days during the test, so that most of the time the roads were soft and in bad condition.

Street Cleaning and Garbage Removal

American municipalities have been comparatively slow in taking up motor truck apparatus in their street and sanitary engineering departments, primarily because the motor manufacturers have not until very recent years devoted attention to the development of body designs suitable for municipal service. In Europe the motor-driven road sprinkler, road oiling machine and motor garbage wagons have been in service for several years, and European municipalities have developed the use of motor truck apparatus to a high degree of efficiency. For instance, in Rouen, France, all street cleaning apparatus is of motor-driven type, and economies as great as 66 2/3 per cent. over former horse equipment are reported. In New York City Commissioner Edwards is now experimenting with motor garbage carts, and reports that the cost by former equipment was as much as 80 cents per ton of garbage removed, whereas the motor trucks have shown cost of but 23 cents per ton. The number of American cities using motor garbage carts on a very small scale, however, can be counted on the fingers of one hand. For house-to-house collection, the gasoline motor garbage cart is unsuitable, as frequent starts and stops do not enable the gasoline motor to operate economically.

Street Sprinklers

Motor-driven street sprinklers in which the gravity principle is utilized and similar in design to horse truck wagons have been in use for four or five years, but their application, for some reason, has been relatively slow.

Pressure regulated sprinklers, in which a double-acting water pump is worked by the driving engine of the sprinkler, are coming into vogue, and offer decided advantages over the gravity type, due to better control of the area to be sprinkled and more uniform distribution of water. In Europe motor-driven sprinklers discharging from the front instead of the rear of the machine are more popular. St. Louis is the only American city employing a sprinkler of this type. This sprinkler (see illustration) is mounted on a 6½-ton chassis of standard construction. The riveted tank, which is 4½ feet in diameter and has a capacity of 1,400 gallons, is mounted on a cradle and "guyed" with cross-stays provided with "turnbuckles," so that shifting is impossible. The most novel features of the device, however, are the double-acting force pump, which, driven by the motor, forces the water thru the nozzles; and the location of the nozzles themselves, about a foot in advance and on either side of the motor hood. This location was adopted so that the truck itself would not cause the very evil it is designed to cure; the forward position of the spraying apparatus wets down the street in advance of the wheels, so a cloud of dust is not raised as a preliminary to the dust-laying.

It is claimed that a roadway from 70 to 80 feet wide can be sprinkled at one operation, and at any rate over 10 miles an hour, which naturally is quite beyond the scope of the horse-drawn sprinkler.

Street Sweepers

A great opportunity for the development of pneumatic motor street sweepers exists in the United States, but few practicable types are yet on the market, and these have had but little application. The vacuum type, utilizing the principle of the household vacuum cleaner, is being experimented with in New York and several other large cities, but is too cumbersome in its present form. Its future, however, is promising. An Indianapolis inventor has recently put out a pneumatic type of motor-driven sprinkler in which the general plan is that the air used for sweeping is recirculated, being used over and over again, with the exception of the small leakage. The sweeper is worked by a suction fan, and is equipped with small boiler, which serves a double purpose. Steam, added to a centrifugal separator mounted over the dirt receptacle, entrains the dust particles and aids in the separation of dust from solids, and it also dampens the mass so that dust is prevented when dumping. The sweeping fan is driven by a gasoline four-cylinder engine, thru a cone clutch and spur gears running in oil. The maximum speed of travel is 5½ miles per hour. Two men are required to operate it; one controls the steering, fan speeds, etc.; the other controls the pressure in the air system, raises and lowers the dust hood by levers, fires the boiler and dumps the dirt. This machine has swept, under test, 125 blocks, or about 6½ miles of street per day.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
A Pressure Regulated Motor Sprinkler of 1,400 Gallons Capacity Used in St. Louis, Mo.

A PROBLEM OF THE GROWING CITY.

By Albion Fellows Bacon, Evansville Ind.

"THE Growing City" means hustle and push, enterprise, growth of commerce, increase of wealth. But, fundamentally, it means a growing population, for we are judged by our census, first and last.

The problem of the growing city is, therefore, the problem of providing for an increasing population. As the first and simplest civic need of those who come to a city is for shelter, and as every newcomer is a veritable "home-seeker," the housing problem becomes the most urgent one of the growing city.

ALBION FELLOWS BACON.

It is the intent of this article to show that the housing problem is not for the housing reformer alone, but is for the city planner, the civic improver, the municipal engineer; in fact, all who work for the improvement of cities. The oft-stated principle of social service that "the relation of all social evils calls for the correlation of all remedial agencies" is a principle that might well be applied to civic effort. Certain it is that we must extend our vision beyond the customary limits of our specialties, to take in this, or any other great civic problem, as a whole.

Because the housing problem is too often left to the housing reformers, that does not argue that it is his exclusive job. It only shows the weakness of the civic policy that goes on making more housing reformers necessary.

It should be remembered that the housing problem of a city takes in much more than the cure or prevention of slums. It has to do with all the housing of all the people, and one of its most serious factors is the frequent inadequacy of the supply of dwellings for present needs, as well as for future growth.

It should be remembered, too, that the lack of city planning and municipal engineering has given a great deal of occasion for housing reform, and forces upon the housing reformer many things, outside of house construction, which would have been prevented by the timely employment of the other experts. The greatest point of contention, in securing housing laws, is sufficient lot space to admit light and air to the required windows of new, as well as of existing buildings; and the meager spaces that are won, after long and hard battles, contrast with the generous allowances of the city planner.

The next hardest battle must be fought to get water, drainage and sewerage, with proper plumbing, especially in existing houses, and to attend properly to all disposal of waste, and all occasion for filth. The fact that water and sewer mains are not laid to the end of all streets, but that buildings precede them, and that even tenements are built in the outskirts thus unsupplied, makes more trouble for the housing reformer. His mission being to make dwellings sanitary, fit and safe for habitation, much of his attention must be spent on plumbing, the abolition of cess-pools, the prevention of damp floors, wet cellars and on a water supply, etc.

The Value of Sanitary Maps

Nothing but a sanitary map of our cities, such as Dr. George Thomas Palmer, made of Springfield, Ill., would convince the public of the amazing number of lots in a large number of our cities, which are without water and sewer connections. By marking such lots black, on the map, the showing is striking and conclusive. The most astonishing fact that would be proven, in many cities, is that the black spots are distributed all over the map, and are not confined to any poor district. But maps, figures, photos, words, all fail to give any idea of the sights and smells that these black spots designate, or the misery and sickness they too often stand for.

The worst feature is the old vault or cess-pool, which, covered by a decaying shed on the rear of the lot, is a blot upon civic beauty, poisons the air of the whole neighborhood, breeds swarms of flies, and, in many cases, pollutes the water of the cistern, which is in some places the only supply for one or a dozen families, by water, and the means of disposing of waste, necessarily means filth, and filth is one of the chief causes of the slum.

While it is true that cisterns or wells are not used in some cities, and the water supply is all piped, it is equally true that landlords refuse or neglect to supply water, very often, and the occupants of a whole tenement will be found carrying water a square or more from a public fountain. Or, several families will be forced to use one yard hydrant in common. But in the smaller towns the polluted cistern and the cess-pool, with the seepage. With no sink on the premises, suds and dish water are thrown upon the yard, where they stand in slimy pools till a scum forms, or trickle in an offensive sluggish stream to join the other filth of the alley. The water thus thrown out also seeps into the cistern, which, having no pump or cover, is also full of floating trash. It is not uncommon to find several families, using out of such cisterns, having cases of typhoid fever in each family. Much of the sickness of our cities, and much of the infant mortality, may be traced to these conditions. The lack of sodden yard, give to urban life only an intensification of rural inconveniences and lacks.

THE PROBLEM OF A GROWING CITY.
Rear of a "Double" in a Middle Western City. Note Unsanitary and Unsightly Surroundings Among Which the Women Work. Rents for $14 a Month.

Housing Laws Must Be Improved

With such conditions the housing reformer must contend, as well as attending to house construction. In this work, too, he has much to hamper him. As housing reform can be secured only by compulsion in all but rare instances, strict laws are needed for this purpose, with strong enforcement, and everlasting 'vigilance to prevent their evasion.

It is not fair to presume that the housing laws, which have been secured only after long and bitter legislative battles, represent the ideals of those who drafted them. In too many instances, all that can be required is the merest minimum necessary for health and decency. Light and air, water, drainage, sewerage, privacy, fire protection, necessary repairs, disposal of garbage, such are the things for

THE PROBLEM OF A GROWING CITY.
A Thirteen Suite House in a Small Western City. Three Rooms to a Suite; the Middle Room With no Outside Air or Light.

THE PROBLEM OF A GROWING CITY.
Rear of the House Shown Above. Note the Single Pump Which Supplies all the Suites, and the Fact that the House is Built Flat on the Ground.

which the housing reformer fights! Not beauty, not conveniences, not even comfort would he dare to give as a requirement in asking housing laws. Yet it is the hideous ugliness of the slums that often drives the housing reformer to his work, and it is a vision of the waste places redeemed, of the beauty that shall be given for ashes, that keeps him at his task.

Housing reform is no clean-cut problem of engineering. It differs from these as organic chemistry differs from inorganic. It is a mixed social and civic problem. Faults of location and construction make bad housing. It takes people, with all these, to make slums: the landlord and the tenant, neglect, overcrowding, filth.

The Great Problem of the Growing City

Lest it be thought, from this talk of housing reform, that this article applies only to large cities, we hasten to say that every growing city in the country is included. Every one of them has a housing problem. Moreover, reports of the last two years show that not only our great cities have slums, but they exist in most of our towns, and in many of our villages. We are just waking up to the fact that they have been with us for a good while, only they had never been diagnosed. We didn't know a slum when we saw one.

We thought slums were the exclusive property of great cities. We listened aghast to Jacob Riis's stories of the New York slums, of the dark, foul, crowded tenements, where unutterable wretchedness and crime made existence hideous, and we were so thankful that we didn't have slums! It is like being thankful that we haven't any heathen, because we don't live in China. We simply did not realize that as "pigs is pigs," anywhere you find them, so "slums is slums," on the edge of a village or in the heart of a great city. We thought that land congestion was the only congestion there was. We had to learn that "room congestion" is the very worst and commonest kind, and makes the worst type of slums.

Nothing but the "personal touch" of the actual thing can give an adequate conception of the horrors of "room congestion," with a whole family, or perhaps two families, crowded into one room, that room already being full of beds and other articles of furniture, including a cooking stove. Hundreds of families, in even moderate sized towns, live in this fashion. Hundreds of others live in two or three rooms. The commonest type of a slum quarter is the "converted house," which is oftenest an old residence, built for one family, and rented by eight or a dozen. The common use of the one hall and stairway, the yard, cistern and yard closet, is one great cause of vice in the slums.

It is not unusual to find from five to ten people living in two rooms, one of which has no window, the sleeping room, of course. Fifteen to seventeen people have been found in two rooms, and a family of twelve in one room. The foul odors and filth, due to lack of ventilation, lack of water and sewerage, and to overcrowding, can hardly be imagined, and would not be dwelt upon only that we wish to call special attention to these conditions, as they are important factors in the housing problem, and have to do with the growth of the city.

The significant fact on which we wish to dwell is this: that not only the poorest classes are found in such abodes, but too often our working men's families are housed in this miserable manner. The scarcity of decent houses, in some of our cities, forces our workmen, who could afford comfortable homes, into the crowded tenements, or, if not in the same building, into slum neighborhoods. Here their families are exposed to both physical and moral contagion from association with the vicious and degraded, and from the unsanitary surroundings. Here the rosy children, brought from the country or the village, grow sickly and pale, and the older boys and girls learn the allurements of the street. Home life is impossible, with the lack of comfort, convenience and privacy, and the family standards are gradually reduced.

It is bad enough in the case of our American citizens, who can speak English, and have some chance of protecting themselves. The outrage of our cities is the way we serve ignorant foreigners, who, being the easy prey of the unscrupulous, are charged high prices for sub-let rooms, where they are crowded like cattle, amid the filthy and degrading surroundings.

THE PROBLEM OF A GROWING CITY.
Three Persons Exist in This Ruin.

Overcrowding Is Expensive

It is to the rivalry among our growing cities, to get big quick, and to get rich quick, that much of this overcrowding can be charged.

To get more factories seems to be the ruling passion, so factories are bid for and brought in. Working men have to be imported to operate the factories, so they are brought with their families by the score. By the flourish of a pen, hundreds of citizens are added to our numbers, when, perhaps the city cannot provide for all it already has. Hundreds of children are transplanted from one soil to another, perhaps to a deadly environment. Human lives, human souls, are poured, as from one vial into another, as lightly as a chemist pours his drugs. If we had decent homes for all who come, as good as they could afford to pay for, we might take honestly this great responsibility of human health and welfare. But already our old tenements, hovels, warehouses, even stables are crowded full, in many places, already the problem is beyond our control. Yet we continue to draw in more, crowding them into the human coops that we call houses.

All over the United States this is happening. Normal families are being forced into subnormal environment. Too often, in the course of time, they sink to the ranks of the delinquent or dependent. Much of the gold that the added industries bring in is paid out for the added cost of dependency, crime and disease. Our civic growth is unhealthy, for we grow diseased and rotten at the core. The citizens we have brought in are too often a drag upon civic progress, and we have not even the gain we are working for.

These results are supposed to be met by charity, philanthropy, housing reform and by various civic doctors and surgeons. It is first of all a problem for the commercial clubs. If they bring people to a town, they are responsible for them. Yet so often they wash their hands of all responsibility, after the bonus is paid and the factory is landed. In about forty of our cities, however, commercial clubs are taking up housing reform, and other cities are being added to the list. This shows that business men are waking up to the fact that the housing question is a business proposition, involving the depreciation to real estate in slum neighborhoods, the public cost of typhoid, tuberculosis, and other diseases prevalent in the slums; also that they are waking up to the commercial value of the working man, whose health and efficiency are jeopardized by bad housing.

This is a most hopeful sign, for when the men who manage the business of our cities are fully impressed by the commercial aspect of the housing problem, we may expect all of its phases to receive their attention. This means that housing reform will be followed by the building of new houses, in a well planned effort to provide for the needs of the growing city.

How this is to be done is a matter for the business men to decide, with the help of civic experts. From the semi-philanthropic plans of providing good and cheap houses for the working man, to the schemes of the speculator who develops suburbs and builds groups of houses solely to make money there is a broad range. We have faith that our business men, working the problem out with the aid of municipal experts, will before long come to a practical demonstration of the fact that lives are worth more than land, that there is plenty of room on the outside, and that every citizen must be given a legal right, as he has a moral right, to sunlight and air. With this right established, convenience, comfort, beauty, will follow. But the housing reformer, looking wistfully over the Land of Promise, must stop in the desert, content to have in his keeping the tables of the law that are to hold back the tribes of men from civic sins. It is his part only to exact that every new dwelling shall have in it no lurking seeds of death.

But with each extension of building lines, the housing reformer faces another difficulty. City laws extend only to city limits. Unless those limits are given timely extension, or unless suburbs are built up under wise restrictions, as to lot spaces, sewerage, etc., all sorts of housing evils may be expected. There is no need to cite examples of cities whose suburbs are a menace to the whole municipality. This is especially true of those cities whose slums form veritable "ragged edges" and are spread over outlying districts of hovels, like leper colonies. The greater danger of our colonies is that they do not remain afar off, with the warning cry, "unclean," but they mix with the life of the town itself as freely as if under its laws.

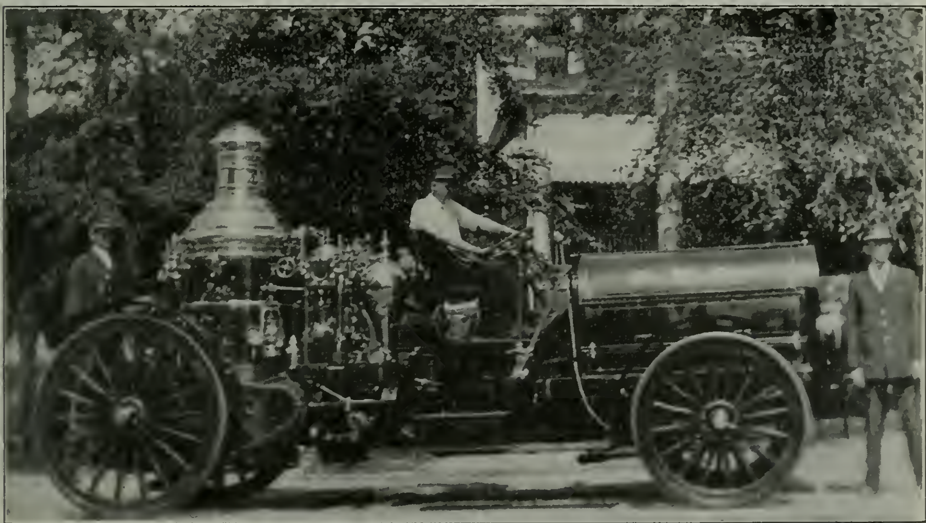
FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALA.

By Maury Nicholson, C. E.

ON January 1, 1910, Birmingham absorbed by extension of its boundaries, nine separate and distinct cities, and increased its area from seven to fifty square miles, the outline of the new boundary being approximately that of a large bird in flight, with a spread of fifteen miles from tip to tip of its wings, and four and one-half miles from head to tail, and taking flight in a northwesterly direction over a series of parallel valleys and ridges from the crest of a mountain range extending northeast and southwest. The nine absorbed municipalities varied in size and age from a corporation eighteen months old with less than 1,000 population to one twenty years old with more than 10,000 population, and topographically from swamp to mountain with a correspondingly varying degree of development in the organization and equipment of their fire departments. To assimilate all these various conditions, organize them into one efficient, economically working department was the proposition that Fire Chief A. V. Bennett had to handle.

The two factors of financial resources and expanse of territory controlled the solution of the problem, and as the city's income is limited to 1 per cent general tax rate, eked out by a schedule of high license, the fire department's proportional share of this income reduced the financial resources almost to the impossible point, when the extremely large territory that must be protected and its physical conditions were taken into consideration.

Speed, endurance, reliability and power was the combination of qualities needed to meet the transportation requirements, while low cost of operation and maintenance with reasonable first cost were required to meet the financial resources. The fulfillment of all these conditions demanded an equipment of the highest efficiency, designed and developed and tried out to meet such physical demands. The logical result of the full appreciation of these facts was the investigation of motor fire apparatus as representing the most advanced ideas and intelligent efforts of manufacturers and expert fire fighters.



THE FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALABAMA.
A Steam Fire Engine Adapted to Motor Drive.

This investigation and study covered a considerable period of time, a wide field of experience in other cities, a number of practical tests of different makes and types of motor fire fighting apparatus, and led Chief Bennett to the conclusion to recommend the equipment of the entire department with motor apparatus as rapidly as it could be done. This recommendation was concurred in, first by the board of aldermen and later by the board of commissioners of the city when the commission form of government went in effect, and the motorising of the department began in October, 1910, by the purchase of two combination, 4-cylinder, 50-horsepower A. L. A. M. rating combination chemical and hose cars.

THE FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALABAMA.
Gasoline Pumping Engine and Hose Car.

At this time the department was composed of sixteen stations, That territory served by No. 3 is the only portion of the city where it is necessary to supplement the hydrant pressure over the entire area served with pumping, and this being a high-priced popular residence section, well built up over its entire area, which reaches from the foot to the crest and along the side of Red Mountain for a distance cf two and one-half miles, it was necessary to equip this station with apparatus to meet these conditions. This was done by taking a discarded second size Ahrens steam fire engine and having it rebuilt and motorized into a 4-cylinder, 78-horsepower motor fire engine, which was, when installed, the second of its kind in the United States. This, supplemented with a 6-cylinder, 79-horsepower combination chemical and hose car, carrying one 40-gallon chemical tank, 200 feet of chemical hose, 2,000 feet of 2½-inch rubber lined cotton hose, one 25-foot extension ladder, one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc., completed the apparatus equipment for this station. The remaining stations except as noted were equipped with the combination chemical and hose cars, which replaced all horse-drawn apparatus, except steamers and aerial trucks. The territory served by station No. 11 has some high sections in which it is necessary to supplement hydrant pressure with pumping; this section is, therefore, equipped with a triple combination chemical and hose car, having rotary pumps of 750 gallons per minute, estimated capacity. This car is a 4-cylinder, 52-horsepower A. L. A. M. rating, carrying one 40-gallon chemical tank. Station No. 13 has a similar equipment to station No. 11, as it serves a territory that is supplied with water from a small separate system, which does not give sufficient hydrant pressure to make pumping unnecessary. All the other stations serve territory in which the hydrant pressure makes pumping unnecessary and they are, therefore, equipped with combination chemical and hose cars.

The motorising of the department has extended over two years, and at present the total motor equipment consists of twenty-one pieces of fire apparatus and a car each for the chief and first assistant, described as follows: Twelve 4-cylinder, air-cooled, 52.9-horsepower, combination chemical and hose cars, equipped with one 40-gallon chemical tank, 200 feet of chemical hose, 1,800 feet of 2½-inch rubber lined cotton hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc.

Six 6-cylinder, air-cooled, 79.3-horsepower combination chemical and hose cars, equipped with one 40-gallon chemical tank, 200 feet of chemical hose, 1,000 feet of rubber lined 2½-inch cotton fibre hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc. The motor is of the air-cooled type, 6-cylinder, with 5¾-inch bore and 6-inch stroke, developing 79.3 horsepower, according to the A. L. A. M. rating.

Two 52.3-horsepower, water-cooled, triple combination machines, equipped with one chemical tank of 40 gallons capacity, 200 feet of chemical hose, 1,000 feet of 2½-inch rubber lined cotton fire hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc. These machines are also equipped with rotary pumps with an estimated capacity of 750 gallons per minute.

One motorized steam fire engine. This is a second size Ahrens steam fire engine rebuilt and equipped with a 78-horsepower motor. All horsepower is according to A. L. A. M. rating.

This equipment represents an investment of $80,000, and a monthly interest charge of $333.33. At the present time it is impossible to give a detailed comparison of cost between the motorized and horse equipment that would not be misleading, owing to the comparatively short time the motors have been in use, and the fact that the firemen have had to acquire in this short period the radically different knowledge and skill demanded for the proper care and operation of the machines. An intelligent and accurate comparison of the two can only be made by a study of carefully compiled records kept for a period of five or six years. Chief Bennett states, however, that even the short period the motors have been in use has demonstrated their superiority over the horse equipment under the existing conditions; in the greatly increased territory that can be protected by one station and the consequent reduction of the number of stations necessary to protect the whole city.

An examination of the department records for February, 1912, which is taken as an average of the heavy work months, shows very clearly how the physical conditions of the streets over which runs are made affects the cost of operating the cars. The cost varies from 4 3-10 cents per mile at station No. 1, that answered 53 alarms and traveled 65.2 miles over paved streets and low grades, to station No. 13, answering 2 alarms and traveling 7.2 miles over unpaved streets and steep grades, at a cost of 16 cents per mile. The cost in both cases being for gasoline and oil only. All necessary data concerning cost of operation and maintenance are being compiled so that at the end of a period of five or six years a complete and intelligent comparison of the relative efficiency of the motor and horse equipments can be made. The change from horse to motor power is a logical step in the process of evolution brought about by necessity, and it must undergo the test of the law of survival of the fittest before the last word is said.

AUTOMOBILES OF SPRINGFIELD, MASS.

By Joseph H. Bay, Springfield, Mass.

THAT motor-driven apparatus is an economy, compared with horse-drawn vehicles, has been clearly demonstrated during the last decade, with the result that few cities in the United States now are without at least one automobile in some one department, but it remained for Springfield, Mass., to take the initiative in introducing fire-fighting autos and following up its own example by applying this principle of economy and efficiency, until now the city owns thirty-eight motor-driven pieces of apparatus, leading, in comparison, the entire world in its municipally owned machines.

It was back in 1904 that the city decided to try its first experiment with an auto, in the form of an auto police patrol, and within a few months the street-lighting department purchased a small runabout for its superintendent. Another few months brought forth another runabout for the use of the water department officials.

Fire Department

The pace had been set, and in 1906 the fire department introduced one of the first fire-fighting autos in the country, if not the very first. This is termed an auxiliary squad car, designed to carry eight men, a chemical tank, and about thirty pieces of fire-fighting and life-saving appliances.

This machine proved such a success in quickly reaching fires and demonstrating its own efficiency over any kind of horse-drawn apparatus, that the fire department officials were convinced that Springfield was on the right road, and that the auto, as a fire-fighting agency, had come to stay.

A similar squad car was purchased in March, 1907. This was followed by a small touring car for Chief William H. Daggett the following month, and a similar car for First Assistant Chief Everett A. Kimball, later in the same month.

Meanwhile the fire department officials were considering the purchase of a chemical or combination auto, with the result that in August, 1908, a combination chemical and horse auto was placed in service.

THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Group Showing Two Squad Cars, Two Chief's Cars, and Old-Style Hose and Chemical Car.

Electric Horse Car

Several other machines were purchased by the fire department in rapid succession until 1910, when it was decided to deviate from the gasoline-driven machine and try an experiment with an electric machine in the form of another combination hose and chemical auto.

The ninth machine in the fire department was this electric combination, which was placed in service in January, 1911. The first combination car was of the ordinary auto type, with body set low between the wheels, while the eight other combination cars are of the commercial type, with body built high and above the wheels.

This experiment with the electrically-driven combination proved so successful that the fire department the following month put into service the first electrically-driven aerial ladder truck in the country, at a cost of $10,000.

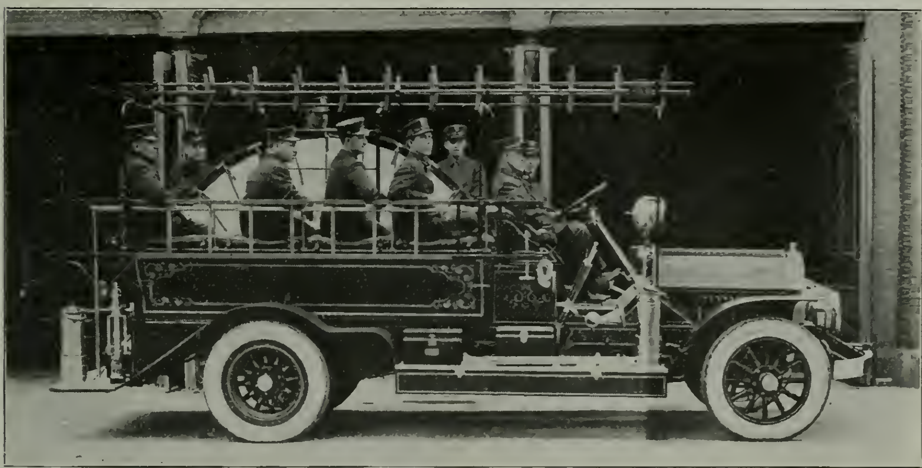
The three-horse aerial ladder truck at headquarters was changed into a motor-driven machine thirteen months later by the adaptation of an electric tractor.

of five autos which are electric, these being two electric combinations and three electrically-driven aerial ladder trucks, one of which is tractor driven.

The motor-driven apparatus is made up of nine combinations, three ladder trucks, one water tower, two auxiliary squads, four autos for the chief and three assistant chiefs, two pieces in the fire-alarm department, one a runabout and the other a work car, and one spare gasoline-driven vehicle similar to the squad cars.

Other City Cars

But the introduction of auto-driven apparatus was not confined to the fire and police departments, although the fire de-



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Auxiliary Squad "B" Life-Saving Car.

Within a few months after the regular electric truck had been put into service the department decided that a similar machine was necessary, with the result that a second electric truck, at a cost of another $10,000, was put into service last July.

Many other pieces of auto apparatus were installed in the fire department since the first experiment in 1906, the last being a second electric combination, which went into service in August.

At the present time Springfield's fire department is equipped with twenty-two machines, all of which are gasoline autos furnished by the Knox Automobile Company, of Springfield, with the exception

partment has played the most prominent part in this comparatively recent innovation.

Their experiments resulted in the departments of street lights, water, highways and parks, and the city property committee adopting automobiles, until at present the water department has six, the highway four, park two, police two, and street-lighting department and city property committee one each.

Replacements

Since the adoption of motor-driven apparatus by the city the fire department has discarded three machines, the first two auxiliary squads being replaced by larger cars of the same type, and Chief Daggett's original car being replaced by a larger and more powerful car of similar type.

Squad A, the first car to be introduced into the fire department, was replaced in 1911. This squad, like Squad B, put into service in March, 1907, was a 30-horse-power Knox car, Squad B being replaced in July, 1912, by a 40-horse-power car, the same as Squad A was replaced in 1911. Thus each of the original squads performed service for about six years before being replaced by larger and more powerful autos.

The other cars discarded and replaced were used by the department of street lights and the water department. The first car taken into service by the department of street lighting was a Knox runabout, 18-horse-power, two cylinders, which remained in service from 1904 until 1907, when it was traded for another Knox car, touring design, five passengers, 30-horse-power.

The car discarded by the water department was a Knox runabout, 8-horse-power, single cylinder, which remained in service from 1904 until 1910, when it was traded for a Knox touring car, five passengers, 30-horse-power, four cylinders.

There are several other old autos now in service in various departments, which soon will be replaced by larger cars.

Water Department

Next to the fire department, the water department leads with the largest number of autos, six now being in service. The second auto, which was a touring car, used by the engineer and superintendent, it is estimated, has covered an average of 10,000 miles a year.

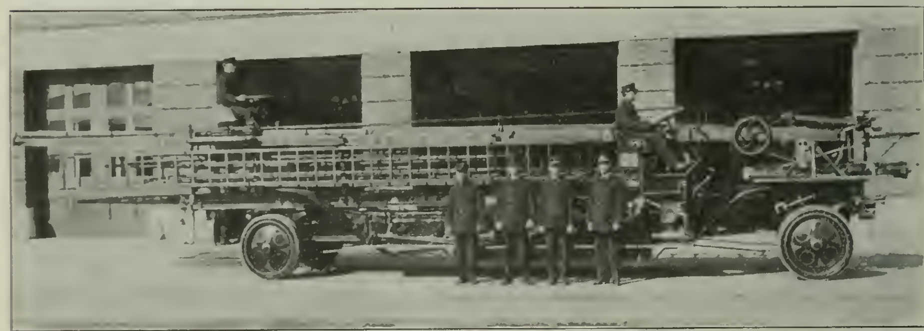
This car was converted into a work car in 1910, and at the present time, with its tonneau removed to provide for a "box" in the rear, it is used for installing and removing meters and other similar work.

The third car to come into the water department was a Knox runabout, four passengers, 30-horse-power, four cylinders, which was used by the superintendent from its installation in 1908 until last year for general purposes, and since last year has been in general use by other employes of the department.

This car was followed by the purchase of a seven-passenger Knox touring car, 40-horse-power, four cylinders, in 1910, for the use of the chief engineer, and since its installation it has held the annual record for mileage, it being estimated from readings of the cyclometer that it covers an average of 15,000 miles a year.

The next auto in this department came into service in April, 1911, this being a Hudson runabout, four passengers, 22-horse-power, four cylinders, which it is estimated averages 8,000 miles annually. The success of autos induced the department to introduce a three-ton Knox truck, 40-horse-power, four cylinders, into the department in August of this year.

This was followed by the last auto to be purchased by the water department, which is a Cadillac, touring, four-passen-



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Electrically-Driven $10,000 Aerial Ladder Truck.

ger, 30-horse-power, four-cylinder car, which is designed for the use of the superintendent.

Highway Department

In the highway department there are now four autos, all of which are of the runabout or touring type, the first machine, which is a Knox runabout, 30-horse-power, four cylinders, coming into the department in 1908. This was used by the superintendent of streets until 1911, since which time it has been used by the paymaster of the department. It is estimated that the yearly average mileage of this machine until 1911 was 7,000 miles.

In June, 1910, the department installed a two-passenger Stanley steamer runabout, 10-horse-power, for the use of the assistant superintendent of streets. This machine is still in service and covers about 12,000 miles a year.

The third machine was of similar make and type, and was put into service the following month. It is used by the superintendent of sewers, and covers about 7,000 miles a year.

The last auto to be purchased by the highway department was a Ford two-passenger runabout, which went into service

THE AUTOMOBILES OF SPRINGFIELD, Combination Hose and Chemical Car, 50-h.p., Gasoline Driven.

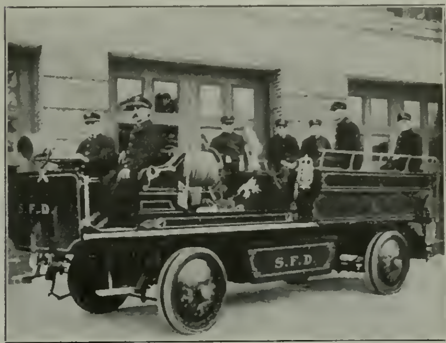
in August of this year, and is used by the superintendent of ashes and garbage.

Park Department

There are only two machines in the park department, both of these being trucks, the first being a three-ton Knox truck, 45-horse-power, four cylinders, which came into service in February, 1910, and the second being a two-ton truck of similar make and build, which was put into service last February. It is estimated that each of these trucks covers 10,000 miles a year.

Police Department

Although the police department was in fine condition, so far as its autos were



THE AUTOMOBILES OF SPRINGFIELD, New Electric Combination Car at Headquarters.

concerned, several years ago, it now has the two most inefficient machines in the city, both being antiquated and worn out so completely that breakdowns are a common occurrence on the streets.

The first of these machines went into service in February, 1904. This is a Knox, 14-horse-power, two-cylinder machine, weighing 3,600 pounds, with underslung engine, air-cooled, it being the only example of its kind in the city departments. During the first few years of its service it proved its efficiency, but since April, 1909, when the second police auto went into service, it has proved expensive and burdensome to the drivers, as well as the other members of the department.

The second machine was installed in April, 1909. This is a Knox, 35-horse-power, four cylinders, of the ordinary type, with engine in front instead of underslung beneath body, as in the case of the first machine, yet this last machine, too, being air-cooled and worn out, is as burdensome as the original machine.

Light and Property Departments

The other departments owning autos are the department of street lights, the superintendent of which operates a Knox touring car, and the schoolhouse agent, who uses a combination touring car and runabout, purchased for the use of the city property committee, this being a Knox, 30-horse-power, four-cylinder car, which, it is estimated, covers about 4,000 miles a year. The tonneau has been removed from this car and the rear converted into a "box" for commercial purposes. This car was purchased in April, 1910, and is in fine condition.

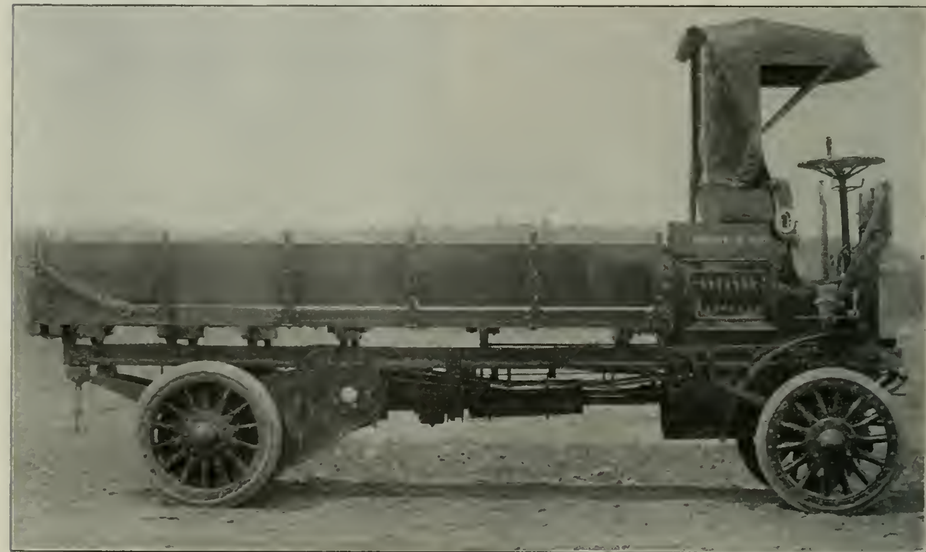
Comparisons of Cost

Roughly estimated, a three-horse hitch in the fire department costs about $1,000 a year, including forage, etc., horseshoeing, veterinary treatment, and other similar expenses. For a similar piece of apparatus, electrically driven, the fire department estimates a cost of $250 a year, and this estimate is liberal. Thus there is a saving of $750 a year.

Similar figures are offered to show the comparative cost of the two-horse hitch, nine of which horse-drawn pieces of apparatus have been replaced by combination hose and chemical autos, the old chemical engines, so-called, being discarded and replaced by machines which combine both chemical and hose apparatus.

A double-horse hitch costs the department about $650 a year. The modern combination costs approximately $50 a year, and this is a liberal estimate. Thus it will be seen that there is a saving of $600 a year for each combination installed in service, the cost for the electric combinations probably being slightly less than for the gasoline machines.

As a concrete example, the service of hose and chemical combination No. 7, gasoline driven, may be cited. From June, 1911, to June, 1912, this machine made 204 runs at a total cost of $36.44, which is seen to be far below the estimated cost of $650 a year for the two-horse hitch.



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Truck Used by Park Department.

As none of the fire apparatus is equipped with cyclometers, it is difficult to estimate the cost per mile, but the average mileage for each run, except the squads and autos used by the chief and his three assistants, who respond to very nearly every alarm, is about one mile, which means that most machines do not travel more than 200 or 300 miles a year, a vast difference when compared with the touring and runabout cars in the other departments.

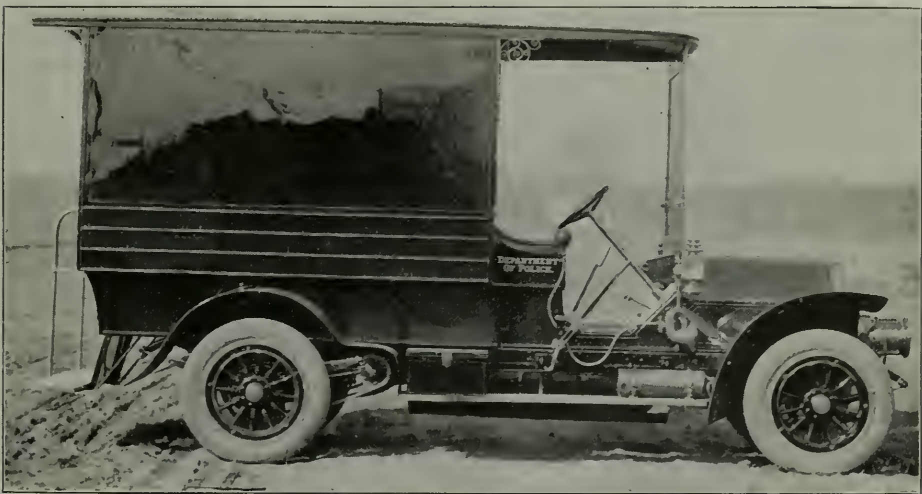
Then, again, another feature of cost must be considered when it is realized that throughout the winter it is customary to keep the gasoline engines running free while extinguishing a fire, for fear of freezing engines. This unavoidable feature costs several hundred dollars in gasoline for the department every year, and demonstrates one of the advantages of electrically-driven apparatus.

Although the mileage of most of the apparatus is comparatively small, the chief of the fire department, as well as his three assistants and the two auxiliary squads, it is estimated, cover from 1,000 to 2,000 miles a year, the chief leading with probably a little more than 3,000 miles each year.

Expensive Old Cars

Figures furnished by the police department, however, are much greater, the reason for this increase being the worn-out condition of the two cars. For the year 1910 the department expended $1,859 for repairs and supplies on both cars, and in 1911 it cost the department $1,074 for similar expenses, making a total of $2,933 for two years, an average of $1,466 for both machines each year, which means a yearly average of $733 for each machine.

It is estimated that this yearly expense can be reduced 30 or 40 per cent. with modern machines, and, regardless of the breakdowns, which are so frequent, this is one of the strong arguments being used by the police department officials in asking for new equipment.



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
The Second Police Patrol in Service.

The success of the motor-driven apparatus in the fire department has resulted in ten of the thirteen fire stations being equipped with at least one piece of such apparatus, the exceptions being the Indian Orchard, Armory and Plainfield street stations.

The cost of operation in the other departments is about the same as may be expected of touring and runabout cars operating each day, summer and winter, those in the water department, it being estimated, averaging $600 each, while the highway department is slightly less.

There are several other departments in the city which have appropriated funds for the purchase of automobiles, and with the increase of autos in the departments already equipped, it is expected that in another year Springfield's municipally owned motor-driven apparatus will very nearly touch the 100 mark.

CHICAGO PLAYGROUNDS.

By Theodors A. Gross, Superintendent Playgrounds and Bathing Beaches, Chicago.

IDEAL playground planning contemplates the establishment of playgrounds close to or in connection with schools. The present movement for school neighborhood centers eventually will place the playground under the same control as that of the schools, and the ideal will have been reached when school and playground, with all their modern activities shall have become one. Because of their great expense in construction and operation, but few cities can emulate the playgrounds of Chicago. When the playgrounds shall be combined with the schools, the movement will spread more rapidly, and it will be possible for every school, even in the small towns and in the country districts, to afford a playground under such a plan.

CHICAGO PLAYGROUNDS.
Girls' Race. Field Day at Dante Playground.

Playground Equipment

Each playground is equipped with play apparatus, shelters, sand courts, athletic fields, and the larger grounds contain wading pools, running tracks and baseball diamonds.

The formal organized activities, such as baseball leagues, athletic tests, athletic meets, races, exhibitions and play festivals, are given more attention than ever.

Among the boys and young men the team spirit is fostered and stimulated in every manner because of the immense educational value of group play in developing co-operation, co-ordination, loyalty, self-denial, and the many other commendable qualities so essential to the development of strong character and the making of good citizenship.

Playground ball, which is practically the regulation indoor baseball game played outdoors, is the most popular game, because it is similar to the national pastime, baseball, which every healthy boy loves to play, and because it can be played in a comparatively small field. This game is played daily at each Chicago playground, and aside from the informal "pick up" games, 1,095 matched games were played during 1911, of which 122 games were played by girls.

A series of tournaments are held in June, July and August. The boys are arranged in two divisions, according to age and height.

Uses of Equipment

At the Wrightwood, Christopher and McCormick playgrounds the field house contains a large room which is equipped with light gymnastic apparatus, swinging clubs, wands, dumb bells, mats, kindergarten and industrial work material, and pianos loaned gratis. Women physical training teachers give systematic instruction thruout the entire year to classes of girls and young women each afternoon and two evenings each week in gymnastics, calisthenics, dancing, games, raffia weaving and sewing. The remainder of the time these gymnasiums are occupied by boys and young men engaged in gymnasium work under the leadership of the directors.

The field houses are also utilized as meeting places for boys' and young men's clubs. The meetings are always conducted under the guidance of the directors, the boys receiving a training in parliamentary practice and methods of government. The club rooms are also used by the girls for parties, dances and other social entertainment under the supervision of women instructors.

The playgrounds are popular in winter also. On December 1st the greater part of the play apparatus is taken down and stored away, and the grounds are prepared and flooded for skating.

Toboggan slides are erected in the larger playgrounds and have proved to be very popular among those who do not care to skate.

CHICAGO PLAYGROUNDS.
Dedicatory Exercises. Audubon Playground.

Free Skates

As hundreds of children patronizing the playgrounds daily during the skating season do not possess ice skates necessary to fully enjoy the pleasure afforded by the flooded ponds, an appeal is made through the public press for discarded skates, which results in collecting nearly one hundred pairs of skates annually which are distributed among the deserving boys and girls or held by the directors and loaned to the children.

However, the demand for skates far exceeds the supply from this source and another method has been employed. The commission conceived a plan whereby these children could be accommodated with skates each season free of charge. Through an appeal for cash contributions sufficient funds were secured to purchase 450 pairs of skates, which were distributed equally among fifteen grounds, providing thirty pairs for each playground. These skates are kept in the possession of the commission and loaned, free of charge, to the patrons each day.

Efficient Directors

The directors employed in each playground to look after the play activities render invaluable service in organizing teams, teaching gymnastics, athletics and games, promoting play in all aspects, insisting on fairness and regard for others,

CHICAGO PLAYGROUNDS.
Girls' Race. Field Day, Adams Playground.

and establishing a feeling of good fellowship among the patrons. It is mostly due to their effective and earnest co-operation that progress is made in organizing and developing the educational play and physical training activities.

The police officers stationed at each ground also render a valuable service in establishing a feeling of safety and confidence. Their method of enforcing public order and maintaining discipline aids in upholding the high standards of efficiency required by the commission.

The general conduct of the patrons of all grounds is satisfactory. The patrons are allowed as much liberty and freedom in the use of the facilities as can be permitted without interfering with the welfare of others. The few repressive rules governing the use of the grounds are rigidly enforced, so that patrons soon learn that they must conduct themselves properly in order to enjoy the privileges of the playground.

The few offenses committed are minor infractions of the rules, the punishment in

CHICAGO PLAYGROUNDS.
Winter Sports. Skating at Hamlin Playground.

each case being temporary suspension. Only 266 girls and 523 boys were penalized in this manner during 1911, which was considerably less than in 1910. The conduct of the older patrons is to be commended and every means is used to encourage parents to visit the playgrounds.

South Parks Equipment

In each of ten parks of the South Park district there are two indoor gymnasiums, one for men and boys and the other for women and girls. These gymnasiums are equipped with modern apparatus, steel lockers and ample baths. There are also outdoor gymnasiums or playgrounds and at least one baseball diamond in each of the ten parks. All gymnasiums and playgrounds are in care of trained instructors, who conduct classes in gymnastics, dancing and games indoors from October to May, and games, athletics and sports outdoors from May to October. Playground equipment has been selected with special reference to play instincts and tendencies of all groups and ages. Gymnasium classes, sports and pastimes are organized for school children, young working

In connection with the gymnasium and playgrounds of the South Park district, there are ten park building assembly halls, club rooms, reading rooms, refectories, locker rooms and shower baths. The buildings are open for the use of the people every day of the year.

The gymnasium and playgrounds during the school year are open from 3:30 in the afternoon until 10 o'clock at night, except on Saturdays and holidays, when they are open at 10 o'clock in the morning.

The swimming pools are open about June 1 and until about October 1, two days a week being set aside for women and girls.

The shower baths are in use every day in the year.

Operating Force Required

The force required in each park to operate the facilities named is as follows: 2 gymnasium instructors, one for the women's side and one for the men's side; 2 women attendants for the locker rooms and shower rooms; 3 men attendants; 2 janitors; 1 woman attendant for reading room; 1 playground attendant; 1 fireman; 1 engineer; 2 additional women attendants; 2 additional men attendants; total, 17.

During the swimming season additional attendants are employed as follows: 2 women; 2 men; 2 or 3 life savers, as required by the size of the pool.

The park commissioners furnish bathing suits, towels and soap, for which there is no charge made. Neither is there any charge made for the use of any of the facilities in the building, except in the refectories, where the prices are the very lowest.

CHICAGO PLAYGROUNDS.
Winter Sports. Toboggan at Hamlin Playground.

BALTIMORE'S MUNICIPAL MOTORS.

By Stuart Stevens Scott.

THE municipality of Baltimore owns thirty-four automobiles and fourteen motorcycles to do the work of its numerous departments. In spite of the bad streets and heavy grades, the automobile, both for pleasure and business, has found favor and the number is steadily increasing.

Of the municipally owned cars there are eleven in the fire department, twelve in the police department and eleven in what is known as the "city hall," the latter including the departments of sewerage, park board, commissioners for opening streets, paving commission, street cleaning, building inspector, subway, water, health, etc.

Police Department Motors

The introduction of the automobile in the police department was in 1909, when a 60-horsepower Locomobile patrol wagon was put in service. This machine did so well that since then the department has added three more 60-horsepower and five 40-horsepower Locomobiles, so that all of the patrol service in the city is done by automobiles. Besides these machines the marshal has been given a 38-horsepower car, while the linemen of the department have been given a 30-horsepower White gasoline truck. Seven 4-horsepower Indian motorcycles have been put into service for traffic men, completing the motor equipment of the department.

There are on file with the police board elaborate reports from every one of the eight districts showing the mileage, costs of repairs, reports, etc.

In summing up, Morris A. Soper, president of the police board, said: "We find that our machines give us as good service as they would give any other city, considering that our streets are exceedingly hilly, which is hard on engines and tires. Our statistics show that the cost of maintenance of all of the machines in service is equivalent to 12 cents per mile. The statistics of the horse-drawn vehicles, as near as we could figure, puts the mileage at 11 cents per mile.

BALTIMORE'S MUNICIPAL MOTORS.
Some of the Automobiles Used by Various City Departments.

Comparison of Motors with Horse Equipment

"On basis of 100,000 miles per year for all of the machines this would appear to be a saving of $1,000 in favor of the horses, but when one considers that there is a difference of seventeen drivers for the machines as against nineteen drivers for the horses, this $1,000 is more than made up.

"We have retained our mounted squad for patroling the outskirts of the city, but the motor cycle squad has done what the mounted men have been unable to do —check the speeder. Ten of our motorcycle patrolmen ride in citizen clothes and they have practically a roving detachment, commissioned to go at will thru the city and especially upon those thorofares where the speeder is tempted to try out his machine.

"We have found the automobile our greatest asset for the marshal and his deputy. Formerly it required all day for the deputy to make the rounds of the station houses and inspect them. He now accomplishes his work in the mornings and saves half a day.

"We have materially reduced the cost of maintenance by having our own repair shop. This shop is equipped with lathes and tools by which almost any part of an engine may be made and although it has been open but two years, it has more than paid for itself."

board, is enthusiastic over the automobile in the fire department. He asserts that within a very few years every piece of fire apparatus will be self-propelled. There will be no more horse-drawn pieces of apparatus added to the department in the future. Everything that comes in new will be powered.

The high pressure service trucks are an example of the value of the motors. They are so heavy that six horses would make no speed with them, and yet, under their own power, they not only can make but have made 40 miles an hour.

Fire Department Ambulance.

One of three 40-h.p. Chief's Cars

One of two 60-h.p. High Pressure Trucks.

One of two 40-h.p. Supply Trucks of the Fire Department.

BALTIMORE'S MUNICIPAL MOTORS.

The fire department has only had automobiles since 1909, when a 40-horsepower White steam car was purchased for the chief. A few months later another car of this type was purchased for the deputy. Now the department has an ambulance, a 40-horsepower White; a supply wagon, a 40-horsepower Mack truck; a 40-horsepower White roadster for the superintendent of machinery; two 60-horsepower Mack trucks in the high pressure service, and two 40-horsepower Mack trucks that are hose wagons.

Richard H. Johns, president of the fire

Mayor Preston in Favor of the Automobiles

Mayor Preston is conservative yet favorably inclined in his estimate of municipal automobiles. He says:

"Of course every department wants an automobile, but we sometimes have to stop and ask whether it really would be economy to let them have it.

"There is no question about an automobile giving good service if it is used enough and that is usually the question that has to be answered by the department head. If any department chief can show us that there is actual need for a machine then it is given. For example, the department of lamps and lighting wants a machine. If we ascertain that there is enough work to keep the machine busy we will grant the request.

"The first city department to get a machine was the park board and now there are eleven city departments that have them. All of the cars are of the ordinary pleasure type, touring cars, and they are of different makes. All of them have given satisfaction and their cost of maintenance has been just about what such cars would cost an individual.

"Next year we are going to put the city cars on a different basis. At present the cars are stored at different places, but next year we will have a municipal garage. There will be no such thing as a department car, as all of the cars will be there and at the service of those who need them. This will not only keep the idle cars off the streets, but it will enable the city to save money by having fewer men to look after them and we will have our own repair shops where minor repairs can be made.

"I keenly appreciate the value of the automobile as an adjunct to any line of business. I use a machine regularly, and I venture to say that within a few years there will not be a horse-drawn vehicle in any of the city departments."

Efficiency of City Jail Motor Van

A power car that has only been in service six months but which has proved itself a most excellent investment is the city jail van, the vehicle in which all of the prisoners are carried between the jail and the Criminal Court. This van is a 30-horsepower White gasoline car and during the time it has been in service it has run more than 15,000 miles on one set of five tires.

"In addition to the speed we also have increased efficiency, for the machine will carry seventeen prisoners whereas the horses could draw but ten at a time and then they could not make more than five miles an hour. The motor van will make twenty miles an hour, up hill and down, loaded to capacity, while on level stretches it will make thirty miles an hour.

Besides having a big touring car the street cleaning department also has seven 4-horsepower Indian motorcycles, which are ridden by inspectors who traverse the city to see that the gangs of street cleaners do their work properly. In former years it was customary for these inspectors to walk and use the street cars, but since the advent of the motorcycle, three years ago, the inspectors have been able to accomplish several times the work they formerly did and as a result of their activities Baltimore is a much cleaner city than it ever was before.

BALTIMORE'S MUNICIPAL MOTORS.
Touring Car and Three of the Inspector's Motorcycles Used by the Street Cleaning Department.

THE TUSSOCK MOTH.

By J. H. Prost, City Forester, Chicago.

CHICAGO'S civic motto is "Urbs in Horto," which means "a City Set in a Garden." Its citizens should deserve that title by beautifying its streets with trees and shrubbery.

It is encouraging to know that Chicago has fifty or more well organized improvement associations and many other organizations, which have co-operated in various efforts for civic betterment. All these organizations have long realized that more attention should be given to tree

THE TUSSOCK MOTH.
Cocoons and Egg Masses.

planting. They appreciated the fact that the tree is not only an indispensable factor in making the city more beautiful, but a necessity and essential to an ideal residence street.

Washington is considered the most beautiful city in America. Every visitor to the Capital is impressed by the prominence and grandeur of its trees. These trees form attractive backgrounds, which enhance the dignity of every statue and frame every residence in a fringe of green.

Numerous inquiries and complaints have been received by the Special Park Commission of Chicago relative to the ravages of the larvae or caterpillars of the White Marked Tussock Moth (Orygia Leucostigma). Citizens and improvement associations have been urged to carry on a continual warfare against this pest, destroying it in any form wherever found.

The Caterpillars

When the larva of this insect is fully developed it is one of the most beautiful of our caterpillars, being characteristic in appearance (See Figure 3). The larva or caterpillar is easily recognized by its bright red head and the velvety black back, bordered with yellow stripes. Four conspicuous tufts of cream-colored hair are found growing straight up on the dorsal aspect of the abdominal segments and a pair of long black pencil-like plumes extend forward from the head at an angle from the body and a single one extends back from the posterior end of the body.

The Larvae

When first hatched the young larvae migrate to the under sides of the leaves, where they feed upon the chlorophyl, or green matter of the leaf, often completely defoliating the tree.

After the larvae are about four weeks old they begin to migrate to the crevices of the tree trunk, to fences, walls, porches, eaves and other protected places.

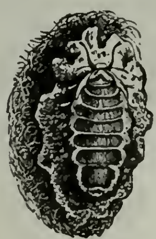


Figure 1.

Figure 2.

THE TUSSOCK MOTH.

Here they spin cocoons composed of the silky threads, which are easily distinguished, and in these the insect changes from the larva to the pupa stage and from the pupa to the adult stage.

The Moths

The male adult (See Figure 2) is a brown colored moth with two pairs of wings, while the female (See Figure 1) is a sluglike moth with wings. Soon after emerging from the pupa the female crawls upon her cocoon and after mating she deposits her eggs on the empty cocoons, covering them with a conspicuous mass of white frothy wax.

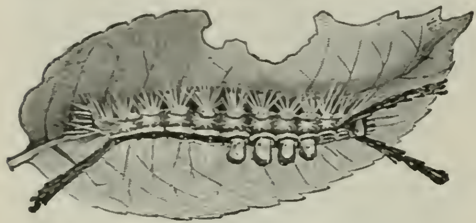


Figure 3.
THE TUSSOCK MOTH.

Many insect pests infest the caterpillars and do much toward controlling this pest, while our native birds, wherever they exist, feed upon the young larvae.

Destroying the Pest

Spraying the young foliage early in the spring with arsenate of lead, in proportions of four pounds of lead to fifty gallons of water, is one of the best methods of combating this pest. This insecticide must be carefully applied and thoroly understood.

Citizens can do a great deal individually by destroying the larvae. This can easily be accomplished by squashing or crushing the pupa which are hidden in the cocoons and by gathering the egg masses and burning them. The crushing can be done by poking a stick against the cocoons or by using long poles, where the cocoons are up in the trees. This is the most simple and economical way of combating the pest. When the tree has been cleared of the egg masses and caterpillars, re-infestation may, in a great measure, be prevented by placing a band of "tanglefoot" or cotton batting around the trunk, for the insect can only spread while in the larva stage.

PHAROS AIR PRESSURE GAS LAMP.

By Leonard Keene Hirshberg, A. B., M. A., M. D., John Hopkins.

IN recognition of the success which has followed the introduction into Marseilles, Bordeaux, Paris, and other European cities, of a high-powered incandescent system of gas illumination, Mr. McCuen, the commissioner for lighting streets in the city of Baltimore, has planned a trial of the new method in the Monumental City. The old scheme, now in universal use, is dependent for increased gas light upon numerous extra burners, while the French system, on the other hand, involves the use of increased pressure of either or both air and gas and the laying of special mains containing air under high pressure. These mains run parallel to the others and the gas is sent through at ordinary pressures.

This combination gives a much higher candle power at the burner, and at the same time permits more gas to emerge from the tip. Thus the gas light equals in brilliancy and intensity the electric arc. Economically, it is claimed abroad, the new combination of gas and compressed air gives the luminosity of an arc at the cost of a little above the ordinary gas mantle.

In Paris they have already extended the new system throughout the Boulevard de l'Opera, and the type of lamp is a cluster of three inverted burners. Each group of three emits a candle power of 1,500, raised twenty feet above the roadway. An automatic stopcock and button arrangement reacts spontaneously to certain pressures within the central gas station, thus extinguishing and also turning on the gas burners, without the need of city lamp lighters. A few inspectors are employed, however, in order to cut out and repair any injured or defective burners, and this exigency is met by providing all lamps with separate valves and keys for lighting or putting them out when necessary.

The inspectors also clean the lamps and

examine them twice each week. At that time new mantles are adjusted, and broken globes, if any, are replaced. An idea of the saving from the use of such lamps may be derived from the statement that 5,000-candle-power lamps cost 10 cents an hour, or in winter about one dollar a night per lamp. For an equivalent 5,000-candle-power arc lamp the cost each night with electricity, at 70 cents an hour (five kilowatt hours times 14 cents), the city must pay seven dollars for each arc, or ten times the cost of the high-pressure gas lamp.

A GERMAN STREET SWEEPER.

By Dr. Robert Grimshaw, Dresden, Germany.

THE sweeping machine made by the Frankfurter Kehrmaschienen Fabrik is distinguished from the majority of apparatus for the same purpose in that the cylindrical brush can move independently of the general frame of the machine, so that instead of letting dirt lie in the low places, which one is sure to find on the street surface, and which must be removed by hand-sweeping, the brush goes down into these low places, without, however, having to be pressed into them so firmly that one horse can hardly haul the machine. In case this "remedy" is resorted to, the wear and tear of the brush is greatly increased; furthermore, the street covering—especially with macadam and telford roads—is unnecessarily worn.

The "Cardamus" two-wheeled machine here illustrated has the brush frame hung on a hollow axle to the main running-gear frame, so that it can rotate about this axle, as well as about that of the wheels, this permitting a movement equivalent to one about two axes cutting each other perpendicularly in a plane. For this reason the main frame can take any position whatever, without influencing that of the brush and its frame, the brush pressing the street surface with its own weight only. The brush, which lies diagonally to the machine, rotates in the opposite direction to the running-gear wheels. It is driven by shaft, bevel gears and chain from the last-named wheels, each of which is mounted on a common axle. All these parts run in a dust-tight oil bath. The main wheel bearings are long; all others are steel ball bearings, protected by felt rings from dust. The machine makes almost no noise when running. It weighs 490 kg. (1,078 lbs.), has a brush 200 cm. (79 inches) long, sweeping a path 190 cm. (75 inches) wide. When drawn by one horse it sweeps about 6,500 square meters (70,000 square feet) of street an hour. On level streets it can be drawn by any ordinary horse; on grades of 10 per cent., by a good stout one.

A special machine, made by the same firm, for forest roads in mountain districts, weighs 400 kg. (800 lbs.), has a brush 150 cm. (59 inches) long, sweeping its full width and covering about 4,500 square meters (48,400 square feet) an hour. The roller is adjustable, so that it can sweep to right or left as desired, this being necessary on all mountain roads. The brush stands out laterally from the main wheel on the side toward

A GERMAN STREET SWEEPER.
Note the Brush Axle Is Independent of the Cart Axle.

which it sweeps. The main wheels track 100 cm. (40 inches) wide. The adjustability of the brush enables the machine to sweep roads only 40 inches wide, altho the brush is 60 inches long. The brush being held to the road surface by its own weight only, conforms to all inequalities of the surface.

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THE AUTOMOBILE IN MUNICIPAL SERVICE.

The automobile as a municipal service vehicle for practically all departments has already proved its efficiency and economy to such an extent as to command the attention of every wide-awake city official. And yet this commercial application of automobiles is of such comparatively recent origin that city officials generally have not fully awakened to the possibilities. The "Roll Call of Cities Operating Automobiles," in this issue of Municipal Engineering, gives a very comprehensive idea of the progress of this important development to date. Of the 1,200 machines operating in nearly 150 cities covered in this report, not more than ten per cent were in operation in 1909 and practically no motor driven municipal service vehicles were in use prior to 1905. The movement has meant in many cases revolutionary changes in methods, but the results have been gratifying alike to city officials and to the tax-paying public. Cities which foster an ambition to be leaders in their class will lose no time in profiting by the examples before them and in realizing the full benefits of economizing time and money and increasing efficiency.

EFFECT OF AUTOMOBILE ON STREET IMPROVEMENTS.

The adaptation of the automobile to the requirements of properly conducting various departments of public work can not help but have an important bearing ultimately at least upon certain kinds of physical improvement work. The fullest efficiency of the automobile is dependent upon good, well built streets and roads and upon proper housing and garage facilities. It makes possible the creation of larger districts in the police, fire, park and health departments. The constant use of automobiles by city officials in conducting their work will serve to impress the importance of good boulevards and extensions of present boulevard systems. It makes more easily possible the annexation of suburbs and outlying districts and the consequent reduction of what now may seem to be necessarily congested districts.

The municipal automobiles for their highest efficiency, especially in covering outlying territory, emphasize the necessity for better pavements in such districts. It has been thought that a simple grading or a gravel street was sufficient improvement for streets not yet fully built upon. But when a fire engine gets caught in a mud hole the benefits of the new system are lost. It is no better than the old horse system. The road builders have developed cheap methods of improving country roads which are equally good for the streets in the new districts in a developing city, during the process of development.

Small towns are oiling their streets with benefit. Cities can do the same, or can improve on this by using the various methods of making bituminous surfaces with tar or asphalt. There will shortly be as great an increase in the use of these materials on many miles of city streets as there has been in the past few years on main country roads.

RELIEF OF CONGESTED TRAFFIC.

The suggestion made by a prominent traffic official in Chicago to the effect that traffic congestion could be largely avoided by the elimination of horse drawn vehicles from crowded streets is well worth considering. The time is probably not far distant when the larger cities will be compelled of necessity to adopt some such ruling.

HOUSING AN IMPORTANT MUNICIPAL PROBLEM.

The housing problem is as much a problem of the city official and of the legislator as of the housing reformer. The article in this issue of MUNICIPAL ENGINEERING by Albion Fellows Bacon in "The Problem of a Growing City" points out conditions resulting from overcrowding and explains how such conditions are a menace to public health and morals. It mentions also the burden of expense imposed upon cities as a result of such deplorable conditions. This expense burden, when properly impressed upon those in authority or those in position to effect reforms, will probably be more likely to awaken an active interest calculated to accomplish something worth while than all the volumes which might be written on the side of health, morals, decency, comfort or convenience. When the public is thoroughly aroused to the fact that the slums are productive of moral and physical derelicts who become expensive public burdens, then our slums will disappear.

THE ROLL CALL OF CITIES OPERATING AUTOMOBILES.

THE following tables contain a compilation of information relative to automobiles in municipal service. These data were taken from reports sent to MUNICIPAL ENGINEERING by the mayors, or department heads of the various cities included in the list. The great volume of information submitted made necessary the use of abbreviations in a great many instances, and the following explanation is appended to make clear any doubtful meaning:

Am. La Fr. for American La France.
Pope-Hart. for Pope-Hartford.
Pierce for Pierce-Arrow.
Kissell for Kissell Kar.
Stoddard for Stoddard-Dayton.
Har.-Dav. for Harley-Davidson.
Excels'r for Excelsior.
Stev.-Dur. for Stevens-Duryea.
R. C. H. for R. C. Hupp.
(c) for motorcycle.
(t'k) for truck.
A. Ladder for aerial ladder.
Comb. H C for combination hose and chemical car.
Comb. P H for combination pumping engine and hose car.
Comb. P H C for triple combination pumping engine, hose and chemical car.
Comb. H L for combination hose and ladder car.
Water Tow. for water tower.
Comb. P A for combination patrol and ambulance.

In cases where cars have been described as serving two or more departments of the municipality, they have been classified only under that department in which they give the greater service.

FIRE DEPARTMENT MOTORS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
ALABAMA.					
Birmingham—					
12	....	52.9	...	.....	Comb. H C
6	....	79.3	...	.....	Comb. H C
2	....	52.3	...	.....	Com. P H C
1	....	78.0	...	.....	Pumping
(Motorized Steam Engine.)					
Mobile—					
1	....	50	...	.....	Comb.
Montgomery—					
2	Am. La Fr.	70	...	.....	Comb. H C
1	White	40	...	.....	Chemical
CALIFORNIA.					
Bakersfield—					
1	....	..	...	.....	Chief
1	Waterous ..	..	...	.....	Pumping
Berkeley—					
1	Pope-Hart.	60	...	.....	Squad
2	Knox	50	...	.....	Comb. H C
1	Seagrave ..	80	...	.....	Comb. H.C
Pasadena—					
1	Robinson ..	..	...	.....	Chemical
1	Schenk	..	...		
2	Seagrave ..	..	...	.....	Comb. H C
Redlands—					
1	Seagrave ..	52	...	.....	Comb. H C
San Diego—					
2	Seagrave ...	80	...	.....	Comb. H C
1	Seagrave ..	90	...	.....	A. Ladder
1	Rambler ...	40	...	.....	Comb. H C
1	Stutz	40	...	.....	Chief
San Francisco—					
1	Pope-Hart.	..	...	.....	Chemical
1	Am. La Fr.	..	...	.....	Chemical
1	Seagrave ..	80	...	.....	Ladder
2	Pierce	..	...	.....	Chief
1	Pope-Hart.	..	...	.....	Chief
San Jose—					
1	Winton	60	50	$3.50	Chemical

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
COLORADO.					
Colorado Springs—					
1	Knox	..	...		
(Tractor attached to engine.)					
1	Knox	60	...	.....	Comb. H C
1	Gramm ...	40	...	3.50	Comb. H C
1	Chalmers ..	30	...	15.00	Chief
CONNECTICUT.					
Hartford—					
3	Amoskeag ..	..	...	.....	Engines
1	Pope-Hart.	..	...	.....	Chemical
1	Am. La Fr.	..	...	.....	Tractor
1	Pope-Hart.	..	...	.....	Comb. H C
1	Knox	..	...	.....	Comb. H C
3	Pope-Hart.	..	...	.....	Comb. H C
(Ordered for Immediate Delivery.)					
1	Pope-Hart.	..	...	.....	Practice
3	Pope-Hart.	..	...	.....	Chief
Middletown—					
1	Pope-Hart.	..	...	3.50	
New Haven—					
1	Pope-Hart.	50	60	2.00	Squad.
1	Webb	90	30	5.00	Comb. H C
1	Pope-Hart.	50	25	2.00	Comb. H C
1	Pope-Hart.	50	800	20.00	Chief
1	Pope-Hart.	40	800	20.00	Marshal
2	Ford	20	300	2.75	Chiefs
1	Continent'l	30	200	3.50	Alarms
Norwich—				.....	Chemical
1	....	..	...		
Stamford—					
1	Am. La Fr.	100	9.53	9.12	Comb. P H
1	Locomobile	45	26	5.73	Comb. H C
FLORIDA.					
Tampa—					
1	....	..	...	.....	Chief
3	....	..	...	.....	Comb. H C
1	(Ordered for Immediate Delivery.)				

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
GEORGIA.					
Atlanta—					
1	....	..	...	.....	Chief
Augusta—					
1	Webb	90	300	8.62	Comb. P H
2	Webb	60	125	6.38	Comb. H C
1	Oldsmobile	.45	...	7.03	Chief
Rome—					
2	Seagrave ..	53	20	3.82	Comb. H C
1	Buick	22	50	4.60	Chief
ILLINOIS.					
Bloomington—					
1	Seagrave ..	75	40	5.00	Comb. H C
Chicago—					
1	Webb	70	8	2.49	Comb. H C
3	Mais	24	...		
3	Robinson ..	80	4186	94.80	Comb. H C
17	Harder	45	...	.....	Comb. H C
3	Harder	48	...	.....	Squad
	(Not in service.)				
1	Special	30	...	.....	Official
1	Pierce	48	...	.....	Official
2	Halladay ..	40	5264	45.52	Official
3	Overland ..	30	...	.....	Official
1	Apperson ..	40	...	.....	Official
Decatur—					
1	Special	57	15	3.00	Comb. H C
1	Special	..	...	.....	Comb. H C
	(Made by Townsend Bros. local, Atterberry Chassis.)				
1	Rambler ...	45	185	5.00	Chief
Evanston—					
1	Robinson ..	..	...	.....	Com. P C H
Kankakee—					
1	Kissel	50	10	0.75	Comb. H C
Peoria—					
1	Robinson ..	80	...	.....	Comb. H C
1	Robinson ..	110	...	.....	Comb. P H
Quincy—					
1	Seagrave ..	50	...	28.36	Comb. H C
1	Hupmobile .	20	...	11.90	Chief
Rockford—					
2	....	..	...	.....	Pumping
3	....	..	...	.....	Comb. H C
1	....	..	...	.....	Ladder
Waukegan—					
1	Seagrave ..	53	25	3.25	Comb. H C
INDIANA.					
Elkhart—					
1	Webb	90	53	3.21	Comb. P H
Indianapolis—					
1	Am. La Fr.	..	...	.....	Comb. P H
2	Am. La Fr.	72	...	.....	Comb H C
1	Packard ...	30	129	4.23	Squad
1	Packard	30	179	.....	Squad
1	Mais	30	...	.....	Ladder
1	Buick	..	...	.....	Supply
1	Premier ...	..	...	.....	Chief
1	Stutz	..	...	.....	Chief
Muncie—					
1	Cadillac ...	..	...	.....	Chief
South Bend—					
1	Rambler ...	50	200	.....	Chemical
1	Studebaker .	30	300	.....	Chief
Terre Haute—					
1	Oldsmobile .	30	35	1.75	Comb. H C
1	Cadillac ...	36	95	3.50	Alarm
IOWA.					
Davenport—					
1	Buick	..	...		Chief
1	Seagrave ..	..	...	.....	Tractor
1	Seagrave ..	..	...	.....	Comb. H L
1	Seagrave ..	..	...	.....	Hose
	(Purchased for October Delivery.)				
Des Moines—					
1	Chalmers .	40	694	.....	Chief
Marshalltown—					
1	Kissel	50	...	.....	Comb. H C
Sioux City—					
1	Robinson ..	110	...	.....	Com. P H C

No. in Service	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
KANSAS.					
Atchison—					
1	Webb	90	40	7.00	Comb. P H
1	Webb	90	40	7.00	Com. P H C
Wichita—					
1	Webb	90	...	.....	Pumping
1	Webb	60	...	.....	Chemical
KENTUCKY.					
Louisville —					
1	American .	60	...	.....	Chief
1	American .	..	...	.....	Mechanic
Newport—					
1	Schacht ...	45	...	.....	Comb. H L
LOUISIANA.					
Shreveport—					
1	Seagrave ..	52	...	7.00	Chemical
1	Seagrave ..	90	...	6.50	Tractor
1	Martin	45	...	.....	Tractor
	(Made by Knox Co.)				
2	Am. La Fr.	50	...	.....	Comb. P H
1	Am. La Fr.	50	...	.....	Comb. H C
1	Cadillac ...	40	...	.....	Chief
1	Cadillac ...	40	...	.....	Electrician
MARYLAND.					
Baltimore—					
1	White	40	...	.....	Chief
1	Mack	40	...	.....	Supply
1	White	40	...	.....	Ambulance
1	White	40	...	.....	Mechanic
2	Mack	60	...	.....	Hose
	(High Pressure Service.)				
2	Mack	40	...	.....	Hose
MASSACHUSETTS.					
Beverly—					
1	Am. La Fr.	..	...	.....	Comb. H C
	(Ordered for Immediate Delivery.)				
Boston—					
1	Columbia ..	..	...	.....	Official
3	Ross	..	...	.....	Official
1	Buick	..	...	.....	Official
1	Cadillac ...	..	...	.....	Official
Brookline—					
1	Knox	..	...	.....	Chief
1	Knox	..	...	.....	Comb. H C
Holyoke —					
1	Knox	60	...	.....	Squad
1	Knox	60	...	.....	Comb. H C
1	Stevens	30	...	.....	Chief
Lynn—					
1	Knox	48	...	.....	Comb. H C
1	Pope-Hart.	40	...	.....	Squad
Melrose—					
1	Knox	..	...	.....	Chemical
Newton—					
1	....	20	...	.....	Chief
1	....	30	...	.....	Chief
2	Knox ..	40-50	...	.....	Comb. H C
Pittsfield—					
1	Pope-Hart.	50	...	2.96	Comb. H C
1	Am. La Fr.	50	...	.....	Ladder
Quincy—					
1	Am. La Fr.	40	...		
2	Kissel ...	40-30	...		
1	Ford	22	...		
Salem—					
1	Am. La Fr.	..	...	.....	Comb. H C
	(Ordered for Immediate Delivery.)				
Somerville—					
1	Pope-Hart.	40	...	.....	Comb. H C
1	Cadillac ...	30	...	.....	Chief
1	Pope-Tol. ..	30	...	.....	Chemical
Springfield—					
3	Couple Gear	80	24	6.00	Ladder
2	Knox	60	92	3.60	Squad
1	Martin	45	...	.....	Water Tow.
7	Knox	60	27	1.44	Comb. H C
2	Couple Gear	80	...	.....	Comb H C
	(Electric.)				
5	Knox	24-45	...	.....	Officials

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
1	Knox	16	...	.....	Alarm
1	Knox	40	...	.....	Utility
Taunton—					
1	Pope-Hart.	50	75	3.20	Comb. H C
Worcester—					
1	Pope-Hart.	40	150	3.10	Squad
1	Thomas	40	300	6.00	Chief

MICHIGAN.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Battle Creek—					
1	Am. La Fr.	75	35	3.60	Comb. H C
1	Am. La Fr.	105	25	4.50	Com. P C H
1	Jackson ...	50	325	.....	Chief
Bay City—					
3	....	..	...		
Detroit—					
1	Seagrave ..	..	...	.....	Water Tow.
1	Seagrave ..	..	...	.....	Service
2	Packard ...	30	...	.....	Squad
4	....	..	...	.....	Pumping
Flint—					
2	Am. La Fr.	90	...	.....	Pumping
1	Am. La Fr.	60	...	.....	Comb. H C
1	Buick	32	...	.....	Chief
Grand Rapids—					
1	Oldsmobile	60	....	4.02	Chemical
1	Oldsmobile	60	....	3.41	Chemical
1	Seagrave ..	58	...	2.80	Comb. H C
1	White	60	...	6.32	Comb. H C
1	Overland ..	30	...	3.06	Chief
1	Reo	12	...	3.76	Alarm
1	Jackson ...	45	...	.....	Marshal
	(Ordered for Immediate Delivery.)				
Kalamazoo—					
1	Michigan ..	40	...	.....	Chief
Lansing—					
1	Oldsmobile	60	30	3.00	Comb. H C
1	Webb	90	50	4.15	Pumping
1	Oldsmobile	60	50	4.25	Chemical
1	Oldsmobile	40	200	7.00	Chief
2	Oldsmobile	74	25	3.00	Comb. H C

MINNESOTA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Duluth—					
2	Kissel	40	...	.....	Chief
1	Am. La Fr.	70	...	.....	Comb. H C
1	Am. La Fr.	90	...	.....	Comb. H C
	(Ordered for Immediate Delivery.)				
1	Am. La Fr.	70	...	.....	Salvage
Minneapolis—					
1	Stoddard ..	..	...	.....	Chief
1	Rambler ..	..	...	.....	Chief
2	Cole	..	...	.....	Chief
1	Am. La Fr.	..	...	.....	Squad
1	Am. La Fr.	..	...	.....	Comb. H C
2	Seagrave ..	..	...	.....	Comb. H C
1	Wilcox	..	...	.....	Comb. H C
1	Nott	..	...	.....	Com. P H C
St. Paul—					
1	Cadillac ...	30	...		
3	Pierce	40	...		
1	Pierce	60	...		
1	....	..	...	21.70	Alarm
1	....	40	...	12.75	Chief
1	....	40	...	14.00	Chief
1	....	40	...	.....	Chief
1	....	30	...		
	(Delivered Sept. 1)				

MISSISSIPPI.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Jackson—					
1	Seagrave ..	80	...		
	(In Service Aug. 15.)				

MISSOURI.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Joplin—					
1	Webb	90	...	.....	Pumping
3	Webb	60	...	.....	Comb. H C
1	Webb	35	...	.....	Chemical
1	Webb	90	...	.....	Comb. P H
St. Joseph—					
1	Cadillac ...	30	...	.....	Chief
1	Velie	40	...	.....	Chief
Webb City—					
1	Am. La Fr.	70	60	.....	Comb. H C
1	Oakland ..	40	20		
	(Comb. Hose and Patrol Car.)				

MONTANA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Butte—					
1	Seagrave ..	80	...	.....	Squad
1	Seagrave ..	80	...	.....	Comb. H C
	(Both cars ordered, not yet in service)				

NEBRASKA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Omaha—					
1	Stearns	30	...	.....	Chief
1	Seagrave ..	80	...	.....	Comb. H C
1	Knox	60	...	.....	Comb. H C

NEW JERSEY.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Atlantic City—					
2	Nyburg ...	40	...	.....	Chief
1	Oldsmobile	40	...	.....	Chief
1	Buick	..	...	.....	Alarm
New Brunswick—					
1	Robinson ..	..	...	.....	Service
	(Ordered for Immediate Delivery.)				
Orange—					
1	....	..	...	.....	Chemical
Passaic—					
1	Webb	50	...	1.75	Comb. P H
4	Knox	40	...	2.00	Comb. H C
1	Pope-Hart.	..	...	2.00	Comb. H C
1	Thomas ...	50	...		
1	Seagrave ..	80	...	4.00	Ladder
1	Seagrave ..	90	...	4.00	
1	Buick	30	350	10.00	Chief
1	Ford	18	125	5.00	
Trenton—					
2	Webb ...	60-90	...	13.00	Comb. P H
1	Stanley ...	30	...	4.50	Comb. H C
	(Steam Power.)				
1	Stanley	30	...	6.00	Chief
	(Steam Power.)				
1	Thomas ...	48	...	7.00	Supply

NEW MEXICO.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Albuquerque—					
1	Am. La Fr.	90	12	.....	Comb. P H

NEW YORK.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Auburn—					
3	....	..	...		
Dunkirk—					
1	Am. La Fr.	48	...	5.40	
Middletown—					
2	....	40-60	200	20.00	Com. P C H
Mt. Vernon—					
1	White	40	20	1.75	Comb. H C
1	White	..	...		
	(Same as above has been ordered.)				
Newburgh—					
1	Chemical ..	..	...		
New Rochelle—					
1	Am. La Fr.	90	...	4.00	Pumping
1	Knox	45	...	4.00	Chemical
1	Knox	45	...	.....	Squad
Nyack—					
1	Stearns ...	60	...	5.00	Comb. H C
Poughkeepsie—					
1	Kanawha ..	30	81	2.50	
Rochester—					
1	....	..	...	.....	Comb. H C
5	....	..	...	.....	Chief
Watertown—					
1	Am. La Fr.	90	...	.....	Com. P C H
1	Franklin ..	25	500	4.25	
Yonkers—					
2	Boyd	60	80	.....	Comb. H C
1	Webb	90	80	.....	Pumping

NORTH CAROLINA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Asheville—					
2	Seagrave ..	80	100	5.00	Comb. H C
Charlotte—					
1	Knox	..	...	.....	Comb. H C

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Durham—					
1	Webb	60	...		
Wilmington—					
2	Am. La Fr.	48	...		
	(In Service Sept. 15.)				
Winston—					
1	Am. La Fr.	100	...		
	(Not yet in Service.)				
OHIO.					
Alliance—					
1	Robinson ..	70	50	3.50	Pumping
1	Sampson ..	60	50	3.50	Comb. P H
1	Chalmer ...	40	150	5.00	Squad
1	Excelsior ..	4	200	1.00	Motorcycle
Ashtabula—					
1	....	..	...	.....	Pumping
1	....	..	...	.....	Hose
1	....	..	...	.....	Chemical
Lakewood—					
1	Am. La Fr.	102	...	.....	Pumping
Lorain—					
1	Seagrave ..	90	30	.....	Ladder
1	Seagrave ..	90	30	.....	Ladder
Mansfield—					
1	Seagrave ..	..	...	.....	Comb. H C
Toledo—					
1	Overland ..	45	666	14.00	Chief
1	Overland ..	30	75	4.00	Chief
Zanesville—					
1	Am. La Fr.	90	...	.....	Pumping
1	Seagrave ..	79	...	.....	Comb. H C
	(Both Cars to be put in service Oct 1.)				
PENNSYLVANIA.					
Bradford—					
1	Garford ...	60	100	14.00	Chemical
Johnstown—					
1	....	..	...	.....	Chief
1	....	..	...	.....	Chemical
New Castle—					
1	Knox	60	50	6.50	Chemical
1	Knox	70	40	5.00	Com. P C H
Philadelphia—					
1	Webb	..	...	.....	Ladder
1	Couple-Gear (Electr			.....	Water Tow.
1	Mack	..	...	.....	Comb. H C
2	Boyd	..	...	.....	Comb. H C
5	Cole	40	...	.....	Engineers
6	Ford	18	...	.....	Engineers
1	White	60	...	.....	Chief
1	Mack	..	...	.....	Emergency
(Above cars ordered but not yet Delivered.)					
Pittsburg—					
1	Christie ...	..	...	.....	Tractor
4	Am. La Fr.	..	...	.....	Comb. H C
4	Knox	..	...	.....	Comb. H C
1	Webb	..	...	.....	Comb. H C
Scranton—					
1	Buick	30	...	.....	Squad
3	Am. La Fr.	..	...	.....	Comb. H C
	(Ordered but not delivered.)				
Wilkinsburg—					
1	Knox	40	...	.....	Comb. H C
1	Am. La Fr.	60	...	.....	Comb. H C
RHODE ISLAND.					
Pawtucket—					
1	Webb	..	...	.....	Pumping
1	....	..	...	.....	Chief
TENNESSEE.					
Chattanooga—					
1	....	..	...	.....	Comb. H C

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Nashville—					
3	Am. La Fr.	95	...	.....	Com. P C H
	(Put in Service during Sept.)				
2	Marathon ..	35	480	10.00	Chief
TEXAS.					
Austin—					
1	Webb	78	...	.....	Comb. H C
1	Reo	30	...	.....	Chief
1	Rambler ...	40	...	.....	Marshal
Dallas—					
3	....	..	...	.....	Pumping
2	....	..	...	.....	Comb. H C
1	....	..	...	.....	Chief
1	....	..	...	.....	Electrical
El Paso—					
2	....	..	...		
Fort Worth—					
1	Am La Fr.	..	...	.....	Comb. H C
1	Webb	..	...	.....	Comb. H C
UTAH.					
Ogden—					
1	Stoddard ..	30	...	6.00	Squad
VIRGINIA.					
Roanoke—					
3	Seagrave ..	80	40	5.60	Comb. H C
WASHINGTON.					
Bellingham—					
1	Ford	18	230	15.00	Chief
Seattle—					
2	Waterous .	101	...	.....	Hose
1	Seagrave ..	80	33	4.27	
1	Seagrave ..	90	1266	3.10	
	(Tractor attached to 85-ft. Aerial Tr.)				
1	Waterous .	101	...	.....	Comb. H C
1	Seagrave ..	80	2366	3.12	
1	Seagrave ..	80	4505	5.10	
1	Chase	20	...	.....	Truck
2	Indian	705	...	.....	Alarm
	(Motorcycles.)				
2	Cadillac ..	32	736	14.94	Chief
1	Pope-Hart.	..	...	.....	Chief
1	Autocar ...	..	...	.....	Chief
Tacoma—					
1	Seagrave ..	..	...	.....	Hose
1	Seagrave ..	..	...	.....	Ladder
4	Seagrave ..	..	...	.....	Comb. H C
1	Seagrave ..	..	...	.....	Com. P C H
2	Stoddard ..	..	...	.....	Chief
Walla Walla—					
1	Seagrave ..	80	40	6.00	
WEST VIRGINIA.					
Charleston—					
1	Kanawha .	32	...	5.00	Chemical
WISCONSIN.					
Beloit—					
1	Am. La Fr.	60	...	.....	Comb. H C
Eau Claire—					
1	Harder ...	70	...(recently installed)		
Kenosha—					
2	....	50	12	1.70	Comb. H C
Superior—					
1	Studebaker	20	...	7.00	Chief
1	Thomas ...	60	...	4.00	Comb. H C
1	Seagrave ..	80	...	5.00	Tractor

POLICE DEPARTMENT MOTORS.

	No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
ALABAMA.						
Mobile—						
	1					Patrol
Montgomery—						
	2	Har-Dav.	4			
CALIFORNIA.						
Alameda—						
	1	Pope-Hart.				Patrol
	1	Indian (c)				Emergency
Berkeley—						
	1	Pope-Hart.	40			Comb. P A
	1	Excels'r (c)				Patrol
	1	Thor (c)				Emergency
	6	(Cycles, to be purchased Oct. 1.)				
Pasadena—						
	1	Hudson				Patrol
	3	Indian (c)				
San Diego—						
	1	Cadillac	30			Emergency
	5	Excels'r (c)	7			
San Francisco—						
	2	Knox				Patrol
	5	(Cycles)				Park
	1	Peerless				Chief
	1	Peerless				Detectives
San Jose—						
	1	Indian	6		$5.00	Patrol
COLORADO.						
Colorado Springs—						
	1	Ford	20		20.00	Chief
	2	Indian (c)	7			Speeders
CONNECTICUT.						
Hartford—						
	2	Pope-H't.	35-45	863		Patrol
	1	Pope-Hart.	35	212		Ambulance
	3	Indian (c)		750		Patrol
	1	Pope (c)				Patrol
New Haven—						
	1	White	30	641	11.98	Patrol
Stamford—						
	1	Pope-Hart.	50	263	10.50	Comb. P A
DISTRICT OF COLUMBIA.						
Washington—						
	1	Franklin				
FLORIDA.						
Tampa—						
	1					Comb. P A
	1					Chief
GEORGIA.						
Augusta—						
	1	Lozier	51	831	27.00	Patrol
	3	Reading (c)	5			
	1	Excels'r (c)	305	100	10.00	
Rome—						
	1	Hudson	30			Patrol
ILLINOIS.						
Chicago—						
	9	Cy. of Chi.	50			Patrol
	15	Excels'r (c)	4	1200	12.50	
	12	Excels'r (c)	7			
	1	Staver	35			Chief
	1	Royal	35			Chief
	1	Ford	20			Chief
Kankakee—						
	1	Buick	22	10	75.00	Patrol
Oak Park—						
	1	White				Ambulance
Peoria—						
	1	Glide				Patrol
	1	Glide				Ambulance
Quincy—						
	1	Pierce (c)	4			
Rockford—						
	2	(Cycles)				
INDIANA.						
Elkhart—						
	1	Crow	35			Comb. P A
Fort Wayne—						
	1	Auburn		500	16.55	Patrol
	1	Indian (c)			10.00	
Hammond—						
	1	Rapid	30		18.00	Patrol
	1	Indian (c)	4		7.00	Patrol
Indianapolis—						
	2	Packard				Patrol
	1	Rapid				Patrol
	1	Premier				Detective
	1					Alarm
South Bend—						
	1	Studebaker	40	375		Ambulance
	1	Pierce	60	300		Auxiliary
	1	Har.-Dav	8	2000		Patrol
Terre Haute—						
	1	Pierce	48	430	17.00	Patrol
	2	Indian (c)	4	275	3.00	Speeders
IOWA.						
Davenport—						
	1	Meteor	50			Patrol
Des Moines—						
	1	White	30			Comb. P A
	1	Cadillac	30			Officials
Marshalltown—						
	1	Kissel	50			Comb. P A
Sioux City—						
	1	Cadillac	30			Patrol
KANSAS.						
Wichita—						
	1	Cadillac	30			Squad
	1	Indian (c)				
KENTUCKY.						
Louisville—						
	3	Oldsmobile				Patrol
	1	Cadillac				Patrol
	3	Cadillac				Officials
	1	Autocar				Detective
MASSACHUSETTS.						
Beverly—						
	1	Yale (c)				Patrol
Boston—						
	1	Columbia				Official
	5	Ross				Official
	1	Ford				Official
	1	White				Patrol
Brookline—						
	1	Marmon				Official
Holyoke—						
	1	Knox	40	150	5.57	Patrol
	1	Indian (c)	7	2000	2.00	
Lynn—						
	2	Knox	40			Ambulance
	2	Indian (c)	5			
Newton—						
	1	Ross				Chief
	1					Comb. P A
Quincy—						
	1	Knox	30			Patrol
Somerville—						
	1	White	40			Comb. P A
	1	Indian	7			
Springfield—						
	2	Knox	20-40	800	25.00	Patrol
	2	Knox	20-40	800	25.00	Ambulance
Worcester—						
	2	White	40	962		Patrol
	1	White	40	1042		Ambulance
	4	Marsh-Metz	4.5	1250	8.46	Cycle
	1	White	30	99		Official

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
MICHIGAN.					
Battle Creek—					
1	Jackson	50	400		Comb. P A
Bay City—					
1					Patrol
Flint—					
1	Buick	32			Patrol
1	Excels'r (c)	4			Sanitary
Grand Rapids—					
1	Oldsmobile	60			Comb. P A
1	Reo	30			Patrol
1	Chase	20			Sealer
2	Indian (c)	7			
2	Indian (c)	4			
Kalamazoo—					
1	Michigan	40			Chief
1	Oldsmobile	60			Comb. P A
Lansing—					
1		60	900	20.00	Patrol
MINNESOTA.					
Duluth—					
1	Franklin	60			Emergency
1	Kato	60			Patrol
Minneapolis—					
3	Rambler				Patrol
1	Rambler				Ambulance
1	Rambler				General
6	Thor (c)				
St. Cloud—					
1	Pierce (c)	4.5	250		Chief
St. Paul—					
1	White				Squad
3	(Cycles)				Patrol
MISSOURI.					
Joplin—					
1	Forsythe	10			Patrol
St. Joseph—					
1	Peerless	40			Comb. P A
Webb City—					
1	Oakland	40	20		
	(Used as Patrol & Hose Car.)				
NEBRASKA.					
Omaha—					
1	Inter-State	40			Patrol
2	Franklin	60			Patrol
NEW JERSEY.					
Atlantic City—					
1	Electric				Patrol
1	Oldsmobile	40			Patrol
1	Indian (c)				
1	Merkel (c)				
Passaic—					
1	Cadillac	40	465	12.00	Comb. P A
1	Indian (c)	4	900	4.50	Patrol
Perth Amboy—					
1	Indian (c)	7	900		Patrol
Trenton—					
1	Thomas	48	250	30.00	Comb. P A
1	Indian (c)	7			Patrol
NEW YORK.					
Auburn—					
1					Patrol
Dunkirk—					
1	White	30		2.15	Comb. P A
1	Thor (c)	4		3.15	Patrol
Middletown—					
1	(Cycle)				General
Mt. Vernon—					
2	(Cycle)	4			Patrol
2	(Cycle)	6			Patrol
	(72,000 Miles at cost of $11.40.)				
Poughkeepsie—					
1	White	30			Patrol
Rochester—					
2	Autos				Patrol
1	Auto				Chief
8	(Cycle)				Patrol

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Watertown—					
1	Har-Dav.	7	1200	3.94	Cycle
NORTH CAROLINA.					
Asheville—					
1	Chase	30	250	15.00	
OHIO.					
Alliance—					
1	Argo (Elec)		70	0.25	Comb. P A
1					
Dayton—					
1	Speedwell	50	1500		Patrol
1	Speedwell	50	1500	60.00	Ambulance
6	Merkle (c)		1200	50.00	Patrol
Lorain—					
1	Indian	7	200	2.50	Emergency
Toledo—					
12	(Cycle)	7	4680	26.00	
PENNSYLVANIA.					
Erie—					
1	Oakland	30			Patrol
1	Indian (c)				General
1	Thor (c)				General
Harrisburg—					
1	Rambler				Comb. P A
Johnstown—					
1	Auto				Patrol
New Castle—					
1	Auto				Chief
	(Ordered for Immediate Delivery.)				
Philadelphia—					
1	Knox				Patrol
5	(Generals Motor Co.				Patrol
50	Indian (c)				Patrol
	(Ordered for Delivery soon.)				
Pittsburg—					
11	White				Patrol
12	Indian (c)				Patrol
2	Staver (c)				Patrol
1	Pierce (c)				Patrol
RHODE ISLAND.					
Pawtucket—					
1	Cadillac	32	315		Comb. P A
2	M.&M. (c)	.253			Traffic
TENNESSEE.					
Chattanooga—					
1	Auto				Patrol
1	Auto				Chief
Nashville—					
1	White	40	1100	33.00	Patrol
1	White	40	950	27.50	
TEXAS.					
Austin—					
2	Indian (c)	7			General
Dallas—					
1	Auto				Chief
1	Auto				Patrol
1	Auto				Comb. P A
Fort Worth—					
1	Rambler				Patrol
1	Selden				Ambulance
1	Indian (c)				General
WASHINGTON.					
Seattle—					
1	Stev.-Dur.	60	1000		Official
1	Studebaker	40	1000		Official
1	Knox	30	300		
5	Indian (c)	7	4000		Patrol
Tacoma—					
1	Stoddard				Comb. P A
4	Indian (c)				Speeders
WISCONSIN.					
Green Bay—					
1	Indian (c)				Patrol
Superior—					
1	Seagrave	54		6.50	

PUBLIC WORKS DEPARTMENT MOTORS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
ALABAMA.					
Montgomery—					
1	White	30	...	.....	Engineer
CALIFORNIA.					
Alameda—					
1	Regal	30	...	.....	Street Supt.
Berkeley—					
2	Auto	..	...	.....	Street Supt.
Pasadena—					
1	Maxwell	..	...	.....	Engineer
1	Maxwell	..	...	10.55	Supt.
1	Brush	..	...	9.82	Supt.
1	Maxwell	..	...	11.33	Foreman
Redlands—					
1	Mitchell	30	...	.....	Street
1	Mitchell	30	...	.....	Water
San Diego—					
1	Maxwell	16	...	.....	Water
1	Metz	20	...	.....	Repair
3	Excels'r (c)	4	...	.....	Meter
1	Buick	40	...	.....	Street
1	Maxwell	16	...	.....	Street
1	Briggs	30	...	.....	Sweeper
1	Maxwell	16	...	.....	Inspection
1	Maxwell	24	...	.....	Repair
1	Buick (tr'k)	20	...	.....	Repair
1	Kissel	30	...	.....	Repair
1	Excels'r (c)	4	...	.....	Electrical
1	Maxwell	16	...	.....	Electrical
1	Studebaker	20	...	.....	Gas
2	Excels'r (c)	4	...	.....	Building
1	Maxwell	16	...	.....	Inspection
San Francisco—					
1	Peerless	..	...	.....	Commis'rs
San Jose—					
1	Studebaker	30	...	.....	Engineer'g
CONNECTICUT.					
Hartford—					
2	Ford	22	2000	.....	Street Supt.
New Haven—					
1	Overland	..	...	.....	Engineer
1	Overland	..	...	.....	Official
1	Hudson	..	...	.....	Official
FLORIDA.					
Tampa—					
1	Auto	..	...	.....	Electrical
GEORGIA.					
Atlanta—					
2	Auto	..	...		
Augusta—					
1	Overland	30	900	15.00	Supt. Sts.
1	Ford	20	900	.....	Engineer
ILLINOIS.					
Peoria—					
2	Indian (c)	..	...	.....	General
INDIANA.					
Indianapolis—					
1	Premier	40	...	.....	Board
1	Penn	30	...	.....	Street Supt.
1	Buick	18	...	.....	Streets
1	Chalmers	30	...	.....	Engineers
1	Chalmers	30	...	.....	Inspection
2	Reo	24	...	.....	Engineers
2	Reading (c)	5	...	.....	Inspection
1	R. C. H.	25	...	.....	Asphalt
1	Buick	18	...	.....	Street
1	Reo	24	...	.....	Street
1	Buick	18	...	.....	Chemist
Terre Haute—					
1	Thor (c)	5	270	2.85	Inspection

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
IOWA.					
Des Moines—					
1	Marion	40	...	.....	Official
Sioux City—					
1	Krit	..	...	.....	Engineer
1	Ford	..	...	.....	Street Supt.
1	Ford	..	...	.....	Water Wks
1	Ford	..	...	.....	Inspection
KANSAS.					
Wichita—					
1	Indian (c)	..	...	.....	Engineer
MASSACHUSETTS.					
Brookline—					
1	Pope Hart. (Rented)			.....	Building
1	Cadillac	..	...	.....	Water
1	Maxwell (Rented)			.....	Engineer
1	Johnson	..	...	.....	Electrical
1	Johnson (tr'k)		...	.....	Emergency
2	Buick	..	...	.....	Highway
Boston—					
1	Carter	..	...	.....	Bridges
1	Columbia	..	...	.....	Bridges
1	Maxwell	..	...	.....	Bridges
2	Stev.-Dur.	..	...	.....	Highway
2	Columbia	..	...	.....	Highway
2	Oakland	..	...	.....	Highway
2	Metz	..	...	.....	Highway
1	Rambler	..	...	.....	Highway
1	Cadillac	..	...	.....	Highway
1	Carter	..	...	.....	Highway
1	Pope	..	...	.....	Sewer
1	Reo	..	...	.....	Sewer
1	Overland	..	...	.....	Sewer
5	White (Including 2 trucks)	..	...	.....	Water
1	Corbin	..	...	.....	Water
1	Carter	..	...	.....	Water
1	Cadillac	..	...	.....	Water
Cambridge—					
1	Auto	..	...	.....	Electrical
1	Auto	..	...	.....	Water
Holyoke—					
1	Knox	38	500	.....	Electrical
1	Buick	24	...	.....	Gas
1	Elmore	32	500	5.25	Engineer
1	Elmore	50	1000	31.50	Building
1	Buick	30	890	7.35	Supt.
Lynn—					
1	Studebaker	20	...	.....	Engineer
1	Federal (tk)	30	...	.....	General
2	Ford	22	...	.....	Official
Newton—					
1	Studebaker	20	...	.....	Official
Pittsfield—					
1	Berkshire	36	600	20.00	Engineer
Quincy—					
4	Ford	22	...	.....	General
Somerville—					
1	Ford	22	...	.....	Highway
1	Studebaker	20	...	.....	Electrical
Springfield—					
2	Auto (Contracted for			.....	Sprinking
1	(Cycle)	..	...	.....	Street
2	Auto	10	700	.....	Street Supt.
1	Auto	30	...	.....	Official
MICHIGAN.					
Grand Rapids—					
1	Ford	20	...	.....	Street
MINNESOTA.					
Duluth—					
1	Studebaker	40	...	.....	Official
1	Mitchell	60	...	.....	Inspection
Minneapolis—					
1	Buick	..	...	.....	Bridge
1	Buick	..	...	.....	Paving
1	Velie	..	...	.....	Sewers

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
1	Mitchell				Water
1	Hudson				Engineer
2	Reliance (tr'k)				Sewer
1	Ford				Electrical
1	Buick				Street
1	Van Dyke				Water
1	Maxwell				Gas
St. Paul—					
	(All cars for this department are rented.)				

NEBRASKA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Omaha—					
1	Stoddard	40			Official
1	Hudson	20			Street
1	National	40			Board

NEW JERSEY.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Orange—					
1	Auto				Water
1	Auto				Electrical
Passaic—					
1	Ford	30	250	10.00	Engineer
Trenton—					
1	Ford	22	400	5.00	Engineer
1	Ford	22	1100	11.00	Official
1	Ford	22	600	20.00	Building

NEW YORK.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Auburn—					
2	Auto				General
Mt. Vernon—					
1	Buick		1404		Commiss'er

OHIO.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Lima—					
1	Auto				Official
Toledo—					
2	Gramm (tk)				General
1	Overland	24	600	8.60	Engineer
3	Indian (c)	7	3800	22.50	Inspection

PENNSYLVANIA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Philadelphia—					
1	Knox	40			
2	Cole	30			
2	Locomobile	30			
1	Garford	50			
5	Ford	30			
Pittsburg—					
4	Auto				Engineer
3	Alco				Street
	(Trucks, 7½ Tons Each.)				
Scranton—					
1	Oakland	30			Director

RHODE ISLAND.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Pawtucket—					
1	Gramm	36		21.32	Street
1	Studebaker	30	1083	21.48	Official

SOUTH DAKOTA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Aberdeen—					
1	Ford	20			Street Supt.
1	Ford	20			Engineer

TENNESSEE.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Chattanooga—					
1	Truck				Scavenger
Nashville—					
1	Marathon	35	850	12.00	Inspection
1	Marathon	35	900	12.00	Supt.
1	Marathon	35	900	11.75	Street

TEXAS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Dallas—					
1	Auto				Engineer
Fort Worth—					
1	Marmon	30			Engineer
1	Cadilac				Engineer
1	Buick				Engineer

VERMONT.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Rutland—					
1	Mack	40			Highway
	(7 tons.)				

WASHINGTON.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Seattle—					
1	Cadillac	30	500	25.00	Engineer
1	Franklin	20	250	25.00	Engineer
	(Cost includes $15.00 Garage Charges.				
Tacoma—					
1	Merkle (c)	7			Engineer
1	Buick				Commiss'er
1	Reo				Street Supt.

HEALTH DEPARTMENT MOTORS.

CALIFORNIA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Alameda—					
1	(Cycle)				Sanitary
Berkeley—					
1	Pope-Hart.				
	(To be purchased.)				Ambulance
Pasadena—					
1	Buick				
	(Rented.)				Inspection
1	Brush				Inspection
Redlands—					
1	Regal	30			Inspection
San Diego—					
1	Cadillac				Inspection
San Francisco—					
1	Pope-Hart.				Ambulance
1	Haynes				Official
1	Velie				Hospital

COLORADO.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Colorado Springs—					
1	Thor (c)				Inspection

CONNECTICUT.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Hartford—					
1	Maxwell	28	800		Inspection
1	Ford	18	1000		Inspection
1	Studebaker	28	1200		Inspection
	(Privately owned, loaned to the City.)				
New Haven—					
1	Buick	25	1500		Inspection

GEORGIA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Atlanta—					
2	Trucks				Garbage
2	Autos				Inspection

ILLINOIS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Chicago—					
1	Kissel	45	1950	28.89	Ambulance
1	Oldsmobile	40	1950	28.89	Ambulance
1	Buick	25	100	2.30	

INDIANA.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Indianapolis—					
1	Waverly (electric)				Ambulance
1	Buick				Ambulance
Terre Haute—					
1	Indian	4	320	3.25	Inspection

KANSAS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
Wichita—					
1	Indian (c)				Inspection

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
	MASSACHUSETTS.				
Brookline—					
1	Cun'ngham	..	...	.....	Ambulance
1	Cadillac	..	...	.....	Ambulance
Boston—					
2	Buick	..	...	.....	Official
2	Stev.-Dur.	..	...	.....	Official
1	Electric	..	...	.....	Ambulance
4	Autocar	..	...	.....	Ambulance
Lynn—					
1	Flanders	20	...	.....	Board
Newton—					
1	Stoddard	28	...	.....	Official
Springfield—					
1	Ford	20	...	.....	Inspection
	MICHIGAN.				
Flint—					
1	Indian (c)	7	...	.....	Inspection
Grand Rapids—					
1	Auto	..	...	.....	Ambulance
	(Privately owned, rented by City.)				
1	Auto	..	...	.....	Official
	(Privately owned, rented by City.)				
1	Indian (c)	4	...	.....	Inspection
	MINNESOTA.				
Minneapolis—					
1	Ford	..	...	.....	Inspection
	NEW JERSEY.				
Passaic—					
1	Ford	30	200	7.50	Inspection
Trenton—					
1	Stanley	10	1000	20.00	Crematory
2	Ford	22	1000	20.00	Inspection
	OHIO.				
Toledo—					
1	Kelly (tr'k)	30	1800	27.50	Garbage
	PENNSYLVANIA.				
Philadelphia—					
1	Electric	..	...	.....	Ambulance
1	White	..	...	.....	Ambulance
1	Knox (tr'k)	..	...	.....	Supply
	(Ordered for Delivery soon.)				
	TENNESSEE.				
Chattanooga—					
1	Auto	..	...	.....	Inspection
Nashville—					
1	Marathon	35	500	9.40	Disinfection
	TEXAS.				
Austin—					
1	Ford	20	...	.....	Inspection
1	Hupmobile	20	...	.....	Inspection
Dallas—					
1	Auto	..	...	.....	Official
1	Auto	..	...	.....	Chemist
Fort Worth—					
2	Ford	..	...	.....	Inspection
1	Maxwell	..	...	.....	Inspection
	WASHINGTON.				
Seattle—					
1	Pierce (t'k)	30	1200	.....	Garbage
1	Buick	30	2111	17.00	Official
1	Everett	30	466	.....	Official
1	Everett	30	383	.....	Official
1	New Era (c)	..	...	.....	Inspection
Tacoma—					
1	Merkel (c)	7	...	.....	Inspection

PARK DEPARTMENT MOTORS.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
	CALIFORNIA.				
Pasadena—					
1	Indian (c)	..	...	.....	Inspection
San Francisco—					
1	Oldsmobile	..	...	.....	Commiss'er
	COLORADO.				
Colorado Springs—					
1	Indian (c)	3	...	.....	Inspection
1	Cadillac	30	...	.....	Commiss'er
	CONNECTICUT.				
Hartford—					
2	Coldwell (Rollers.)	10	...	$20.00	
2	Ford	20	1200	15.00	Supt.
New Haven—					
1	Hudson	20	1000	17.25	Supt.
	GEORGIA.				
Augusta—					
1	Ford	20	900	.....	Supt.
	ILLINOIS.				
Chicago—					
2	Oldsmobile	40	...	.....	Commiss'er
1	Cadillac	30	...	.....	Secretary
1	Cadillac	30	...	.....	Supt.
1	Ford	20	...	.....	Police
1	Ford	18	...	.....	Foreman
1	Oldsmobile	20	...	.....	Electrician
1	Buick (t'k)	22	...	.....	General
1	Overland	30	2000	30.00	Official
2	Hardy (Spraying Machines.)				
	INDIANA.				
Indianapolis—					
1	Overland	30	...	.....	Official
Terre Haute—					
1	Indian (c)	4	225	2.30	Supt.
	IOWA.				
Des Moines—					
1	Marion	40	...	.....	Official
Sioux City—					
1	Indian (c)	4	...	.....	Supt.
	MASSACHUSETTS.				
Boston—					
1	Metz	..	...		
1	Grout Stm.	..	...		
3	Columbia	..	...		
1	White	..	...		
1	Packard (3-ton Truck.)	..	...		
1	Buick	..	...	.....	Bath
1	Buick (t'k)	..	...	.....	Bath
1	White	..	...	.....	Bath
1	Welch	..	...	.....	Bath
1	Studebaker	..	...	.....	Cemetery
Brookline—					
1	Studebaker (Rented.)	20	...	.....	Trees
Cambridge—					
1	Auto	..	...	.....	Supt.
Newton—					
1	Maxwell	22	...	.....	General
	MICHIGAN.				
Flint—					
1	Indian (c)	4	...	.....	Supt.
Grand Rapids—					
1	Excels'r (c)	7	...	.....	Supt.
	MINNESOTA.				
Minneapolis—					
2	Buick	..	...	.....	Supt.
1	Buick (t'k)	..	...	.....	Repairs

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
1	Schurmeier (Truck.)	..	...	.....	Repairs
2	Auto (Rented from Employees.)	..	...	.....	General
2	Indian (c)	..	...	.....	Police
2	Marcel (c)	..	...	.....	Police
1	Isol (c)	..	...	.....	Playground
1	Indian (c)	..	...	.....	Forester
St. Paul—					
1	Haynes	40	...	30.50	Supt.
1	Wagner (c)	3	...	3.00	Police
2	Packard	30	...	31.50	Sightseeing
	NEBRASKA.				
Omaha—					
1	Cadillac	40	...	.....	General
	OHIO.				
Toledo—					
1	Oakland	30	875	10.75	Supt.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
	PENNSYLVANIA.				
Philadelphia—					
1	Winton	50	...	.....	General
Pittsburg—					
1	Franklin	..	...	.....	Official
	TENNESSEE.				
Chattanooga—					
1	Auto	..	...	.....	General
	TEXAS.				
Dallas—					
1	Auto	..	...	.....	Supt.
Fort Worth—					
1	Jackson	..	...	.....	Supt.
	WASHINGTON.				
Seattle—					
1	Winton	40	...	32.27	Official
1	Ford	20	1200	20.86	Official
2	Caldwell Automowers				

MOTORS FOR GENERAL USE.

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
	ALABAMA.				
Montgomery—					
1	White	30	...	.....	Official
1	Mitchell	20	...	.....	Water
	CALIFORNIA.				
Alameda—					
1	White	30	...	.....	Lighting
1	Buick	..	...	.....	Lighting
Pasadena—					
1	Ford	20	...	.....	Plumbing
1	Maxwell	20	...	.....	Building
San Francisco—					
1	Peerless	..	...	.....	Supervisors
2	Brush	..	...	.....	Lighting
2	Studebaker	..	...	.....	Lighting
1	Pope-Hart.	..	...	.....	School
1	Peerless	..	...	.....	Mayor
1	Studebaker	..	...	.....	School
	COLORADO.				
Colorado Springs—					
2	Indian (c)	4	...	.....	Water
	CONNECTICUT.				
Hartford—					
1	Pope-Hart.	45	1200	.....	Water
New Haven—					
1	Buick	25	600	.....	Building
Norwich—					
1	Auto	..	...	.....	General
	GEORGIA.				
Augusta—					
1	(Cycle, used by Secretary to the Mayor)				
	ILLINOIS.				
Peoria—					
1	Glide	..	...	.....	Fire Marsh'l
Rockford—					
1	Auto	..	...	.....	Water
	INDIANA.				
Indianapolis—					
1	Truck	..	...	.....	School
	MASSACHUSETTS.				
Beverley—					
1	White	..	...	.....	Water
Boston—					
1	Columbia	..	...	.....	Building
1	Knox	..	...	.....	Mayor
1	Columbia	..	...	.....	Official
1	White	..	...	.....	Official
1	Pierce	..	...	.....	Building

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
1	Buick	..	...	.....	School
1	Westcott	..	...	.....	School
1	Carter	..	...	.....	School
1	Overland	..	...	.....	School
1	White (t'k)	..	...	.....	School
1	Buick	..	...	.....	Electrical
1	Carter	..	...	.....	Electrical
Holyoke—					
1	Knox	40	800	26.00	
Lynn—					
1	Ford	22	...	.....	Building
Springfield—					
1	Knox	50	450	8.45	Lighting
Worcester—					
3	Buick	32	3000		
	(Used by Street, Water & Sewer Departments for Inspection.)				
	MICHIGAN.				
Flint—					
1	Indian (c)	7	...	.....	Lighting
Lansing—					
2	Reo	30	300	.....	Lighting
	MINNESOTA.				
Minneapolis—					
1	Ford	..	...	.....	School
1	Overland	..	...	.....	Building
	NEW JERSEY.				
Trenton—					
1	Buick	14	300	6.00	
	(Used by Inspectors of Weights and Measures.)				
1	Warren	27	...	12.00	Water
1	Gramm	30	...	15.00	Water
1	Ford	22	600	20.00	Building
	NEW MEXICO.				
Albuquerque—					
1	Hupmobile	20	1500	15.00	Official
	NEW YORK.				
Poughkeepsie—					
1	Mack (tr'k)	35	...	.....	Water
Rome—					
1	Buick	..	...	.....	Water
	OHIO.				
Toledo—					
1	Cadillac	10	285	9.60	Cemetery
1	Overland	30	1400	24.60	Official
1	Overland	24	1500	20.50	Harbor
1	Overland	30	3000	42.90	Water
1	Overland	24	900	16.20	Water
1	Ras'll (t'k)	35	1500	24.70	Water

No. in Service.	Make.	Horse Power Rating.	Mileage per Month.	Cost per Mo. Fuel & Oil.	Service.
PENNSYLVANIA.					
Harrisburg—					
1	Cadillac	...	.....		Highway
1	Cadillac	...	.....		Water
Philadelphia—					
1	Oldsmobile	40	...	.....	Mayor
1	National ..	40	...	.....	School
Pittsburg—					
1	White	...	.....		Official
1	White (5-ton Truck)			.....	General
2	White	...	.....		Inspection
3	Auto	...	.....		Water
RHODE ISLAND.					
Pawtucket—					
1	Studebaker	30	266	6.20	School
1	Gramm ...	24	500	13.06	Water
1	Maxwell ...	20	700	13.60	Water
(The two latter are trucks.)					
TENNESSEE.					
Nashville—					
1	Haynes	40	1000	19.40	Official
1	Marathon ..	45	900	20.50	Official
1	Marathon ..	35	700	18.60	Official
(Three cars above used by Mayor, Board of Works & Supt. of Schools.)					
2	Studebaker	30	850	15.00	Lighting
TEXAS.					
Austin—					
1	Brush	12	...	.....	Water
1	Stoddard ..	30	...	.....	Lighting
Fort Worth—					
1	Premier		...	.....	Mayor
1	Buick		...	.....	Building
1	Buick		...	.....	Water
1	Ford		...	.....	Water
2	Jackson		...	.....	Lighting
WASHINGTON.					
Seattle—					
1	Chase	20	400	6.40	
(Truck used by Weight and Measure Department.)					
1	Studebaker	30	467	9.97	Water
1	Ford	20	772	8.47	Water
(The cars below mentioned for water service are trucks.)					
1	I. H. C.....	22	450	9.64	Water
1	Chase	15	330	9.05	Water
1	Chase	20	588	10.42	Water
1	Chase	20	348	10.72	Water
1	Chase	20	543	8.26	Water
1	Chase	20	413	8.57	Water
1	Chase	20	389	7.96	Water
Tacoma—					
1	Ford	20	...	.....	Water
1	Excels'r (c)	3	...	.....	Water
1	Buick	23	...	.....	Lighting
1	Overland ..	20	...	.....	Lighting
WISCONSIN.					
Eau Claire—					
1	Buick	18	...	.....	Water

USERS' OPINIONS ON MOTOR EQUIPMENT.

PHOENIX, ARIZ.

The city of Phoenix has in use one automobile now, which is used by the superintendent of the water department. We recently instructed the purchasing agent of the city to buy an auto for the street superintendent. We have found the machine saved a great deal of time and consequently is a very paying investment.

LLOYD B. CHRISTY, Mayor.

SAN DIEGO, CAL.

The city owns twenty-three automobiles and twelve motorcycles used as noted in the tables. In addition to these, allowances for private machines used in city business of a total of $125 are made. For your further information we state that in practically every case the auto and motorcycle are giving satisfaction and doing a greater amount of work than was done by horses and the upkeep is reasonable, all the supplies being purchased at wholesale prices by purchasing bureau. The city owns no garage.

P. E. WOODS, Supt. of Finance.

SAN FRANCISCO.

With the completion of the five-million-dollar high-pressure water system, San Francisco today is one of the best fire protected cities in the country. But the present official administration, headed by Mayor James Rolph, Jr., will not be content until the horse-drawn vehicles are replaced by up-to-date motor-driven fire apparatus.

It was only recently that the modern motor-driven chemical engines were introduced into San Francisco's fire department. Owing to the many steep grades and hilly sections to be covered it was believed for a long time that the apparatus propelled by motor power could not be used here to advantage.

Mayor Rolph and the fire commissioners, nothing disheartened by croakers, decided to determine for themselves the possibilities of the motor-driven engine, and for the test they chose the steepest section in the city, the California street hill.

The start of the test piece of motor apparatus was made from the levee at California and Montgomery streets. The moderate grade between Montgomery and Kearny streets was traversed with the speed of an arrow. From Kearney street to Grant avenue the grade is much heavier and there was but slight decrease in the speed of the engine. Between Grant avenue and Stockton street the incline is so steep that it would be nigh impossible for heavy draft horses to haul a small delivery wagon up it—much less a ponderous steam engine. The motor chemical took this grade, but when half way up the hill it came to a dead stop.

The croakers shouted, but almost immediately the engine again started up the hill and flashed across the summit.

Deep was the disgust of the opposition when the announcement was made by the fire officials that the test called for the engine being brought to a stop when half-way up the grade and then started again without any loss of ground when the brakes were released.

That test sounded the death knell of horse-drawn fire apparatus in San Francisco.

An eight-horsepower hook and ladder truck with a guaranteed speed of 35 miles an hour on the level ground and 10 miles on the grades was recently purchased by the fire commissioners, together with two chemical engines. The commissioners now have under consideration bids for furnishing a half dozen or more combination chemical and hose wagons. Within the next year several hundred thousand dollars will be spent for motor-propelled fire apparatus and if the program outlined by the administration is carried out, the entire department will be completely equipped with motor vehicles before the opening of the Panama-Pacific Exposition in 1915.

Motor apparatus is also being introduced into the police and health departments. One motor ambulance is in the hospital service and another will be ordered before the new year. The police department has one motor patrol wagon and proposals for three more are being prepared. No time will be lost in equipping all of the city departments with motor apparatus, now that it has been established to the satisfaction of the officials that the motor-driven engines, ambulances and patrol wagons can be successfully piloted over the steep grades and hilly sections of San Francisco readily.

JAMES P. SLEVIN,
Clerk Board of Supervisors.

PASADENA, CAL.

Very frequently I have been called upon to make a statement regarding the use of the city's automobiles. I shall take this opportunity to answer all these inquiries on the subject and the following table shows the cost of operating, repairing and equipment, city automobiles, for 1911-12:

Street Department—	
Superintendent's machine, 12 months	$424.24
Foreman's machine, 12 months	495.67
Assistant Superintendent's, one and one-half months	42.52
Engineer's Department—	
City engineer's machine, 12 months	425.01
Chief inspector's, 10 2/3 months (estimated)	382.45
Plumbing and Electric Inspector's Department—	
Inspector's machine (new six months), approximately	125.00
Inspector's machine (old six months) approximately	175.00
Building Inspector's Department—	
Inspector's machine (six months) approximately	175.00
Police Department—	
Police machine 12 months	582.26
Municipal Light Department—	
Manager's machine (new six months)	108.53
Manager's machine old six months	288.08
Health Department—	
Sanitary inspector's machine, 12 months	124.38
Veterinary's machine (five months rented)	125.00
Health officer's machine, 12 months, no charge	.00
Fire Department—	
Chief's machine, (12 months rented)	300.00
Auditor's Department—	
Auditor's machine (rented)	80.00
Efficiency Bureau—	
Bureau's machine (eight months, no charge)	.00
City Council—	
Councilmen's machines, no charge	.00
Total auto expense (exclusive of depreciation 1911-12)	$3853.14
Estimated depreciation on nine machines	2000.00
Total	$5853.14

Cost of operation, maintenance and depreciation on five motorcycles not included.

During the present fiscal year the municipal lighting department will run two auto trucks at a big saving over horse hire. The fire department has just added an old Hudson to its equipment for the assistant chief and a new machine must be purchased for the chief, and as soon as we take over the water companies, five additional machines will come into service, including two trucks.

When all of these machines are in the care of a central garage the efficiency bureau will keep account of the gasoline, oil, repairs, mileage, depreciation, etc., of every city automobile, provide the most economical method for purchasing supplies and insist on the cheapest operation and the most careful handling.

WILLIAM THUM, Mayor.

WASHINGTON, D. C.

Maj. Richard Sylvester, superintendent of police for the District of Columbia, is especially an enthusiast on the subject of motor equipment. While he has but one automobile patrol in service in his department at present, that one being a Franklin machine assigned to the second police district, Maj. Sylvester's department has made estimates for five additional motor vehicles to take the place of ten horse-drawn vehicles.

Maj. Sylvester states that he bases these conclusions on experience already had. Relative to the cost of operation of the one machine which he has in use, the following figures are furnished, comprising a detailed account of expense of operation for the fiscal year ended June 30, 1912:

Tires	$222.75
Inner tubes and repairs	7.25
Rubber patches	.80
Oil	21.13
Gasoline, 900 gal	76.50
Repairs	94.60
Miscellaneous supplies (waste, spark plugs, etc.)	52.28
Total cost	$474.87

Chief Wagner, of the fire department for the district, is a thoro convert to the motor fire truck and he has one now in service. In the event appropriations are available, Chief Wagner's department most probably will be equipped with two more trucks in the near future.

ROBINSON.

TAMPA, FLA.

In addition to the motor equipment mentioned in the tables, we contemplate buying this year for the sanitary department, a street sweeper, sprinkler, and a number of garbage trucks.

D. B. MCKAY, Mayor.

CHICAGO, ILL.

Besides the automobiles given under the various headings in the tabulated list, the city rents machines from private garages, for the use of all other departments. These machines are obtained on a requisition thru the city purchasing agent.

FRANCIS A. EASTMAN, City Statistician.

PEORIA, ILL.

The city has at present, only the two fire department machines, mentioned and described in the tables. The peculiar topography of the city makes them very useful for the work at hand, as the residence portion of the city is almost entirely situated upon a bluff rising above a river. The auto apparatus is enabled to take the heavy grades without the delays incident to dragging heavy horse-drawn equipment up the hills, and without the exhaustion to the men; for under the old system, it was necessary for the men on the apparatus to walk up the hills, and often to help pull the heavy old-style equipment up by hand. Then too, the gasoline pumping engine is kept at a station on the bluff, and used in almost all fires, for the hydrant pressure is inadequate for fire service on the higher ground. It is probable that it will be found necessary to purchase a chief's car within the next year.

THOMAS M. WORM,
Chief of Fire Department.

ROCKFORD, ILL.

Long, hard runs for the horses compelled the adoption of auto equipment, and also did away with the need of stations in the outlying factory districts, for with motor apparatus, the runs can be made from the central station in the same time as would be needed by horses stationed in the outer fire houses. It is expected that the police department will soon adopt motor cars.

W. W. BENNETT, Mayor.

ELKHART, IND.

The purchase of the motor engine after the Conn fire of 1910 and a full investigation of all apparatus has been a pronounced success both from an economical and practical point of view. First, its greater efficiency by reason of rapid transit and increased radius of action is most favorably to be commended, also from the fact that it carries its own hose to the amount of 1,250 feet and its full complement of firemen to handle same. The cost of installation was about the same as a first-class steam fire engine and equipment, but the cost of maintenance is less, as it requires 2 men less and does away with three, if not four, horses.

The expense of operating our engine for the year 1911, for gasoline and oil, to attend 201 alarms, covering 636 miles, was $38.50; for tire replacement or repair, $30.00; miscellaneous supplies and equipment, about $20.00, making a total of less than $100.00. This is a very favorable comparison against the keep of three horses, and supplies that would have been required for a steam engine. Such has been our experience in the use of the automobile fire engine, that we can state that all sub-stations will be similarly equipped as rapidly as possible.

The same can be said of the police patrol, as all phases of the matter were gone into before ordering same.

The efficiency of the motor fire engine in heavy snow is most decidedly in favor of same. It goes out at a high rate of speed, where a team could only walk and flounder thru, at the best. We believe it has come to stay and will replace all horse-drawn apparatus in the near future.

E. L. BURNS, City Controller.

SAGINAW, MICH.

A belated report from George C. Warren, auditor of this city states that the city uses one combination auto fire engine and hose truck, and an auto police patrol.

WEBB CITY, MO.

A unique piece of apparatus is in use in this city. An Oakland 40-horsepower car is made use of for the purposes both of a police patrol and combination hose car. The hose is carried in a "fals" box suspended over the car, when it is not on duty, or when being used as a patrol in police service. In event of a fire, this box is dropped into the car and is ready for instant service. The box carries 500 feet of hose and two 3-gallon hand chemical tanks.

J. A. BALLARD, Fire Chief.

NEW BRUNSWICK, N. J.

A city service truck, carrying 340 feet of ladder, and all equipment has just been ordered, and within a short time a triple combination fire engine will be added.

HARRY J. FRANCIS,
Chief of Fire Department.

ASHEVILLE, N. C.

While our experience with auto-propelled apparatus has been short, it has been very satisfactory, considering both economy of operation and efficiency.

One year ago this month, a committee was appointed from the city council to look into the matter with the result that on the 27th of September, 1911, a contract was signed with the Seagrave Company, of Columbus, O., for two 80-horsepower combination hose and chemical trucks, carrying in addition to the regular equipment two 20-foot extension ladders, regular equipment consisting of 2,000 feet of 2½-inch hose, one 45-gallon chemical tank, with 150 feet of ¾-inch chemical hose, two 5-gallon hand extinguishers, axes, crowbars, etc. Since the fire trucks were bought, we have added a 30-horsepower Chase model patrol wagon, which also figures in the fire department equipment.

The decision in favor of them was based on two factors—first, economy of operation, and second, the decisive sixty seconds gained in reaching the fire.

Considering the first factor, we had three double teams, which were costing us about $1,500.00 per annum to maintain, and in addition the fact ever before us of the horse that is getting too old and having to be replaced at a sacrifice. In comparison with the above, the average expense per month of operating the three machines is about $20.00, this being for gasoline and lubricating oil.

As to the second factor, we have only one station and an area of 2½ miles square to cover, station house about the center. Our service is volunteer, with the exception of four paid drivers, but most of the firemen are employed near enough the station to catch the truck and in the event they do not, we follow up the fire truck with the patrol wagon, with officers and firemen who failed to catch the truck.

Perhaps we will not reach a fire near the station any quicker now than with the old apparatus, but on a long run, the motor will save from one to two minutes every time. On first alarm one truck responds, on second alarm the other truck responds, trailing a fully equipped hook and ladder wagon with 30-foot extension ladders, life net, etc. This is our old horse-drawn hook and ladder wagon, with the tongue cut to six feet in length. It works admiraoly and one would be surprised how short a turn can be made with this lengthy apparatus. Our equipment is beyond the experimental stage and we vote them a success. We are now asking for bids on a 4,000-pound truck for our sanitary department.

J. M. CLARK, City Auditor.

WILLIAMSPORT, PA.

The city has at pre ent no automobiles in service, but there is ar ordinance in the council at the present time providing for one for the fire department, and one for the police department.

SAMUEL STAHLER, Mayor.

YORK, PA.

We have no automobiles in our city service. Plans are about developed, however, for the fire chief to have a motor car and it is expected that the police patrol will be a motor vehic'e within the next year.

JOHN R. LAFEAN, Mayor.

PAWTUCKET, R. I.

In addition to two machines now in service the city has just completed a new fire station to house nothing but motor-driven apparatus. It is the first city in the state of Rhode Island to construct such a house. There is under construction for this house a Garford combination hose and chemical wagon. It weighs 6,180 pounds with equipment, excluding men. It is built on a Garford chassis and the body was built by local people. The car recently on a trial carried sixteen men up High street, in addition to the regular equipment of the car. This new fire station will also house a ladder truck with tractor.

GILES W. EASTERBROOK, Mayor.

NASHVILLE, TENN.

The first purchase of an auto for the city of Nashville was an ambulance for the city's charity hospital in 1910. The city having increased its area from about nine to eighteen square miles, taking in several suburban districts which had become thickly settled, it was found that more horse-drawn ambulances would be required to take care of the emergency calls occasioned by the increased territory. To obviate this, it was decided to purchase an auto ambulance, which was an immediate success, and at once demonstrated its superiority over the horse-drawn vehicle.

The next purchase was a touring car for use of the field corps in the engineering department, where formerly surreys and teams were used. The adaptability of the auto for this service was at once apparent.

Then came the auto for the fire chief, built on up-to-date lines and equipped with chemical extinguishers, etc. It required but a few days to convince even the most skeptical of the vast possibilities of the auto in this branch of the service.

During the past year automobiles have been purchased for the mayor, board of public works, and the superintendent of the city schools. The benefits the city derives in having her officials equipped so that they can give constant and proper attention to the schools, public improvements and the various municipal departments, are incalculable.

The same conditions having arisen in the police department as with the city hospital, the horse-drawn patrol wagon was replaced with the auto, resulting in better service at less expense.

Quite recently an auto roadster has been provided for the assistant fire chief, and also one for the disinfector in the health department, whose duty it is to look after the fumigation of houses where contagious diseases have been confined. The superintendent of the municipal lighting plant has likewise been furnished with an auto run-a-bout, the better to attend to his duties, and the night trouble man in this department is also equipped with an auto, thereby enabling him to render much better service than with the old fashioned cart and horse. The installtaion of these machines, in every instance, has been a step toward better service.

The last acquisition of autos in our municipal service is the purchase of three motor triple combination fire engine, chemical and hose cars for the fire department, which are now being built especially for Nashville. On account of their speed and equipment they will mainly be used in the suburbs where the distance between fire stations is larger than in the uptown districts. This will make a total of seventeen automobiles in the city service.

J. W. DASHIELL,
Secretary Board of Public Works.

OGDEN, UTAH.

Ogden City has recently adopted the commission form of government. There are three commissioners. I am pleased to say that two of the three commissioners are owners of automobiles, which they are glad to use in the business of the city when its interests can in any way be furthered thereby.

A. G. FELL, Mayor.

ROANOKE, VA.

The three combination Seagrave, hose and chemical cars mentioned in the tables, are all stationed in the residence section, where long runs are necessary. They are housed in specially built brick stations, with slate roofs, constructed after the fashion of residences. The three houses cost, exclusive of lots, about $20,000.

JAMES MCFALL,
Chief of Fire Department.

SEATTLE, WASH.

The tables show the automobiles in service in the police, park, water, health, fire utilities and city engineering departments. The law department, legislative department, buildings department, city treasurer's department, city comptroller and ex-officio city clerk's department, harbor department and library department have no cars, altho it may be of interest to know that the harbor department has a 42-foot launch for patrol work of the department during the day and for police patrol at night. The launch is equipped with a 20-horsepower Frisco Standard engine and uses $27.50 worth of gasoline and $3.00 worth of oil in the service, which will approximate about five hundred miles per month.

As the ordinance regulating the use of automobiles by city employes may be of some interest to you, I am transmitting herewith copy of same.

Be it ordained by the City of Seattle as follows:

Section 1. That it shall be unlawful for any official or employe of the city of Seattle to use any automobile belonging to the city of Seattle unless such machine is properly lettered in accordance with the provisions of Ordinance No. 22187, and it shall also be unlawful for any official or employe of the city of Seattle, or other person, to use any automobile belonging to the city of Seattle at any time of the day or night, for any purpose other than the transaction of business for and on behalf of the city of Seattle.

Sec. 2. That any person found guilty of a violation of the provisions of Section 1 hereof shall be deemed guilty of a misdemeanor and shall be fined in any sum not exceeding one hundred (100) dollars or imprisoned in the city jail for a term not exceeding thirty (30) days, or may be both fined and imprisoned.

Ordinance 22187, as amended by Ordinance 25479:

Section 1. That the board of public works be and it is hereby authorized and directed to letter, in characters not less than four (4) inches in height, all automobiles belonging to the several departments of the city government of the city of Seattle, in such manner and in a conspicuous place on each machine as will properly designate such vehicles as the property of the city of Seattle and the department to which the same belongs, and that for such purpose the sum of two hundred and fifty ($250) dollars, or so much thereof as may be necessary, be and the same is hereby appropriated from the general fund; provided, however, that the provisions of this ordinance shall not apply to machines of the police department of the city of Seattle.

A. L. VALENTINE, Superintendent,
Department of Public Utilities.

THE QUESTION DEPARTMENT

Catch Basins to Prevent Escape of Odors from Sewers.

I would be pleased to receive information on sanitary catchbasins for use on streets and in public places, to eliminate bad odors from sewers. Possibly you can indicate different makes and how basins can be constructed with or without ventilation to abate such odors. MUNICIPAL, New York City.

The surest way to prevent the escape of odors from sewers is to remove the sewage so rapidly that there is no odor to escape. While this is impossible, very close approach to it is possible where there is good fall in the sewers and care is taken to prevent the entrance into the sewers of anything which will deposit in them and thus produce pools of sewage and cause decomposable matter to remain behind on the walls of the sewer when a flood time has passed and the water has subsided to the usual low water flow.

Catchbasins are primarily for that purpose, and they are not always trapped, because, under the best conditions, the traps are not particularly needed. They are usually trapped because the conditions are not ideal and too much odor is at times exhaled from the sewer. Much of the bad odor observed about catchbasins comes not from the sewer, but from decomposing street dirt and washings in the catchbasin itself.

Cleanliness is the only preventive of catchbasin odors which the writer knows, and cleanliness of the catchbasins is the large factor. If the basins are cleaned after rains, before the material on them has had an opportunity to decompose seriously, and the basin and trap are filled with comparatively clean water, much of the complaint of catchbasins will be eliminated.

Traps are not infallible, and if they depend on water they may be opened by its evaporation or leakage. Repair of basins and reduction of water area for evaporation to a minimum help here. But, again, cleanliness of the sewer is the surest way of keeping odors below the point of nuisance. Therefore, the sewers should be cleaned as frequently as the presence of odors demands. The frequency of the cleaning will depend upon the condition of the sewer as to design and care in construction, entrance of street dirt or other material producing deposits, and the like.

Cleanliness is expensive, and so is not usually insisted upon.

If there is any form of catchbasin or trap or sewer which does not demand cleanliness to prevent nuisance, the writer does not know it.

If factories of any sort discharge offensive matters into the sewers, a special condition is produced which demands special remedies. Public opinion is traveling toward the position that a single factory should not be permitted to place a burden upon the whole system of sewers and every one affected by them, which, when odors on the street from sewer openings or leaks is concerned, includes every inhabitant of the city. This position, when reached, will require each such factory to disinfect and deodorize its own trade waste before discharging it into the sewer.

Numerous designs for catchbasins of all sorts and conditions will be found in the volumes of MUNICIPAL ENGINEERING, but none of them can prevent sewer odors on the street at all times without the constant aid of the sewer and catchbasin cleaning gangs.

Siphoning Sewage Over Hill

Will you kindly advise us as to any sewerage systems where any form of the siphon was either successfully or unsuccessfully used to carry sewage over a hill?
W. C., ——, N. Y.

Can our readers cite any cases of this sort? None which are actually siphons are known to the writer, though he knows of several so-called inverted siphons.

Siphons for carrying water over rises of ground 20 or 25 feet above the water level from which water is to be taken were described in MUNICIPAL ENGINEERING several years ago, with some of the difficulties overcome in making them practically successful. These might be used in carrying sewage over similar hills, but there would be several additional difficulties, such as the accumulation of floating matter at the summit of the siphon, and accumulation of gases as well as air at the same point, with consequent necessity for special provision for withdrawing the gases continuously or at frequent intervals and for drawing off the floating matters whenever they become troublesome. It is quite probable that all this would cost more than the excavation of the comparatively few feet necessary to put the sewer through on a down grade all the way.

Economy and Efficiency of Electrical Treatment of Sewage

What is the present prospect of efficiency and economy in electrical treatment of sewage? What manufacturers or engineers are offering it as a business in practical form?
C. E. V., ——, Ohio.

The efficiency of the electrical treatment of sewage is high, theoretically, for the chemicals producing the desired effect are used at the time of most activity. Practically it depends upon the design and operation of the electrical apparatus. That in use at Santa Monica, Cal., and in Oklahoma City, Okla., is reported to be quite as efficient as any other process. Claims of economy are also made, but there is not yet a sufficient amount of evidence to make them certain. The plants used thus far are small, what would be termed experimental plants in the study of the treatment of the large amounts of sewage produced by large cities, so that neither efficiency nor economy is yet certain for them. All that can be said at present is that the process gives promise of future development toward greater efficiency and economy.

C. B. Irvine, Santa Monica, Cal., and A. J. McMahan, Oklahoma City, Okla., can give information as to the practical installation of plants.

Form of Ordinance for Assessing Cost of Sewers

I would like to have references to articles in MUNICIPAL ENGINEERING containing model form of ordinance for assessing cost of sewers.
B., City Attorney, ——, Ala.

The exact form of such an ordinance must be governed by the statutes of the state. A form of ordinance used in Georgia is given in vol. xlii, p. 113, which may serve also in principle, if not exactly in form, for Alabama cities.

Specifications for Concrete Street Pavement

Please tell me where to get a copy of specifications for concrete streets. We are thinking of paving one of our streets with concrete (without brick).
C., Councilman, ——, Mo.

Specifications for concrete street paving, as adopted by the Society for Standardizing Paving Specifications, will be found in the annual report of that organization, which can be obtained from the secretary, J. B. Hittell, City Hall, Chicago, Ill., for $5. The report also refers to the patented concrete pavements, which should be laid according to the specifications of the patentees. Names of some of these will be found in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings, "Armored Concrete Pavements," "Granocrete Pavement," and constructors of such pavements will be found in the list of "Paving Contractors."

Specifications for concrete pavements will also be found in the "Handbook for Cement Users" ($3).

Specifications for the concrete paving in Mason City, Ia., will be found in MUNICIPAL ENGINEERING, vol. xl, p. 174. Earlier numbers contain specifications used in other cities.

Cement Sidewalk Specifications

I am anxious to secure the most approved specifications for the construction of concrete sidewalks. Our city has used two or three different specifications for this work, and I am frank to say that the work done under them has not been very satisfactory. I don't know whether the specifications were at fault or the contractor. I would be very greatly obliged to you if you could furnish me with any information along this line.
F. C., City Attorney, ——, Ky.

Standard specifications for cement sidewalks, as adopted by the Society for Standardizing Paving Specifications, are printed in the annual reports of that association, obtainable of J. B. Hittell, secretary, City Hall, Chicago, Ill., for $5.

It is quite possible that the contractor is at fault. If the specifications are good and are not followed carefully, the results may not be good. Contractors not under efficient and honest inspection can reduce the amount of work and the amount of materials, especially of cement, and still not show the defects on the surface of the completed work, but they develop later, usually after his responsibility therefor has ended. The foundation and base of the walk need inspection while the work is going on; the top can be inspected at any time, and the inspection of base is more important than that of top.

Information about ordinance for concrete sidewalk construction is given in MUNICIPAL ENGINEERING, vol. xlii, p. 116, and xxxvi, p. 30.

How to Design a Reinforced Concrete Smoke Stack

I have just designed a reinforced concrete smoke stack for the city pumping station here, and if your question department has at hand any formula for figuring the reinforcing steel for a stack of this kind. I would like a copy of it so that I can check my own figures for it.

T., City Engineer, ——, Mich.

Buel and Hill's "Reinforced Concrete" ($5) gives the steps of the process used to compute the overturning moment of wind at the base and the moment of resistance of the steel reinforcement about the center of figure of the base. Then the maximum stress per square inch of steel on the windward side will be equal to the overturning moment divided by the moment of resistance of the steel. Examples are worked out in detail to show how to apply the process.

McCullough's "Reinforced Concrete" ($1) gives a similar process, somewhat more complicated in statement.

Taylor and Thompson's "Concrete, Plain and Reinforced" ($5), has the most complete discussion of the problem, covering nine pages and having tables of constants for use in formulas, which should be followed closely if their method of computation is adopted.

Book on Reinforced Concrete Reservoirs

I want to build a million-gallon reservoir, reinforced concrete, and would like to get the best book that can be bought on this class of work. If you have such book, please give me name and price on same.

G. City Engineer, ——, Ga.

Gillette and Hill's "Concrete Construction" ($5) gives descriptions of reinforced concrete reservoirs, both smaller and larger than the size mentioned, covered and uncovered. Heidenreich's "Engineers' Pocket Book of Reinforced Concrete" ($3), Reid's "Concrete and Reinforced Concrete Construction" ($5), give some space to the subject. None of these books treat reservoirs in more than incidental manner, and the writer knows of none that is more complete.

Ordinance Ordering Paving in Illinois Village

I have a paving ordinance to draft and will be glad to have one favorable to Illinois villages. B., Village Attorney.

The procedure in Illinois is rather complicated, and the National Paving Brick Manufacturers' Association has prepared a book giving all the forms required. This can probably be obtained on application made to Will P. Blair, secretary, Locomotive Engineers' Building, Cleveland, Ohio.

Codifications of City Ordinances

I am engaged in the revision and compilation of the city ordinances of our city, and thought perhaps you had a model set of ordinances for a city that would give me a great many ideas as to the arrangement and form of the ordinances, and, if so, I would be pleased to receive such as you think would help me out. Also, would be pleased to receive such information as you have that relates to licensing and regulations for automobiles in the city, and also such data and information that you have in reference to the levying and collection of a license tax upon occupations.

C. A., City Attorney, ——, Kans.

Among the smaller cities of the Mississippi valley having printed codifications of city ordinances are Dubuque, Ia., Hammond, Ind., Lincoln, Neb., Sioux Falls, S. D. The city attorneys of these cities would doubtless supply the city attorney of a sister city with copies for his use. Kansas City, Mo., and Indianapolis, Ind., have specially complete volumes. All the special ordinances desired will be found in them. A form of automobile ordinance is given on p. 38 of the July number of Municipal Engineering. A form of ordinance providing for collection of license taxes is given on p. 178 of the September number, with selections from its provisions. This is from Harrisburg, Pa., and is one of the most complete compilations of license taxes in use in the smaller cities.

Ordinances Requiring Weed Cutting and Refuse Removal

The Colorado legislature recently passed a law permitting cities to require property owners to remove weeds, brush and rubbish from lots and alleys behind, and sidewalk area in front, and, upon his failure to do so, the city might have same done and cost assessed against the property. Any information on this subject would be desirable, as to constitutionality of act, etc.

S., City Attorney, ——, Colo.

Such ordinances are very common and will undoubtedly come under the police powers of the city if there are no special legislative acts governing their form or content. They would also come under the police powers of the state, and so would be constitutional unless some special provision in the constitution might rule them out. The first Indianapolis ordinance on the subject was passed in 1889, and made the maintenance of weeds a misdemeanor, punishable by $25 fine. After the charter of 1891 was granted, a new ordinance was passed giving the department of health power to cut weeds and assess the cost on the property in case the property owner failed to attend to it on official notice.

Ordinances providing for inspection of nuisances on property and fine on failure to remove upon notice have been in existence since 1871. Ordinance requiring dirt or mud to be removed from sidewalk by owner or occupant of the abutting property was passed in 1896, and one requiring occupants or owners of unoccupied property to clean off snow and ice was passed in 1899. Ordinance giving board of health power to inspect lots, alleys and streets, and enforce cleaning of same by occupants of adjoining lots or by owners of unoccupied lots, was passed in 1872.

It will be noted that all the ordinances passed before the new charter of 1891 provide for fine in case of failure to clean up as required, and this was probably all that could be done under the existing statutes. The new charter gave the city power to do the work on failure of the individual and to assess the cost on the property. The constitutionality of both procedures would doubtless have been tested within the twenty-two years, if not before, if there had been any question of the same.

Installation of Hypochlorite Plant

I am anxious to get some information regarding the installation of hypochlorite water purification outfits. In our case it will be necessary to install a pump or injector so as to force the water into our intake, as we have no intake well. T., ——, Mich.

Will our readers send us statements of their experience and descriptions of the machinery and methods used for the benefit of our correspondent and others?

Some information can be obtained from an article on "Sterilization of Water," in Municipal Engineering, vol. xxxviii, p. 313; in articles on the sterilization of the Boonton reservoir of the Jersey City water supply, in vol. xxxvii, pp. 6, 86 and 158; and in the article on the purification of the McKeesport, Pa., water supply, in vol. xxxviii, p. 383.

Franchise for Electric Light and Water Company.

We want to obtain franchise from our city council for combined electric light and water plant. Can you furnish us with copy of franchise that will meet our requirements? G., ——, Tenn.

No franchise for combined electric light and water plant happens to be at hand. Perhaps the Loveland Citizens' Electric Company, of Loveland, O., whose plant is described in Municipal Engineering, vol. xli, p. 198, would be willing to send a copy of their franchise. Many forms and skeletons of franchises for various public service utilities have been published in Municipal Engineering, a list of the more recent of which will be found in this department, under the heading "Forms of Franchise Ordinances for Public Utilities."

If any of our readers will send a copy of such a franchise as our correspondent wishes, we will forward it to him and give its provisions in this department for the benefit of all who may be interested.

Qualities of Concrete Pavement

This city has a paving proposition up at present. We have very poor laws in Arkansas in regard to bonding for public improvements, and I don't think we will be able to raise the money for brick or creosoted blocks, but think we can for concrete, and I would like very much to get any information you can give me as to whether this pavement is durable, how it should be mixed and laid, and proper expansion. We will probably have to use a gravel we have near here, which is a very good gravel and has in it quite a lot of very good sand. G. A., ——, Ark.

There are great differences of opinion regarding the durability of concrete pavements, due, no doubt, to the differences in design of pavements, materials and methods of construction. Like all concrete construction, a concrete pavement is very poor if it is poorly constructed. Likewise concrete has been put on some streets without proper attention to design of details in accordance with the special requirements of the case and has, therefore, failed. There are many reports of good success with concrete streets, some of them giving enough detail to show the conditions under which success is attained.

Good specifications for a concrete street will be found in the proceedings of the Society for Standardizing Specifications for 1912, copy of which can be obtained of John B. Hittell, secretary, City Hall, Chicago, Ill., for $5.

Some recent articles in Municipal Engineering will give information as to cost, methods of construction, suitability, etc.: "Cost of Concrete Roads," vol. xliii, p. 44.

Vol. xlii: "The Blome Concrete Pavement," p. 340. "The Dolarway Bituminous Surface Concrete Pavement, p. 136. "Bitucrete Pavement," p. 233.

Vol. xli: "Mixing Concrete for Street Paving," p. 50. "Concrete Pavement with Bituminous Wearing Surface," p. 376. "Bituminous Wearing Surface for Concrete Pavements," p. 215. "Paving in Mason City, Iowa," p. 461.

Vol. xl: "Cement Concrete Paving in Mason City, Iowa," p. 174.

Vol. xxxix: "Fond du Lac's Cement Streets," p. 136. "Street Paving in New Orleans," p. 260, mentions granitoid as a popular form of paving. "Cement Streets of Fond du Lac, Wis.," p. 284. "Concrete Pavement in Delphi, Ind.," p. 294.

Vol. xxxviii: "Specifications for Concrete Sidewalks, Curbs and Gutters, and Pavements," p. 244.

Vol. xxxvii: "German Artificial Stone Paving," p. 121.

FROM WORKERS IN THE FIELD

How to Waterproof a Pump Pit.

Editor of Municipal Engineering:

Sir—In the September number of Municipal Engineering, I noted that one of your readers was seeking information in regard to waterproofing a pit 22 feet square by 17 feet deep with a 15-foot head of water at the bottom.

There is no waterproofing compound on the market that will adhere to a surface through which water is leaking. There are several which are entirely satisfactory as waterproofing agents if the water is stopped long enough to allow the waterproofing substance to set up or harden. Usually to stop the water temporarily is a very expensive proceeding.

In the *Engineering Record* of March 9th, this year, was published an article describing a method of stopping leaks while the water is running through the surface.

In applying the method to your reader's case I would proceed as follows: Take two pieces of 2x12-inch rough plank 12 feet long. Place them edge to edge with a 2-inch strip of burlap between the full length of the joint—12 feet. Clamp the two planks together tightly with ship clamps and nail on 4-inchx4-inchx12-foot battens, two feet apart the full length of the planks, using 20-penny nails. On the side of the planks opposite to the one with the battens, ½ inch from the edge all the way around nail on ½-inch-diameter rope made of burlap tightly twisted by hand. Use 4-penny nails for this, spaced 2 inches apart.

As your reader stated that it was the bottom two feet of his pit that leaked, it is this portion that we will treat. With pick, hammer or wire brush take off the surface of the portion mentioned to a depth of 1/16 inch. Then throw on water and scrub off every loose particle with a broom. Our planks, already prepared, have been made into a form or packing which is to hold in place a coating of mortar. This mortar has been treated by the Sylvester process to make it waterproof. Take 1/3 pound lye to 1 pound powdered alum, well dissolved in water, which is added to the water used to temper the mortar, using one sack of cement and double that amount of sand.

Cover the face of the plank from inside the burlap rope with ½ inch of prepared mortar, trowelling it to an even surface. Turn the form over with the mortar to the leaking wall and by means of stout braces from the center of each batten to the opposite wall hammered into place with a sledge, force the form against the wall, allowing it to remain there three or four days. The wall should have an even surface where the burlap rope comes in contact with it, as this rope is really a gasket, to keep the mortar from oozing out, so must be tight against the wall at all points. Should there be cavities in the wall these should be filled with stiff mortar before the plank form is applied. If the water prevents this put enough mortar on the plank form in a cone shaped mass to fill the cavity, being careful to locate it correctly on the plank. If one to two per cent of bicarbonate of soda is added to the mortar immediately before it is placed on the plank it will cause the mortar to set up quickly, so that the form may be removed in twenty-four hours and placed again.

Edward O. Keaton,
Civil Engineer and Contractor,
Cincinnati, O.

How to Find a Lost Sewer.

Editor of Municipal Engineering:

Sir—In the August number of Municipal Engineering, I notice that E. W. R. asks how to locate a lost sewer. Let me suggest that he use a wireless pipe locator. First, send thru the sewer a light float, to which is attached a light string, long enough to reach any man hole that he has located. When float reaches man hole, tie string to a light wire and pull thru, bring wire up and complete circuit and connect the machine. If there is not sufficient water to pass the float use rods to pass the wire thru.

J. E. H., Oak Park, Ill.

An Individual Garbage Destructor.

Editor of MUNICIPAL ENGINEERING:

Sir—An individual garbage destructor built and used by the writer for the past three years has given such uniformly satisfactory results that its application to the requirements of small towns seems a simple matter. The plant has been very efficient on every class of garbage.

The general construction of the burner is shown in Figure No. 1, from which it will be noted it consists simply of a cement body containing two grates, one above the other, and a chimney made of an ordinary piece of tile. The frame or body of the burner, it will be seen, has but three sides, the fourth being left entirely open without even a door. In the first burner constructed, a door was provided, but it was found that better results were obtained by leaving off the door.

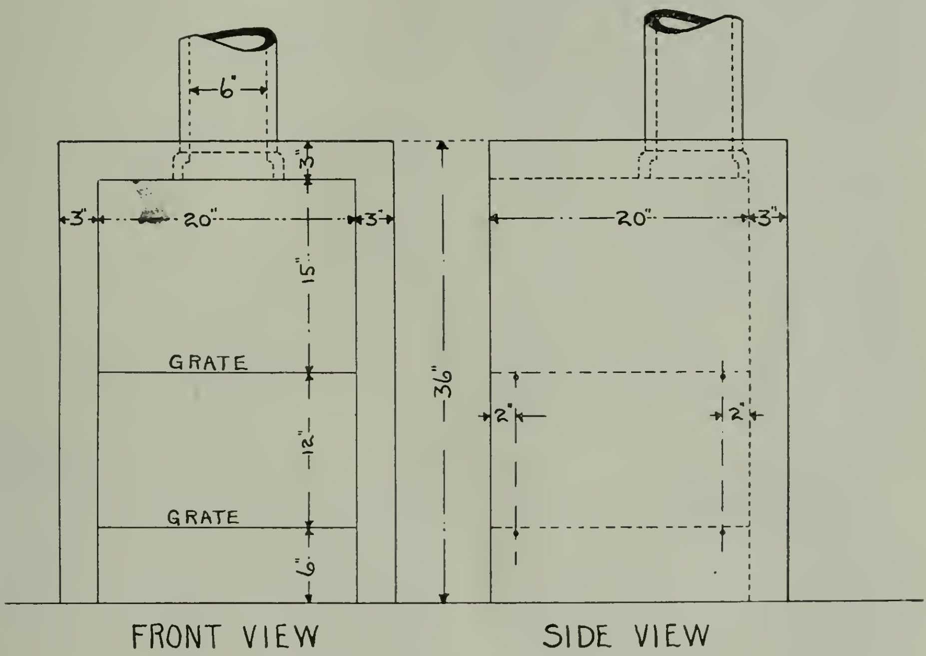


Fig. 1.
AN INDIVIDUAL GARBAGE DESTRUCTOR.

A fire is started on the lower grate, a wood fire being of ample life, and the garbage is then placed upon the upper grate. If a good fire is obtained before putting in the garbage, the incineration of the matter takes place rapidly and without any objectionable or unpleasant odors.

The mold for the concrete frame can be made very cheaply from wood secured by tearing apart old boxes. In order to make it easy to remove the boards making up the mold, after the cement has set, the following construction is suggested:

The back inner wall of the mold should be made as shown in Figure No. 2, the strips holding the individual boards together being screwed to the separate boards, not nailed. The two inner sides are similar. The strip A is to be screwed on, while the other strips may be nailed on. Be sure to make one side right hand and the other left hand.

The top of the inner part of the mold No. 2 are assembled and fastened together by nailing the side boards to the strips A on the back. Be sure to nail into this strip and not into the boards of the back as otherwise there will be trouble in removing the boards. Likewise the top boards are nailed to the strips A. It is not necessary to make a hole in the top for the chimney.

For the outside of the mold two sides will be needed. The back will consist of boards long enough to permit their being nailed to the strips A when the two strips are nailed 26 inches apart, measured from inside to inside. No top is needed.

The outside is assembled around the inner wall of the mold as shown in Figure No. 3, the strips X and Y being nailed on in front, not only to hold the front ends of the outer frame, but to act as a front retaining wall for the cement.

The mold as constructed should be placed on the spot selected for the burner and the inner wall squared with the outer one. Dirt should be thrown up against the bottom on both inside and outside of the mold to keep the cement from running out at the bottom.

After everything is ready holes about ½ inch in diameter should be drilled thru both inner and outer walls on both sides as indicated in Figure No. 1 and round sticks inserted. These are to provide holes in the concrete thru which pass the supports for the grates. The tile chimney, which should be about 6 inches in diameter, is placed upon the inner wall and everything is ready for the pouring of the concrete. A good concrete for this purpose is made of three parts good, sharp, clean sand and one part of a good grade of portland cement thoroly mixed together and moistened to have the consistency of mud. All it is necessary to do is to fill up the space between the two walls of the mold with this concrete, bringing the concrete up to the top of the mold, which will give a thickness of 3 inches for the top of the burner. The top can be reinforced by pushing into the concrete forming the roof of the burner a few flat iron bars of the size used for making the grates, tho this is not necessary.

After allowing several days to elapse for the concrete to harden, the mold can be removed. The outer wall can be readily taken off by knocking it apart. It will probably be best to first knock out the

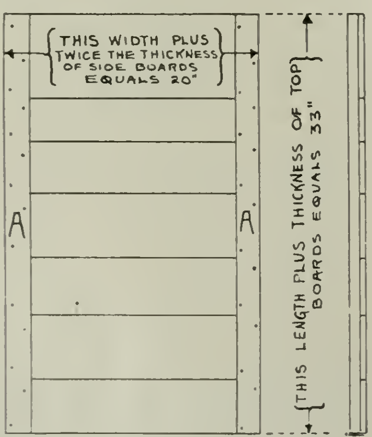


Fig. 2.
AN INDIVIDUAL GARBAGE DESTRUCTOR.

round sticks referred to. These will drive out very readily. The inner wall will come out easily if the screws used in holding part of it together are removed. When the top section is taken off it will be found that the hole for the chimney has been provided by the tile which was set upon this top section, and the concrete in the roof will hold the tile in place.

Thru the holes left by the wooden plugs

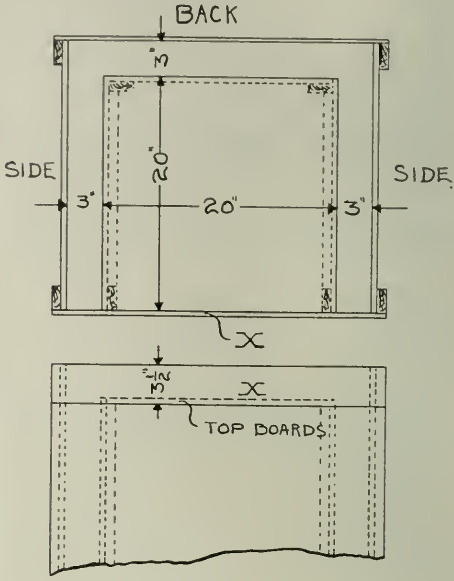


Fig. 3.
AN INDIVIDUAL GARBAGE DESTRUCTOR.

⅜-inch round rods are passed to support the grates. If these rods are threaded and provided with nuts on both ends it will be better, as then they cannot slip out of place.

The grates are made of ⅞x⅛-inch flat iron. The pieces forming the grate proper, are riveted to the cross pieces. These grates are placed upon the ⅜-inch supporting rods and the burner is completed.

Cost of Construction

A liberal estimate of the cost of this outfit, figuring that the mold will be made of old boxes so the wood will cost nothing, and based upon one doing the work himself will be as follows:

1 sack portland cement	$0.75
1 tile for chimney	.35
4 pcs. ⅜x27-inch round iron	.20
Threading 4 ends and 4 nuts	.40
4 pieces ⅞x⅛x19½-inch flat iron and 26 pieces ⅞x⅛x19-inch flat iron	.75
52 rivets and Drilling holes for 52 rivets	1.00
Total	$3.45

KARL W. KNORR, C. E.,
Mishawaka, Ind.

Chevy Chase Experimental Road, Washington, D. C.

CONDITION DURING FIRST SUMMER AFTER CONSTRUCTION BY PENETRATION METHOD.

The experimental road running from the boundary line of the District of Columbia to the Country Club, and the roads running from it, were built of different materials and treated in various ways to test both materials and methods of building first-class country roads, using mainly bituminous materials applied by the penetration method.

A correspondent who visited the road on July 14 sends the following report of the condition of the various sections on that date:

Lane adjoining north end and Chevy Chase Club.—This lane got so soft that they had to give it an additional coating of sand within two weeks after the road was finished.

District line, section 1.—The surface of this section is very soft in places, and today the tar coating was so soft that it was running and would stick to your shoes. It does not present a uniform surface, as in spots there does not appear to be any tar surface and the coarse stone shows on the surface.

District line, section 2.—An excess of tar on the surface, and it is softer, considerable of the excess of tar having run into the gutter. District line, section 2, can scarcely be distinguished from the adjoining pavements, but the tar surface was extremely soft to-day, with the tar in some places running toward the gutter.

District line, section 3.—The surface on this section in some places toward the city end shows what appeared to me like evidence of repairs. This section is not uniform in appearance, the top in some places showing an excess of tar, which is very soft, and in other places a deficiency, with the stone showing thru the surface, these spots appearing to be dry.

District line, section 4.—This section was very soft and sticky, the horses' hoofs cutting into it readily in many places. It seemed to me that there was an excess of tar used in the surface. The road was rather wavy and uneven, and there was evidence of repairs at the north end of this section. It was also beginning to ravel slightly at this end.

District line, section 5.—This piece of roadway was constructed on both east and west side of car tracks. It seems to be quite wavy, but does not show softness. It has apparently been repaired in several places, and in some places is now showing signs of raveling. I also noticed in one or two spots that this piece was showing signs of rutting.

District line, section 6.—This piece of roadway was also constructed on both east and west side of car tracks. The pavement appears to be very wavy in places and seems to be quite dry in spots, and in other places bleeding slightly. The general appearance, however, is fairly good. There were one or two places which to me showed evidence of repairs.

District line, section 7.—This is a very small section, but looks much better than section 8. It has more the appearance of an asphalt top, but seems to me to be quite dry and hard. There are several places, however, in this piece, that are beginning to ravel out in the surface.

District line, section 9.—This piece of road appears to be very dry and dusty to some extent, and is very uneven on the surface, and in some places raveling quite badly. There are also a number of places in this piece of road showing evidence that they will soon begin to ravel. I think this section of roadway will require considerable repairs very shortly. It had the appearance to me of a fairly well-built macadam road.

Motor Trucks Relieve Street Congestion.

BY CAPTAIN CHARLES C. HEALY, OF THE CHICAGO MOUNTED POLICE.

Take the horses off the streets. Replace them with motor driven vehicles. Then you will have gone a long way toward solving the problem of constantly increasing traffic congestion in our large cities.

I made this answer the other day when a man asked me, with much concern, if there was any immediate practical remedy for the crowded conditions that prevail in the Chicago loop district.

Our big State street stores were the first to realize the possibilities of the rapid delivery and relief of traffic congestion by installing motor trucks. They all have their delivery stations in remote parts of the city and convey packages to these depots, whence they are transferred either in small motor cars or in horse-drawn vehicles to the residences of purchasers. One of the largest State street stores has seventy-seven motor trucks, forty-four being of the heaviest gasoline type, 30-horsepower and carrying up to three tons, and thirty-three electric vehicles, which are employed in lighter delivery.

Furthermore, the motor truck, being more easily managed, will get away twice as quickly as the horse truck. There is no geeing and hawing and backing and sidestepping. You turn on your power and away you go, regulating your speed to meet conditions. I went into a good many of these details when I was called into conference with the Chicago Plan Commission, in connection with the so-called "link" or driveway connecting Michigan boulevard with the North Side.

MUNICIPAL MATTERS IN COURT

East Orange Damages for Diverting Underground Water

The city of East Orange, N. J., obtains its water supply from artesian wells at White Oak Ridge in Milburn. The state has had a series of seven years of deficient rainfall, amounting in all to about twenty-five inches, and ending only with 1911. Nevertheless, the pumping from the city's artesian wells is blamed for dry brooks and dry wells. The engineer of water works, A. A. Reimer, states his opinion that a succession of dry years reduces the ground water level and that subsequent wet years do not produce equal accumulations. A number of suits have been filed asking for considerable damages from the city for withdrawal of ground water from property in the vicinity of its wells. One of these brought for $20,000 damages by William E. Crosby, was decided by the Supreme Court, which gave Mr. Crosby $500.58 damages.

The city has procured much evidence as to the geology and water tables in the vicinity of its wells for use in this and other suits, and is so fully convinced of the justice of its cause that it has appealed to the Court of Errors and Appeals, where the case is now pending.

Two suits for damages were settled in connection with purchases of land in extension of the city's holdings under its plans for extension of its water supply filed with the State Water Commission. Threatened suits by a group of small property owners were settled by laying a small main along the road to supply them, thus securing a cession of all underground rights to the city.

One suit for $20,000 damages has not yet come to trial.

Ordinances Controlling Automobiles in Oklahoma City.

The commissioners of Oklahoma City, Okla., have passed a new automobile ordinance requiring all chauffeurs to be examined before they shall be permitted to receive a license. A feature of the ordinance is a section which provides that any operator of a motor vehicle who is connected with an accident on the streets shall at once report such accident to the police department. All license fees received by the city for automobiles are to be placed in a fund for the express purpose of maintaining Grand boulevard, the 28-mile driveway around the city. It is expected that this fund will amount to $12,000 per annum, thereby assuring the proper condition of the finest boulevard in the southwest.

Decisions of the Higher Courts of Interest to Municipalities.

Liability for Cost of Changing Grade of Water Pipes—Not Indebtedness—In May, 1905, defendant city passed an ordinance granting to plaintiff a new franchise for the period of twenty years, to take effect at the expiration of the old franchise, and which ordinance expressly provided that, in case of a change of grade of any street, the city should reimburse plaintiff for the expenses incurred by it in changing and relaying its mains and pipes necessitated by a change of such grade, and pursuant to such ordinance an express contract was entered into between said parties embracing, among other things, an express stipulation to the like effect. Held, That such ordinance and contract are valid and enforceable, and the city did not exceed its powers in obligating itself to reimburse plaintiff for such expenses; that such ordinance in this respect is not retroactive but prospective in its operation, although it applies to mains and pipes which were laid during the life of the old franchise; that under the provisions of such ordinance and contract the city is liable to the plaintiff for such expenses, whether the change of grade is from a grade already established by ordinance, or merely from a natural grade; that the obligations thus assumed by the city do not create an indebtedness in excess of the constitutional debt limit. Such stipulation created no indebtedness, but merely a contingent future liability. Bismarck Water Supply Co. v. Bismarck, (N. D.) 137 N. W. 34.

City Can Fix Rates Under Existing Contract, Notwithstanding Establishment of Public Service Commission—Act of 1912, creating a public service commission, authorized to fix charges for gas and electricity, did not abrogate a right to fix charges, which was expressly reserved by the city of Charleston in the franchise granted to a public service corporation, where the commission had not undertaken to fix such rates. Charleston Consol. Ry. Ltg. Co. v. Charleston, (S. C.) 75 S. E. 390.

Right to Fix Rates May Be Reserved in Franchise Granted by City—While the state's power to fix charges of a public service corporation is not confered upon cities, and a city cannot fix such charges, unless the right to do so is expressly reserved in the franchise under which the public service corporation operates; yet, where this right is so reserved, the city may fix such charges. Idem.

Street Intersections Assessed on Property Benefited in Iowa—Code provides that the cost of paving a street may be assessed to the abutting property; that the cost, so assessed, shall not exceed the special benefits conferred by the improvement; and that the cost of street improvements at intersections may be assessed against the property abutting or fronting on that portion of the street so improved in proportion to the linear feet fronting or abutting on such improvement. Held, That the word "improvement," as so used, includes the entire work under construction on a particular street, and is not limited to the work done directly in front of the particular parcel of ground, so that the cost of paving street intersections was properly treated as a part of the whole improvement and taxed to the entire property abutting on the part of the street improved. Perry v. Albia, (Iowa) 136 N. W. 682.

Vote on Bond Issue for Both Light and Water System Is Not Invalidated by Constructing Only One—An ordinance, providing for the submission to the voters of the question whether the city should issue bonds to the amount of $23,000, for the purposes of installing and maintaining an electric light and water system, or either of these systems, submitted but a single proposition, the issuance of the bonds, and is not invalid in giving the council discretion to construct either both or one of the systems. Swann et al. v. City of Murray et al., (Ky.) 142 S. W. R. 244.

Drainage System Can Be Included in Street Paving Contract—The court will take judicial notice that a street improvement is permanent in nature, and that a system of drainage connected with such improvement is necessary and proper, and hence germane to the subject of an ordinance ordering such improvement. Gerlach v. Spokane, (Wash.) 124 Pac. 121.

Minimum Wage Excess Cost Not Assessable on Property—A property owner has a right to have free and open competition in the matter of improvements to be paid for by special assessments, unrestricted by any arbitrary rule or requirement which would have a tendency to increase the cost of the work, so that where a contract for street improvements was let under a city ordinance, fixing the minimum wage for work on the improvement at a rate at least 75 cents higher for an eight-hour day than was paid in private employment for a nine-hour day, a property owner may have a reduction of the assessment against his property in equitable proportion to the excess sum paid as wages. Idem.

Bonds for Municipal Water Works Issued Prior to Expiration of Franchise—A city, preparing for the construction of a water works plant four years before the expiration of the franchise of the existing water works company, and providing for the issuance of bonds for the acquisition of such a plant, does not abuse its discretion, and the court will not restrain the issuance of the bonds. Griffith v. Vicksburg, (Miss.) 58 So. 782.

Street Drainage Over Private Property—Where a city in constructing streets and alleys increased the flow of water to the sewer pipe of an individual, and the surface water from many acres of land was carried to the pipe, while such water had a natural drainage in another direction, and the pipe at the time of its construction was sufficient to drain the land naturally drained by it, the city must at its own expense provide a way for the escape of the water diverted by its improvements, and it could not compel the individual to provide at his expense drainage for such water. Stanford (Ky.) v. Aldridge, 147 S. W. 750.

Water Company's Services Offset for Taxes—Limit of Indebtedness—An agreement between a city and a water company that the company will furnish and supply all water for public buildings, etc., for such amount annually as shall equal the amount assessed by the city in taxes upon the water works system and franchises, in the absence of anything to show the want of good faith, that the contract is inequitable or imposes an unjust burden on the other taxpayers, or that the services performed by the company are disproportionate to the amount of taxes, will not be regarded as an exemption from taxation, but as a provision for the payment of the taxes by rendering services equivalent thereto, and hence is valid, especially where it has been carried out by the parties for a number of years. If the contract constitutes the creation of an indebtedness within the meaning of a provision of the charter limiting the amount of the indebtedness which the city may incur, it will not be held invalid on that ground, unless the city alleges and proves that by such contract an indebtedness exceeding the specified limit was imposed on the city. Winchester (Ky.) v. Winchester Water Works Co., 148 S. N. 1.

CIVIC BEAUTY

Tree Surgery

Tree surgery is a profession which has grown to considerable importance. In this way sick and diseased trees are being restored to health. Briefly, tree surgery consists in cutting out the rotted parts and filling the cavities thus made with some substance which will make the cavity water and air tight. Most of these cavities on city trees are the result of improper trimming. A stub is left where a branch has been amputated. This stub, into which the living sap no longer flows, becomes saturated with moisture, rot spores become active—the stub soon rots off leaving the beginning of a pocket or cavity which is gradually increased by the action of the rot spores and boring insects. Then the birds and squirrels begin to build their nests in these cavities and help to increase them until almost the entire center of the tree trunk has been destroyed. Unless this rotting is stopped the strongest and most magnificent tree will be destroyed.

The proper way to proceed is to clean out the entire cavity, using a chisel or gouge to remove all the rotten wood. Then wash the interior of the cavity with a solution of copper sulphate made by dissolving in a wooden vessel, one-fourth of a pound of copper sulphate in ten gallons of water. The solution can be sprayed into the cavity by means of a smal hand pump. This solution will kill all the remaining rot spore and the cavity is now ready to be filled with cement. The filling is made by using three parts of clean, sharp sand to one part of cement. Fill the cavity with this mortar and then bring the filling to a smooth water-tight finish, with a mortar made by using one part of sand to one part of cement.

TREE SURGERY.
Result of Poor Tree Work.

When the cavity is large, iron rods are sometimes used to reinforce the cement. Where defects of this sort are remedied before they have spread to any considerable extent the cure is simple and certain, and gradually the annual growth of the tree will cover the filling and conceal the patch of cement beneath the new bark; but while many trees can be saved in this way, there are an equal number beyond redemption, and the best thing to do is to remove them and plant healthy young trees to take their place.

TREE SURGERY.
Useless Tree Banding.

Chicago's Street Improvements

Improvement of the streets of the business section of Chicago thru co-operation with public authorities is the function of the committee on down-town streets of the Chicago Association of Commerce.

This movement aims at the realization of greatest efficiency and public convenience and does not overlook the matter of good appearance.

Permanency in public improvements relating to city streets naturally is one of the first objects sought and to this end the Committee is giving much consideration to the problem of the disposition of underground utilities, seeking to obviate the constant tearing up of the streets for repairs and extensions.

Inspection of paving work throughout the city to make certain that specifications are complied with, is another line of the Committee's work. Installation of superior lighting systems is another, notable progress in this direction having been accomplished by enlisting the co-operation of property holders. Erection of street signs that shall be clearly read, durable in construction and, being attached to the buildings shall not add to the number of posts occupying the street, is yet another of the Committee's undertakings.

The Committee on Downtown Streets was organized about a year and a half ago. Its personnel consists of August Gatzert, Rosenwald & Weil, Chairman; Henry Beneke, Hibbard, Spencer, Bartlett & Co., Vice Chairman; E. J. Brundage, Richard T. Fox, W. F. Juergens, Juergens & Anderson Co.; William H. Rehm, Hotz & Rehm; Chas. E. Rollins, Jr., Rollins & Burdick; Philip W. Seipp, A. O. Slaughter & Co.; Edward M. Skinner, Wilson Brothers; E. U. Kimbark, The Paper Mills Co., ex-officio.

The problem of street congestion in Chicago being very acute, the undertaking of the Committee on Downtown Streets is in consequence highly important —in fact it is to be doubted whether any movement directed at physical public improvements is of greater importance to Chicago's welfare.

The Committee has formulated a general program of action, features of which are the following:

1. Underground Utilities: Galleries must be provided to contain underground utilities, which shall be readily accessible for repairs, extensions, etc., without disturbing the surface of the street.

2. Street Improvements: The serviceability of the pavement depends very largely upon the manner of its construction; therefore one of the first specific activities of the Committee shall be to inspect each step of paving construction, thus co-operating with the public authorities to make certain that specifications are enforced.

3. Street Signs: These should be attached to buildings to lessen the number of obstructions in the street. A sign modeled after a London sign has received the approval of the Committee and a number are being erected in an experimental way to determine their applicability to Chicago conditions. The sign is of white opaque glass, backed with concrete and mounted in a narrow rust-proof frame, readily attachable to any building. The letters are black, being chemically burned into the glass and when properly mounted the sign is believed to be practically indestructible. In size it is 30 inches long and 6 inches high, the charac-

ters being 4 inches in height. It was described in full in MUNICIPAL ENGINEERING for September, 1912.

4. Street Lighting: In selecting a system of street lighting, individual conditions in various streets necessarily are determining factors. The financial questions involved add other phases to the problem and the Committee's work in this department, which is more fully described elsewhere in MUNICIPAL ENGINEERING has been that form of co-operation with property holders and public authorities which opportunity for immediate practicable work has suggested. The Committee's first undertaking in this line will shortly result in the installation of flaming arc lights in Dearborn street, between Lake and Polk streets. Working with the Dearborn Street Improvement Association, where the plan originated, the Committee on Downtown Streets has been instrumental in securing the consent of three-fourths of the property holders to a plan by which cost of installation and maintenance will be equally distributed. The progress of this undertaking has reached a point where its consummation is apparently a matter of but a few weeks' time.

In the field of inspection of pavement construction, the Committee has performed a highly useful service and undoubtedly has raised the standards of such construction in Chicago. The Committee's engineer, Mr. L. A. Dumond, has given personal attention to this work and it was found that there were a number of directions in which this kind of supervision was quite essential.

There was discovered at times, for example, a tendency to leave the subgrade too high in cases where a dump was not near at hand. This made is necessary either to leave the final grade above city grade or to diminish the thickness of the concrete foundation underlying the surface paving material. Other details, such as the proper proportion of the ingredients in the concrete, were found to repay supervision and in general this field is regarded by the Committee a very productive one.

The Committee is proceeding with care in the formulation of its policies and is basing these upon very wide information, taking steps to exhaust available facilities for procuring all pertinent facts relating to the various subjects comprised. Besides such information as is available in written form, the Committee at its weekly meetings has conferred personally with prominent authorities upon municipal engineering subjects and with city officials and engineers engaged in local improvements. The chairman, Mr. August Gatzert, spent several months in Europe shortly after the Committee's formation, making a personal study of street conditions in foreign municipalities and obtaining from the authorities the results of their own experience in meeting the problems which are presented.

With the problem of subway construction which is before Chicago, that of the construction of utility galleries is closely bound. The attitude of the Committee is that no subway plans should receive the city's approval that do not provide adequately for galleries to house utility conduits.

That there is much waste in public improvements effected without reference to a common improvement program is obvious. When the aim of the Committee to have all street improvements made along lines determined by a comprehensive plan is realized, a plan that shall begin with conditions underlying the pavements and shall include every feature of city streets, it is believed that the large sums of money constantly expended in improvements will yield far more efficient results and that superior street conditions may soon be realized in Chicago.

High French Tax on Signboards

CONSUL CARL BAILEY HURST, LYON.

A heavy stamp tax is about to be levied in this district and elsewhere in France on all signboards that can be seen from any public path, road, or railway. All such advertisements set up, except on the wall of a house or inclosure or within 328 feet of any group of houses or buildings, will be taxed as follows per square meter (10.764 square feet):

Less than 6 square meters (64.583 square feet).....	50	$9.65
Over 6 square meters and less than 10 square meters (107.64 square feet).....	100	19.30
Over 10 square meters and less than 20 square meters (215.28 square feet)......	200	38.60
Over 20 square meters......	400	77.20

Motorists in particular have campaigned against the wayside signboard, and in some places here restrictive measures have already been taken by the local authorities within their jurisdiction. Many people would like to suppress the signboards in rural districts altogether, but it is considered an encroachment on the personal liberty of a land owner to prohibit him from allowing signboards to be erected on his own property. It is, however, possible, thru legislative enactment, to impose a tax sufficiently high to diminish the quantity of signboards that are increasing in a disturbing manner in some of the most beautiful regions in France.

ROADS AND PAVEMENTS

Wood Block Paving in St. Louis

At present the city of St. Louis has 156,732 square yards of wood block paving. There are now 79,590 additional square yards in course of completion, 5,377 square yards under contract and ordinances are pending for 6,857 square yards.

Wood blocks are being placed on the following streets:

Street Under Work	From	To	Length Feet	Sq. Yards
Delmar	Rosedale	Skinker	1,020	5,062
Delmar	Skinker	City Limits	620	2,451
De Baliviere	Forest Park	Delmar	2,832	14,789
Taylor	Forest Park	Maryland	2,000	7,635
Olive	Channing	Grand	1,180	2,764
Benton	Twentieth	Jefferson	2,438	8,843
Locust	Fourth	Thirteenth	3,055	6,787
Washington	Twelfth	Eighteenth	2,447	9,010
St. Charles	Fourth	Seventh	880	2,891
Franklin	Fourth	High	2,890	9,917
Seventh	Market	Washington	1,332	5,104
Ninth	Market	Washington	1,365	4,337
Total			22,059	79,590

Between the years of 1844 and 1892 St. Louis laid almost eight miles of the old, untreated blocks, representing 146,350 square yards, at a cost of $475,590. This entire area has long since been replaced by other forms of paving. These failures had no effect upon the later use of creosoted yellow pine paving block.

The first test of this form of street paving was made in the spring of 1903, when over 50,000 square yards of wood block were laid in two of the finest residence thoroughfares in the city; namely, Washington and Westminster boulevards, from Grand to Taylor avenues. It was truly a test and a practical one on a large scale, for it represented, approximately, 2¾ miles of roadway, at a cost of some $163,000.

An interval of five years elapsed. The test had been made and the streets had not been found wanting. On the contrary, the test was highly succesful, and during the year 1908, 5,000 yards were laid. This was followed in 1909 by 6,500 yards, in 1910 by 32,000 yards, and in January, 1911, by 10,000 yards, with 16,000 yards under construction. So on March 1, 1911, St. Louis had, in all, about 5½ miles, or 120,600 square yards, of creosoted yellow pine wood block paving.

The foregoing figures do not include the area of wood block streets paved and maintained by the street car companies, which amounts to some 4 per cent. of the city's area.

In St. Louis all the crossings on streets paved with granite blocks in the business district are paved with wood blocks. These clean, smooth crossings have proven a source of great comfort to the shopping public. These crossings aggregate some 5,700 square yards.

Under the earlier contracts, the creosoted blocks were treated with an oil of specific gravity of 1.08 at 38 degrees C. to the extent of 16 pounds of preservative per cubic foot of timber, and were laid at an angle of 67½ degrees with the curb. Under these contracts transverse and longitudinal expansion joints one inch in thickness were used, the transverse joints occurring every 100 feet. The joint filler used under the earlier contracts was coal tar pitch.

Many engineers connected with the treating of paving blocks are of the opinion that, at least on the lighter traffic business streets and in most residence districts, 16 pounds of oil is all that is required for the most successful wood block. Blocks thus treated give much less trouble from "bleeding" and experience has proven that they last as well as those treated with a larger quantity of oil.

Sand filler is used between blocks.

WOOD BLOCK STREETS. CITY OF ST. LOUIS. Office of the Street Commissioner, St. Louis, July 12, 1912.

The following statement correctly represents the cost of wear and maintenance on the following streets:

(Signed) JAS. C. TRAVILLA,
Street Commissioner, St. Louis.

was the sinking of the concrete foundation beneath the blocks. This, of course, was no fault of the wood itself, but had to be charged to wear and tear of the street.

The actual expenditure last year on 50,000 square yards of yellow pine creosoted wood blocks laid on streets in St. Louis in 1903 was less than two-tenths of a cent per square yard for upkeep. The streets are in perfect condition today, showing no evidence of failure or needed repairs.

Streets	From	To	Tot. No. Sq. Yds.	Date Accepted	End of Guarantee	Wear and Tear '08	'09	'10	'11	'12
Washington	Grand	Pendleton	24,643.22	3-26-03	3-26-10	...	...	2.10	14.60	32.10
Washington	Pendleton	Taylor	8,023.00	3-16-03	3-13-10	...	...	...	5.47	46.60
Westminster	Vandeventer	Sarah	4,125.00	8-19-03	8-19-10	4.00	...	...	1.49	4.60
Westminster	Sarah	Walton	12,823.00	10-19-03	10-19-10	...	...	...	....	....
Pine	Third	Fourth	823.95	8-6-08	8-6-18	...	...	...	....	....
Third	Chestnut	Pine	795.31	8-6-08	8-6-18	...	...	...	7.40	....
Olive	Fourth	Twelfth	11,661.00	11-17-09	11-17-14	...	...	...	....	....
Washington	Fourth	Twelfth	10,066.21	10-6-10	10-6-15	...	...	...	....	....
Fourth	Chestnut	Wash'gton	4,944.97	10-6-10	10-6-15	...	...	...	....	....
Washington	Kingshighway	Union	12,329.54	11-12-10	11-12-15	...	...	...	....	....
Rauschenbach	Benton	Hebert	6,217.02	12-2-10	12-2-15	...	...	...	....	....
Gay	Twelfth	Thirt'nth	595.09	1-7-11	1-7-16	...	...	...	....	....
Twelfth	Tyler	Robert	9,489.89	3-1-11	3-1-16	...	...	...	....	....
Twelfth	Franklin	Tyler	5,889.52	3-3-11	3-3-16	...	...	...	....	....
Eighteenth	Cass	N Market	7,263.57	7-12-11	7-12-16	...	...	...	....	....
Eighteenth	Biddle	O'Fallon	3,585.16	9-5-11	9-5-16	...	...	...	....	....
Eighteenth	O'Fallon	Cass	1,530.65	9-5-11	9-5-16	...	...	...	....	....
Twelfth	Hebert	Branch	1,583.11	9-5-11	9-5-16	...	...	...	....	....
Pine	Fourth	Twelfth	5,377.56	11-8-11	11-6-16	...	...	...	....	....
McPherson	Kingshighway	Union	8,186.17	9-8-11	9-8-16	...	...	...	....	....
Eighteenth	Washington	Biddle	4,449.26	1-5-12	1-5-17	...	...	...	....	....
Benton	Broadway	Twenti'th	13,421.59	2-5-12	2-5-17	...	...	...	....	....

The claim, frequently advanced, that it is not practical to lay wood blocks on an appreciable grade is not borne out by the experience of St. Louis, where streets with grades as heavy as 3½ per cent are paved with wood blocks with perfect satisfaction.

The contracts for the earlier streets, those laid in 1903, required a seven years' maintenance. One contract in 1908 called for ten years, but those of recent years included but a five year maintenance clause.

Wood blocks are laid on a six-inch concrete basis and one inch coarse sand cushion, except when a telford macadam roadway is being resurfaced, in which case the old foundation is used.
old curb or curb and gutter is removed and a six-inch granite curb of highest quality is substituted.

As to the efficiency of the wood block pavements which have been laid in St. Louis, a few figures touching on the cost of maintenance might be of interest.

During 1909, the sixth year of contract maintenance of the 50,000 square yards, or one and one-half miles, of the oldest contract in St. Louis, the wear and tear cost was $2.10, which represents about two and one-half square yards repaired. The cause of wear and tear in every case

The Parker-Washington company states that during their seven years' maintenance of 50,000 square yards of yellow pine creosoted wood block pavement laid by them in 1903 they did not spend one dollar for repairs, therefore the total expenditure for upkeep on 50,000 square yards of yellow pine creosoted wood blocks laid nine years has been less than two-tenths of a cent per square yard for maintenance, with every indication that the streets will give the city and property owners as many more years of service.

While the first cost of wood blocks in St. Louis was greater than for other types of pavement, there has been practically no maintenance cost in ten years of service.

The sand bed is used for the purpose of providing a uniform cros-section of the finished pavement. In laying wood blocks the street commissioner found a lack of uniformity in the depth of the blocks and it is difficult to always have the concrete of proper grade without applying a mortar bed; therefore the sand is used for the purpose of taking up these irregularities. The less sand used for the cushion the less opportunity for moisture to be held under the blocks, and from an economic point of view it is advisable to use a minimum amount of sand.

Mr. J. C. Travilla, street commissioner of the city, has the following to say regarding the methods of reducing slipperiness of wooden block surfaces, in which he has been very successful:

"The necessity of treating surfaces of hard pavements to lessen their slipperiness has been recognized for some time by the city of St. Louis, and many experiments have been made to alleviate the trouble. In many ways, and for many conditions of the pavement surface, sand has been generally used. Fine cinders, too, have found their way to the surface of slippery pavements, their effectiveness being correspondingly shorter lived compared with sand because of the lesser wearing qualities.

"Frequently in dry, cold weather a dusty condition of the pavement surface alternates with slipperiness. As a means of preventing both nuisances, it was first thought necessary to heat sand, incorporate oil, and then spread the mixture on the street. This process is rather expensive where mechanical means for drying and oiling the sand, previous to spreading the latter on the pavement, are not available. Hand turning during the process of drying, and then mixing the sand with oil in asphalt pans, is a slow, tedious, laborious and expensive process.

"From the standpoint of dust, it is essential that the sand carry as much oil as possible, and still permit of satisfactory hand distribution. If an attempt be made to store this hot oil-sand in a bin for future use, much of the oil will be found at the bottom of the sand after twenty-four hours. The hot oil, having its normal viscosity greatly reduced, tends to percolate through the sand pile, from grain to grain, to the bottom of the bin, resulting in a sloppy mixture at the floor. A coarse sand, heated, will carry about five per cent by weight of an 18 to 20 degree B. oil as a maximum. Dry sand, at a lower temperature, will, of course, carry a larger per cent by weight of oil. By expermimenting, it was found that more lasting and better results can be obtained by applying a thin layer of oil first and then spreading the sand.

"By using a specially designed wagon, fitted up with fan sprays and a hand air pump, for producing a pressure on the oil, the oil, above mentioned, has been spread on wood block asphalt streets at the rate of about 0.15 gallons per square yard, at an air temperature as low as 15 degrees Fahr. Under a pressure of from 10 to 15 lbs. to the inch, with the oil at a temperature of from 250 to 350 degrees Fahr., no difficulty was encountered in spraying the oil at the above air temperature. A liberal coating of coarse sand was then

WOOD BLOCK PAVING IN ST. LOUIS.
Laying Yellow Pine Creosoted Blocks on Washington Avenue Between Union and Kingshighway. A 3.5 Per Cent. Grade is Maintained in the First 600 Feet East of Union Avenue, to Entire Satisfaction.

applied, which, under traffic, with the oil scon formed a mat, assuring a foothold for horses.

"We find it convenient to first put the sand in small piles along the side of the roadway, and then by using small amounts, it is distributed uniformly over the surface. A sand-spreading wagon, however, would be more economical.

"The amount of sand used has been about 0.09 cubic feet per square yard. The oil applied first tends to hold all the sand in place, and prevents rapidly moving vehicles, such as automobiles, from throwing it to the sides. For an old asphalt pavement, this treatment would necessarily tend to give life to the surface, as well as seal small cracks, hence tend to prevent the entrance of moisture. The life and usefulness of this process varies from four to eight weeks, depending upon traffic. On grades, this surface application is said to be invaluable to horses. The total cost, including materials, labor, teams, and the preparation of the oil, varies from 1 to 1½ cents per square yard.

"For economy, the whole area of residential streets is not treated, but the oil is kept about four feet from the curb, and there is left untreated a strip about four feet wide in the center of the street. This method of distribution requires but two trips of the wagon for each half of a 40-foot roadway. Experience in St. Louis shows that rapidly moving automobiles tend to run towards the center, but remain to the right of the crown."

Wearing Surfaces for California's State Highways.

The League of California Municipalities appointed a committee at its last meeting to consider the progress of the State Highway Commission, the committee being composed of three city engineers, Chris P. Jensen, of Fresno; S. J. Van Ornum, of Pasadena, and J. J. Jessup, of Berkeley.

A report of progress was made recently, which is excellent, except that perhaps it has too marked a preference for roads practically equivalent to city pavements. This is doubtless due to their practice as city engineers in part, and is also due in part to the fact that under most California conditions of climate and materials the city paveemnts and the road surfaces have approached the same general design, tho beginning at opposite ends of the scale.

The route of the state highway system, running north and south, is located approximately in the law and branches connecting it with the county seats of the counties east and west of those in which it lies are provided for. The State Highway Commission has located 2,300 miles of the main routes and 400 miles of laterals. The $18,000,000 appropriation makes the average expenditure per mile $6,667, which the committee considers insufficient for the best class of work.

Specifications have been adopted for the construction of about 100 miles of the selected routes.

Austin B. Fletcher, the state highway engineer, states that the principal characteristics of the state highways will be rights of way 60 feet wide, as direct lines as possible, gradients not exceeding 7 per cent., even in the mountains, open curves never of less than 50 feet radius, enough culverts and of sufficient capacity for drainage, traveled way of 21 feet, except 16 feet in the mountains, center surfacing 15 feet in width to be such as to be hard and smooth at all times of the year, smoothly graded roadsides reserved for future tree planting.

For the main roads the choice seems to be between oil-macadam and concrete with bituminous surface, the latter being much more expensive.

The committee of city engineers believe that the 2,700 miles of road required should be graded and as much pavement should be constructed as the funds will permit, believing that this will be more certain to secure additional appropriations than an attempt to make a road thruout of the average cost stated. They say:

"As a commentary on the matter of oil-macadam, we would call to mind that Los Angeles county, alone, spent $3,500,000 on oil-macadam highways, and that in the latter part of 1911, when practically all of the bond issue was spent, the grand jury of the county met and in a final report stated, as we recall the words, 'that the oil-macadam roads in Los Angeles county were an absolute failure.'

"It is our belief that particularly up and down the San Joaquin Valley, motor trucks will come into use immediately upon the completion of the highway for the purpose of transporting freight from terminal points, and this factor should be taken into careful consideration before specifications are adopted for such highways.

"Having in mind the increasingly greater traffic demands which will be made after the completion of the highway, we would suggest three classes of pavement as being much more permanent and satisfactory in every way than those proposed:

"1. A standard pavement consisting of a cement concrete base, and a bituminous wearing surface at least 2½ inches thick, constructed according to best modern practice; this form of pavement has been proven to be successful in large cities and is considered a standard by all municipal engineers.

"2. A pavement consisting of a 5-inch cement concrete base, as before, but overlaid with a 2½-inch thickness of bituminous rock, similar to many pavements in San Francisco and other cities.

"3. A pavement commonly known as asphalt concrete, consisting of a base course 3 inches thick and a wearing surface 2 inches thick, each course to be separately rolled to complete resistance. This form of pavement has been in use for many years and has proven entirely satisfactory.

"A bituminous concrete similar to the asphaltic concrete might be used to advantage along the line of the coast route. For the present highway purposes in most localities, we consider that the asphalt concrete form of pavement would be in all respects, the best pavement to be had under existing circumstances.

"In conclusion we would remind your body that approximately 70 per cent. of the burden of taxation wil fall upon the incorporated cities. If poor pavements, or experimental pavements are laid between cities, they will be the greatest sufferers and would, therefore, have the best right to be heard in the matter of pavements."

Street Railway Track Construction in Springfield, Mo.

The franchise of the Springfield, Mo., Traction Company requires it to pave its tracks and two feet outside the rails when the city paves the street. During 1911 the company paved more than three miles of line under the supervision of A. C. Polk, who has described the work for the American Society of Civil Engineers.

Rails

The rail has a 7-inch, 70-pound, T-rail section. Each rail is 62 feet long, fastened to steel ties 4¼ inches deep imbedded in concrete, and under each rail is a longitudinal concrete beam 9 inches deep below the general bottom of the 5-inch concrete pavement foundation or 12 inches below the bottom of the rail, each being reinforced with two ½-inch twisted steel rods. These beams are 22 inches wide and the reinforcing rods are set near the bottom and 6 inches each side of the center line.

Steel Ties

Under the rail joints the steel crossties are of I section with top flange 8½ inches and bottom flange 4½ inches wide web 4¼ inches high and with a weight of 20 pounds per foot. They are 6 feet 8 inches long and are set in the concrete foundation of the pavement and a concrete beam is placed under each crosstie, 30 inches wide and extending 3 inches below the bottom of the longitudinal concrete beam, or 10¾ inches below the bottom of the crosstie. This makes the distance from top of rail to bottom of lowest concrete 22 inches. Ties are spaced as nearly 5 feet apart as location of rail joints permits, and the ties intermediate between rail joints have 6 and 4-inch flanges and the concrete underneath them is at least 2 inches thick and extends 4 inches each side.

Joints

Special lugs and T-headed bolts with square shoulders next to the head were used to fasten the rails to ties.

Six-bolt continuous joints were used to join rails together. The rails and joint plates were carefully cleaned and polished with files and emery cloth, removing all scale, rust and particles of dirt and leaving the surfaces bright. The contact parts were then greased, the joint plates fastened and the bolts tightened by special methods until a wrench with a 30-inch handle could not stir them. These joints require no further electric bonds and similar joints showed a first-class negative return circuit after two years under traffic.

Laying Track

Except in the case of asphalt, the construction began with the contractor laying the street for the city on each side of the track or tracks. The old track was then moved to one side or the other on the completed pavement and the excavation on the street railroad area was made, first 10 inches being taken out over the whole area, then two longitudinal trenches under the rail positions 9 inches deep and 22 inches wide and cross trenches under rail joint locations, 30 inches wide and 12 inches deep, with trenches about 2 inches deep and about 8 inches wide under each intermediate tie.

The new track, put together as above described, was then put in place and supported on small piers of old brick under every other tie and under the rail. Oak wedges were used on top of the piers to give the final surface, which was kept slightly ahead of the concreting gang. The two twisted reinforcing rods were also put in place and supported at intervals on bricks, raising them about 2½ inches above the ground. Under each joint two extra 4-foot lengths of the steel rods were placed. Concrete was then put in place, the bricks and wedges as well as rods, rails and ties being imbedded in the concrete. Between rails and tracks the concrete was crowned slightly to conform with the finished grade of the pavement, a special templet being used to give the exact form.

On part of the work the mixer was mounted on car trucks on the old track temporarily laid on the pavement and driven with a 10-h.p. motor. It was supplied with material by a work train with flat cars running on the temporary track. This method blocked traffic on the track in use, requiring transfer of passengers around the concreting in progress when there was but a single track, and there were frequent delays in delivery of material. On other parts of the track the mixer was mounted on wide tired wheels, driven with a 15-h.p. motor and having a charging bucket. Materials were delivered by wagons in proper proportions ahead of the mixer. This method delayed traffic but little and the mixer was seldom delayed for lack of material.

A 1-inch sand cushion was used under the brick. Along each rail a 2x4-inch piece of timber was laid, then a longitudinal course of brick parallel to the rail and ½ inch below its top, then the transverse rows were laid. Before grouting the pavement the timber along the rail was removed and the space was filled with concrete so as to leave 1 inch of depth for flanges of wheels to run in. After this had set the rest of the pavement was grouted.

The construction is believed to be permanent, similar track showing no movement after 3 years in operation and being in as good condition as on the day it was finished. This makes the cost of $5 per linear foot of single track seem reasonable. The method is reported to require less concrete than that of filling in and around wooden ties, and it certainly places the concrete in the most necessary places, thus promoting permanency. It is believed that this roadbed will outlast two or more sets of rails under heavy traffic. If the fastenings to the ties are properly designed the rails can be replaced without disturbing the foundations.

New Stadium Bridge for Harvard

The Massachusetts Metropolitan Park Commission has prepared plans for a handsome new three-span concrete arch bridge across the Charles river from North Harvard street in Brighton to Boylston street in Cambridge, giving access to the Harvard Stadium and Soldiers' Field. It takes the place of an ancient wooden bridge which has outlived its usefulness.

The bridge will be ornamented with granite and red brick trimmings to conform with the local structures. It is 440 feet long and 64 feet wide, and will cost about $200,000, for the bridge proper, and some $50,000 for temporary bridge and approaches. To offset the increased obstruction of the channel by piers and abutments, the river is widened 25 feet at the bridge. It is set 13 feet higher than the old bridge to give the 16-foot clearance which the law requires for a bridge without a draw. This act of Congress was passed primarily for the benefit of this bridge.

It is said that Larz Anderson, a Harvard alumnus, will pay most of the expense of the bridge proper. John R. Rablin is the engineer of the park commission, having the plans in charge, and Wheelwright, Haven & Hoyt are the architects.

A Delayed Automobile Patent.

On May 8, 1879, George B. Selden, of Rochester, N. Y., made application for a patent on a "road engine," which was divided and a new application filed September 7, 1895, upon which a patent was issued June 4, 1912, No. 1,028,501.

The patent is on the combination with the body of a road engine or self-propelling vehicle of a driving and steering truck therefor, the driving and steering devices both acting upon the front truck of the vehicle.

The delay in the issue of this patent is unconscionable and demonstrates the possibility of manipulating laws or regulations so as to extend the practical life of a patent much farther than the seventeen years which the issued patent has to run.

Modern automobile manufacturers do not ordinarily put their driving gear on the front axle, so that this patent is apparently useless. Its appearance in the list of patents granted this summer gives a flavor of ancient history to the ordinarily up-to-date *Patent Office Gazette*.

ORGANIZATIONS & INDIVIDUALS

American Road Builders' Association

Governor Judson Harmon of Ohio has evinced his interest and his sympathy with the efforts of the American Road Builders' association to the extent of addressing letters to the governors of all of the other states, strongly indorsing the purposes for which the meeting has been called and requesting the appointment of official delegates. Although this letter was sent out only a short time ago, and although some of the chief executives to whom the leter was addressed were absent from their states, delegates have been appointed by Governor O'Neal of Alabama, Governor Deneen of Illinois, Governor Oddie of Nevada, Governor McDonald of New Mexico, Governor Burke of North Dakota, Governor Colquitt of Texas, and Governor Mann of Virginia. Governor Brown of Georgia has signified his intention of complying with the request, and Governor Foss of Massachusetts, Governor Cruce of Oklahoma and Governor Aldrich of Nebraska have taken steps to name delegates.

The meetings and exhibits will all be held in Music hall, Cincinnati, O., on Dec. 3-6. The city officials and citizens of Cincinnati, as well as the state officials of Ohio, are co-operating with the American Road Builders' association and putting forth every effort to make the 1912 convention the most successful ever held.

The Central States Water Works Association

The sixteenth annual convention of the Central Water Works association was held in Detroit, Mich., on Sept. 24 to 26, with headquarters at the Cadillac hotel.

The following papers were read: Efficency of Coagulating Basins, by W. T. Monfort; The Great Lakes as a Water Supply, by Capt. J. C. Beardsley; Reaching the High Pressure, by H. E. Cole; Treatment of Public Water Supplies with Hypochlorite, by W. H. Dittoe; Stop the Waste, by A. L. Holmes; Depreciation, by Halford Erickson; Benefits and Restrictions of the Wisconsin Public Utility Law, by C. B. Salmon; Fire Protection, by C. W. Wiles; Water Rates, by Philip Burgess; Description of Detroit Water Plan, by George H. Fenkell; Description of Akron, O., Water Plant, by H. H. Frost.

U. S. Civil Service

The U. S. Civil Service Commission will hold examinations as follows:

October 16-17—Engineer draftsmen in the office of the supervising architect, at salaries of from $1,600 to $2,000 per annum.

October 23—Laboratory assistant in ceramics in the bureau of standards, Department of Commerce and Labor, at salaries of from $900 to $1,200 per annum.

The Cement Shows

The uniform success which has attended the Cement Shows in the past has led to the perfection of plans for exhibitions in the cities of Pittsburgh and Chicago, two important centers, both easily accessible from all points in a big and active territory in concrete construction.

It will be noted that the exhibitions will be held somewhat earlier in the season than heretofore, the one at Pittsburgh being December 12-18, and the one in Chicago January 16-23. The experience of the management leads to the conclusion that December and January offer ideal conditions for the holding of successful trade exhibitions. In December and January manufacturers and salesmen have the most leisure for attending exhibitions. Dealers have more time to make trips away from business. Contractors, engineers and architects are not so busy preparing plans, specifications and estimates. Building operations are less active than at any other time and there is little in the building line to occupy the attention of the trade

The National Association of Cement Users will join in the Pittsburgh meeting by holding their ninth annual convention during the Cement Show.

Calendar of Technical Meetings

AMERICAN ROAD CONGRESS—Annual Meeting, Atlantic City, N. J., September 30 to October 5. Logan Waller Page, president, Washington, D. C.

NEW YORK FIRE EXPOSITION AND INTERNATIONAL CONFERENCE OF FIRE PREVENTION, PROTECTION AND EXTINGUISHMENT — Seventy-First Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

AMERICAN GAS INSTITUTE—Annual Meeting at Atlantic City, N. J., October 16-18. Geo. G. Ramsdell, secretary, 29 West 39th street, New York.

AMERICAN ASSOCIATION FOR THE PREVENTION OF THE POLLUTION OF RIVERS AND WATERWAYS—Annual Convention at Cleveland, O., October 23-24. H. De B. Parsons, secretary, 22 William street, New York.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT—Annual Convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION—Ninth Annual Convention, Music Hall, Cincinnati, O., December 3-6. E. L. Powers, secretary, 150 Nassau street, New York City.

NATIONAL ASSOCIATION OF CEMENT USERS—Annual Convention, Pittsburgh, Pa., December 12-18. R. L. Humphrey, president, Harrison Building, Philadelphia, Pa.

Technical Associations

The fortieth annual convention of the New York State Firemen's association, held at Newburgh, elected the following officers for 1912-13: Fred A. Davis, Fort Edward, president; Thomas Honohan, Frankfort, secretary; and John P. Powers, Ossining, treasurer.

At the regular meting of the Municipal Engineers of the City of New York, held on September 25, a paper was presented by Fred W. Lindars, entitled "The Segregated Budget as Applied to Municipal Engineering Work."

At the third annual convention of the Pacific Highway association, held in San Francisco, Cal., the following officers were elected: President, Judge J. T. Ronald, Seattle; Frank M. Fretwell, Seattle, secretary; Falcon Joslyn, Fairbanks, vice president for Alaska; A. E. Todd, Victoria, and F. R. McD. Russell, Vancouver, vice presidents for British Columbia; Alfred Thompson, Dawson, vice president for Canadian Yukon; A. G. Briggs, San Francisco, and F. W. Jackson, San Diego, vice presidents for California; Frank B. Riley, Portland, vice president for Oregon; Samuel Hill, Maryhill, vice president for Washington.

A. Lincoln Fellows presented a paper on "The Cherry Creek Problem," before a meeting of the Colorado Association of Members of the American Society of Civil Engineers, held on September 14.

Among the papers presented before the convention of the New England Water Works association, held in Washington, D. C., on Sept. 18-20, were the following: State Control of the Design and Construction of Dams and Reservoirs; actual Practice in Eastern Connecticut, Charles E. Chandler, C. E., Norwich, Conn.; Certain Legal Aspects of Water Power Development in Maine, by Cyrus C. Babb, chief engineer Water Storage Commission of Maine, Augusta, Me.; State Control of Dams in Pennsylvania, by Prof. Frank P. McKibben of Lehigh university, South Bethlehem, Pa.; Reasonable Requirements Imposed Upon Water Works Systems by the Fire Protection Problem, by Clarence Goldsmith, C. E., superintendent of High Pressure System, Boston, Mass.; The Organization and Administration of a Supply Bureau, illustrated, by E. C. Church, C. E., secretary Department of Water Supply, Gas and Electricity, New York, N. Y.; State Regulation of Public Utilities, by Morris Knowles, director Department of Sanitary Engineering, University of Pittsburgh, Pa.

The fourth National Conservation Congress will be held in Indianapolis, Ind., on October 1-4. Vital Resources will be discussed in many sections by men whose knowledge and achievement command world-wide attention. Forests, waters, lands and minerals will receive prominent attention.

At the closing session of the International Association of Fire Engineers, held in Denver, Col., September 20, New York City was selected as the next meeting place. Chief H. F. Magee, Dallas, Tex., was elected president; Chief T. W. Haney, Jacksonville, Fla., first vice president; Chief Hugo R. Delfs, Lansing, Mich., second vice president. Chief James McFall, Roanoke, Va., was re-elected secretary, and Chief George Knofflock, Mansfield, O., treasurer.

The sixteenth annual convention of the League of American Municipalities was held in Buffalo, N. Y., September 18, 19 and 20. Among the subjects discussed were: City Charters and the Short Ballot; Importance of the City of Modern Society; Playgrounds, and How to Acquire Them; Civic Awakening; Relations of the Library to the City; Taxation.

The twelfth annual convention of the Union of Canadian Municipalities was held at Windsor, Ont., on Aug. 27-28. Among the more important subjects discussed were the following: Equitable Municipal Taxation, by T. A. Clarke; The Georgian Bay Canal and Its Water, by Mayor Hopewell, Ottawa; The Price of Cement, by Controller Harvey, Winnipeg; Winnipeg's Hydro-electric Power Plant, by J. W. Cockburn; and Municipal Government by Commission, by S. M. Wickett. The secretary-treasurer of the

Union is W. D. Lighthall, Westmount, Que.

American Society of Municipal Improvements

The city of Dallas, Tex., is proposing much for the entertainment and instruction of its visitors at the convention of the American Society of Municipal Improvements, to be held November 12 to 15, with a meeting of the general committee on standard specifications on the 11th. President E. A. Kingsley, Little Rock, Ark., is arranging for special accommodations on a train from St. Louis, concerning which he will send full information to all asking for it, as soon as arrangements are perfected. At but little additional cost tickets can be purchased to Galveston or any other desired point, which will be good through Dallas, and give opportunity for stop-overs at the principal cities in Texas and Oklahoma.

Dallas is a city which is very fully improved with pavements, sewers, sidewalks, water works, parks, playgrounds, electric railways and lights, and has much of interest in these lines, particularly in its solution of its water problem.

American Road Congress

The second road congress held under the auspices of the American Association for Highway Improvement is in progress at Atlantic City as this number of MUNICIPAL ENGINEERING is issued, and is doubtless as excellent as the first congress. Its devotion to the practical side of the question has been called in question lately by some who would like to relegate it to the field of promotion only, but the program of the congress is sufficient refutation of such puerile charges.

The construction and maintenance section has a program extending over two full days, with papers by state and county highway commissioners and engineers, city and consulting engineers in charge of street and road construction, contractors and experts on paving and roadmaking materials. Fuller statement of what was actually presented will be given next month.

This is the first national highway association under any name which has not been under the guidance or control of some special or individual interest, and this fact has given it a standing and an authority which no other association has had heretofore.

Personal Notes

John McMillan has been appointed city engineer of South Pasadena, Cal., succeeding B. Dupuy.

Frank LaF. Anders has been reappointed city engineer of Fargo, N. D., in which capacity he has been serving since 1910.

G. W. Pearsoll has resigned as city engineer of Park City, Tenn., and Frederick Thomas has been appointed to succeed him.

J. B. Logan, formerly an engineer with the Maryland State Roads Commission, has been appointed city engineer of Annapolis, Md.

C. J. Renner of Mount Vernon, N. Y., has been appointed city engineer and superintendent of streets, water and sewers of St. Albans, Vt.

Prof. William J. Carrel of the department of civil engineering, State University of Kentucky, has been appointed bridge engineer of the Kentucky State Highway Department.

Prof. Granville R. Jones and Prof. R. B. H. Begg have been appointed members of the engineering faculty of Kansas university. Their field will be sanitary, municipal and hydraulic engineering.

David H. Ray, Assoc. Am. Soc. C. E., for the past two years chief engineer of the Bureau of Buildings, New York City, has resigned to enter private practice as a consulting engineer, with offices at 27 West Thirty-third street, New York City.

Francis F. Longley, Assoc. M. Am. Soc. C. E., who this year became professor of civil engineering at Harvard university, has been admitted to partnership in the firm of Hazen and Whipple, consulting engineers, 103 Park avenue, New York City.

Michael M. O'Shaughnessy, M. Am. Soc. C. E., and chief engineer of the Southern California Mountain Water company, has been appointed city engineer of San Francisco, Cal., by Mayor Rolph. Mr. O'Shaughnessy succeeds Marsden Manson, resigned, and his position carries with it the highest salary on the regular city payroll, $15,000 per year.

Charles K. Walker, formerly superintendent of the water department of Manchester, N. H., died in that city on Sept. 10. He was born in 1830 and was educated at Bedford academy, studying civil engineering later under Gen. George Stark, at Nashua, N. H. In 1875 he became superintendent of the Manchester water works, which were built in 1874, and since that time he had held the position continuously.

MACHINERY AND TRADE

Street Signs and Sign Posts

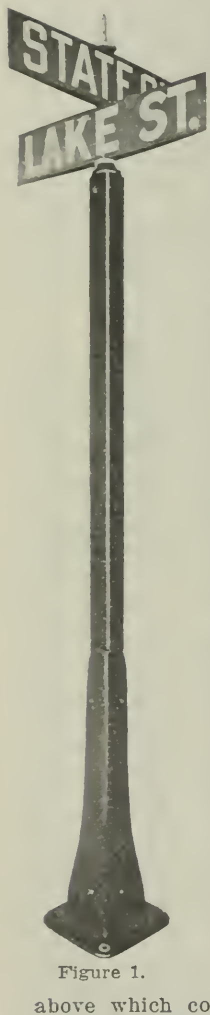


Figure 1.

There has recently been placed on the market a very strong, durable and economical sign post. The main standard is of 2½x2½x 3/16-inch angle iron, of the proper length to hold the signs 7 or 8 feet above the ground. Signs are attached in a very simple manner to a square iron casting, with a wrought iron bolt, cast in the center of the cast iron holder, to which are attached four signs, placed back to back in pairs, running at right angles to each other, or in other words, a four-way sign, fastened together with brass bolts as shown by Fig. 1.

These posts are made for placing either in the ground in the parkway or for placing on the cement sidewalks in the business districts. The first mentioned is to be placed in the ground thirty inches. The bottom of the angle iron post being first flattened and then turned at a right angle, so that the bottom end has a wide horizontal flange and to this is securely riveted a 3/16-inch plate 10x10 inches to set in the bottom of the post hole, above which concrete can be placed if deemed necessary to more securely hold the same in position. At the air line, or more generally termed the ground surface line, and extending ten inches downward is another angle iron plate 4x4x 3/16-inch securely riveted to the main angle iron standard. This affords lateral resistance from four directions, and at the same time serves the purpose of giving double strength and double thickness at the point where there is the greatest strain on the post, and where the rusting and corroding usually take place in all posts, just at the point where the air, water and earth come together.

The post to be used in the business district, which is to be set on and secured to cement sidewalks, has a heavy cast iron base extending 29 inches above the sidewalk, and this cast iron base is reinforced in the back by the angle iron standard itself, which runs clear to the bottom of the post and is securely riveted to the iron casting, giving to the post very great strength at this point.

Figure 2.
STREET SIGNS AND SIGN POSTS.

Fig. 2 illustrates the style of bracket adopted by the city of Chicago for holding street signs and attaching same to trolley poles, electric light poles, etc. Provision is made for attaching either to iron poles or posts as well as to wooden posts. This bracket is very simply constructed and is strong and substantial and calculated to hold four street signs, or in other words, two pairs of signs, technically called a four-way sign.

The Mercury Truck in Municipal Service

Light motor driven apparatus is being used in all departments of municipal work. Contractors who are handling work in various parts of the city can, by using such a truck, cover their work with greater ease and rapidity and can

THE MERCURY TRUCK IN MUNICIPAL SERVICE.
Truck Used by Chicago Telephone Co.

make deliveries of supplies and materials without hindrance to the work which is going on.

City engineers and park commissioners who are compelled to look after various improvements in remote parts of their cities or districts can, and in many cases are, already using light trucks of this class. For carrying instruments, light materials and light equipment which are constantly in demand and which must be transported quickly from place to place, no other means of transportation begins to fill the requirements so admirably.

THE MERCURY TRUCK IN MUNICIPAL SERVICE.
Truck Used by Peoples Gas Light & Coke Co., Chicago.

In preparing the following figures, based upon averages taken from cost records furnished by municipal owners of horse equipment and municipal users of Mercury trucks, W. A. Zimmerman, of the Mercury Manufacturing Co., Chicago, has endeavored to draw an equitable comparison, but has favored the horse in some instances.

He states that one Mercury truck will readily displace and do the work of three horses and two wagons, and at an annual saving which will more than pay for the truck.

Cost of Horse Equipment for a Period of Five Years.

Cost of three horses	$450.00
Two wagons	150.00
Three sets harness	90.00
Feed, shoeing and veterinary, 3 horses, each at $20 per mo.	3,600.00
Repairs, 2 wagons, $7.50 per month each	75.00
Painting, 2 wagons, $25 per year each	250.00
Repairs, 3 sets harness	25.00
Two drivers, $12 per week	6,240.00
	$10,880.00

Cost of One Mercury Truck for a Period of Five Years.

Cost of one Mercury truck	$800.00
Gasoline, daily average 30 miles, 300 days per year	375.00
Barn or garage rental	600.00
Lubricating oil	300.00
Transmission grease	50.00
Recharging batteries	21.50
Repairs, $10 per month	600.00
Painting, $25 per year	125.00
Tire replacement, based on 1 cent per mile	410.00
Incidentals, cost of oil for lamps, etc.	175.00
One driver, $12 per week	3,120.00
	$6,576.50

Savings in five years, $4,303.50.

Expert's Opinion on Oklahoma Asphalt

Below we append the opinion of S. F. Peckham, A. M., Chemist of the Department of Finance, New York City, upon the improvement that has been made to Oklahoma asphalt pavement by the addition of bitumen and sand to soften and temper limestone asphalts. This improved form of Ardmore rock asphalt pavement is far superior to anything that was laid in the earlier stages of the use of the material. Mr. Peckham says:

"My attention has been called to the present system of mixing the ingredients used by the Shelby Downard Asphalt Company, in which the bitumen used to soften the mixture of asphalt rock (bituminous limestone and bituminous sandstone) is extracted from native bituminous sand found in the immediate vicinity of the deposit of the other rocks. This bitumen is a maltha that is readily separated from the sand, with which it is found in nature by means of boiling water. It has, therefore, never been exposed to a temperature above the boiling point of water, and consequently has not been "burned." This method of procedure results in a minimum use of heat to effect a mixture of ingredients for street service and avoids one of the most potent sources of bad surfaces, which are accompanied by careless handling of materials otherwise of an unexceptionable excellence.

"This method of procedure resembles that which has been followed with such excellent results by those who are in European countries, using the rock asphalt deposit of Seyssel and Neufchatel, wherein the bitumen extracted from the poorer portions of the rock is used to soften the richer portions, thus introducing into the mixture no bitumen of a foreign nature.

"I can see no reason why similar satisfactory results should not follow this treatment of our natural asphaltic rock which occurs in such abundance in Oklahoma, and I most cheerfully endorse such management as following the lines indicated by experience and scientific theory.'

An Effective Earth Handling Grader

An elevating grader loading into automatic dump wagons is a system of earth-handling which has developed into the most popular of the age, for the reason practical experience has proven that where it is possible to use an elevating grader that it will do the work with a greater degree of economy than is possible in any other way.

This illustration shows the New Era elevating grader made by the Austin Manufacturing Company, of Chicago, and also the Austin contractors' dump wagon, on work done under the West Park Commission of Chicago.

The New Era elevating grader has been on the market and in use for more than forty years, and its reputation as an economical and reliable earth-handling machine is well established among municipal, railroad and other contractors.

AN EFFECTIVE EARTH-HANDLING GRADER.
Machine at Work in West Park District, Chicago.

The ordinary elevating grader when employed for building a grade, levee or embankment, and when used for making canals where the earth is not to be delivered beyond the direct scope of the elevator or carrier of the machine, will handle in a day's time of ten hours a thousand cubic yards of material, and where the conditions are fair, the machine will do even better. The working force required to handle this amount of earth, if horses are used, is six teams and three men, and, therefore, the cost of handling the amount of earth stated is the wages of this outfit per day. Appreciating that the modern traction engine can be employed with a greater degree of economy than horses, many of the owners of elevating graders now use a traction engine for power instead of teams.

The ordinary elevating grader weighs about 9,000 pounds, and being mounted on wheels of large diameter, is easily transported from place to place, and can be moved to work remote from transportation facilities with very little expense.

These machines are not only used on railroad construction largely, but are also employed for making canals and ditches, in the construction of dams and reservoirs and for road and street building, and they will be found in use wherever work of this nature of any importance is being done.

Contractors having earth handling to do, who are not familiar with machines of this kind, will do well to investigate the economy with which they can be employed before buying their equipment.

Municipal Dump Wagons

The accompanying photograph shows one of the prize winning dump wagons owned by the city of Pittsburgh, Pa., and made by the Bain Wagon Company, of Kenosha, Wis.

MUNICIPAL DUMP WAGONS.
Bain Wagon in Service in Pittsburgh.

This type of dump wagon is decidedly practical and is being used by municipalities in all sections of the country. Only one lever is employed for either closing the doors or dumping the load. Because of the large drum, on which the chain is wound, it is necessary to move the lever forward and back only a few times. Only one chain is used. It is impossible to dump the load by accident. The shaft and drum are placed across the front end of the wagon. This design distributes the strain and prevents the right hand front corner from sagging.

The doors are hung by heavy loops instead of hinges. This allows them to be raised about eight inches and prevents them from being torn off when moving forward after dumping. The doors close almost water-tight.

The steel axles are reinforced by heavy hickory bed pieces, securely clipped on, which strengthens them and prevents springing or breaking. No malleable iron standards are used. The neck is reinforced by a plate of sheet steel both inside and outside, running back to the forward side trap.

The wheels are made with oak hubs, dodged mortised; oak rims and oak or hickory spokes. They are soaked in hot linseed oil, and the tires are set hot in the old-fashioned way.

Technical Advertisers

An evidence of the increasing attention being given to the most efficient methods of advertising and marketing engineering and technical products appears in the announcement of the formation of Wightman & Richards, technical department of Joseph A. Richards & Staff, General Advertising Agents, Tribune building, New York City, representing the association of Joseph A. Richards, Lucius I. Wightman and Paul Morse Richards.

Joseph A. Richards is the head of the agency, having his name, founded by Joseph H. Richards in 1872, and since identified with some of the most conspicuous national successes in advertising salesmanship. Mr. Wightman is an engineer who has for many years specialized in the advertising and marketing of machinery and engineering products, and brings to the association several important technical accounts. Paul Morse Richards is a publisher, sales manager and advertising made of wide experience, until recently with the "Motor World," and prior to that, advertising manager for "Power" and other technical journals. His extended experience will aid in the conduct of advertising, selling and marketing campaigns.

A New Road Oiling Machine

The economy of treating city streets and country roads with asphalt oil or coal tar preparations has been so satisfactorily demonstrated, where carried on under favorable conditions, that such practice is no longer looked upon as an experiment. Aside from selecting what oils or tars are best suited for the local requirements, the most important consideration is the selection of a machine which will handle the dust-laying compound in a satisfactory manner.

The Austin Manufacturing Company, in an effort to design a street and road oiling machine which would meet engineers' and contractors' specifications, has spent some time in experimenting, which has resulted in the presentation of a power oil distributer of exceptional merit.

The distributing apparatus consists of a force pump driven by gearing attached to the right hand rear wheel of the sprinkler truck, and the oil being forced under air pressure thru especially designed nozzles which give a fan-shape discharge. This machine differs from others of the same general character in that all variations of the discharge and of the air pressure are controlled by the driver from the front seat.

The sprinkler shown in the accompanying illustration is designed for handling the lighter grades of oils and tars, and is intended more for dust-laying purposes than for new construction.

The manufacturers claim for this machine that it combines simplicity of design with efficiency in operation to a degree not heretofore obtained. The machine, when working to its full capacity, delivers a spray 8 feet in width, which, however, can be reduced by 2 feet at a time as the occasion demands. The spray pipes are so mounted that in striking an obstruction they are not damaged, but, on

A NEW ROAD OILING MACHINE.
Side View of Oiling Machine.

A NEW ROAD OILING MACHINE.
Rear View Showing Control Mechanism.

the other hand, swing aside, and after the obstruction is passed they can be thrown back to the original position. The quantity of oil varies according to the air pressure, which is controlled by the driver, and the present style of machine gives a variation of from 1/20 to ¾ of a gallon per square yard. The spray is uniform the full width of the discharge, and the quantity of oil can be increased or decreased instantly as the condition of the roadbed may require.

"The Standard" Junior Mixer

There has been such a demand for a small machine modeled along the lines of "The Standard" low charging concrete mixer that the Standard Scale & Supply Co., 1345 Wabash avenue, Chicago, has perfected "The Standard" Junior mixer. This mixer is especially adapted for sidewalks, curbs, gutters, small foundations, culverts, etc. Any contractor who is mixing by hand or with a cumbersome continuous or heavy batch mixer should look into the merits of this machine.

"The Standard" Junior mixer is low in first cost, low in operating cost and gives a better mix with less cement, and in mixes twice as much material with the same amount of labor as hand mixing.

The mixer complete on trucks, engine and all, weighs not over 1,200 pounds, and one man can move it anywhere on the job, or it can be hitched on the back of the tool wagon, doing away with all the cartage that is necessary with big mixers or mixing boards.

"The Standard" Junior mixer is designed so it can often be placed to discharge into the forms, and by placing the material near the mixer, the sand, stone, etc., can be shoveled directly into the mixer, thereby doing away with all the wheeling.

This mixer is similar to "The Standard" regular machines, that are so well known, the only difference is that it is smaller. Any additional information can be had by addressing a card to any of the offices of The Standard Scale & Supply Co.

"THE STANDARD" JUNIOR MIXER.

New Form of Spiral Pipe

The Standard Spiral Pipe Works, 25 North Dearborn street, Chicago, are placing on the market a reinforced galvanized spiral pipe which is made from two strips of steel of different widths and with a continuous interlocking seam. Both strips of steel are rolled to shape on the edges and are interlocked and rolled down under very high pressure in a special machine which this company has patented. The strips of steel are first cut to the required width from long sheets of steel and the ends are welded together. The steel is then placed on large spools. The strips used for the outside or the reinforcing band come from the steel mills in long lengths on reels. Both of these strips are fed into the machine at one end, rolled down and interlocked in the machine, coming out at the other end in the shape of pipe.

This pipe is smooth on the inside and has the reinforcing band running on the outside the entire length of the piece, and can be made endless. This strip is not welded or soldered on the pipe, but is interlocked in the form of a continuous seam. Ample folds are made at both sides so that a large bearing surface or contact is obtained at the seam.

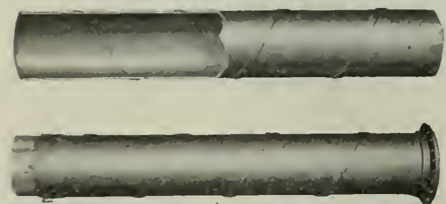
The pipe is smooth on the inside, therefore has the least possible frictional resistance to flow of water or other substances and will not allow particles to adhere to the inner wall of the pipe and thus reduce the diameter and increase the fricton.

Its lightness enables it to be moved easily and also to be installed in places difficult of access.

At the point where the reinforcing band passes around the pipe there are four thicknesses of metal. A number of bursting tests have been made on this pipe. In one at the Armour Institute, with a piece of 18-inch No. 20 reinforced galvanized spiral pipe, it required 235 pounds of hydraulic pressure to burst the seam. From this it will be noticed that the efficiency of the joint is very great. Another test was made on a piece of 16-inch No. 20 gage where the hydraulic pressure rose to 320 pounds, at which the wide band of steel between the two seams commenced to bulge out and actually expanded ¾ inch in diameter. The pressure was then turned off and it was found that the seam had not been affected in the least. There was no sign of fracture or opening up of the seam either on the inside or on the outside.

This company is furnishing a slip sleeve joint made with a seamless sleeve welded into one end of the pipe. Lugs are also welded on the outside of the pipe. In making connections one end is slipped into the other and the pipes are then drawn together by wires over the lugs and a good joint is obtained for water pressure up to sixty pounds.

The other style connection which this company uses is a forged steel flange which is electrically welded on to the end



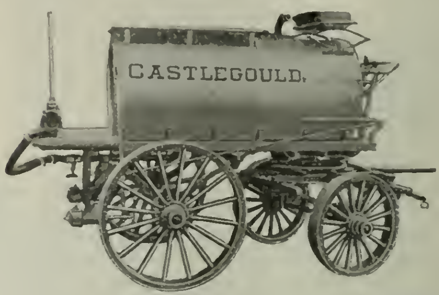
NEW FORM OF SPIRAL PIPE.
Section of Pipe Showing Spiral Joints.

of the pipe and furnished with bolts and gaskets complete. The pipe is furnished in any required length.

This pipe can also be furnished with cast iron or forged steel bolted joints. The company is prepared to furnish fittings and valves necessary for a complete installation of water supply, exhaust steam, blow pipe, and dust collecting systems.

A Park and Cemetery Sprinkler

The accompanying photograph shows the Austin platform gear sprinkler used on the estate of Mr. George Gould, New York. This sprinkler is equipped with platform and pump for watering flower beds and for spraying trees and shrubbery, and can be used to advantage in all parks and cemeteries. The single lever pump mounted on the rear platform can be arranged to either empty or fill the tank. In some cases the sprinkler can be used for country road work.



A PARK AND CEMETERY SPRINKLER.
Note Attachments for Tree Spraying.

Trade Publications.

Hetherington and Berner, Indianapolis, Ind., have prepared a booklet describing asphalt paving plants and machinery. It contains much of general interest in relation to plants for the handling of asphalt, and is well illustrated. The portion of the booklet relating to the construction of their railway car plants contains a number of points of design which are not familiar to the average engineer.

The September issue of the Bulletin published by the Universal Portland Cement Co., 72 West Adams street, Chicago, Ill., contains mention of a type of girder bridge used widely in Illinois, some tests of concrete pipe, concrete roads, a filtration plant in Niles, O., and some notes on concrete bridge and culvert design.

The B. F. Goodrich Co., Akron, O., have a number of publications describing the application of their type of "wireless" tires for motor trucks. Especial mention is made of municipal trucks, and the features recommending the "wireless" to fire motor service.

The Kelly Island Lime & Transport Co., Cleveland, O., have a small but interesting pamphlet describing their product, "Rubber Stone," which is a chloride road compound.

The Jeffrey Manufacturing Co., Columbus, O., has issued Bulletin No. 74, containing 134 various illustrations, showing mechanical equipments that were designed especially for the economical handling of various materials, including an improved type of finger tray elevators for raising and lowering packages, barrels, boxes, sacks, etc., also their swinging tray elevator platform carriers designed for a variety of uses.

The particular features of the Troy dump wagon are described in a recently published folder by the Troy Wagon Works, South Crawford street, Troy, O. Mention is made of the oak used in the beds, the steel doors, and the system of operation of the dump doors.

The Goulds Manufacturing Company, Seneca Falls, N. Y., have just issued a new edition of Bulletin No. 109, dealing with pressure pumps. This publication covers types of pumps for special services requiring special features of construction, such as pumps for water works, oil pipe lines, refineries, chemical and refrigerating purposes, hydraulic pressure, etc. Specifications are given for double-acting triplex plunger pumps, double-acting duplex plunger pumps, portable electric triplex and duplex mine pumps, single-acting triplex pressure pumps and ammonia triplex piston pumps.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bloomington, Ind.—Oct. 8, 2 p. m. Constructing two stone roads in Perry and one in Richland township. Horace Blakely, auditor.

Crawfordsville, Ind.—Oct. 8, 10 a. m. Constructing eleven gravel roads. Bennett B. Engle, auditor.

Crown Point, Ind.—Oct. 8, 12 m. Constructing three gravel roads. Chas. A. Johnson, auditor.

Lafayette, Ind.—Oct. 9, 10 a. m. Constructing a gravel road. Bond double the amount of bid. Geo. W. Baxter, auditor.

Lawrenceburg, Ind.—Oct. 8, 12 m. Constructing highways in three townships for a distance of about 10 miles. Wm. S. Fagaly, auditor of Dearborn county.

Logansport, Ind.—Oct. 8, 10 a. m. Constructing two roads in Eel township and one in Boone township. J. E. Wallace, auditor.

Madison, Ind.—Oct. 8, 11 a. m. Grading, draining and paving a road in Monroe township. Estimated cost, $3,995. Bond double the amount of bid. A. M. Taff, auditor Jefferson county.

Marion, Ind.—Oct. 8, 2 p. m. Constructing a gravel road in Washington township. E. H. Kimball, auditor.

Rockville, Ind.—Oct. 8, 1:30 p. m. Constructing two gravel roads in Washington and one in Howard township. James E. Elder, auditor.

Vincennes, Ind.—Oct. 8, 2 p. m. Constructing a gravel road in Johnson and Vincennes townships. John T. Scott, auditor.

Washington, Ind.—Oct. 8, 2 p. m. Constructing a gravel road in Washington township. Lew S. Core, auditor.

Winamac, Ind.—Oct. 10, 12 m. Constructing gravel road in county. W. E. Munchenburg, auditor.

Cleveland, O.—Oct. 9, 11 a. m. Improving the Warren road. Certified check, $1,000. Frank R. Lander, county surveyor; John F. Goldenbogen, clerk, Cuyahoga county.

Cleveland, O.—Oct. 9, 11 a. m. Improving the Warren, Munn and Triskitt roads. Certified check, $1,000. John F. Goldenbogen, clerk of Cuyahoga county.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving with bituminous surface treated concrete and brick pavement the Ashland-New London road. State highway "F," Pet. No. 339. Length, 2.51 mi.; width, 14 ft. Estimated cost, $2,373.60. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Owl Creek road with waterbound gravel macadam. State highway "D" Pet. No. 611. Length, 2 mi.; width, 10 ft. Estimated cast, $2,373.60. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Sinking Springs road with waterbound macadam. State highway "G," Pet. No. 615. Length, 1 mi.; width 12 ft. Estimated cost, $2,778. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Waverly-Beavertown road with waterbound macadam and concrete. State highway "F," Pet. No. 613. Length, 1 mi.; width, 12 ft. Estimated cost, $4,123.75. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Piketown-Richmond road with waterbound gravel macadam. Length, 1 mi.; width, 10 feet. Estimated cost, $2,829.85. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Grassy Fork road with waterbound gravel macadam. State highway "C," Pet. No. 610. Length, 2.09 mi.; width, 10 ft. Estimated cost, $3,558.60. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Lake Shore road with bituminous surface treated concrete pavement. State highway "E," Pet. No. 608. Length, 1 mi.; width, 12 ft. Estimated cost, $7,137.30. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Delphos and Ft. Jennings road with waterbound macadam. State highway "B," Pet. No. 637. Length, 3.45 mi.; width, 14 ft. Estimated cost, $10,716.99. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Akron-Canton road with brick. State highway "F," Pet. No. 495. Length, .93 mi.; width, 13 and 14 ft. Estimated cost, using sandstone curb, $31,163.98; estimated cost, using concrete curb, $29,720.95. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Big Basin road with waterbound gravel macadam. State highway "E," Pet. No. 612. Length, .97 mi.; width, 10 ft. Estimated cost, $3,168.06. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Wadsworth-Wooster road with brick. State highway "C." Pet. No. 548. Length, .77 mi.; width, 10 ft. Estimated cost, $9,654.42. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the State road with bituminous surface treated macadam. State highway "D," Pet. No. 607. Length, 1 mi.; width, 10 ft. Estimated cost, $5,835.10. Alternate bids will be received for paving the same with a bituminous surface treated concrete pavement. Estimated cost, $6,967.90. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Columbus, O.—Oct. 11, 2 p. m. Grading and paving the Springfield road with sulphite macadam. State highway "C," Pet. No. 543. Length, 2.55 mi.; width, 16 ft. Estimated cost, $15,399.10. Alternate bids will be received for grading and paving the same with bituminous bonded macadam. Estimated cost, $16,842.82. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

Huntington, W. Va.—Oct. 9, 1 p. m. Grading, curbing and paving Bridge street; also constructing a lateral sewer in an alley. Certified check, $500. L. A. Pollock, commissioner of streets; A. B. Maupin, city engineer.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing six miles of state-aid road, to A. F. Bearden, Birmingham, Ala., $12,000.

Freeport, Ill.—Paving Henderson avenue, to Gund-Graham Co., $29,901.

Monmouth, Ill.—Paving South D street, to the Burlington Construction Co., $15,400.

Peoria, Ill.—Paving Fourth street with brick, to Canterberry Bros., $14,799. Paving Arcadia avenue with brick, to A. D. Thompson Co., $30,351.

Urbana, Ill.—Paving Orchard street, Lincoln avenue and Michigan avenue, to John W. Stipes, Champaign, Ill., $40,000.

Argus, Ind.—Constructing a stone road, to Beal & Belle, Logansport, Ind., $26,789.

Bicknell, Ind.—Constructing 8,000 ft. of curb and gutter, to Harry Marberry, and paving several streets with brick paving, to Ewing Shields, $38,000.

Gary, Ind.—Improving West Fifth avenue, to the Cain Construction Co., $19,931.85.

Marion, Ind.—The following road contracts have been awarded: The Daniel Gunder road, to Dillard Artis, $15,388; the John T. Williams road, to Erie Stone Co., $10,490.

Shreveport, La.—Paving five miles of the Harts Island road, to R. E. Shisler, $22,000.

Baltimore, Md.—Paving Oren avenue, Parkwod avenue and Woodbrooks avenue, to F. E. Schneider Paving Co., $11,843.50.

Owosso, Mich.—Paving West Main street, to Andrew Geeck, $17,000.

Meridian, Miss.—Constructing 22 miles of sand clay road, to the Healy Construction Co., $50,000.

Poplar Bluff, Mo.—Paving several streets, to Roy L. Williams, Cairo, Ill., $86,000.

St. Louis, Mo.—The following paving contracts have been awarded: Alaska street with brick, to Eyermann Construction Co., $21,613; reconstructing Ninth street with brick, to Skrainka Construction Co., $36,451; improving Terry street with asphalt, to the Trinidad Asphalt Mfg. Co., $12,913; improving Minnesota street with wood, to Eyermann Construction Co., $23,808; improving Fair street, to Perkison Bros. Construction Co., $17,330.

Vandalia, Mo.—Paving Main street, to the Illinois Construction Co., Springfield, Ill., $21,000.

Long Island City, N. Y.—Paving Seneca avenue with asphalt blocks, to Cannon Engineering Co., $99,960.

Akron, O.—The following paving contracts have been awarded: Annadale street, to Windsor Bros., $12,525.56; paving Augusta street, to E. McShaffrey, $36,472.21; Princeton street, to Windsor Bros., $14,579.08; Harvard street, to the same, $19,284.80; Yale street, to the same, $13,167.05.

Alliance, O.—Paving Vine street, to J. C. DeVine Co., $20,022.

Cincinnati, O.—Improving the Clough creek pike, to Van Camp Bros., $10,746.

Columbus, O.—Constructing eight miles of macadam road in Union, Madison and Franklin counties, to J. M. Stouffer, $40,000.

East Liverpool, O.—Paving the Lisbon road, to Patterson & Grafton, Wellsville, O., $17,740.39.

Marion, O.—Resurfacing Prospect street and paving Lincoln avenue, to the Asphalt Block Co., Toledo, O., $16,756.

Toledo, O.—Paving Albion street with vitrified brick, to John McMahon, $35,512.

Durant, Okla.—Paving North Third street for a distance of six blocks, to the Cleveland-Trinidad Paving Co., Cleveland, O., $17,397.

Stillwater, Okla.—Paving several streets with asphaltic concrete, to the Radcliffe-Dudley Construction Co., Nowata, Okla., $42,000.

Port Allegheny, Pa.—Paving two streets, to John Sheehan, Bradford, Pa., $18,244.13.

Warren, Pa.—Paving Main street, to L. A. Coates, $22,768.

Wilkes Barre, Pa.—Constructing 10,200 ft. of rock road, to B. G. Coon Construction Co., $22,078.

Memphis, Tenn.—The following paving contracts have been awarded: East Iowa street with brick, to M. E. Larkin, $15,150; Third street with wood block, to the same, $14,474.

Houston, Tex.—Paving Houston avenue with brick, to Horton & Horton, $12,621.

Temple, Tex.—Paving Central avenue with brick, to J. A. Gregory, Dallas, Tex., $26,380.

Stanwood, Wash.—Paving Main and Market streets, to A. R. Gibson, Seattle, Wash., $14,618.

Toppenish, Wash.—Paving several streets with bitulithic, to the Barber Asphalt Paving Co., Spokane, Wash., $70,426.

Huntington, W. Va.—Constructing the McCoy road, to H. L. Wright, $20,000.

CONTEMPLATED WORK.

Larkspur, Cal.—A $35,000 bond issue for street improvement has been voted. E. G. Vocke, town clerk.

Ontario, Cal.—A $72,000 bond issue for street improvement has been voted. R. O. Brackenridge, city clerk.

San Francisco, Cal.—The paving of a street, to cost $90,000, is contemplated. Board of Public Works.

Denver, Col.—Paving of old Sante Fe Trail is contemplated at an estimated cost of $53,966. Board of Public Works.

Plant City, Fla.—A $25,000 bond issue for paving construction has been voted.

Longmeadow, Mass.—Grading and filling of state road is contemplated. Appropriation, $15,000. W. F. Emerson, town clerk.

Winona, Miss.—A $40,000 bond issue for road improvement has been voted. Jos. T. Parke, county clerk.

Springfield, Mo.—An $18,000 bond issue for road construction has been voted.

Mamarneck, N. Y.—A $35,000 bond issue for the improvement of Post road has been voted.

Charlotte, N. C.—Improvement of various streets, to the amount of $400,000, is contemplated. Joseph Firth, city engineer.

Akron, O.—Grading, curbing and paving several streets and constructing sidewalks in same streets is contemplated. W. L. Carlton, president of council.

Alliance, O.—The grading, draining, curbing and paving of several streets with brick is contemplated. Chas. O. Silver, city clerk.

Roseville, O.—The paving of five streets, at an estimated cost of $10,000, is contemplated.

Wilsville, O.—The paving of Commerce street is contemplated. W. H. Moore, mayor.

Bartlesville, Okla.—The paving of several streets is contemplated. City Engineer Kirkpatrick.

Franklin, Tex.—A $100,000 bond issue for road improvement has been voted. State highway commissioners.

Houston, Tex.—A $300,000 bond issue for paving construction has been voted.

Sherman, Tex.—A $100,000 bond issue for paving construction has been voted.

Chatham, Va.—A $100,000 bond issue for road improvement has been voted. S. S. Hunt, clerk Dan River district.

Norfolk, Va.—Paving construction, to cost about $23,000, is contemplated.

SEWERS.

BIDS REQUESTED.

Wilkes Barre, Pa.—Oct. 9, 6 p. m. Constructing a storm sewer on Main street. Certified check, $100. Frank C. Rowe, secretary, 727 Hazel avenue.

Huntington, W. Va.—Oct. 9, 1 p. m. Grading, curbing and paving Bridge street; also constructing a lateral sewer in an alley. eCrtified check, $500. L. A. Pollock, commissioner of streets; A. B. Maupin, city engineer.

CONTRACTS AWARDED.

Rockford, Ill.—Constructing the Auburn street sewer, to E. R. Harding, $38,000.

St. Charles, Ill.—Constructing several sewers, to Dearborn & Jackson, Cedar Rapids, Ia., $100,000.

Detroit, Mich.—Constructing several sewers, to Carpenter & Anderson, Grand Rapids, Mich., $150,000.

Albert Lea, Minn.—Constructing a sewer on several streets, to Illstrup & Olsen, $24,-052.

Enderlin, N. D.—Constructing a sewer system, to William Robertson and L. K. Van Alstine, Grand Forks, N. D., $30,000.

Providence, R. I.—Constructing sewers in Washington Park district, to Frederick E. Shaw, $29,034.

Seattle, Wash.—Constructing the Brooklyn avenue sewer, to the International Dredging Co., $43,588.

CONTEMPLATED WORK.

Russellville, Ark.—Plans for a sewer, to cost $28,000, have been completed.

Haywood, Cal.—A $62,000 bond issue for sewer construction has been voted. F. Griffith, city secretary.

Hermet, Cal.—A $44,000 bond issue for a sewer system and disposal plant has been voted. Frank Lathrop, Higgins Bldg., city engineer.

Plant City, Fla.—A $25,000 bond issue for sewer improvement has been voted.

Morris, Ill.—The city will construct a sewer system at an estimated cost of $51,374.

St. Charles, Ill.—The construction of a sanitary sewer system complete is contemplated. G. N. Lamb, city engineer.

Duluth, Minn.—The construction of a sanitary sewer, with four booster pumps, to cost about $21,500, is contemplated. John Wilson, city engineer.

Kermett, Mo.—A $75,000 bond issue for water works and sewers has been voted.

Madison, Neb.—A $16,000 bond issue for sewer construction has been voted. F. J. Dauken, city clerk.

Albuquerque, N. M.—The construction of a storm sewer is contemplated. J. N. Gladding, city engineer.

Beverly, Pa.—The construction of a sewer system, to cost $35,000, is contemplated.

Donora, Pa.—The construction of several public sewers is contemplated. George W. Allen, borough clerk.

Scranton, Pa.—A $15,000 sewage disposal plant is contemplated. Scranton Poor Board.

Sharon, Pa.—A $100,000 sewage disposal plant is contemplated.

Knoxville, Tenn.—A $125,000 bond issue for sewer improvement has been voted.

Cuero, Tex.—A $25,461 bond issue for a sewer system has been voted.

Yoakum, Tex.—A $32,000 bond issue for sewer construction has been voted.

Chase City, Va.—A $20,000 bond issue for sewer improvement has been voted. N. H. Williams, city treasurer.

Petersburg, Va.—A $300,000 bond issue for water works, sewers and other improvements has been voted.

WATER WORKS.

CONTRACTS AWARDED.

South Bend, Ind.—Constructing a 6,000,-000-gallon reservoir, to C. H. DeFrees, $51,676.

Medicine Lodge, Kan.—Constructing a water works plant, to the Kansas Construction Co., $40,000.

Dennison, O.—Constructing a 20-mile water system between New Comerstown and Cambridge, including two reservoirs, a pumping station and a 10,000,000-gallon reservoir, to the American Water Supply Co., Pittsburgh, Pa., $500,000.

Dallas, Tex.—Constructing a water purification plant, to the American Water Softener Co., Philadelphia, Pa., $201,674.67. Plans were prepared by James H. Fuertes, New York City.

Grafton, W. Va.—Constructing improvements to the water works system, to the Enterprise Construction Co., Elkins, W. Va., $86,000.

CONTEMPLATED WORK.

El Centro, Cal.—A $40,00 bond issue for water works improvement has been voted.

Sacramento, Cal.—The installation of new pumps at the water works pumping station, at an estimated cost of $25,000, is contemplated.

Kersey, Col.—The construction of a $10,-000 water works system is contemplated. Marshall E. De Wolfe, town clerk.

Winter Park, Fla.—A $12,000 bond issue for water works improvement has been voted.

Pooler, Ga.—A $10,000 bond issue for water works improvements has been voted.

Driggs, Idaho—A $10,00 bond issue for water works installation has been voted.

Freport, Ill.—A $25,00 bond issue for water works improvement has been voted.

Olney, Ill.—A $35,000 bond issue for water main extension has been voted.

Churdan, Ia.—A $15,000 bond issue for water works and electric lighting system has been voted.

Honeoye Falls, N. Y.—A $42,000 bond issue for water works improvement has been voted.

Tonkawa, Okla.—A $20,000 bond issue for the construction of a water works system has been voted.

Lima, O.—A $100,000 bond issue for water works construction has been voted.

Henrietta, Tex.—An $18,00 bond issue for water works improvement has been voted.

Sherman, Tex.—A $10,000 bond issue for water main extension has been voted.

Chase City, Va.—A $25,000 bond issue for water works improvement has been voted. N. H. Williams, city treasurer.

Petersburg, Va.—A $300,000 bond issue for water works, sewers and other improvements has been voted.

Farmington, Wash.—The installation of a $10,000 water works system is contemplated.

Tacoma, Wash.—The construction of a water main on several streets is contemplated. Homer H. Edwards, city clerk.

Fond du Lac, Wis.—A $25,000 bond issue for water works improvement has been voted.

Encampment, Wyo.—A $30,000 bond issue for a water works system has been voted.

Rawlins, Wyo.—A $30,000 bond issue for water works improvement has been voted. C. W. Morgan, mayor.

Shoshone, Wyo.—A $12,000 bond issue for water works improvement has been voted. Theo. Becker, mayor.

BRIDGES.

BIDS REQUESTED.

Stockton, Cal.—Oct. 8, 10 a. m. Constructing the Garwood bridge. Eugene D. Graham, clerk.

Bluffton, Ind.—Oct. 8, 10 a. m. Repairing the bridge over the Wabash river. Board of county commissioners.

Sante Fe, N. M.—Oct. 8, 12 m. Constructing a bridge at the Orroyo Atascoso near Galtsteo, N. M. Certified check, 10 per cent. Jose Ortiz Y Pino, chairman; M. O. Ortiz, clerk, Sante Fe county commissioners.

Cleveland, O.—Oct. 23, 11 a. m. Constructing a steel bridge. John F. Goldenbogen, clerk commissioners of Cuyahoga county.

Lorain, O.—Oct. 14, 1 p. m. Constructing new abuttments to the Reis bridge on Marks road. T. L. Gibson, county surveyor.

Huntsville, Tex.—Nov. 11. Constructing two bridges, 50 and 75-ft. spans. A. T. Randolph, county clerk.

CONTRACTS AWARDED.

Birmingham, Ala.—Constructing a bridge over Mulberry creek, to the Virginia Bridge Co., $20,000.

Little Rock, Ark.—Constructing the Little River bridge, to the Vincennes Bridge Co., Vincennes, Ind., $12,185.

Pine Bluff, Ark.—Constructing the Free bridge across the Arkansas river, to the Roemheld Construction Co., Chicago, Ill., $605,000.

Sac City, Ia.—Constructing a bridge over Coon river on Main street, to the Clinton Bridge Iron Co., $11,800.

Pittsburgh, Pa.—The following bridge contracts have been awarded: Repairing the Seventh street bridge ,to Pittsburgh Construction Co., $44,000; repairing the Thirtieth street bridge, to the same, $27,000.

Clintonville, Wis.—Constructing the Main street bridge, to the Worden Allen Co., Milwaukee, $8,000.

CONTEMPLATED WORK.

Washington, D. C.—Plans for a $275,000 bridge across Rock creek at Q street have been completed. T. C. J. Bailey, engineer of bridges of the District.

Macon, Ga.—The construction of a bridge, to cost $20,000, is contemplated. County commissioners.

Dayton, O.—A $15,000 bond issue for bridge construction has been voted.

Pittsburgh, Pa.—Construction of a $500,000 bridge is contemplated. Bureau of construction.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Oakland, Cal.—Plans have been completed for a $60,000 incinerator.

Tampa, Fla.—The city will purchase a street sweeper, sprinkler and some garbage carriers. D. B. McKay, mayor.

STREET LIGHTING.

CONTEMPLATED WORK.

Churdan, Ia.—A $15,000 bond issue for water works and an electric lighting system has been voted.

New London, Ia.—A $2,000 bond issue for an electric light plant has been voted.

Mt. Clemens, Mich.—The construction of an ornamental lighting system or "White Way" is contemplated.

Frederickstown, Mo.—A $12,000 bond issue for a municipal electric light plant has been voted.

Ephrata, Pa.—A $10,000 bond issue for electric light improvement has been voted.

FIRE APPARATUS.

CONTEMPLATED WORK.

Tampa, Fla.—The city will purchase a combination hose and chemical car in thirty days. The purchase of another car is contemplated. D. B. McKay, mayor.

Sherman, Tex.—A $12,000 bond issue for the fire department has been voted.

Milwaukee, Wis.—Will ask for about 1,000 ft. of hose for motor fire truck. Director of public service.

MUNICIPAL ENGINEERING

The World's Leading Municipal Publication.

DALLAS CONCRETE VIADUCT AND ORNAMENTAL LAMPS.

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CHARACTERISTIC STREET

IT is generally conceded that there is no public improvement of which the benefits are more evident and far-reaching than the installation of ornamental or decorative street lighting. Radical changes in the types of illuminants used for lighting public highways are taking place and are likely to continue for some time. Almost every city in the country has removed the old-fashioned arcs on at least two or three of the most important streets and has installed the more attractive and more efficient types of lighting. It is estimated that no less than five hundred cities have now adopted the "low lighting" system. While the majority of these new installations seem to be centered in Ohio, Indiana, Illinois and Michigan, a great many cities of the progressive West and South have "white ways" to illuminate prominent thoroughfares that have heretofore been in semi-darkness.

When first introduced, the ornamental system was looked upon as an expensive luxury that would probably be used only for small installations put in privately by individuals, or for the exterior lighting of public buildings. The idea that this form of outdoor lighting would be adopted generally to light the entire business sections of many cities was not appreciated at that time. The first installations were costly. The use of heavy cast iron posts and expensive underground conduit construction made the system almost prohibitive. However, the introduction of standards of lighter design and the perfection of a well-insulated, lead-covered, steel-taped cable for underground use without conduit has brought the cost of ornamental lighting within the reach of any community.

Interesting Ball Globe Installations

A great deal of local interest is often aroused in working up a new street light-

Much of the information and a number of photographs contained in this article were furnished by Alan Bright, Pittsburgh, Pa.

ing system. It is only natural that every city should try to make its posts suggest local manufacture or embody some particular feature that is characteristic of the locality. A very unusual and unique installation is that in Bloomington, Ind. This city has erected 120 posts that are cut from native limestone. The posts are inexpensive and handsome, and represent one of the chief industries of the city. The system not only attracts local trade for the merchants on the main streets and pleases the public in general of that city, but furnishes an excellent advertisement for the city itself.

St. Paul, Minn., has a fine installation of ornamental lights. The posts are of attractive design, and support five lights, one erect and four pendant Alba ball globes, with tungsten lamps. There are about 300 of these in the downtown section. But St. Paul is not satisfied with "letting well enough alone," for a permanent installation of festoon lighting is provided for special occasions, holidays, etc. The festoons extend from a central circle of lamps, by a series of loops to the posts on either side of the street. The circle is especially intended for displaying an emblem or device suggestive of any special festivity for which the illumination may be provided.

Another interesting example of unusual ornamental lighting may be seen in Riverside, Cal. The top of the post resembles the Greek letter "Pi" standing upright on a plain cross-arm. From the center of the top and from either extremity of the cross-arm are suspended tungsten lamps, inclosed in shades that are designed to resemble in shape the old mission bells of the city.

There is hardly a traveler that has not at some time had his attention called to the beautiful lighting of the Michigan boulevard in Chicago. This system was put in some time ago, and is an excellent example of the amount of advertising a city may derive from a well-lighted highway. Each ornamental standard supports

ORNAMENTAL LIGHTING.
Night View of Ball Globe Lighting on Michigan Ave., Chicago.

six 60-watt tungsten lamps inclosed in ball globes. At intervals single light standards equipped with red globes are placed in the center of the boulevard to act as "channel markers" for all traffic.

One of the most prominent of recent installations is the new system of lighting the famous board walk in Atlantic City, N. J. This well-known promenade was formerly lighted with arc lamps on tall standards and festoons of incandescent lamps. The festoons did little to actually illuminate the board walk, and gave it a temporary, undignified appearance. Not only the business and hotel men of Atlantic City, but many of the regular visitors urged the adoption of a modern system of lighting. The city officials who were familiar with the success of the cluster system in other cities and appreciated its advantages, only awaited public support. Ornamental standards of rather unique design were adopted. Each post supports four 60-watt lamps and one 100-watt lamp inclosed in Alba ball globes. The top globe is raised some distance above the four pendant globes—an arrangement unlike that in any other city. There are 302 standards, spaced at 65 feet apart. The new system covers a distance of two miles—from the million-dollar pier, at the lower end of the busy part of Atlantic City, to the inlet.

ORNAMENTAL LIGHTING.
Adaption of Globe to Location of Police and Fire Alarm Boxes.

Three-wire 110-220-volt alternating current is used. The switch control boxes are located at alternate street intersections, so that each switch turns on and off two blocks of standards, one in either direction. The standards cost approximately $90 each. The "under the board walk" distribution system cost approximately $50 per standard. This cost is considerably higher than would be expected, as one would suppose that a system where no underground construction is necessary would cost appreciably less than one where the distributing wires are placed beneath expensive pavements in steel and lead-protected, insulated cable costing 25 cents per foot or more. However, the extreme atmospheric conditions at Atlantic City have caused the distribution system to compare in cost to that of underground systems in other cities.

Residential Ornamental Lighting

Ornamental street lighting is generally confined to business streets or to boulevards and parks, where plenty of traffic warrants the installation of elaborate concrete or metal standards and expensive underground construction. In residence districts where streets are comparatively little used, old types of arc, incandescent and oil lamps are frequently seen. Quite often attempts have been made to devise some sort of ornamental unit for use in rural districts, but in most cases the excessive cost will not warrant an installation. However, in Toronto, Ontario, the residents of Charles street have adopted a system of lighting that is not only attractive and efficient, but very inexpensive. On light wooden poles set inside the sidewalks are mounted cast iron lantern-like brackets holding an 8x8-inch cylinder of glass that incloses a 150-watt tungsten lamp. The system produces an illumination quite ample for residential streets, with all the novel and decorative effects of an ornamental system. Some of the Pacific coast cities have adopted this system for lighting streets in rural districts.

ORNAMENTAL LIGHTING.
Luminous Arc Lights in Baltimore, Md.

Special Features of Ornamental Lighting

One of the many advantages of the ornamental system of street lighting is its adaptability for service in police and fire alarm systems. Formerly it was the custom in many cities to paint the telegraph pole nearest the fire alarm box red, so that in case of fire one could easily locate the alarm box. For the same purpose the police patrol boxes were painted green. This scheme serves its purpose in daylight, but after nightfall the location of the alarm boxes is no longer visible. What is needed is a system that will indicate instantly the exact location of the alarm box, both at night and in the daytime. As a means to accomplish this result some cities have inclosed the top light of the ornamental street lighting standard nearest the alarm box in a globe, upon which a 6-inch colored band has been burned. On this band may appear suitable lettering. The letters show white thru the colored band. Some cities make use of a colored band on the top globe on street lighting standards to mark railroad crossings.

ORNAMENTAL LIGHTING.
Day View of Grand River Avenue, Detroit, Showing Four Light Standards Closely Placed on a Narrow Street.

In Fort Worth, Tex., "fire alarm" and "police alarm" globes are used on the street lighting standards. In connection with the "police alarm" posts the city has an elaborate system of signaling. Any police officer on duty may be summoned by flashing any particular signal light in his locality. At the present time several of the Pacific coast cities are considering the adoption of signal systems in connection with their ornamental lighting systems.

The Downward Reflecting Type of Unit

Similar in many respects to the ball globe type of street lighting unit, and yet differing in some principles, is the downward reflecting type of light. It is also an incandescent system, with the lamps and shades supported by ornamental poles, and consists of two, three, four or five lamps, as desired. It is the contention of the manufacturers of this system that the light should not be distributed evenly in all directions, but that it is needed at the street surface, and the maximum light should therefore be directed downward at an angle of 60 degrees, with little light thrown to the side or upward. This effect is secured by using a glass reflector so designed as to direct downward within a given angle the light, the source of which is a tungsten lamp suspended at the center of the reflector. Surrounding the reflector and rigidly attached to it is an opalescent envelope or shade of attractive design. A great deal of attention is directed in this system toward securing the proper spacing of units, so that the circle of light from each unit overlaps at the surface of the street with the circles from the units on each side. In this way

ORNAMENTAL LIGHTING.
Night View of Grand River Avenue, Detroit, Showing Effect of Gas Lighting.

the shadows midway between the standards are avoided.

Newark, O., was the first to adopt this style of street lighting, while Cincinnati, O., after a campaign conducted by the Business Men's Club of that city, was the next to install the downward reflecting unit. A full description of the Cincinnati system was given in the March, 1911, MUNICIPAL ENGINEERING.

The Gas White Way

The most notable installation of a gas "White Way" lighting system is that of Detroit, Mich. This installation was made possible by the organization of a "boosters" club known as the Grand River Avenue Improvement Association, working in conjunction with the Detroit Board of Commerce. Grand River avenue is not a main street, and the system is unique in this respect, as it is somewhat unusual, because it was constructed and maintained by property owners along the street, the tenants paying the maintenance. It is stated that the system has transformed the avenue of secondary importance to one of the progressive shopping districts of the city.

The installation consists of forty-two four-light posts set opposite each other, eight posts to the block of 200 feet, and eighty two-light posts staggered at an average of 125 feet apart on each side of the street. All the lamps are of the three-mantle inverted gas arc design, with side supply, giving from 300 to 350 candle power per standard.

The lamps are fitted with alabaster glassware and hung 12 feet from the street. This gives a very brilliant illumination without dazzle or glare, and helps materially to light the show windows all along the street.

The lights are turned on at dusk and turned off at midnight. The total amount for gas and maintenance is divided by the total business frontage, each merchant paying his proportionate share for a foot front per month. These posts are not on special meters or on special mains, but the consumption of each post is estimated and gas is sold at the rate of 55 cents per thousand feet.

The installation necessitated a change in the gas company's franchise to allow them to sell gas without meter measurement.

Ornamental Arc Lights

The new system of public ornamental electric street lighting recently installed in the city of Baltimore, Md., is the first installation of its kind in the country with the single exception of a small installation in the city of New Haven, Conn., and is the largest single initial installation of public ornamental street lighting in the country, comprising some 600 posts, covering approximately sixty blocks in the business district of the city. The promotion of this system was accomplished by Geo. A. Miller.

The lamp employed is the new ornamental inverted luminous arc recently perfected by the General Electric Company. Its chief characteristics are its power of distributing a large volume of light evenly in all directions and the facility with which it may be employed in ornamental street lighting—that is, inverted on the top of an ornamental street lighting standard or post.

One of the peculiarities of the ornamental inverted luminous arc is that owing to the design of the globe it has the faculty of absorbing all shadows, including the shadow of the post itself upon which the lamp is erected, and at the same time diffuses an even volume in all directions.

Owing to the construction of the globe, every inch of which is designed with a view of achieving its particular purpose. it requires a post or lighting standard of a special design to conform to the contour of the globe. In the case of Baltimore, the Municipal Art Commission designed the standard used in that city.

ORNAMENTAL LIGHTING.
Day View, Atlantic City Boardwalk.

The city of Baltimore, in contract with the local electric company, namely, the Consolidated Gas, Electric Light and Power Company, agreed to light and maintain the system after it was installed. The money to defray the cost of the street equipment complete was subscribed by the merchants and property owners along the streets thus lighted at so much per front foot each, according to his individual frontage, and the local electric company agreed, in addition, to furnish its present underground equipment and such other new copper cable as was necessary and make service connections to the new posts that were put in, as in most cases these new lighting standards were placed in the holes made vacant by the removal of the old system.

ORNAMENTAL LIGHTING.
Night View, Atlantic City Boardwalk.

ORNAMENTAL LIGHTING.
Two Light Standard With Gas Lamps.

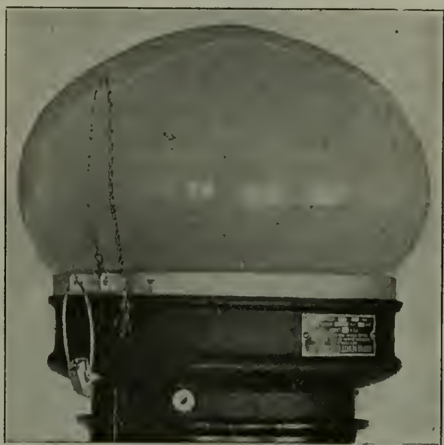
ORNAMENTAL LIGHTING.
Night Transformation Effected by Gas System Shown in the Above Photograph.

Quartz Tube Mercury Arcs

The latest development in street lighting, and one which is yet in the early experimental stage, is the quartz tube mercury arc lamp. There has recently been installed on Randolph street, in Chicago, a trial installation, including six of these lamps. The primary object of this system was to attract trade, and it converts a dark street devoid of sign lights into a well-lighted avenue illuminated to a degree several times brighter than moonlight.

white, with only a trace of the characteristic bluish green mercury flame color. The candle power with clean glass globes and reflectors is stated to average 2,500, with a maximum of 4,900.

The lamps burn from dusk till 1 a. m. Averaging seven hours per night, at 3 cents per kilowatt hour, the total energy and maintenance cost per year is only 69 cents per curb foot. Practically the only maintenance required is periodical cleaning of the outer globes, which is a much simpler operation than with flaming arc



ORNAMENTAL LIGHTING.
The Quartz Tube Mercury Arc.

The units are placed high on the side of the buildings, and in such a way that there is a uniformity of light over the whole street. The six lamps are suspended from boom hangers at a distance of 8 feet from the buildings and 40 feet above the sidewalk. In the 320-foot block the six units are ranged three on each side of the street, the opposite rows being staggered, thus making the distance between lamps on the same side of the street 128 feet, or one lamp for each 64 feet of street. As the width between building lines is 80 feet and each lamp clears the buildings by 8 feet, the distance between the two rows of lamps is 64 feet, thus placing a lamp at two diagonal corners of each 64-foot square.

The color from the lamps approaches

lamps. Renewals of the quartz tubes will probably be much fewer than allowed for; they can be broken only by very careless handling. There is no trimming needed, as there is with all kinds of carbon or flame arcs. To facilitate inspection and cleaning the lamp suspension gear can be swung toward the most available window, thus making the lamp readily accessible. For the entire equipment of lamps, mountings and wiring, the investment ccst was $1 per curb foot.

Conclusion

Among the existing examples of ornamental street lighting a number of different schemes have been used for securing the lights.

Contracts have been made with so many

parties and combinations of parties that it has been impractical to standardize on any particular scheme. Local conditions almost entirely determine the contracting parties, depending to a great extent on who agitates the movement for better street lighting.

Ordinarily it is unsatisfactory for the lighting company to have a contract with the property owners, merchants or tenants, individually. This form of contract involves so many people that there is a constant source of annoyance when anyone becomes dissatisfied, moves away or for other reasons desires to be released from his portion of the expense.

Perhaps one of the best methods of handling this class of business is that of securing contract with the city for the service, and if necessary a special tax assessment on property holders and merchants in the affected district, to pay the cost of the installation.

The proper illumination of streets is a matter of great importance, both by reason of the benefits obtained from good lighting and because of the expenditure involved in securing such lighting. Sufficient professional skill, proportionate, of course, to the importance of the system to be installed, should therefore be engaged to secure the adequacy of type of unit chosen. The types above mentioned all possess points of merit and are presented as examples of good practice in street lighting. All of them are worthy of investigation by cities which are confronted by the problem of securing "more light."

ORNAMENTAL LIGHTING.
Brilliant Effect of Quartz Tube Mercury Arcs on Randolph Street, Chicago.

CHICAGO'S RECREATION CENTERS.

By Sidney A. Teller, Director West Park No. 2, Chicago.

SIDNEY A. TELLER.

CHICAGO has one of the best systems of recreation centers in the world. As regards equipment, cost of buildings, and maintenance, it leads all cities. This wonderful system of recreation centers has developed with the newer ideals of social recreation and the benefits to any large city from adequate play space for the children of that city and sufficient recreation opportunities for the working boys and girls, and the adult population.

Our ideas of recreation have been greatly changed. A few years ago we thought that mere play space was sufficient for children in a large city . From that we have developed the idea—first, of a properly equipped space; secondly, of a properly supervised space, and now, that same space to be so equipped and supervised as to be used all year around. This has been made possible thru the field house idea.

Chicago has seventeen social, civic, neighborhood centers under the control of three park systems: West Chicago Park, South Park and Lincoln Park systems. These seventeen small parks represent an investment for buildings and grounds of about six million dollars and the annual cost of maintenance of about five hundred thousand dollars.

The South Park system in 1903, under Henry G. Foreman, conceived the field house idea, and in 1905 the first grounds and buildings were opened to the public. This wonderful outlay of money for the public use was made possible thru the issuing of bonds which were first submitted to the vote of the people of the community. Considering the city in general, the location of these park sites has been with reference to other existing playground and recreation places, congestion of population, death rate from tuberculosis, existing schools and general social conditions. In several instances the park commissioners have purchased land sites occupied by houses and in addition to building a park have removed detrimental tenements. For example, the site of West Park No. 2, less than three acres of land, was covered with fifty -seven houses. These houses showed a population of 597 people. In such an environment people do not have opportunities for play, recreation, cleanliness and social intercourse. The children have to play on the streets, the houses are contaminated with tuberculosis and disease. Tuberculosis and infant mortality are high and many boys and girls find their way to the Juvenile Court. Our existing large parks at the time these smaller parks were built, were too far away from the neighborhood of our working classes to allow the people of these localities to make use of them. Also, our foreign people living in the slum and congested neighborhoods can not afford to go to the parks. The new idea is to bring the parks to the people.

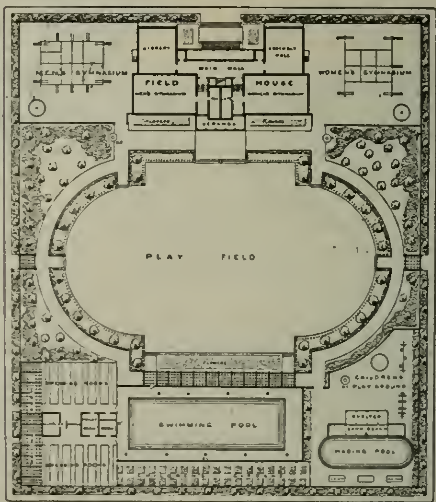
Small children will not go more than a quarter of a mile to a playground. They cannot get out of their radius of consciousness, get into foreign places, cross dangerous street car tracks—so for a playground the radius of efficiency is at most, one-half a mile. Therefore, the first thought in these play spaces was to provide adequate facilities for the play of little children. The play spaces have been well equipped with sand courts, well sheltered, clean wading pools, swings, teeter-totters, merry-go-rounds and slides. Children under ten years of age are allowed to play together and in addition to the play opportunities offered, usually a supervisor with knowledge of children's games and activities is in charge.

After boys and girls reach the age of ten years they have different impulses in their natures and to meet this, separate play spaces are set aside; first, for the boys over ten years of age, and second, for the girls over ten years of age. The girls' outdoor gymnasium is equipped with a frame which supports incline ladders, climbing poles, climbing ropes, traveling rings, flying rings, etc. There are also lawn swings and giant strides apart from the frame and usually enough space for the girls to engage in gymnasium games. In charge is a woman's gymnasium instructor, who teaches the correct use of the apparatus and also teaches new games and folk dancing.

On the boys' side we also have the outdoor gymnasium frame with similar equipment. In addition, however, are bucks, horses, chinning bars, parallel bars, and track and field apparatus. Adjacent to the boys' gymnasium frame is a large play field, which has a running track, pits for high and broad jumping and shot putting. Here the boys can play playground ball, fly kites and have all kinds of athletic contests.

The programs for outdoor work for the different play spaces include lots of free play, group contests, athletic and field events between different parks and a play festival or a closing exhibition for summer. On these play fields band concerts are given at the different small parks and sometimes arrangements are made for outdoor stereopticon pictures. In fact, all of the opportunities, outside of boating, of the large parks are offered at these neighborhood centers. The fundamental idea of providing sufficient and adequate recreation in these play spaces for the children, is well taken care of.

Chicago has twenty-seven miles of lake front and only three bathing beaches. Where shall the mass of these two millions of people get a bath or a swim? Over half of Chicago's population lives in districts which do not afford proper bathing facilities in the home. One of the greatest things that our recreation system has, is the wonderful equipment of outdoor swimming pools and sufficient indoor shower baths. The swimming pools are in operation from approximately June 1st to October 1st. Suits, towels, soap, lockers, shower baths, life guard supervision, are all given absolutely free to anyone and all using these facilities. The pools are kept up to the highest



CHICAGO RECREATION GROUNDS.
Plan of West Park No. 3, Chicago.

standard of sanitation and a strict enforcement of the rule that each person using the swimming pool must first take a warm shower bath and be inspected, prevents contamination of the pool. The indoor shower baths run all the year around. One park in which, under the old conditions, there was only one bath tub in the block, in the year 1911, had a total attendance at the swimming pool which exceeded 155,000, and the shower baths were used 149,000 times. In 1911, the total number of shower baths given in the small parks of Chicago exceeded

CHICAGO RECREATION CENTERS.
Typical View of Congested Section of West Side, Chicago. Old Building Being Torn Down by West Chicago Park Commissioners.

one and a half million and during the one hundred days which the swimming pools were open, the total attendance nearly reached the million mark. All this was done without one cent of direct cost to the public and without a drowning due to carelessness of the supervisors. People often say how much these recreation centers cost Chicago. The important thing is not how much they cost Chicago, but how much Chicago is saving thru these wonderful small parks. The "social profits" from swimming pools and shower baths alone, with the benefits derived in health, cleanliness, and revitalization, exceed the total cost of maintenance of the entire parks.

With the old idea of park centers these spaces were used only in the summer time and when the weather allowed. The

CHICAGO RECREATION CENTERS.
Showing Children at Play on Site Formerly Devoted to Unsanitary Crowded Tenements, Shown Above.

Chicago system, with their field houses, makes use of these play spaces the whole year around. With the field houses, which are equipped with separate gymnasiums for boys and men, girls and women; with sufficient locker and shower room facilities; large assembly halls; club rooms and library; and in some parks, a lunch counter; the same opportunities for recreation and social betterment that are given outdoors in the summer time can be carried on indoors in the winter time. The day the outdoor gymnasiums are closed in the fall of the year, the indoor gymnasiums are opened and the regular class work is carried on from 3:30 in the afternoon until 9:30 at night. School children are taken care of until supper time, and after supper the working boys and girls and the adult population have full use of the parks. The instructors, of course, are employed the year around and in addition to the regular class work there are inter-park contests in basketball and indoor baseball.

Different neighborhood clubs, societies and organizations hold their meetings in the club rooms of these recreation centers. The purposes of these clubs are varied, covering athletic, social, pleasure, literary, musical, first aid to the injured, charitable, public speaking, school alumni, military, civic, etc. Week after week these clubs meet and practice the principles of democracy, then thru interclub debate on such subjects as direct election of senators, employers' liabilities. woman's suffrage, these young men and women are training themselves for the citizenships of tomorrow. These field houses are the people's club houses. They are the schools of democracy evolving a better citizenship which must be. The influence of these park centers does not stop in the immediate neighborhoods of the park. The swimming pools and the club rooms will draw for the distance of a mile. The civic and social benefit cannot be estimated. The big lesson that Chicago is learning is that park centers should be planned in advance of the growing population; that a city should have sufficient recreation centers set aside for the people of each district; that prevention is better than cure.

Again we emphasize it is not how much these recreation centers cost Chicago, but how much Chicago gains; how much social profit we are giving over to the community. The total attendance in these park centers last year exceeded eight millions, in all their uses, indoor and outdoor gymnasiums, shower baths and swimming pools, assembly halls and club rooms; library and lunch rooms. These small parks stand for applied justice, neighborliness, democracy, good citizenship and brotherhood. They give health instead of disease, wholesome normal boyhood and girlhood instead of delinquency. In terms of better citizenship their value cannot be estimated.

CHICAGO RECREATION CENTERS.
Bird's Eye View, West Park No. 3, Chicago.

METHODS OF WATER PURIFICATION.

THE most common reason given for purifying a public water supply is that it may be made safe from a hygienic standpoint, but frequently it is necessary to proceed with the purification only so far as to remove mud, vegetable stain, grosser microscopic organisms, soluble and suspended iron, and in some districts to remove excessive hardness or abnormal corrosive action on pipes and offensive odors and tastes.

Physical Purification of Water

The application of methods sufficient to produce the sort of purification needed for the usual purposes of a water supply not dangerously contaminated were described in a recent paper by George W. Fuller, consulting engineer, which shows that it is frequently sufficient and certainly economical to produce the partial purification.

Sedimentation

Plain sedimentation is the simplest method, but at best it removes but 50 to 75 per cent. of the total suspended matter, the total removed depending upon the state of the river and differing materially with different waters. Prior to 1897 most water supplies drawn from the larger rivers were purified by sedimentation only, and were much of the time far from satisfactory.

A few cities extended the period of sedimentation by means of large reservoirs, some of them large enough to give an opportunity to select the flow of water in the stream which had the least sediment to get rid of. This method is expensive and only available in special cases.

Coagulation

Hastening the process of sedimentation and increasing its efficiency by addition of a sulphate of alumina or sulphate of iron, thus producing a coagulation of the impurities and greater size and weight for the particles to settle out was an early addition to plain sedimentation. This produces a fairly clear effluent if properly applied and the dose of chemical is carefully adjusted to the quantity and quality of turbidity, and is in use in many places, notably cities located on the Missouri river, which is noted for the quantity and extremely fine division of the particles of sediment, making it practically impossible to clarify the water by plain sedimentation.

It is difficult to correct errors in dosing the water, after the treated water has reached the settling basins, so that there are sometimes periods of muddy water for consumers, even with the most careful chemical supervision of the treatment of the water.

Sterilization with hypochlorite of lime is now sometimes added to the coagulation, at times when there is any reason to suspect danger from organic pollution, and, when filtration is considered too expensive, the coagulation method, with the addition of the sterilization process when necessary, produces very reasonably satisfactory results.

Sand Filtration

Plain sand filtration was first advised for a city in this country in 1867, and put in operation on two small Hudson river city supplies some five years or so later. This process was expensive, and its use did not spread until the experiments of the Massachusetts State Board of Health demonstrated the practical necessity of this process or its equivalent to remove danger from bacterial contamination.

Sand filters, when operated at two to six million gallons filtered per acre per day, are efficient in removing fairly coarse silt in large amounts. Fine particles pass through, however, even at rates of filtration as low as 2.65 million gallons per acre per day. This is true very generally of American river waters, even after prolonged sedimentation.

If, however, the coagulation process is used and the water is allowed to stand for 18 to 24 hours before flowing on the sand beds, the coagulated sediment does not reach the sand to clog the filter, unless mistakes are made or the rate of flow of water through the purification plant is pushed too fast. In such cases there will be serious clogging of the filters and frequent cleaning will be necessary. The filter beds and their cleaning, the large sedimentation basins and the coagulation plant all add to the cost of the effluent, so that this combination is seldom, if ever, used, unless bacterial purification is at the same time demanded.

In a few cases pre-filtration is resorted to in addition to sedimentation, thus relieving the fine-sand filters of a portion of their work. If there is not too much fine sediment in the water, this process is satisfactory. At Steelton, and to some extent at Pittsburg, Pa., coagulation is added to th pre-filtration or straining device.

Mechanical Filtration

Where coagulants are required, mechanical filtration seems to be the most efficient method of clarifying water. This process is simply sand filtration at a rate of two to three gallons per square foot per minute, with special provision for washing the filter quickly and easily, once or twice a day, by reversing the flow for five minutes at a time, using mechanical methods or compressed air for agitating the sand during washing and wasting the wash water into the sewer. This process produces water of excellent appearance, and when the apparatus is operated with that end in view, produces excellent results in the removal of bacteria. There are some three hundred such plants in operation, and this process is the one of most general application.

Color Removal

Ordinary sand filters remove one-fourth to one-third of the color from the water passing through them. Sulphate of alumina as a coagulant aids in color removal, but sulphate of iron and lime do not. Overdose of sulphate of alumina to a part of the water treated, offset by following underdosing, seems to increase the amount of color removed at Springfield, Mass. Intermittent filtration aids in decolorization by the aeration of the filter bed between applications of water.

Removal of Tastes and Odors

Microscopic growths in reservoirs give much trouble at times. They may be removed by filtration, with danger of frequent clogging of the filter, and by treatment with hypochlorite of lime or sulphate of copper, the latter being in more general use, because, apparently, more efficacious. Use of hypochlorite before filtering is advantageous.

Most removable tastes and odors, and all of those which are seasonal in their appearance, are due either to organisms which grow in the water or to the decomposition of the dead organisms and to the absorption of the products of decomposition by the water. This decomposition having removed the oxygen from the water, aeration is a great help in removing the products thereof or in carrying the decomposition through by the aid of the oxygen to an unobjectionable stage.

Water Softening

Removal of iron in water by aeration and sedimentation removes taste, odor, stain and some hardness, with more or less completeness, filtration completing the removal of objectionable amounts.

There is but one municipal water softening plant, though there are many in use by railroads and manufacturing plants, the process being most easily applied on the comparatively small scale of the latter plants. Grand Rapids, Mich., is to have a softening plant in connection with its new filters. Lime or lime and soda are used and temporary hardness can be reduced some 50 per cent.

Corrosion of Pipes

The removal of mechanical impurities by filtration, or coagulation and sedimentation, or all three, takes out the material which protects pipes from direct contact with the water flowing through them, and at the same time the processes, especially that of coagulation, seem to produce an amount of carbonic acid sufficient to corrode mains and service pipes. This effect is noticeable where soft waters are treated, but the hard waters are able by deposits on the pipes to give them protection. This is a problem which has been studied in connection with the new Catskill water supply for New York, and it is believed that the amount of carbonic acid can be closely regulated by the addition of proper amounts of lime and soda at the proper places.

With so many methods and combinations of methods for partial purification of water, nearly all of which can be made efficient for bacterial purification, also by greater care in manipulation or by some changes in program, any city can find the one which will be most economical and inexpensive under its conditions, by having a careful expert study made of the necessities of its case.

Bacterial Purification of Water

The processes for rendering water supplies hygienically pure are described by Allen Hazen, consulting engineer, New York, in a recent paper.

Filtration

Emphasis is laid upon the skillful operation of filters as the essential to bacterial purification. The general design of both slow sand and mechanical filters is not materially different from that for simple physical purification, but there must be material differences in operation. Mistakes in treatment can be corrected only with the utmost difficulty, and may readily prove fatal.

Germicidal Treatment

It has become quite common to treat the effluents from the best of filters, especially at critical seasons of pollution, with hypochlorite of lime as a germicide, the effect of very small amounts in clear water, with little organic matter therein, being almost marvelous.

Ozone has been tried, but is expensive and difficult of application.

Sulphate of copper has been used as a germicide before filtering, as well as for killing algae, but many superintendents object to it because of its poisonous nature, although the metallic residue is removed in the process of filtration.

Ultra-violet rays have been suggested as one means of destroying bacteria, but no plants have been installed in this country.

Chlorine gas is used in Cleveland, O.

Hypochlorite of Lime

Hypochlorite of lime must be applied in comparatively large quantities to raw water, for it must produce enough oxygen for the oxidation of the organic and other matter in the water, as well as for the destruction of the bacteria. The quantity must fluctuate with the conditions of the water. The amount necessary for treating the filtered water is less and is more uniform, and it is possible to remove with uniformity and certainty 99.9 per cent. or more of the bacterial life.

THE ADVANCE IN STREET LIGHTING.

IT seems a great advance from the condition of twenty years ago, when a city of 175,000 population made itself satisfied with an open arc lamp on every alternate street corner, to the present time when lamp standards are placed even as close as 50 feet apart and the total illumination spread over the block is perhaps 2,000 candle power as compared with the former rated 2,000 candle power but actual 800 to 1,200 candle power concentrated at one end of the block. Measured by results, the difference is still greater than these figures would indicate.

Much of this advance is due to the advance in the art of electric lighting and in the ability to supply better illumination at lower cost per unit and the rate of development of street lighting has followed the development of the necessary apparatus very closely. Therefore much of the modern system of what is termed ornamental lighting has developed within the last three years, and practically all of it within five years.

Electric Railway Equipment Co. Standard.

Who Pays?

The city's pocket-book is proverbially empty, and the installation of the new systems is somewhat expensive, As a result, the cost of the installation has been borne very largely by the owners or the tenants of the adjoining property. When the current is paid for by the owners or tenants the lighting company pays the cost of installation, the rates being sufficient to cover the initial cost as well as the annual cost of maintenance and operation.

In many instances the city has been induced after a short time to assume the cost of operation, and in almost every municipal electric light plant this is the case.

If the marvelous stories of increase in rental value of property on account of the new lights are true, the city can well afford to do this, because the increase in taxable valuation will take care of a large part of the cost. That they are true is indicated by the willingness with which merchants assume the expense of the installations and of the operation, if necessary. They were not slow in recognizing the business value of more light and better distributed light and more ornamental fixtures and arrangement of the light units. It was only necessary to point to the early successes to remove all doubts wherever there was business enough or prospect of new business enough to warrant the expense.

Where Installed

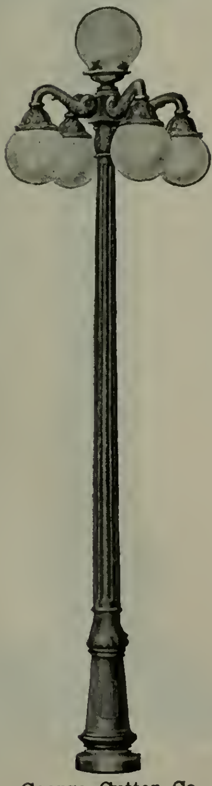
And it is not only the streets devoted to retail trade in the larger cities which adopt the ornamental lighting systems. Indeed, some of them have been a little slow in adopting and extending the uniform systems. On such streets the advertising signs of the merchants have run largely to the electric lighted varieties, and they have been slow to change to the uniform system and drop their individual trade-catchers, and have been equally slow to add the uniform system to what they are already paying for.

In the largest cities, therefore, the de-

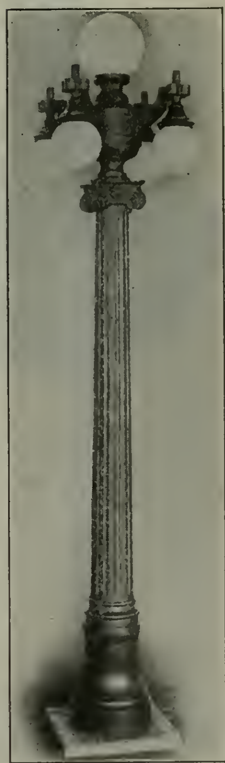
Pettyjohn Co.
Standard.

Flour City
Ornamental Iron Works
Standard.

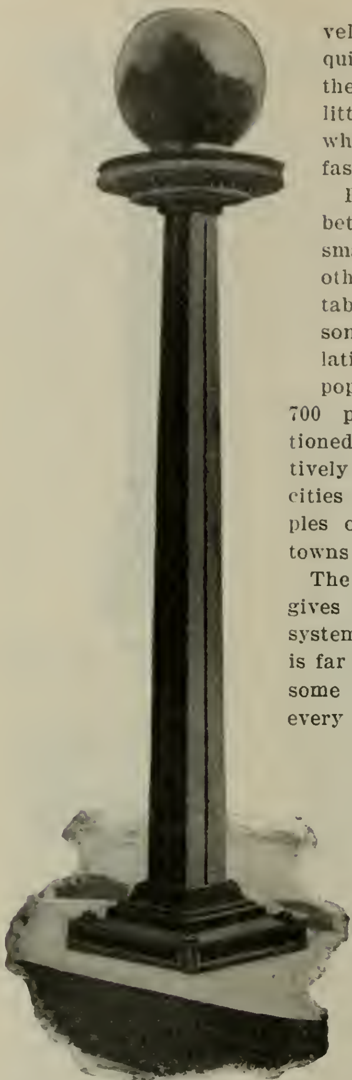
Wallace Machine and
Foundry Company
Standard.



George Cutter Co.
Standard.



Western Gas Construction Company
Standard

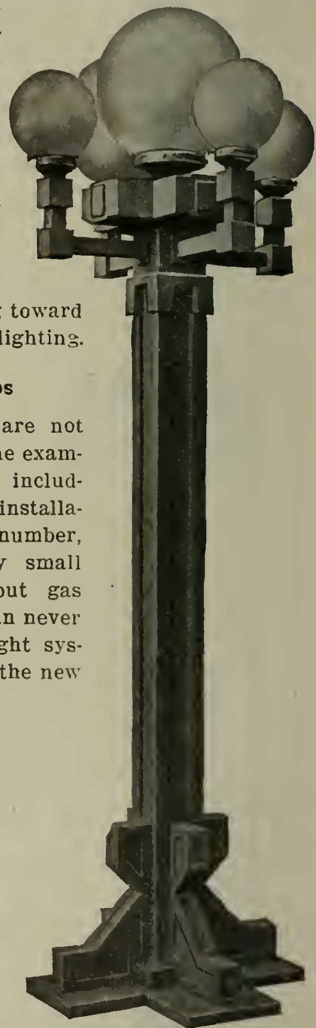


velopment of uniform ornamental lighting has been quite largely in outlying districts, which correspond to the smaller cities and towns, or to the retail streets a little off the main arteries, the latter only coming in when the shifting of trade forces them to follow the fashion.

But the smaller cities and towns have taken up the better lighting with avidity and the systems, though small, are none the less valuable in proportion to the other factors in the case. Many of the names in the table will be recognized as those of small cities and some of them are small towns. Pine Bluff, 25,000 population; Fond du Lac, 18,000 population; Pasco, 4,000 population; Rochelle, Ill., 2,500 population; Nashwauk, 700 population, may be mentioned as examples of comparatively large installations for cities of their size, or as examples of the enterprise of small towns in this respect.

The table is representative and gives examples of nearly all the systems which are in use, but it is far from complete. Indeed, in some sections of the country every city with an electric light plant has done something toward developing ornamental lighting.

Dearborn Foundry Co. Standard.



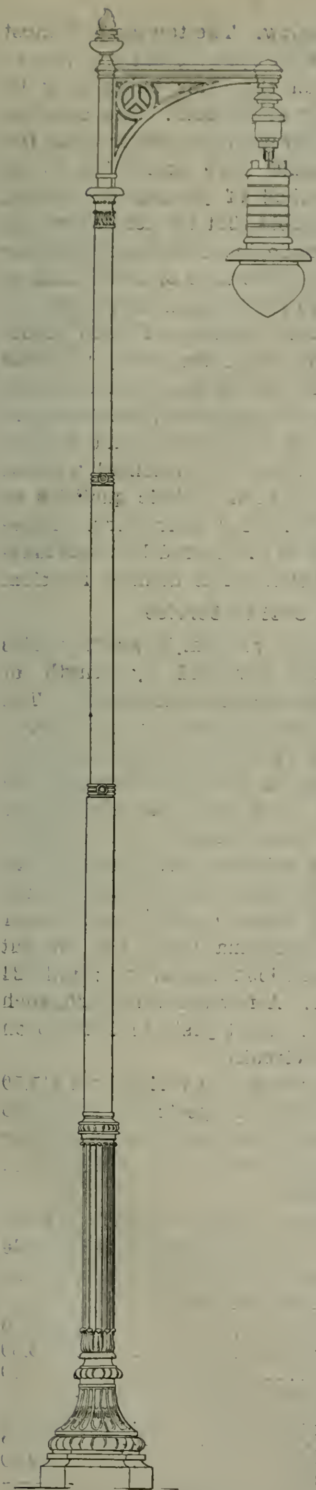
Dearborn Foundry Co. Standard.

Electric and Gas Lamps

That the lights used are not all electric is shown by the examples of gas-mantle lamps included in the table. These installations are increasing in number, but there are so many small cities and towns without gas plants that the number can never equal that of electric light systems. The dependence of the new systems on the new electric lights is shown by the fact that all the systems use either the magnetite or the tungsten lamps or some near kin to them. For this reason the table gives only A for the magnetite or flaming arc lights, I for the tungsten or other metallic filament incandescent lights and G for the incandescent gas mantle lamps, as the abbreviations for kind of light in use.

Standards

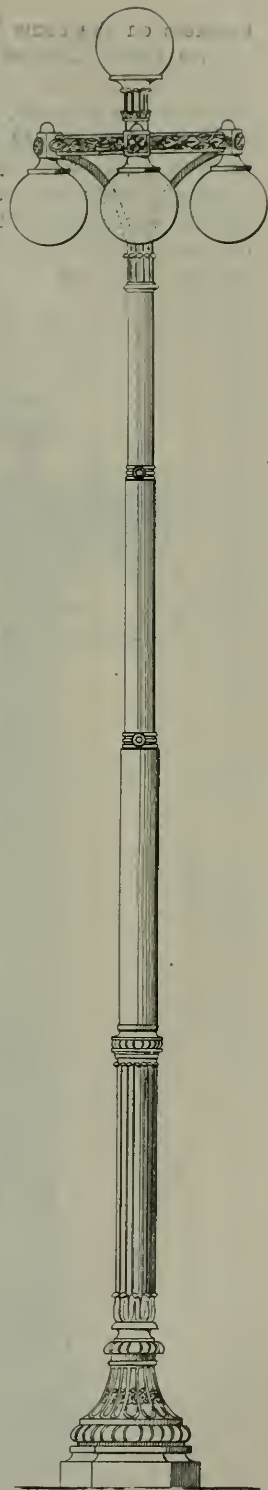
The standards carrying the lights are usually of wrought or cast iron, or steel, or concrete and in one case of cut stone. They are often made by local foundries. Concrete posts are made at home. A few firms



Arc Light Standard Designed for the City of Chicago.

make standards for the general market, such as the Waterloo Malleable Iron Works, Waterloo, Iowa; The Pettyjohn Co., 582 N. Sixth street, Terre Haute, Ind.; St. Louis Car Wheel Co., Bank of Commerce Bldg., St. Louis, Mo.; Smyser-Royer Co., Eighteenth and Filbert streets, Philadelphia, Pa.; Paxton & Vierling Iron Works, S. Seventeenth and U. P. R. R., Omaha, Neb.; Ornamental Lighting Pole Co., 1628 Whitehall Bldg., New York, N. Y.; J. L. Mott Iron Works, Fifth avenue and Seventeenth street, New York, N. Y.; Flour City Ornamental Iron Works, 2637 Twenty-seventh avenue S., Minneapolis, Minn.; The Morris Iron Co., Frederick, Md.; Western Gas Construction Co., Fort Wayne, Ind.; Kerr-Murray Mfg. Co., Fort Wayne, Ind.; Giddings & Lewis Mfg. Co., Fond du Lac, Wis.; Davenport Machine & Foundry Co., 1618-44 W. Fourth street, Davenport, Iowa; Dearborn Foundry Co., 1525 Dearborn street, Chicago, Ill.; The Casey-Hedges Co., Chattanooga, Tenn.; Union Metal Mfg. Co., Clifton avenue, Canton Ohio; The Electric Railway Equipment Co., 2905 Cormany street, Cincinnati, Ohio.

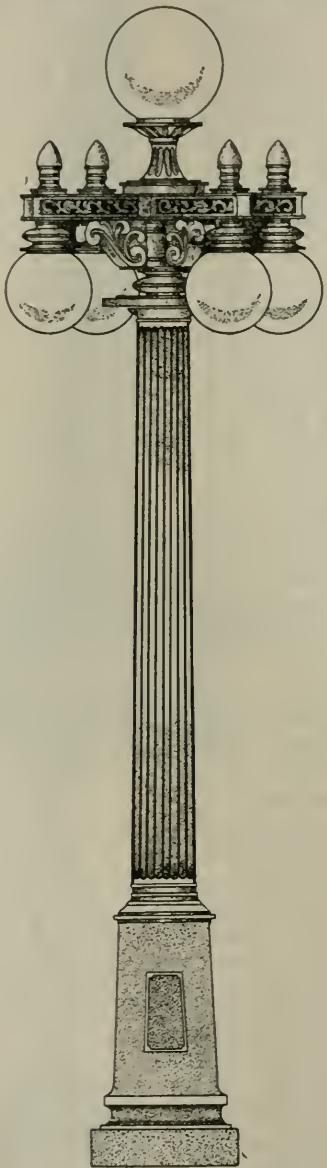
The number of lights on each post varies from one to five. One arc light is sufficient, but in a few cases, particularly along parks and boulevards where the business features of the system are not so prominent, one incandescent light is used. In some of the smaller towns and less important streets, and in residence districts in the cities in which the development has extended so far, three-light standards are used. They are probably 60-watt lamps or one 60-watt on top and two 40-watt lamps below. The five-light standard is the most popular. It may carry any desired combination of lamps. A very common design carries one lamp on top and four lamps on



Ornamental Standard Designed for the City of Chicago.

brackets on the same level below. One or two installations carry the lamps in triangles, one at the apex, two just below and two again below, the globes being reduced in size going down for convenience in design and handling.

All the lamps may be of the same rating, 60, 80 or 100 watts, but it is more common to use a 60 or 100-watt lamp for the top lamp and two or four 40 or 60-watt lamps below. The top lamp in most designs must be upright, but the two or four lamps on the arms below may be either upright or pendant. The distribution of light over the street or upon the buildings should have something to do with the method of placing the lamps, but it is probable that in most cases the decision is made in accordance with the preference of some man or committee as to appearance rather than as to use.



St. Louis Car Wheel Co. Standard

With so many sources of lamp standards there are, of course, many varieties of design. A few of these varieties are shown in the accompanying drawings and photographs as samples of what designs are in use. They are presented without comment as to their artistic qualities or their adaptability for their work. These matters must be considered by those making the selection for a definite location.

Cost of Service

The distance of lamps apart varies largely, being governed by length of blocks and length of pocket-books. The popular cost, as indicated by the table, is from \$1.20 to \$2 per front foot. But few cost less than the former and several run well over \$2. The cost of installation per post is also quite variable. Some of the figures in the table are very low, such as \$30 for Walla Walla; \$4, evidently for the concrete post alone, or \$18 when copper capped, in Oklahoma City; \$35 for cut stone posts in Bloomington, Ind.; and \$24 in Pine Bluff. A few are very high, such as \$330 for arc light posts in Chicago on underground circuit.

Cost of operation also varies from \$17.50 per year for 3-light posts in Peoria to \$135 for 5-light posts in Chicago; and per front foot from 68¾ cents in Duluth to \$1.92 in Atlanta.

The cost of a 5-light standard is itemized as follows, due allowances to be made for cost of installation, kind of materials, etc., for each special case:

Post	\$35.00
Lamp and sockets	5.60
Globes	4.00
Erecting, wiring post and concrete base	8.00
Supply cable, 65 feet	16.25
Laying cable	39.00
Total cost per post	\$107.85

STATISTICS OF INSTALLATIONS OF ORNAMENTAL STREET LIGHTING SYSTEMS.

City.	No. posts.	Lights per post.	Kind of light.	Distance apart. feet.	Lamp rating.	Cost of Installation.	Cost of Operation per year.	Installation paid by	Operation paid by
Anniston, Ala..	...	5	I	45	80w	....	$1.65F	Company	Merchants
Pine Bluff, Ark.	150	4	I	*	....	$24P	$36P	Merchants	Merchants
L. Angeles, Cal.	...	5	I	100	....	125P	....	Merchants	
Riverside, Cal..	...	3	I	100	260wt	....	....		
Pueblo, Col.....	40	1	G	77	3M				
Pueblo, Col....	...	1	A	135	....	65P	72P	Company	Merchants
N. H'ven, Conn.	75	1	A	87S	520wt	3F	1.60F	Owners &	Merchants
Atlanta, Ga....	239	..	I	70	....	2.25	1.92F 45P	Owner & tenant	City
Bloomingt'n, Ill.	28	5	I	60	....	$2600T	....	Merchants	City
Chicago, Ill., Co.	2800	1, 4, 5	I	40-125	1-250w 4-60w 5-60w	....	91 to 135P	Company	Tenant
Chicago, City†	10000	1	A, I	150S	100w	330PAU 110PAO 80PI	49.88A 21.13I		Municipal
Mendota, Ill....	...	3	I	80	60w	12.50‡	48P	Merchants	City
Pana, Ill.......	...	..	I	....	....	50P	....	Merchants	City
Peoria, Ill., bus.	275	5	I	70	....	2F	40P	City	City
Peoria, Ill., res.	135	1	I	100	....	.50F	17.50P	City	City
Rochelle, Ill....	150	3	I	66	60w	....	....	Municipal plant	
Bloom'gt'n, Ind.	120	..	I	....	....	35P	12P	City	City
Ft. Wayne, Ind., bus.....	190	5	I	90	....	1.85F	21P		City
Ft. Wayne, Ind., res.....	60	1	I						
Gary, Ind.......	260	..	I	50	....	1.25F	.71F	Owners	City
Indpls., Ind....	2 mi.	5	I	84	100w	....	1.05F	Company	Tenants
Mishawaka, Ind.	...	5, 3	I	50	5 posts at each street corner				
Burlington, Ia..	...	..	I	....	....	1.67F	....		
Ced'r Rapids, Ia	...	..	I	68S	340wt	100P	70P	Owners	Tenants
Des Moines, Ia.	362	..	I	56	....	1.48F	59.50P	Owners	Tenants
Waterloo, Ia...	181	5	I	90	40, 60w	1.30 to 1.50F	....	City	City
Baltimore, Md..	600	1	A	....	....	....	....	Owne. & Mer.	City
Cambridge, Mass.	36	2	I	150S	200c.p.	....	82.44P	Company	**City
Waltham, Mass.	13	2	G	50	....	48P	72P	Company	Merchants
Duluth, Minn...	90	5	I	92	100w	120P 1.50F	55P .69F	Ten. & Own.	City
Fariba'lt, Minn.	106	..	..	....	....	....	....	Company	
Min'p'lis, Minn..	600	5	I	100	80c.p.	145P 2F	78P 1.25F	Owners	City
Nashwauk, Minn.	22	3	I	95	60, 40w	....	....		
St. Paul, Minn..	350	5	I	75	60, 100w	....	....		
Virginia, Minn..	...	..	I	80	100w	....	....		
St. Louis, Mo..	...	3	A	60	4 amp.				
Billings, Mont..	199	..	..	95	320wt	80P	60P		Tenants
Omaha Neb....	...	..	..	....	....	....	....	Owners	
Newark, N. J..	123	1	A	100	....	....	....		
Manchester, N. H........	32	1	G	....	5M	....	....	Merchants	Merchants
Auburn, N. Y..	135	..	..	85	....	2F	90P	Company	City
Buffalo, N. Y..	83	..	..	70	....	1.20F	37.50P	Own. & Ten.	City
Niagara Falls, N. Y........	...	..	..	....	....	....	....	Owners	
Poughkeepsie, N. Y........	1.5 mi.	4	I	90	100w	....	††48P	City	City
Syracuse, N. Y..	116	..	I	50	....	1.65F	90P	Mer.	Mer. & City

STATISTICS OF INSTALLATIONS OF ORNAMENTAL STREET LIGHTING SYSTEMS.

City.	No. posts.	Lights per post.	Kind of light.	Distance apart, feet.	Lamp rating.	Cost of Installation.	Cost of Operation per year.	Installation paid by	Operation paid by
Fargo, N. D.	...	5	I	....	....	....	....	Owners	City
Grand Forks, N. D.	136	5*	I	SB‡‡	....	$30.000		Municipal plant	
Cincinnati, O.	...	5	I	....	....	....	....	Own & City	
Cleveland, O.	...	3	G	....	2M	also has electric lamps			
Columbus, O.	900	5	replacing former arches						
Dayton, O.	305	..	..	80	....	2.22F	68.50P	Company	City
Hamilton, O.	...	5	..	....	60w	80P	12F	Owners	Tenants
Toledo, O.	2500	2	A	80	4 amp.	....	....		
Warren, O.	86	3, 5	I	65-80	80, 60, 40	....	....	City	City
Portland, Ore.	...	3	G	....	....	....	....		
Phila., Pa.	663	2	A	130	....	....	120.20P		City
Pittsburg, Pa.	...	1	A	90	....	....	....		
Wilkes-Barre, Pa.	120	5	I	75	100w	160P	200P	Company	Owner
Houston, Tex.	105	1	A	....	....	....	70P		City
Ogden, Utah	...	5	I	132	60, 100w	....	....		
Norfolk, Va.	50 arches	10	I	100	70c.p.	....	....		
Pasco, Wash.	42	3	I	130	60w	100P	30P	City	City
Seattle, Wash., bus.	1116	5	I	85-100	50w			Municipal plant	
Seattle, Wash., res.	515	3, 1	I	150-200	50w			Municipal plant	
Walla Walla, Wash.	126	3	I	....	60w	30P	30-35P		
Fond du Lac, Wis.	58	5	I	....	60, 100w	....	....	Merchants	City
Cheyenne, Wyo.	112	5	I	....	....	75P	45P	Merchants	Merchants
Vancouver, B.C.	...	5	I	89-134	75c.p.	2.10 to 2.65F	....	Owners	City
Hamilton, Ont.	8 blks.	5	I	45	100, 125w	....	1.50F	Company	Merchants
Saskatoon, Sask.	500	5	I	100	....	.90F	48P	Owners	City

* 11 per block.

† This is an estimate of the system now being installed by the municipal lighting plant of Chicago under the recent contract made with the Chicago Drainage Canal Commissioners for current.

‡ Average cost per tenant for adjoining stores.

** Merchants pay $500.

†† $14.90 of the $48 cost per year at Poughkeepsie is for maintenance, the rest for current.

‡‡ In Grand Forks there are eight posts for each block of street.

I—Incandescent, tungsten, Mazda or like variety of lamp.

A—Magnetite, flaming arc or like variety of lamp.

G—Gas lamp.

w—Watt.

wt—Total wattage of lamps on post.

M—Gas mantles in lamp.

c.p.—Candle power.

P—Cost per post in column of cost of installation; cost per post per year in column of cost of operation.

F—Cost per front foot in column of cost of installation; cost per front foot per year in column of cost of operation.

T—Total cost of installation.

U—Underground, O—Overhead wiring.

S—Staggered, i. e., the lamps on one side of the street are set half way between the lamps on the other side of the street. In cities not marked S the lamps are opposite each other on the street.

The cost of current in cents per kilowatt-hour is estimated as follows: In Anniston, Ala., 7 cents; Chicago, minimum, 5.7 cents; Ft. Wayne, 3.5 cents; Indianapolis, 1.8; Waterloo, Ia., 5.5; Wilkes-Barre, 5.2; Houston, Tex., 4.24 cents; Pueblo, Col., 3.5 cents.

Vitrified Sectional Sewers.

An interesting piece of sewer construction is now being carried on in Indianapolis by the Julius Keller Construction Company, of that city. The material being used on the job is a recently invented type of vitrified hollow tile manufactured in sections, which are laid in cement mortar to form the sewer.

Attempts have been made to manufacture a hollow tile sectional unit which could be used on sewer work, but in every previous case difficulty has been encountered in securing an end connection between the blocks, as the ends were made flush and could not be laid to a tight joint.

The blocks being used on this job have remedied this fundamental defect. The lengthwise joints are effected by generous male and female, dovetailed joints which are filled with cement mortar when the blocks are laid. The end joint is made in the old style of "ship lap" joint, formed by an overlapping end compensated by an under-cut end on the next block. The photograph illustrates the formation of the ends of the blocks and also the system of webs which strengthen and make practical this form of joint. The blocks were invented by an engineer of the American Sewer Pipe Company.

The sewer now under construction by the Keller Company is the second in which they have used this type of block. The first was a three-foot section, and the present job is a four-foot six-inch sewer, and the contractors state that they are entirely satisfied with the blocks on both jobs.

The present work is being carried on thru about 13.5 feet of gravel, which is stiff enough to require but little sheeting. The trench is 6 feet 6 inches wide. At present a small force of only ten men is carrying on all the work at the rate of about 40 or 50 feet a day, including the digging, sheeting, laying the sewer and back filling.

The trench is excavated by shovels, the bottom being shaped as nearly as possible to the outer radius of the sewer. The three center rows of blocks are then laid to a template, which in this case consists of a semi-circular board, much the same as is used in brick sewer work, tacked to the sheeting at grade. The lower openings beneath the web in these blocks provide under drainage, so that though about nine inches of water is encountered on this job, the contractors find it necessary only to pump previous to laying the three bottom rows. The blocks themselves then take care of the drainage, so that the remainder of the section is built with a perfectly dry sewer for the construction of the arch.

The successive rows up to the spring line of the arch are then laid, a 2-to-1 cement mortar being used in the dovetailed joints on the sides of the blocks, and the ends being thoroughly filled with mortar. The side joints are so constructed that they fit easily into place so that only the center or key blocks need to be slipped into place from the end. Each successive row from the bottom is thoroughly back tamped, so that when the spring line is reached a firm foundation is provided against the side thrust of the arch. This feature, states Julius Keller, Jr., a member of the firm, is the secret of the successful use of the sectional blocks, and by care in this detail the sewer is made a monolithic circular section, capable of supporting at once such fill as may be made over it. On the three-foot sewer before mentioned the back fill was made by dumping cars from an overhead trestle operated with the trenching machine at the head of the ditch. In some cases the car was dumped from the height of 20 feet or more upon the newly finished section, without any injury to the shell of the sewer.

After the completion of the invert to spring line a specially designed form of centering is used to support the arch. This centering is a collapsible form, supported entirely upon the bottom row of blocks. It is 8 feet in length and has a system of longitudinal ribs held in place by radial braces or spokes at both ends.

VITRIFIED SECTIONAL SEWER.
Showing Details of Invert and Arch and Illustrating End Joints.

These braces are connected to a central axle controlled by a crank arm. The turning of this axle turns the braces and draws them inward, bringing the longitudinal ribs or segments with them. This allows the form to clear the arch of the sewer at all points, so that it may be drawn forward and reset. Striking the center and resetting it occupies only about 30 seconds.

The arch blocks are then placed, supported by the centering, until the key blocks are in place, when the material being excavated from the trench ahead is at once thrown back on the newly completed section. The centering is moved forward as soon as the invert is completed.

Mr. Keller is enthusiastic concerning the ease and rapidity with which the blocks are handled. They are two feet in length, ten inches wide and six inches thick, so are not unhandy to lift and place. They weigh only about 30 pounds, so are easily handled into the trench. One man easily supplies them on the bank and lowers them into the trench as needed. For this purpose an iron rod about two feet long and hooked at the end is used. The rod is slipped thru the block and hooked and lowered by means of a rope to the men in the trench, who take the block from the hook and use it immediately, so that there is no rehandling of the blocks by the man who lays them.

The laying is done by two men, unskilled labor at 30 cents an hour being adequate while in the case of brick sewers two brickmasons at 75 cents an hour with two or three helpers are required. One man supplies mortar for laying the blocks and has enough time left to give half of his attention to other work, digging or wheeling the blocks to the bank if required.

The construction is much quicker than in the case of a brick sewer. On this job an 8-foot section is laid per hour, including both invert and arch. A comparison of labor and materials used on brick and on the sectional block sewer shows that on an 8-foot section the cost of constructing a brick sewer is roughly $7, while the sectional sewer costs but $3.50.

The sewer being constructed by the Julius Keller Company at the present time is costing about 25 cents per running foot for labor and materials, exclusive of the first cost of the block and of the trenching.

That portion of the sewer which is completed is an excellent piece of work. The joints are well made, tight and smooth, and the interior of the sewer, by reason of the glaze on the blocks, approaches the smoothness of vitrified tile. The sectional block, while yet very new, has made good.

Gasoline Motor Haul.

By Frank C. Perkins, Buffalo, N. Y.

IN Germany and England coal is now handled very largely by gasoline motor power by means of single trucks and road trains by tractors.

The accompanying cut shows the method of operation of the English gasoline road trains, carrying 15 tons of coal from the Michael Coal Depot, Rangoon.

This gasoline motor system of road transport is said to be the most efficient type of road traction yet evolved, its working capacity being enormous. It is held that its superiority over other forms of traction lies in the fact that it is light, speedy and economical to run. There is no hauling or trailing as with ordinary form of traction engines and trailers, but each vehicle comprising a train is mechanically propelled, although there is only one motor to a train.

The power consists of an 80-horse-power six-cylinder motor of the Daimler sleeve valve type, and all trains are geared so that they can with ease negotiate, fully loaded, any hill up to a gradient of 1 in 5, 20 per cent., or can traverse comparatively soft grounds and tracks. The wagons each have a useful carrying capacity of five tons, and the usual train will carry a total useful load of twenty tons. The speed of such a train on a fairly hard and level road is up to ten miles per hour, but if more vehicles are added, the speed will then be decreased somewhat.

The six-cylinder 80-horse-power gasoline engine was designed for cooling in hot climates with a large steel radiator of the honeycomb type, fitted with a powerful fan to draw air through the tubes, and a water tank is also provided. The drive from the engine is taken through an efficient cone clutch of large size to the gear box, a flexible coupling being interposed to prevent any undue wear on the bearings. It may be stated that the gear box provides four speeds forward and one reverse, and it is so designed that the main driving shaft is continued right through to the rear of the locomotor. Immediately at the rear end of the gear box this shaft is fitted with a worm wheel, which drives a cross-shaft. At the ends of this cross-shaft chain sprockets are provided, and these convey the drive to the rear wheels by means of high-quality roller chains. In this way part of the power from the engine is utilized in driving the locomotor, and the remainder is conveyed through the long driving shaft, mentioned above, to the followers, driving each of these in turn.

It is of interest to note that between the locomotor and the first follower, and also between each pair of followers, two very large universal joints are interposed,

The fact that the steering of the locomotor is communicated to each of the followers is almost as important as the mechanical propulsion of each vehicle, with the result that all the vehicles traverse a single path, forward or backwards, however tortuous this may be. It is explained by noting that on the locomotor a hand-wheel in front of the driver operates the usual worm and sector gearing of large dimensions, and the motion of the sector arm is transmitted to the front wheels by means of suitable links. These front or steering wheels are centrally pivoted, as are all steering wheels in the followers, and this insures easy action as well as preventing road shocks from being transmitted to the driver's arms and various parts of the mechanism throughout.

GASOLINE MOTOR HAUL.
Road Train Hauling Coal in Rangoon.

so that the drive may be transmitted when the train is proceeding around a sharp bend. In the center of each follower there is a gear box, in which a pair of worm wheels transmit the drive to a cross-shaft, just as in the locomotor. From here a pair of chains leads to the central wheels of the follower, which is thus driven at the same speed as the locomotor. The main driving shaft continues through to the next follower, and in this way the power of the engine is divided among all the vehicles in the train. It should be mentioned that in each driving wheel a spring drive mechanism is fitted, so that any inequalities in the drive are effectively absorbed, and, in addition, ease of starting is insured.

Each follower has a self-contained steering mechanism which is automatically controlled by the vehicle immediately preceding it. The direction of the whole train is determined by the driver of the locomotor when going ahead, and, when going backwards, by a man at the last wagon. The steering is simple and ef-

This gasoline road train has high average speed, with economy of power, due to using a light motor, a large percentage of the necessary adhesive weight being furnished by the paying load. A four-ton motor is sufficient to work a train having a tare weight of eighteen tons and carrying a useful load of twenty tons—that is, a gross moving weight of thirty-eight tons.

Chicago Mounted Police.

By Capt. Charles C. Healey, Chicago, Ill.

THE Chicago mounted police squad is not patterned after any other police body. It is a distinctively original, semi-military body, and is constantly being taught new ideas of police duty through means of a weekly school of instruction held at the headquarters, the instructors being Lieutenant Denman and myself. At this school all matters pertaining to street traffic are discussed and any officer with a new idea is free to advance same.

CAPTAIN CHARLES C. HEALY.

At present the mounted squadron consists of 145 men. The average age of mounted officers is 28 years and the maximum weight is 175 pounds. The squadron is divided into two platoons of officers, who work six hours daily and cover every street in the business district, as well as all the important outlying streets. It is estimated that each horse covers about fifteen miles daily, which gives a total travel of 1,875 miles a day. Our discipline is as strict as any military organization in the country.

Mounted officers have definite instructions as to their duty in case of fire, as, for instance, the four officers riding posts on streets adjacent to the fire immediately close traffic from all directions and move all vehicles in proximity to the fire in order to give the fire department all possible room. After this duty has been performed, two of the four officers take posts as near as possible to the burning building and regulate pedestrians.

The late Chief Horan, of the fire department, stated that two mounted officers could do the work of ten men on foot. This is not meant to detract in any way from the efficiency of foot officers, but merely goes to show the advantages of the mounted officer who understands his duty.

When one stops to consider the great volume of traffic passing through our loop district and the smallness of the district, it can readily be seen what Chicago's traffic squad has to deal with. Very few realize that we have the busiest vehicle traffic bridge in the world. It had long been thought that the London bridge had more vehicle traffic in one day than any bridge in this country or Europe, but a census taken in the year of 1911 shows that the Rush street bridge, Chicago, has 16 per cent. more vehicle traffic than London bridge, and that in one hour less time. The actual figures are:

	Vehicles.
London bridge, in 12 hours.........	7,578
Rush street bridge in 11 hours......	8,972

On this same day 10,372 pedestrians passed over the Rush street bridge.

In the days of congestion, before the mounted squadron was anything more than a dream, street railway managers claim that it took a street car eighteen minutes to make the run between Twelfth street and Lake. Now the run can be made in six minutes, a saving of twelve minutes, which is due to street traffic regulations.

Accidents to human life have decreased 60 per cent. since the regulation of street traffic in the loop district. This is important when one considers the tremendous amount of traffic policemen must handle daily in the loop district. There are 3,100 street cars in the loop daily. In 1911 the Chicago City Railways Company carried 358,227,032 persons, 33 1-3 per cent. of whom passed through the loop district.

Although there is no camp life, the mounted policeman is under strict military discipline. He must salute his superior officer and conduct himself at all times as if he were in the cavalry service of the army. On dress parades and in the daily routine the bugle sounds in the quarters and the commands are given by bugle. The first bugle call is sounded five minutes before roll call at 7 o'clock in the morning. Five minutes from the first call the bugle sounds for the assembly. All men must form in line in ranks in the squad room. After the roll call the lieutenant or the captain instructs the men as to the orders from the chief's headquarters and assigns them to their posts. The men are changed once a month from morning to afternoon duty.

Great service has been rendered by the mounted police in strikes, and we would cite in particular the strike of the garment workers in 1911. These people, mostly foreigners, attempted, time and again, to parade through the business district, forming east of the river. They were invariably held in check by two or four mounted officers, and very few arrests were made. This is due to the training received by mounted officers, whose first instructions are to act the gentleman at all times, while being firm in enforcing respect for the law.

A new rule is soon to be taken up whereby pedestrians will have to obey the same rules at crossings as vehicles; it is expected thereby to prevent a great many accidents which now occur owing to a pedestrian crossing the street in one direction while vehicles are going in the other.

THE CHICAGO MOUNTED POLICE.
"Color Bearers" of Chicago Mounted Police.

EDITORIAL COMMENT

ORNAMENTAL STREET LIGHTING

The extension of ornamental lighting of city streets has carried it into small cities to a surprising extent. The total amount in a city is often very small, and it sometimes reminds one of an illumination for a campaign parade, but its effect is nevertheless distinctly favorable.

The earlier methods made use of festoons of electric lights across sidewalks and along curb lines. They are comparatively inexpensive, but do not lend themselves to variety or beauty of design.

A few cities employed arches across the streets, lined with incandescent lamps, the idea having been used first by St. Louis for permanent illumination with gas lights, before the days of electric lights. This permanent use was a development from the temporary illuminated arches used at the great fall parade in that city. When the lights were colored the effects were quite indescribable.

Few of these arch systems were satisfactory, for even if they made a fairly good show at night, they were very unsightly by day, especially after the weather had rusted the metal and soiled every part that would hold soot and dust. Ornamental standards were then devised, and they proved so satisfactory that their use has spread very rapidly. How rapidly they have extended through the streets is suggested by some statistics from the larger cities given elsewhere.

When the city owns the lighting plant it is quite common for the merchants to install the lamp standards, the city then assuming charge of them and keeping them lighted. In some cases of private ownership the companies install the standards and abutting storekeepers or property owners pay for the light at fixed prices.

While some of these systems are somewhat garish and theatrical in design and appearance, they have the same effect upon a town that new improvements always do, emphasized by the fact that the bright light shows up defects very prominently. Unless the town has spent all its money upon the lights, it can hardly fail to improve its sidewalks, curbs, gutters and pavements to correspond, and, most important of all, it moves toward keeping streets and sidewalks clean. No commentary on a town is so uncomplimentary as a dirty street shown up by the brightness of an ornamental lighting system.

THE SOLUTION OF THE STREET RAILWAY PROBLEM

It is refreshing to read a report upon a street railway problem which is so broad and so inclusive and so fair to the interests upon both sides as that upon the present transportation conditions in San Francisco and vicinity, which has just been issued by Bion J. Arnold, the consulting engineer, who has been studying the problem.

The report is notable for two or three things in particular that are of special application in San Francisco, which has been noted for its corporation baiting. But there are many cities more or less under the influence of the same disease, and their citizens will be greatly benefitted if they can reach Mr. Arnold's high and unbiased stand and can come to understand with him that the interests of corporation, city, patrons and citizens are common interests.

San Francisco's legislation, both through the legislature in its charter and through its city ordinances, has been such as to hamper the development of its public service utilities under private management, rather than to help, and the actions of city officials under these laws and ordinances has emphasized the differences between them. The consequence has been inadequate facilities, insufficient service, retardation of development of city districts, misinformation as to company's receipts and profits, all of them causing losses to all the parties interested. The company has not been able to interest the capital necessary for developments; the city has suffered from bad streets, track construction, congestion of streets by cars; the patrons have suffered from insufficient, inefficient and interrupted service; the citizens have suffered from the arrested development of the municipality as a whole, and many of them have suffered from the inability to develop new districts, not to speak of those who have been obliged to live in crowded downtown quarters because the car service was inadequate to carry them back and forth from more open and more healthful districts.

Any one who is interested in the wonderful methods of improving the situation as applied to the case of San Francisco, should read Mr. Arnold's report. It is unassailable from any of the ordinary political standpoints, because it is so eminently fair to both sides.

THE VALUE OF GOOD LIGHTING

The average city in America to-day still bears the earmarks of its haphazard start and somewhat uncertain early development. Little intelligent care was exercised in planning it or in training it so that it might grow along the lines of greatest economy and convenience. Little discredit is this fact, however, to our forefathers. The innovations of the street car, the telephone, the water works system, the central lighting or heating stations, were all vague and uncertain dreams when our cities (at least those of the eastern half of the United States) sprang into existence. And yet each new stage of development has demanded certain expensive changes and adjustments on the part of each growing municipality.

Perhaps no problem of the municipality has had more interesting phases of development than the lighting problem, especially that of street lighting. The first street lighting system was installed in London in the seventeenth century for the purpose of diminishing crime. Crudely constructed oil lamps were maintained by the householders. To recount the long list of improvements since that date would make an interesting story, but would have little bearing upon present-day needs. The old gas lamp, the ordinary carbon arc, and the low-powered incandescent (long strides ahead of the initial installation in London) are now rapidly appearing in the discard. Refinements and improvements in each of the above mentioned types have made possible the introduction of the modern ornamental lighting system.

The value of ornamental street lighting can scarcely be exaggerated. The commercial value to the retail merchant is more than sufficient to warrant his bearing a large portion of the expense. The value to the community lies in the greater convenience and comfort afforded, advantages well worth the cost to the taxpayer. And still another important value is what might be termed advertising or publicity value. A city's streets are its show windows. A live and progressive city, like a live merchant, dresses its show windows well. The constantly increasing stream of visitors to the growing city carries abroad impressions, good or bad, by which that city soon becomes characterized. An unsightly or insufficient lighting system is sure to create an impression of arrested development.

A LESSON TO ENGINEERS AND CITY OFFICIALS.

In a paper before the New England Water Works Association, T. Chalkley Hatton, the engineer who designed and supervised the construction of the Austin dam, which partly failed in January, 1910, and finally collapsed in September, 1911, discusses the reasons for the failure and the factors which influenced the design. The technical features brought out are interesting, but the lesson which the paper should teach to every engineer and to every client of engineers is vital. Mr. Hatton, in a very manly fashion, assumes, in our opinion, more than his share of responsibility. His client's insistence upon certain limitations in cost necessitated a modification of the original plans. Mr. Hatton admits that he made a mistake in not refusing to approve the plans as modified, even though they seemed to allow a reasonable factor of safety. He regrets that he was not accorded the privilege of consultation with at least one other capable engineer.

There is no doubt as to Mr. Hatton's ability as an engineer. He holds a record of many great achievements. His mistake was a common and a natural one. Many an engineer would have done as he did under the same circumstances. The great mistake lay with the owner for whom the dam was built. No important piece of engineering work should be built except upon the concurring advice of at least two capable experts, and no client should insist upon reduction of cost to a point below that which is certainly safe.

THE QUESTION DEPARTMENT

Models of Street Construction in Cities

Can you inform me whether any particular city in the United States or any section of a city is regarded as exemplifying the most advanced type of street construction? I intend to include in this phrase the grade and curvature of cartway and footway surfaces, the formation of gutter and curb, and also the adjustment of sewers, water pipe, conduits, etc., and connections with them from street surface and private property.

E. S. M., Philadelphia, Pa.

Various materials have been developed in various cities so that no one excels in all. In the writer's judgment, Washington, D. C., has the model asphalt streets; Cleveland, O., has the best brick streets; Indianapolis, Ind., the best wooden block streets, altho Minneapolis, Minn., is a close second; Rochester, N. Y., the best sandstone block streets; New York, N. Y., the best granite block streets, if their latest constructions are considered; Providence, R. I., possibly the best bitulithic streets; Richmond, Ind., the most uniformly good macadam streets. As regards the details mentioned, the cities which have the closest control over the sidewalks and the making of connections with the pipes and conduits of public utilities, in general have the best designs, Pittsburgh, Pa., has a good set of standards. The cities of Indiana, most of which follow more or less closely the example of Indianapolis, have good details for level streets. Duluth, Minn., adopted a good set of details for construction of streets and sidewalks on side-hills.

Any of our readers who think their cities should be included in this list are invited to state the reasons for adding them and they will be published.

Regulating Passage of Automobiles Across Sidewalks

The question has arisen in this city as to whether there should be any rules made governing motor cars entering a garage from the street. I am referring, of course, to public garages, which are situated on business streets, and not to those of private individuals in residential districts. I would be greatly obliged, therefore, if you could give me any information on this matter. No doubt some of the large cities on the continent have found some method of dealing with the question.

You will agree that there is always a certain amount of danger where motor cars are allowed to cross at will the sidewalks on busy streets, and it is in order to eliminate this that we are asking for the information.

A. J. LATORNELL,
City Engineer, Edmonton, Alberta.

The city of Cincinnati, O., on September 3, 1912, passed an ordinance "to regulate traffic on and the use of public streets and highways by horses and vehicles of all kinds and by pedestrians," which supplements earlier ordinances and covers most completely the regulation of automobile traffic. With reference to the question asked, it says: "No vehicle shall emerge from an alley, stable or garage at a rate of speed faster than a walk, and when emerging from a garage a proper warning shall be given to passing vehicles and pedestrians. No vehicle shall make any turn at a rate of speed exceeding one-half of the maximum rate allowed by law." It is also provided that "No person in control of a vehicle shall back the same without ample warning having been given, and while backing care must be exercised not to injure those in the rear."

There is but one suggestion offered as to improvement of these provisions, viz: to add the word "enter," so that it will read "No vehicle shall enter or emerge from an alley, stable or garage," etc.

Time for Settlement of Clay Fill

We desire to obtain information as to how soon residences may be built on a fill. We are at present engaged in the development of a tract of land, near Baltimore, on which there is considerable grading. The fills in some instances are as much as sixteen or eighteen feet deep. The houses to be built on these fills will be two and a half story brick, concrete or stone residences, the weight of the walls of which will be about 6,000 pounds per lineal foot. The character of the fill is mostly clay. What we desire to know is:

1. How soon buildings of the above character may be constructed on such fills when the fill is made by team and in layers not to exceed 4 ft. and thoroughly compacted by hauling over same?

2. How soon buildings of the above character may be constructed on such fills when the fill is made by means of steam shovel and cars, the only compacting being that which takes place when the dirt is dumped

from the cars and the compression which is made by the loaded cars running over the fill. THE ROLAND PARK COMPANY,
Baltimore, Md.

The character of the material mentioned is so irregular and its rate and completeness of settlement depend so upon the moisture in it that no definite answer can be made to the questions without full control of all details of handling the materials. It is probable that complete solidity could not be guaranteed under any circumstances, tho it can be approximated quite closely under the best of conditions. Settlement of clay in trenches has been known to take place fully five years after filling.

The safest plan would probably be to place piers on the solid earth and carry them up thru the fill and have weight of the houses carried on these piers. They need not be elaborate or large and would be safe against lateral motion or tipping unless there were danger of slipping of the fill down a side-hill, and would probably be less expensive than repairs in a good house which settled unevenly.

Cities Owning Their Public Utilities

Will you please furnish me with a list of the cities of from 5,000 to 20,000 inhabitants who own their utility plants? I would like to know whether they are operated by steam or water power, and also a comparison of results. Any information on this line will be greatly appreciated.
Y., Mayor, ———, Ga.

The "Municipal Year Book" ($3), published in 1902, gives information as to ownership of public utilities. The "Manual of American Water Works" ($3), published in 1897, gives the detailed information requested, so far as water works were concerned at the date it was issued. The "McGraw Electrical Directory," published semi-annually at $10 a year, gives much of the information desired, as regards light and power plants. Brown's "Directory of American Gas Companies," published annually at $5, gives the data regarding gas plants and the electrical departments, in case companies operate both gas and electric light plants.

Form of Council Record of Ordinance Passage

Will you kindly give me the form for the record showing the minutes of the passage of an ordinance under the laws of Iowa, where a general ordinance is passed at a single meeting of the council of an incorporated town in Iowa? L., ———, Iowa.

Will any of our readers inform our correspondent? Such a form does not happen to be within reach of the writer.

Books on Surveying

This city owns a good surveying transit, but no one to use it. I have assisted in considerable such work, but do not feel competent to risk grade work. Can you inform me of best text-book to secure to enable me to use the instrument and run levels, fix grades, etc.? I have sufficient knowledge of mathematics to make all necessary computations. Please advise also where book may be obtained. K., City Attorney, ———, Ill.

Perhaps the simplest explanation of the processes of leveling and establishing grade lines is given in Staley's Gillespie's "Surveying," first volume ($3.50). The explanations are given in this as in other books on surveying for use with the wye-level, but they can be applied to leveling with the transit, except so far as adjusting the level is concerned. The adjustment of the level on the telescope of the transit is very essential to reasonably good work in leveling with the transit. The method of making the adjustment is given in the description of the transit and its adjustments. The adjustment is one not easy to make by one unfamiliar with instrument work.

Any books named which are in print will be sent by Engineering Publishing Company on receipt of list price.

Municipal Building Restrictions

We would like to know, through your valuable magazine, if any city has restrictions in districts as regards the class of residences to be constructed, or location of such restrictions with reference to the street line; if so, how are these restrictions carried out?

I do not, of course, refer to fire restrictions, but rather to restrictions that might be desired in residential sections, in order to make them desirable residential sections and prevent the location of shacks and unsightly buildings and also in some cases to exclude the erection of business places.
A. J. LATORNELL,
City Engineer, Edmonton, Alberta.

The writer knows of no city in the United States having such restrictions, aside from a few more or less successful attempts to limit the height of buildings by ordinance, some of which have failed and some of which are now in force. It is quite probable that any such restrictions as are commonly made in high-class platted property by the owners thereof, as a condition of the purchase, could not be made by the municipality. Indeed, it has sometimes been found that the original restrictions made upon the first purchasers of property are not binding upon subsequent purchasers of the same property under the conditions surrounding their purchase.

Examples of such legislation must be sought in European countries. Probably the editor of *Town Planning*, a quarterly published by the University of Liverpool, England, could give exact information regarding such regulations in England, France and Germany.

Can our readers give any information on this line?

Terms of Electric Light Franchise

This city is about to grant an electric light franchise to a company, and as the matter of getting a proper franchise for the best interests of the city and the patrons of the company rests with myself I am interested in obtaining all the information from the experience of others that I am able to do.

S., City Attorney, ———, Ind.

The franchise for a company furnishing gas, electricity and heat, most of which is quoted in an article on "Franchise for Gas Company," in MUNICIPAL ENGINEERING, vol. xlii, p. 185, is modern and contains some valuable provisions. Reference should be made to that article for the provisions in the sections not quoted below, which are the sections of the franchise referring particularly to electric light:

"Section 1. That the Taylorville Gas and Electric Company, its successors and assigns, is hereby authorized and empowered, and the right, privilege and franchise be and is hereby granted to the said Taylorville Gas and Electric Company, its successors and assigns, to locate, erect, construct, equip and maintain the necessary poles, conduits, wires, cables and other necessary apparatus, appliances and appurtenances requisite and proper for the manufacture and distribution of electricity for the purpose of furnishing light, power and heat to the citizens of the city of Taylorville, and the said city of Taylorville, upon the terms and conditions in this ordinance contained, and subject to such lawful regulations as may hereafter be made by said city by its ordinances from time to time, and subject to the statutes and laws of the State of Illinois now in force or hereafter to be enacted which shall be applicable to the business of the said company and the rights, privileges and franchise by this ordinance granted. Said rights are given in, along, upon, across and over said streets, alleys and public grounds as the same are laid out and established, to-wit: (here follows a list of streets covered by the franchise.)

"Section 4. All poles hereafter erected upon the streets by the Taylorville Gas and Electric Company by virtue of the grants herein shall be as near as practicable of uniform height and size and of first-class material, and shall be smooth shaven and painted with two good coats of paint as soon as placed in position, and the poles of said company now on the streets of said city shall be painted within two years from the passage of this ordinance. And at all times thereafter during the life of this grant such of said poles as are upon or along the streets shall be kept in good condition and shall be repainted at least once in each period of five years thereafter, and of such color as required by the street and alley committee of said city. And shall have such poles of the height and diameter required by the street and alley committee of said city.

"Section 5. All poles, wires, fixtures, conduits and appurtenances and apparatus shall be installed under the direction of the street and alley committee of said city, or person duly authorized by said city, and shall be so placed and maintained as not to materially interfere with the use and occupation of said streets and alleys for the purpose of travel; all poles to be erected within the fire limits of said city shall be of metal, and shall, before being erected, be first approved by the street and alley committee of said city. And no poles shall be erected upon the public square in said city, except for supporting wires and lamps for street lighting purposes at each corner of said square, and all poles, wires or apparatus now owned, operated or controlled by the said Taylorville Gas and Electric Company, for the furnishing of electric current for light, heat and power, located upon the public square in said city, shall be removed from the public square within six months from the date hereof; and all poles and fixtures owned, operated or controlled by said company, of wood or other inflammable material, now situated within the fire limits of said city, shall be replaced with metallic poles within a period of three years from the date hereof. All poles and apparatus of said company now on the streets of said city that are located in gutters and which materially interfere with or obstruct the free flow of the water upon said streets, shall be removed and placed as herein provided within two years from the date hereof; and the said company shall immediately remove all wires in said city which are in an unsafe or dangerous condition and replace the same with a standard grade of insulated wire.

"Provided, that all such poles, wires, fixtures, conduits, appurtenances and all other apparatus, shall not be installed, erected or maintained in such manner as to obstruct or interfere with the use of the property of any other person, persons or corporations, enjoying a like or similar franchise from the city of Taylorville. And all overhead wires erected upon or strung over any of the streets, alleys or public grounds of said city, or private property of the citizens thereof, by virtue of this ordinance, shall be of a standard grade of insulated wire, and shall at all times be kept in first-class repair, and upon notice from the street and alley committee of the city of Taylorville or other person duly authorized by the city council of said city, any wires, poles, conduits, appurtenances or apparatus upon said streets, alleys or public grounds, which may be deemed unsafe, insecure or dangerous to the public, shall immediately be repaired or replaced and put in a proper and safe condition by said company.

"Section 6. The machinery contained in the plant of said company shall be safe and suitable for the purposes, and the poles, wires, conduits, appliances, fixtures, apparatus and appurtenances installed by the said company upon the streets and alleys of said city, shall be of first-class standard pattern, and all outside wires erected upon or strung along any of the streets, alleys, public grounds or across private property, shall be of standard grade, ample size, and thoroughly insulated, in the most modern and approved manner, and all poles, cross-arms and other fixtures and apparatus of said streets, alleys and public grounds shall be of first-class material and workmanship."

Sections 7 and 8, printed in the article above referred to, give general conditions applicable to all the business of the company, including electric light.

"Section 9. The said Taylorville Gas and Electric Company shall furnish electric current for light, heat and power purposes to all persons living along or upon the streets, alleys or public grounds of said city, occupied by the poles, wires, appurtenances and apparatus of said company, upon proper application being made to said company for such service, by such person, persons, companies or corporations, subject to all proper rules and regulations, as are or shall be adopted by said company, which shall be uniformly applicable to all other persons, companies or corporations, and shall charge the same rates for the same amount of service to all such persons, companies or corporations similarly situated, and under similar circumstances, without discrimination, and shall furnish to such consumer, upon request, a meter, which shall be of the best standard pattern, and all charges computed at the regular rates according to the meter readings, for consumers using meters, and the said company may, at its option, install meters for all consumers not on a flat contract rate.

"The maximum rates and charges for electric current for incandescent lights, arc lights, electric power and heat, to any person, persons, company or corporation making application therefor, as hereinbefore provided, shall not exceed the rates and charges contained in the following schedule:

"a. The maximum meter rate for electric current for incandescent commercial light shall not exceed the price of nine cents per thousand watt-hours (9c per k.w.-hr.)

"b. The maximum rate for electric current for arc lights to private consumers shall not exceed the sum of nine cents per thousand watt-hours (9c per k.w.hr.)

"c. The maximum rate for electric current for power furnished to motors, dynamos and other mechanical purposes to private consumers shall not exceed the price of seven cents per thousand watt-hours (7c per k.w.-hr.)

"Provided, that all motors of one-half horse-power (½-h.p.) or less, used in residences, may be connected with the light current and the said company may charge for the current for the same at the same meter rates as charged for current for lights.

"d. The maximum rate for electric current for heating purposes furnished to private consumers shall not exceed the price of nine cents per thousand watt-hours (9c per k.w.-hr.)

"e. The maximum rate for electric current for commercial incandescent lights upon flat rates and not according to meter, shall not exceed the price of 50 cents per month per light for one sixteen-candle-power light or its equivalent to one consumer, and at the rate of not to exceed 30 cents per month per light to one consumer using four or more of such lamps on the same premises.

"Provided, however, that said company may not be required to furnish meters to parties using less than four lights in the same premises."

Section 10 concerns steam heating rates and section 11 gas rates.

Sections 12, 13 and 14 contain general provisions applicable to all services, section 13 being particularly valuable, as it gives a method of securing revision of rates on application of either city or company. They will be found in the article above referred to.

"Section 15. The said Taylorville Gas and Electric Company shall properly place and maintain, at such heights, points and places as the city council shall designate or select, all the poles, wires, lamps, appurtenances and apparatus necessary for street lighting purposes within a reasonable time after notice from the said city of Taylorville, of such number and character as the city may desire and designate in said notice. And shall furnish to said city for street lighting purposes from twilight until daylight during all the time required by said city of Taylorville during the life of this ordinance, and at not to exceed the following schedule of prices, viz.: Two thousand candle power inclosed arc lights, not less than ten in number, at the rate of four dollars ($4) per month per lamp; forty candle power incandescent lights, not less than one hundred in number, at a rate not to exceed one dollar ($1) per month per light; and thirty-two candle power incandescent lights, not less than one hundred in number, at the rate of not to exceed eighty cents (80c) per month per light, provided that all incandescent lights required by the said city of Taylorville for street lighting purposes by virtue of this section for any period of time shall be of the same candle power. And any number of sixteen candle power incandescent lights at the same price as charged to consumers in said city. And which said lights or either of them may be required of said company at the option of said city of Taylorville, and shall be furnished by said company upon notice as herein provided.

"Provided, however, that said city shall not require any service from said company as in this section provided for a less period of time than five years, but said city reserves unto itself the right to require such services as herein provided or to contract for street lighting service with said company, or any other person, persons, company or corporation.

"It is further provided that if the said Taylorville Gas and Electric Company shall be furnishing current to the city of Taylorville for street lighting purposes by virtue of a contract, they shall continue to furnish said electric current at the same prices provided in said contract after the expiration of the term of their contract, for a period not to exceed one year or until such time as a contract may be entered into by the city of Taylorville with the Taylorville Gas and Electric Company or other person, persons, company or corporation.

"Provided, further, that said arc lights furnished to the said city of Taylorville shall burn with a steady light and shall at all times be supplied with a current of sufficient power to cause said lamps to burn at the full rated candle power herein provided, and all incandescent lamps shall burn with a steady and uniform light and shall be supplied with current of sufficient power to cause said lamps to burn at the full rated candle power herein provided. And the said city of Taylorville, by its street and alley committee or duly authorized agent, shall have the right to test any and all lights provided for in this ordinance, for the purpose of ascertaining whether or not they are in conformity with the provisions hereof, and for that purpose to enter upon the premises of the said company, and if it shall be found that the service herein provided for is not being given by said company, the said company upon notice thereof shall promptly and as speedily as practicable proceed to bring the lights and current herein provided for up to the standard."

Sections 16, 17, 18 19 and 20 are the sections covering exclusive rights, saving city from damages from construction and operation, default of company in carrying out contract, assignments and term. They are printed in the article above referred to.

Rates for Coal Gas

Our board of city commissioners is anxious to get information regarding the meter rates of coal gas in towns of 10,000 to 50,000 population. Will you kindly inform us where such information can be obtained?

JOHN P. JACKSON.

Rates for gas in most of the cities and towns in the United States will be found in Brown's "American Gas Directory" ($5).

The cost of gas depends so much upon the cost of coal and that so much upon freight charges on coal of proper quality, that a rate cannot be fixed arbitrarily. Process used and amount of gas sold also have an important effect.

The prices allowed in Taylorville, Ill., and the method provided for determining and changing rates are given in MUNICIPAL ENGINEERING, vol. xlii, p. 185.

A series of articles giving rates charged for gas, process used, cost of coal and oil in many cities and towns of 5,000 to 10,000 population will be found in vol. xl, pp. 38, 125, 220, 347.

Modern Street Cleaning Machinery

I am very anxious to find out what is the present state of development of labor-saving street-cleaning machinery, especially such as will work efficiently under the favorable conditions of sheet asphalt pavement. I have noted the account in your present issue of a pick-up hand sweeper. Are there no pick-up horse or motor sweepers? If you know of any I should be much obliged for the makers' names and addresses. If you do not can you tell me where I can find out why various schemes have not worked ?

H. W., ———, N. Y.

Hand, horse and motor street sprinklers, sweepers, flushers and carts are in use for street cleaning. Descriptions of the modern apparatus will be found in MUNICIPAL ENGINEERING, following being a list of recent articles:

Vol. xliii: "A Motor Street Sprinkler," p. 118; "An Original Street Flushing Machine," p. 118; "The Peerless Pick-up Hand Sweeper," p. 125; "A Squeegee Street Washing Machine," p. 192.

Vol. xlii: "Pneumatic Street Cleaning," p. 160, describing the new Furnas motor-driven machine; "Snow Removal in Indianapolis," p. 260; "Receptacles for Street Sweepings and Washings," p. 445; "The Matchless Sanitary Street Cleaning Machine," p. 492, a man-propelled apparatus.

Vol. xli: "A Foreign Street Sweeping Machine," p. 61, describing a brush machine with pneumatic pick-up; "Street Sprinkling in Denver, Colo.," p. 115; "An Automatic Dump Cart for Street Cleaning," p. 408.

Vol. xl: "Cost and Efficiency of Street Cleaning Methods," p. 32, giving cost of various methods in various cities in some detail; "Railways and Snow Removal," p. 34; "Flushing Streets Under High Pressure," p. 131; "Flushing Street Pavements with Water Under Pressure," p. 132; "Cleaning Streets by Flushing," p. 427, containing also a list of previous articles on street cleaning methods and results.

Attention is called to the German broom sweeper described on p. 235 of the October number. Pick-up sweepers are manufactured by the Briggs Labor-Saving Specialty Co., Waterloo, Ia., Duplex Mill and Manufacturing Co., Springfield, O., H. B. Walker, Tarrytown, N. Y., and a hand apparatus by the Matchless Street Cleaner Co., Troy, N. Y. The Baker Manufacturing Co., Chicago, the National Street Cleaning Co., Spokane, Wash., and the Furnas Street Cleaning Co., Indianapolis, Ind., manufacture modern street sweepers, the latter being a pneumatic machine.

The Austin-Western Co. and the Studebaker Corporation manufacture modern street sweepers and scrapers.

Books on Railway Track Work

Kindly inform me as to what books treat on railway track work, as I would like to get full information on a practical system covering ties, rails, etc., in handling work.

O'D., San Francisco, Cal.

The book probably wanted is Camp's encyclopedic book on "Track" ($3). It is a compendium of practical information on track work in all its details.

Form of Ordinance and Contract for Sewer in Illinois City.

Can you furnish me with a copy of a sewer ordinance and contract? We are contemplating a $15,000 system.

L., City Attorney, ———, Ill.

The improvement laws of Illinois are so complicated and in some respects contradictory that one outside the state hesitates to make recommendations of forms. The National Paving Brick Manufacturers' Association, some four years since, recognizing the difficulties in preparing forms for ordinances and contracts, employed an Illinois attorney to bring as much order out of the existing chaos as possible, and the result is a book of "Forms for Special Assessments, Illinois," which can probably be obtained of the secretary of the organization, Will P. Blair, Locomotive Engineers' building, Cleveland, O. Form 24, in this book, is an ordinance providing for constructing a pipe sewer, paying in instalments, issuing bonds and making special assessments. While the forms in general were prepared with special reference to their use for paving purposes, most of them seem to be equally applicable to other improvements.

Forms 83 to 89 give those necessary in asking for bids, instructions to bidders, form of proposal, form of contract and bond.

Time Required to Connect Telephone Systems

I would like to get some information as to how long it ought to take to make connection between an automatic and manual phone system, between an automatic system having 5,000 subscribers and a manual system having 4,500 subscribers, so that there will be universal service between the two systems.

F., City Attorney, Neb.

This is a question which is beyond the knowledge of any one but an expert who has done the work or who has had an opportunity to inspect the proposed work for the purpose of making an estimate of time and expense required. Can any of our readers give any information on the subject?

Prices of Structural Steel

Please inform me what was the mill price for stock sizes, such as used in highway bridges of structural steel shapes, March, 1905. The present price of same? The average cost of shop work on ordinary truss highway bridges, of span of 40 to 100 feet.

HIGHWAY ENGINEER, ———, Okla.

In March, 1905, the quotations for structural steel in Pittsburg showed 1.60 cents a pound for the smaller sizes of beams, channels and angles, 1.70 for the larger sizes, and 1.65 for Z and T shapes. Tank plates were quoted at 1.50 cents at the mill.

In October, 1912, the corresponding quotations are 1.40 cents for smaller sizes of beams and channels, 1.45 to 1.50 for larger sizes.

Full details of cost of shop work are given in Ketchum's "Design of Highway Bridges" ($4). It varies from ½ cent to 1.3 cents per pound, according to kind of bridge and size, the smaller bridges costing most, and would probably be ¾ to 1 cent a pound for the kind of bridges named.

FROM WORKERS IN THE FIELD

Designing a Street for a Small City

Bicknell is a small city in Indiana having at present a population of four to five thousand, which was not in existence as a municipality in 1900 and is included in the census of 1910 as a town with a population of 2,794. Its development has been rapid within the past five years or so on account of the development of coal mining in its vicinity and it had hardly learned how to conduct itself as an incorporated town when it found itself a city of the fifth class.

Thus far its public improvements have consisted of an electric lighting plant owned by a corporation and some miles of cement sidewalks, some laid to established grades but others difficult to fit to any grade system. This summer the city concluded that conditions required the pavement of the main street and proceedings were started covering its entire length from north to south corporation lines, some 5,800 feet. Some of the details of the design will be of interest to other small cities, as they follow the lines of maximum efficiency at minimum cost.

The width of the street is part 50 and part 45 feet between property lines. The business section of the street between Reid and Fourth streets, about 1,500 feet had sidewalks eight feet wide, which had demonstrated themselves to be too narrow for the traffic upon them for certain hours of almost every day, so that there was strong pressure for an increase in their width. While the traffic on the street itself is not light it can be taken care of on a street paved and kept in good condition and free from obstructions which is wide enough to permit a row of vehicles standing at each curb and space between for the passage of vehicles going in both directions. This was carefully considered by the council and a width of 27 feet was adopted for the street pavement thru this business section of the street. This belief in a street sufficient for the traffic even if it is narrow, is one which is not common, tho, fortunately for the taxpayers as well as for the appearance of the city, its popularity is increasing. Each sidewalk will then be 11.5 feet wide, including the curb. This will relieve the congestion of foot traffic materially, but in the judgment of the storekeepers will still be insufficient to prevent some crowding at times under the local conditions, due to the character and habits of many of the inhabitants.

A good balance has been turned between the demands of users of sidewalks and pavements and each class has been taken care of as completely as possible without encroaching unduly upon the rights of the other.

The residence portions of the street from the ends of the business section to the city limits each way do not require even the 27 feet width of pavement and the width on those sections has been reduced to 22 feet. The principal factors in inducing the council to adopt this width were two, economy, and improvement of the appearance of the street. City blocks are short, being but 254 feet, including a 50-foot street and a 12-foot alley. Therefore, while a 22-foot street is too narrow to turn upon, the streets and alleys are so close together that one need go but a few feet to find room to turn either directly or by backing into the alley wing.

With 5-foot sidewalks this gives 9-foot spaces on each side of the street for lawns and trees and already property owners are planning the improvement of these spaces. Many trees are already in place, and it is probable that the location of these trees had something to do with the location of the curb lines. If the street had been made wider some of these trees would have been destroyed.

In carrying out the wishes of the council the engineers have been careful to locate the crown of the street so that the curbs will be in general below the sidewalks enough to give a gentle slope to the lawn, sufficient to drain walk and lawn. The grades of the existing sidewalks being somewhat irregular, this slope is not uniform, but is not so irregular as to produce an objectionable appearance. Indeed, it is possible that the slight irregularities will enhance rather than detract from the beauties of the street.

The southern end of the street is but 45 feet wide, so that the lawns on this section are but 6.5 feet wide.

The business section of the street is on the slope of a hill so that on two blocks grades of 3.5 to 4 per cent were found necessary, and one short stretch at the railroad crossing required 5 per cent. To care for the water on this hill and relieve street crossings of the accumulations of water, a drain was planned for the center of the street with inlets at each street corner. The street is located nearly on a ridge and the amount of water draining into it from side streets is very slight, but little exceeding an average width of 100 feet of drainage area each side of the street. This fact makes the drainage of the street in general quite easy and it is taken care of, elsewhere than as noted, by the gutters of the street, being turned into the drainage channels either side at convenient points.

This makes gutters across the intersections of the side streets, except in the business portion of the street, but they will not be seriously objectionable so long as the side streets are not paved, and when they are paved, they will have their own drainage problems, to which these intersections can be added.

On account of the uniformly good grades on the street, but few of them being slight, a crown of 4.5 inches was considered sufficient.

Combined curb and gutter was adopted, reducing the brick surface to 24 and 19 feet width on the two widths of street.

Five-inch portland cement concrete foundation was adopted, mainly because the hill section was rather wet and liable to slide, and the concrete foundation was believed to be safer to hold the pavement in place should the sub-drainage provided by the street drains above described prove insufficient for any excessive water difficulty.

The contract was let on the lowest of four bids at $1.80 a square yard for the brick on 5-inch concrete, 50 cents a linear foot for combined curb and gutter and marginal curb, and 30 cents a cubic yard for grading. The estimated total cost, including the drainage system, is practically $38,000.

According to the system required by the Indiana law, bids were asked on asphalt, concrete and macadam in addition to brick, the estimate on the asphalt being $7,000 more than on brick and that on macadam $14,000 less. Bidders knew that the property owners had already officially expressed themselves as requiring a brick pavement, so they made bids for brick only. The only effect of the law, therefore, was to raise the estimate limit to that for asphalt pavement. Whether this had any effect in increasing the bids on brick above City Engineer E. C. Williamson's estimate is a matter of opinion. The bids did exceed his brick estimate some $3.000.

Chicago Garbage Removal

Editor MUNICIPAL ENGINEERING:

Sir—The Bureau of Streets is one of the eight bureaus which compose the Department of Public Works. The importance and extent of the work in charge of this bureau is indicated in the statement that it recently expended 45.7 per cent of the total annual appropriation to the Department of Public Works for operation and maintenance.

The character and variety of the duties of the bureau as regards the collection and disposition of refuse and garbage are as follows:

(1) Removal of dead animals.

(2) Cleaning of all streets, alleys and public places.

(3) Collection of ashes, garbage and other refuse.

(4) Removal of garbage by boat to reduction plant, Thirty-ninth and Iron streets.

(5) Disposal, by reduction, of garbage at Thirty-ninth and Iron streets.

(6) Disposal, by dumping in clay holes and low lands, of ashes and other refuse.

(7) Removal of snow.

The tank wagons used in the garbage service consist of steel boxes of 4 cubic yards capacity, constructed so they can be lifted off the wagon bed. There are two hundred of these wagons in the service, all owned by the city; forty-three are handled at the Oakley avenue loading station; seventy-one at the Chicago avenue loading station, and eighty-six go direct by team to the reduction plant at Thirty-ninth and the river. During the year 1911 we collected and delivered to the Chicago Reduction Company 117,775 tons of garbage at a total cost of $447,-740.47, making the cost per ton $3.80, and the per capita cost 19.8 cents.

We also collected during the year 1,-338,200 cubic yards of ashes and rubbish at a total cost of $825,437.67, making the cubic yard cost 61.6 cents, and per capita cost 36.4 cents. We have two hundred and fifty wagons in this service. They are wooden, built to certain specifications and have a capacity of 5 cubic yards. They are not owned by the city. During the winter months ashes and rubbish are used to fill in low streets and alleys in outlying wards; in summer time it is dumped in abandoned clay holes in the outskirts of the city. These wagons make the record show one load per day, regardless of the weight of the load or the length of haul. The distances covered in getting a load vary from .7 of a mile to 6 miles, and average for thirty wards 2.74 miles. The length of haul to the points of disposal varies from .4 of a mile to 6.4 miles, and averages 2.7 miles for thirty wards. The total distance travelled per team per day varies from 3.5 miles to 16.5 miles and the average for thirty wards is 8.14 miles.

The garbage of the north and west side wards is hauled by the wagons to loading stations at Oakley street and at Chicago avenue, and then transported by boat to the reduction plant at Thirty-ninth and Iron streets. The garbage of the south side wards is taken by wagon direct to the plant.

The collection of a city's refuse differs from most transportation problems in that the material is not simply loaded at one point and delivered to another, but must be picked up bit by bit on a house-to-house visit of the garbage and ash men. The amount of garbage per family is small, so the garbage man must travel, our records show, from .7 of a mile to 6 miles, the distance depending on the density of the population, season of the year, etc., before his load is complete. The element of time in getting a load is a large factor in the cost of the work.

The garbage (the refuse animal and vegetable matter) is separated thruout the city from the ashes and other refuse and kept in a separate receptacle. It is collected separately and conveyed by wagon and boat to the reduction or "rendering" plant at Thirty-ninth and Iron streets. The city has a contract with the Chicago Reduction Company, which operates the above plant, to deliver to it all of the garbage of the city 95 per cent pure, that is, containing only 5 per cent of materials other than animal or vegetable matter, for the sum of $47,500 per year.

The Chicago Reduction Company claims that in order to provide for what they believed would be the maximum amount of garbage they constructed a plant of 500 tons capacity per day. The largest quantity they have received for any one day is 450 tons and the average for the years 1908 and 1909 only 300 tons per day.

CHICAGO GARBAGE REMOVAL.
Wagon Used in Hauling Garbage.

Just now the garbage (which is that portion of the refuse consisting of organic, vegetable and animal matter from kitchens, restaurants, butcher shops, etc.) is disposed of by reducing or "rendering," thereby recovering the grease and utilizing the residue as fertilizer base. The practical operation of the reduction plant had proven in the main satisfactory, altho there have been complaints from those living in the neighborhood of the plant. This method has the economic advantage of recovering a saleable commodity and returning, in part, in the form of fertilizer to the soil what is taken from the soil. But while economy must be observed, it is not the first consideration in disposing of material which could easily become a menace to health. Furthermore, it has by no means been decided that reduction is the most economical solution of the problem. This method, if the separation is good, has the further advantage that the rubbish and ashes, being free from garbage, have a commercial value.

As before mentioned, the wagons used in the collection of pure garbage have water-tight iron bodies with hinged covers of the same material. The trucks upon which these tanks are carried were made by the Bain Wagon Co., Kenosha, Wis., and are of very strong and durable construction.

The wheels are made with oak hubs, dodged mortised; oak rims and oak or hickory spokes. They are soaked in hot linseed oil and the tires are set hot in the good old-fashioned way.

F. W. Solen, Superintendent of Streets, Chicago, Ill.

A Book on Garbage Destructors

A book on modern destructor practice by W. Francis Goodrich, an English engineer with years of experience in English practice, has been published by a London firm and J. B. Lippincott Company, of Philadelphia.

Beginning with an ironical chapter on some alternative methods of refuse disposal, Mr. Goodrich gives brief general descriptions of representative types of British destructors and systems of charging them. He gives a brief explanation of combining the operation of destructors with sewage pumping and purification works and with electric light and power plants with large tables, giving the general features of all the British works of these classes. He then describes very briefly a few examples of each of the three classes of plants named, giving their individual characteristics, with another table giving data regarding all the plants in the British Isles.

The book then takes up some of the points to be considered in the design of a plant, including site, form of specifications, design and operation of such details as air supply, boilers, chimney, etc., and utilization of residuals. Some statements of foreign and colonial practice are given by countries, and a chapter is devoted to United States and Canadian practice, particular attention being paid to the installations made on English models and American modifications thereof, with a few brief descriptions of other furnaces, concerning which he is very critical.

The book is valuable in bringing the record of practice down to date, and the engineer who is already somewhat familiar with destructor practice will get an idea of the work done in improving practice. It is so evident an advocate of the destructor that the reader will be disposed to doubt somewhat that the author is wholly disinterested. This is hardly fair to him, although it is almost inevitable.

Book for Highway Engineers

A handbook for highway engineers, containing information ordinarily used in the design and construction of roads warranting an expenditure of $5,000 to $30,000 per mile, by Wilson G. Harger, first assistant engineer, and Edmund A. Bonney, division chief draftsman, New York state department of highways, has been published by the McGraw-Hill Book Company, New York, at a price of $3.

Part I, covering 116 pages of this book, gives the theories of design in use in the New York state highway department, as interpreted by the authors, covering grades and alignment, sections, culverts, small span bridges and underdrains, foundations for broken stone roads, top courses, minor points, such as retaining walls, curbs and gutters, guide signs, etc., materials and their testing and specifications. Some Massachusetts and New Jersey standards are given as well as those of New York. There are some twenty-five tables or more of data.

Part II goes into the practice of the survey, design, estimates and construction in chapters describing the survey, office practice, cost data and estimates, notes on construction and details of specifications for materials and workmanship. There are numerous tables in the text, such as stadia reduction, radii and deflections, curve functions, earth work tables, quantities of oil required, quantities of materials required for concrete culverts, covering nearly eighty pages, and the last chapter passes without notice into the tables for conversions of various sorts, squares, cubes, roots and circular functions, trigonometric formulae and functions, natural to five places and trigonometric to six, and logarithms to six places which are usually found in books on surveying, occupying 132 pages. An index of seven pages seems to be ample for its purpose.

Within the limits set by the title given above, and the practice on New York roads, the book is excellent and sets high standards which all state departments should try to reach with such modifications as their local conditions demand for economy as well as utilization of local materials.

MUNICIPAL MATTERS IN COURT

Decision on Street Lighting of Waupaca, Wis.

In a complaint brought before the circuit court of Waupaca county, the Waupaca El. Lt. & Ry. Co. appealed from the disallowance, by the common council of the city of Waupaca, of bills for street lighting during February and March, 1910. In reply, the city stated that, disregarding the terms of the street lighting contract and without obtaining the consent of city, the company had substituted lamps inferior to those called for by the street lighting contract, and the city had refused to accept them as complying with the contract. Through stipulation of the parties these proceedings were withdrawn from the court and brought before the Railroad Commission of Wisconsin. It was agreed that all differences as to the efficiency and commercial value of the street lights under the present contract and the respective liability of the city and company under the contract be left unreservedly to the commission to investigate, settle and adjust.

The contract for street lighting between the petitioning company and respondent city provided for "2,000 candle power arc lights" in return for $6.36 each per month. The term "2,000 candle power arc lights" was used to designate the 9.6 ampere d. c. open arc lamp in use at Waupaca at the time the contract was entered into and continued in use under the contract until the fall of 1904, when the electric company substituted 6.6 ampere a. c. inclosed arcs, which have been operated at 7 amperes since these proceedings were brought before the commission.

The total reproduction cost, present value and cost of operation were ascertained and apportioned between street lighting and all other service. After readjusting the operating expenses so as to eliminate excessive general office salaries and distributing the remainder, it was found that the income from street lighting is barely sufficient to compensate the electric company for the present a. c. inclosed lamps, and considerably below the operating cost of the 9.6 ampere d. c. open lamp.

In comparing the two types of arc lamps the quantity of light produced was not the only element taken into consideration. Qualitative characteristics, such as steadiness of light and uniformity of distribution, although hard to measure, were also considered. Tests made by the commission's engineers showed that the illumination produced along the street by the 9.6 ampere d. c. open arc is about twice the amount produced by the 6.6 ampere a. c. inclosed arc. The opinion of experts, including men on the commission's staff, showed some divergence as to how far the greater steadiness and uniformity of distribution of the 6.6 ampere a.c. inclosed arcs offsets this lack of intensity of illumination.

It was held that when the greater steadiness and uniformity of distribution of the 6.6 ampere a. c. inclosed arcs is taken into consideration, the deficiency for which the company might be responsible is so small and of such character that it cannot be made the subject of monetary damages, particularly in view of the fact that the rates paid by the city for the services involved are barely sufficient to compensate the company for the present a. c. inclosed lamps, and considerably below the operating cost of the 9.6 ampere d. c. open lamps. This deficiency is so small as to come within the limits of a reasonable difference of judgment based on all the facts in the case. It was the finding of the commission that the city of Waupaca, under the circumstances, had not suffered such damage by reason of the substitution of the a. c. inclosed lamps for the d. c. open lamps as to entitle it to claim any reduction from the contract price of the street lighting service furnished it by the Waupaca Electric Light & Railway Co. from the time of the change in the installation of street lamps up to the present time.

Decisions of the Higher Courts of Interest to Municipalities.

Private Water Company Must Install Additional Facilities to Supply Greater Demand.—A private water company, in consideration of a franchise, contracted to furnish water sufficient for the uses of the city and its inhabitants. It was also agreed that, in addition to the machinery then in use, there should be another station established, capable of delivering not less than 5,000,000 gallons daily into the city, and that, in addition to the reservoir then in use, another reservoir should be constructed. Held, that, the contract having provided that it should run for 30 years, the provisions as to the facilities required were temporary, and not qualifications of defendant's general duty to serve as the exigencies of the future might require, and that it was bound to install facilities to supply an elevated district, which had become populated through the growth of the city. Birmingham Water Works Co. v. City of Birmingham (Ala.) 58 S. R. 204.

Customer Must Pay for Water Stolen by Meter Device—Where a customer of a water company sought to restrain the shutting off of its water, and the water company filed a cross-bill for an accounting for water alleged to have been stolen by the complainant, and the chancellor found that an average of 9,000 gallons a day for twenty-six days a month for a specified period had been misappropriated by means of a meter device, a decree requiring complainant to pay defendant for the amount of water so taken, and enjoining defendant from shutting off the supply, provided complainant complied with defendant's rules, was proper. American Conduit Mfg. Co. v. Kensington Water Co., (Pa.) 83 A. R. 70.

Contractor's Bond Does Not Insure Payment for Coal for Machinery Used—A contractor for the construction of a city water works system gave bond to save harmless the city and its officers and the people of the city against all claims due from the contractor "which may accrue to any person, firm or corporation on account of any labor performed or materials furnished under and by virtue of this contract." Held, that this bond did not insure the payment of coal furnished the contractor for fuel to be used on a dredge in the construction of the water works system. City of Alpena v. Title Guaranty & Surety Co. et al., (Mich.) 134 N. W. R. 23.

Municipality May Condemn Land Outside of City Limits—A municipal corporation, when necessary to do so to obtain a water supply for the use of the town or city, may condemn land, tho situated outside the corporate limits. White v. Town of Romney et al., (W. Va.) S. E. R. 323.

Stamped Notice Upon a Contract Does Not Alter Terms of Contract—Binghamton city charter provides that if any sidewalk be paved by the owner with material other than wood, and, such walk being built for the first time, one-half of the cost of paving shall be paid by the city, but in no case shall the entire cost of the walk exceed $2 per square yard for the purpose of fixing the amount to be paid by it. A property owner applied for the grade and specifications of a sidewalk, and the commissioner of public works stamped on the margin of the application: "This permit is granted upon the express condition that the entire cost of the sidewalk shall not exceed 90 cents per square yard for five-foot wide sidewalk, and $1 per square yard for six-foot wide sidewalk, for the purpose of fixing the amount to be paid by the city. Held, that the stamped notice did not amount to a special contract by the owner with the city reducing the cost of the sidewalk below that provided by section 187 for the purpose of fixing the amount to be paid by the city, in absence of proof that the owner expressly assented thereto; the mere building of the sidewalk by him not implying an assent. Hotchkiss v. City of Binghamton, (N. Y.) 132 N. Y. D. 933.

The Specification "Lake Asphalt" Is Not so Indefinite as to Invalidate the Ordinance—Description of a binder in an ordinance providing for street paving to be made of "lake asphalt, or some other equally good bituminous asphalt binder," was not so vague and uncertain as to render the ordinance invalid, notwithstanding the proof that there were two kinds of lake asphalt which were somewhat different in character. City of Park Ridge v. Wisner, (Ill.) 97 N. E. R. 677.

Land Owned by City in an Adjoining Town Is Liable for Taxation—Land owned by a city in an adjoining town which is not used for reservoir purposes is liable to assessment for taxation by such town. City of Norwalk v. Town of New Canaan, (Conn.) 81 A. R. 1027.

City Liable for Damage From Broken Water Main Only When Water Is Not Shut Off After Due Notice—A city negligently failing to shut off the flow of water in a broken water main is liable only for the damages resulting therefrom, and, where property was flooded and damaged before the city could possibly have been expected to shut off the water, it was not liable for a negligent failure to shut off the water, especially where the owner was negligent in allowing the property to remain where the water would spoil it. Monomoy Co. v. City of New York, (N. Y.) 132 N. Y. S. 438.

Municipal Water Company Must Not Discriminate in Privileges—A water company furnishing water for public use, as a public service corporation having extraordinary privileges, is charged by law with the correlative duty of treating all of the public alike and with an obligation to furnish water to each and every citizen or resident who may have need of it; and the fact that a water works system is owned by a municipal corporation does not change the rule. City of Houston v. Lockwood Inv. Co., (Tex.) 144 S. W. R. 685.

Where An Ordinance May Be Construed

in Two Ways, the Sustaining Construction Will Be Adopted—An ordinance for street paving required the binder to be made of lake asphalt or some other equally good bituminous asphalt binder. A witness testified that lake asphalt, unless fluxed, would not make a proper binder for a top course, and that he would construe the ordinance as requiring pure asphalt, tho all his evidence indicated that he thought that the reasonable presumption from reading the whole ordinance was that the term "lake asphalt binder" meant lake asphalt so treated that it could be used for a top dressing binder. Held, that the ordinance would be so construed under the rule that where two constructions of an ordinance are possible, one of which will render it invalid and the other sustain it, the court will adopt the latter. City of Park Ridge v. Wisner, (Ill.) 97 N. E. R. 677.

Contractor May Have Damages for Enforced Methods More Expensive Than His Own—If a municipal contractor is required to perform portions of the work in a more expensive manner than is required by his contract and the specifications upon which he bid, he can recover his consequent damages. Beckwith v. City of New York, (N. Y.) 133 N. Y. S. 202.

Leakage and Metered Water Bills—A municipality is entitled to compensation for water correctly metered to a consumer, and is in no way interested in what the consumer does with it, and is not responsible for any leaks from the consumer's pipes. Where a user of water agrees with a city to a meter measure, the meter readings are presumptively correct, and the user, on an issue as to the amount of water furnished, has the burden of showing that the city's charge is incorrect. Where a user of water fails or refuses to pay past-due water charges, a city, under the authority of ordinance, may shut off the user's water supply; but such a regulation cannot make the city the judge of its own case or justify the shutting off of water to enforce the payment of disputed bills. Spaulding Mfg. Co. v. Grinnell, (Iowa) 136 N. W. 650.

City Liable for Damage Due to Ill-Advised Effort to Abate Damage—Where a servant of a city, in attempting to remove an obstruction in a sewer which caused the flooding of plaintiff's cellar, tried to force water through the sewer, and thus increased the amount of water in plaintiff's cellar, the city was liable for his negligent act. Board of Councilmen of City of Frankfort v. Buttiner, (Ky.) 143 S. W. R., 410.

City Must Make Safe the Space Between the Curb and Property Lines. It is the duty of a municipal corporation to keep the space between the curb and the property line in a reasonably safe condition. Riley v. Kansas City (Mo.) 143 S. W. R. 541.

Nuisance or Negligence Must Be Proven to Recover Discharge of Sewage By a City.—One seeking to recover damages to his farm and place of residence and for personal inconvenience occasioned by the operation of a sewer system for a city, whereby refuse matter is discharged a mile or more from his residence, must allege and prove either negligence in the construction and operation of the system, or that it is a nuisance, public or private. Stamford Sewerage Co. et al. v. Austin (Tex.) 143 S. W. R. 649.

Damages Caused By Original Grade of Streets Cannot Be Recovered.—Damages cannot be recovered from a city for injuries to private property caused by casting surface water thereon by the original grading of streets and alleys; the statutes authorizing payment of damages for injuries caused by grading a street, expressly providing that the section shall not apply to the original grading of a street. Wood v. City of Tacoma (Wash.) 119 P. R. 859.

City May Be Reimbursed for Damages Paid to Individual and Caused By Negligence of Contractor.—Defendants were subcontractors for sewers for plaintiff city, under a contract to do the work according to the original contract with the city, which provided that its engineer should locate the place where ditches should be cut across the sidewalks to accommodate lateral sewers. The city engineer mistakenly directed that a ditch be cut across a sidewalk at a certain place; but, after it was cut by defendants, they and the engineer discovered the mistake, and he directed defendant not to fill the ditch that night, but to make a plank walk across it for use of pedestrians, though he did not direct the manner of constructing the walk or see it done, leaving that to defendant's judgment, and it was negligently constructed by defendants, resulting in injuries to a pedestrian who recovered damages against the city. Held, that, as the injuries were caused by defendants' negligence, the city could, by way of indemnity, recover from them the amount it paid to satisfy the judgment against it for injuries.—Robertson et al. v. City of Paducah (Ky.) 142 S. W. R. 370.

Where a city bought pumps warranted to lift a certain amount of water per minute with the expenditure of a certain amount of power, and the pumps delivered required a greater power, causing an increased expense, it was not bound to accept and pay for them.

Where a city bought pumping apparatus under a warranty that the pumps would do certain work, and made every possible effort, but without success, in conjunction with the seller's agent, to make the pumps do the work as contracted, and where it offered to return the apparatus which at the time of suit it held merely at the seller's order, it was not estopped to dispute the seller's claim for payment of the purchase price, or to deny that it had accepted the apparatus and thereby waived its right to rely upon the warranty. Montague Compressed Air Co. v. City of Fulton et al. (Mo.) 148 S. W. R. 422.

CIVIC BEAUTY

EDITED BY MYRON H. WEST

Efficient Boulevard Lighting

The use of concrete in forming electroliers for street lighting is a comparatively recent practice, but has, nevertheless, resulted in several exceedingly artistic and practical examples, none more so, perhaps, than the installation in the Lincoln Park system of Chicago.

These posts are the result of experiments carried on by Myron H. West while general superintendent of the system, and have received well-earned praise by electrical engineers and municipal officials, not only in the United States, but abroad.

The chief characteristic of the post is its exterior finish and the successful way it withstands weathering, which in so many cases results in hair cracks in the cement and the gradual breaking up of the exterior surface. This is obviated in the case of these posts by a dense waterproofed mixture of special aggregate and cement used as a veneer with which the post is covered.

The posts are finished in red or gray granite screened to uniform size, the cement for the veneer coat being a special white portland. The post is thoroly washed with muriatic acid to etch away the cement and cause the aggregate to appear clean and clear of the usual muddy colored film of mortar.

EFFICIENT BOULEVARD LIGHTING.
Lake Shore Drive, Chicago, showing Concrete Electroliers spaced one hundred feet apart in parellel.

The posts cast in one piece, including the foundation, are thoroly reinforced and carry a two-inch pipe conduit for wiring. A special bronze grill surmounts the shaft and supports a twenty-inch opalescent globe.

The lighting is provided by means of a special arc lamp supported by a frame, or in some cases by clusters or by a single high power filament lamp. The extreme practicability of the post is brought about by its economy of maintenance as well as of first cost, as the post once set up is practically indestructible and really becomes more attractive as age tends to mellow the color.

The post measures fourteen feet from ground line to center of globe, the foundation being four feet. The top of the shaft measures nine inches square with chamfered corners, enlarging to twenty-two inches at the flanged base. The inner core of the concrete is reinforced with four three-quarter-inch corrugated bars, besides the pipe conduit, which leads from the foundation eighteen inches below the ground line.

Great care must be exercised in casting the post, placing the veneer while the core is still wet and taking precaution to allow the work to season before disturbing.

The quiet gray of the granite textured concrete, together with the weather tarnished cap, forms a color scheme which even heightens the artistic effect brought about by the dignified simplicity of the design.

Although costing slightly more than many of the cheaper cast iron or sheet metal posts on the market, this post cannot but appeal to those who wish to dignify the streets of their city by lighting which is truly ornamental.

EFFICIENT BOULEVARD LIGHTING.
A Sample Post Showing Method of Inserting Street Signs by means of employing Bronze Letters set in the concrete.

City Light in Seattle

The report of the lighting department of Seattle, Wash., for 1911 presents a popular description of the plant and its achievements, with statements of cost of construction and operation, and a technical description of the entire municipal plant.

The mechanical execution of the report is exceptionally good, the photographs of men, and of details of plant and service, and the drawing and records showing the efficiency of the service are numerous, clear and readily understood, and are arranged and printed in artistic and attractive style. The whole publication reflects credit upon R. H. Thompson, city engineer; J. D. Ross, superintendent of lighting, and the others connected with its preparation and issue.

The plant was begun in 1902, first furnished light in 1904, and the street lighting system was attached to the plant in 1905. The expenditure of nearly $5,000,000 on the plant has been authorized, of which $867,643 showed on the construction ledger in the report for 1905, and $3,614,713 showed in the assets at the end of 1911, but $2,240,000 of the authorized bonds being outstanding. The surplus revenues available for extension and new construction have increased each year from $20,717 in 1908 to $153,434 in 1911, showing that the extensions are more than paying for themselves.

For residence lighting, rates vary from 7 to 4 cents, according to quantity; for business lighting, 8 to 1½ cents; for power, from 7 to 0.6 cents, according to connected loads. Certainly very reasonable rates.

The report presents figures in considerable detail with the expressed purpose of refuting numerous charges that the plant was a failure, could not meet its expenses and must be an expense to the taxpayers. There is no apparent attempt to gloss over mistakes or conceal information, and the reader can draw his own conclusions and will doubtless agree with the report in them.

Building Parks from Drainage Canal Sludge

The Chicago Sanitary District trustees have let a contract for dredging the deposits in the drainage canal, primarily to restore it to its full efficiency of discharge. It is estimated that 1,500,000 cubic yards of sludge will be removed. If dumped in the lake, it is liable to pollute the water supply, especially since the federal regulations require that it be towed eight miles into the lake before dumping.

The Lincoln Park Board has invited the Drainage Board to dump the material in the area which it wishes to fill in for use for park purposes along the north shore, between Cornelia and Devon avenues, and the contract for the excavation and dredging of the canal calls for this disposition of the earth and sludge.

The material is excellent for the purpose, and out of the slime of the drainage canal will arise one of the finest parkways in the city.

EFFICIENT BOULEVARD LIGHTING.
Lake Shore Drive, Chicago, by Night.

SEWERS AND SEWAGE DISPOSAL

Properly Built Flush Tanks

All engineers recognize the necessity of keeping a sewer system clean as a sanitary measure. No matter how well a sewer system may be designed and constructed it will not satisfactorily serve its purpose if any deposit or accumulation of decomposing matter is allowed to occur. It does not pay to wait until actual stoppage takes place. The system should be kept clean from the start and experience has shown that this can only be done by periodic flushing either by hand or by automatic flush tanks.

Hand flushing can only be depended upon when in charge of responsible, intelligent and untiring care-takers.

Automatic flush tanks can always be depended upon to do their duty if engineers will only give sufficient thought to the matter to select a simple, reliable, efficient and durable siphon. They should be careful as to capacity, according to the size and grade of the sewer and length of line to be flushed. They should be properly constructed and made watertight. Necessary instructions should be given to the authorities having in charge the maintenance of the sewer system as to their proper handling and the amount of water to be used.

A flushing apparatus may apparently work under all conditions, discharge at a very rapid rate, and continue to give perfect service for several months, and in some cases a year or more, but if, sooner or later, this apparatus ceases to do its proper work, it will either have to be repaired, or replaced by another at great expense to the users. Durability depends upon simplicity of construction, absence of moving parts and subsidiary devices.

In excavating for the cistern, enough earth should be removed to allow a space of 6 inches all around outside of the wall. After the excavation is made the siphon trap should be placed in position, put vertical both ways, and then secured in position by concrete. The bell should then be placed in its proper position to prevent mortar or debris from falling into the siphon. The connection with the sewer should then be made. The walls should then be built and with sufficient footings; the bottom of the cistern afterwards. The walls should be built of hard burned brick and laid in full joints of cement mortar. No lime whatever should be allowed on the job. Both the walls and the bottom of the tank should be thoroly plastered, both inside and out, with cement mortar ½ inch in thickness. After hardening of the plaster, but before it has become fully dry, the walls and bottom of the tank should be coated with pure cement slush applied with a brush so as to make the work absolutely watertight.

The feed pipe should be inserted at its proper place and built in the wall at the time of construction, and should be fitted with suitable brass cock and regulator for controlling the rate of supply to the flush tank. The vent pipe should enter the tank above the high water line. The excavation around the cistern should be thoroly filled and tamped with earth to the surface of the street, and if any sodded, graveled, macadamized or paved surface was removed in excavation, the same should be restored to its former condition.

The tank should be swept clean, the trap of the siphon filled with water, and the bell again placed in position.

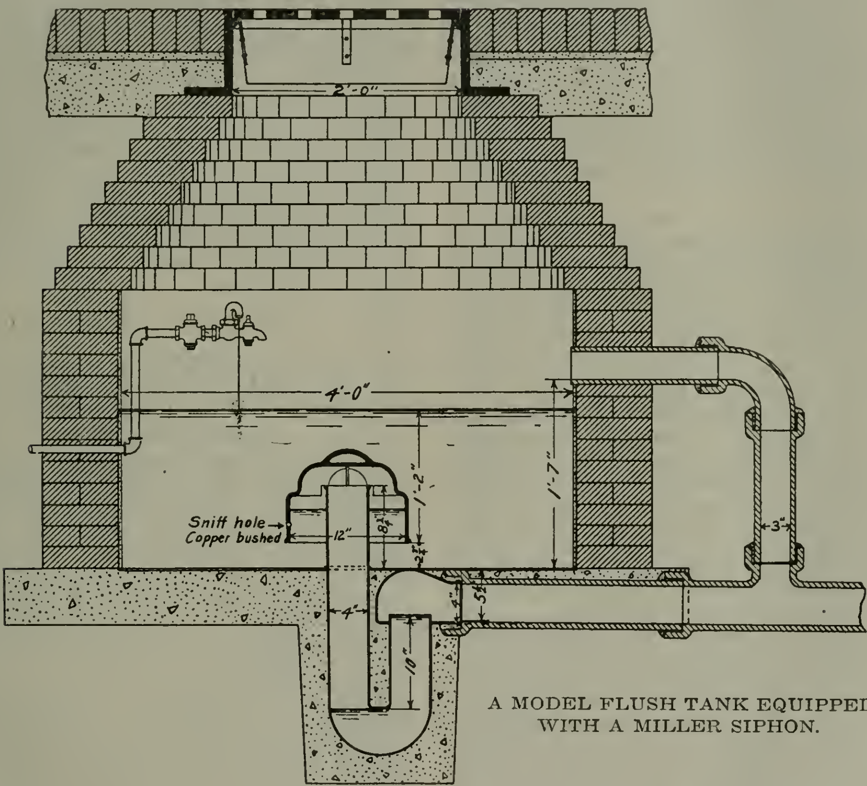
Considerable publicity has been given to the matter of water waste in the city of Memphis. We have personally investigated the conditions at Memphis and find that while a considerable amount of the total waste reported was caused by leaky flush-tanks, at the same time, the part of the flush tank that occasioned the leak was simply the ordinary black-iron pipe used to connect the water from the main to the flush tanks, which completely rusted out. Some of the stop-cocks were also clogged, owing to the pressure of iron in the water.

Mr. J. H. Weatherford, city engineer of the city of Memphis, states: "Inasmuch as the report is being circulated that this waste is on account of the siphons, I am writing to advise that the waste is not in any way connected with the siphons but is caused solely by leaky connections from the water mains to the flush tanks. Those conections were put in years ago of common black-pipe and have rusted out and are being replaced, wherever found, with lead pipe, but those that have not been replaced are in a great many instances leaking badly. This is certainly no fault of the flush tanks themselves or of the siphons in the tanks and any statement to this effect is absolutely false."

Assuming that an ordinary flush tank is operated once in twenty-four hours, the average water cost is about one cent for each flush, yet many flush tanks in use are flushing every thirty minutes and wasting enormous quantities of water. This great waste can be entirely eliminated if the tank is occasionally inspected and by using a proper regulating device to control the supply. They are on the market and will save their cost in from three to six months. But even with a proper regulator, water may be wasted if the flush tank construction is faulty and permits water to leak out as fast as it comes into the tank. Several cases of this kind have developed where the water leaked out thru the masonry as fast as it came in, and yet the flush tank, or more properly the siphon, is frequently blamed for this defect.

Flush tanks may be equipped with a proper regulator but if the pipe connections are leaky or old rusty pipe is used that soon develops leaks, the regulator obviously cannot help the conditions. The safest way and cheapest way is to build the tank absolutely tight and supply the water thru a regulator connected up to the water supply thru lead or lead-lined pipe, or at least with new galvanized pipe, and common wrought black pipe should never be used.

When flush tanks are built and siphons are set by those unfamiliar with them, use blue prints showing proper way to set siphons and specifications should be obtained from the maker.



A MODEL FLUSH TANK EQUIPPED WITH A MILLER SIPHON.

A Miller two-piece siphon as originally constructed, set twenty years ago, is still operating every twelve hours. This siphon is inspected at regular intervals but has never needed repairs. If sewers need flushing (and that they do in parts of nearly every system is conceded) the cheapest and best way to accomplish the result is by means of flush tanks built properly.

ORGANIZATIONS & INDIVIDUALS

The American Highway Association

That the movement for a better system of highways in the United States has been greatly advanced by the American Road Congress held in Atlantic City, September 30 to October 5, was the assertion of all the directors of the American Association for Highway Improvement at the meeting held in Atlantic City at the conclusion of the 1912 American Road Congress.

For the sake of convenience, the title of the American Association for Highway Improvement, now entering its third successful year, was changed at the annual meeting to the American Highway Association, as it will be henceforth known. Logan Waller Page, director of the United States Office of Public Roads, was re-elected president of the association. W. W. Finley, president of the Southern Railway Company, was elected vice-president in place of W. C. Brown, president of the New York Central lines. J. E. Pennybacker was re-elected secretary, and Chas. P. Light was re-elected organizer and field secretary. Lee McClung, treasurer of the United States, continues as treasurer of the American Highway Association.

The newly elected directors of the association are James H. MacDonald, state highway commissioner of Connecticut; George W. Cooley, state highway engineer of Minnesota; A. G. Batchelder, chairman executive committee of the American Automobile Association; C. A. Kenyon, president of the Indiana Good Roads Association, and Dr. Joseph Hyde Pratt, state geologist of North Carolina.

The greatest satisfaction was expressed by the directors of the American Highway Association, not only over the great growth of the association itself, now having more than forty state and interstate road associations affiliated with it, but over the fact that the American Road Congress, which consolidated the conventions of the American Highway Association, the American Automobile Association and the National Association of Road Material and Machinery Manufacturers, was by far the greatest road convention ever held.

Fifty states and countries were represented at the congress, while twenty-four highway commissioners participated in deliberations. The government of France was represented by M. de Pulligny, chief engineer of bridges and highways; Canada, by Minister Caron, of the department of agriculture and roads, of Quebec; the corps of engineers of the United States army, by Col. Spencer Cosby. The exhibit at the congress was the largest ever made at any road convention in the world, even surpassing the exhibit at the International Congress held in Brussels in 1910.

The Dallas Convention of the American Society of Municipal Improvement.

The American Society of Municipal Improvement will hold its next convention in Dallas, Tex., November 12 to 15. Arrangements have been made for the northern and eastern members to leave St. Louis over the Missouri, Kansas and Texas railroad on the morning of Sunday, November 10, on a special train, which will arrive in Dallas about noon on Monday, November 11.

Those wishing to go on this train should notify President E. A. Kingsley, Little Rock, Ark., at once.

The meetings of the committee on standard specifications will begin on Monday afternoon, and the meeting of the executive committee will be held on Monday evening. The program has not been announced up to the date of going to press, but it is always good.

Dallas is a city of 111,000 population which has had a very substantial development in its life and growth of sixty years.

The city has many municipal improvements of good quality, both as to design and construction. They include over 100 miles of pavements of all the standard kinds and 168 miles of water mains with the necessary reservoirs and artesian wells into three separate strata of underground water. Plans are under way for a filtration plant for the surface water supply which the city is also required to use. There are 161 miles of sanitary sewers, and bonds have been voted for a sewage disposal plant. The city is specially rich in parks and playgrounds. More than half the city's improvements, including also its sidewalks, street car lines, viaduct and lighting system, have been constructed in the past seven years.

Hotel accommodations are ample, the latest, just opening, being twenty-two stories high.

The city has two cement factories and uses much of this material in its work, the latest large structure being a reinforced concrete viaduct, 5, 840 feet long and the full width of the street.

The decorative lighting on Elm, Main and Commerce streets is an attractive feature. Magnetite lamps are placed on each side of the street each 75 feet.

Those from the east of the Mississippi river can get special winter tourist rates, and for but a little more can purchase round trip tickets to Houston via Dallas, and thus be able to see both Houston and Galveston.

The American Road Builders Association

No question is of more vital importance to the American people that that of highway improvement. Interest in the subject is already widespread, and is daily becoming more intelligent. The American Road Builders' Association is endeavoring to emphasize the importance of expending the funds appropriated for highway improvement to the best possible advantage. The sum annually expended for road construction and maintenance is enormous, and it must be admitted that a very considerable proportion of it is used to poor advantage, if not actually wasted. Lack of foresight in the laying out of a rational and comprehensive system of highways for improvement; blunders in the selection of the type of road surface best fitted for the traffic to be accommodated, and the topographical and climatic conditions; failure to use to advantage local materials which, in proportion to their cost, will give better service than those transported great distances at correspondingly great expense; lack of appreciation of the value of cost data both for construction and repairs; inefficient organization and ignorance of the fundamental principles of economical maintenance—all these are exacting a heavy toll from the people of the western continent.

The ninth annual convention of this association will bring together in a great national body some of the foremost road building and paving experts in the United States and Canada. These men will meet for the purpose of discussing the many problems connected with highway and street improvement. To this have been invited all the highway officials in each state of the United States and the provinces of Canada, the city, county, and township officials, contractors, engineers, superintendents, governors of states, legislators, freeholders, farmers, automobilists and, in fact, everyone interested in the subject.

The aims and objects of the association stated briefly are as follows:

First, to unite in a national organization all those in the United States and the provinces of Canada who are actively engaged in laying out or supervising the work of construction and the maintenance of roads and streets, and all others especially interested in highway improvement.

Second, to carry on a campaign of education among its members, and thereby raise the standard of road building and street paving.

Third, at its conventions to devote its sessions primarily to the presentation of papers and to discussions on the practical questions connected with the design, construction and maintenance of rural and urban highways.

Technical Associations

Col. John A. Ockerson delivered an illustrated address on October 16 before the Engineers' Club of St. Louis on "The Colorado River Delta and the Salton Sea."

The American Society of Engineer Draftsmen at its annual meeting in New York, October 1, elected the following officers for the year 1913: Prof. Charles W. Weick, Columbia University, president; W. B. Harsel, first vice president; C. A. Clark, second vice president; C. B. J. McManus, third vice president; L. T. Maenner fourth vice president; Walter M. Smyth, secretary; Erwin C. Meyer, treasurer.

A joint meeting of the Engineers' Club of Philadelphia and the Philadelphia Chapter of the American Society of Mechanical Engineers was held on October 5. A. R. McBride, of Pittsburgh, read a paper entitled "Methods and Means of Smoke Abatement," and George H. Perkins discussed the International Smoke Abatement Exhibition held in London last April.

At a meeting at Grand Forks, in response to a call issued by Mayor M. F. Murphy, the North Dakota Municipal League was formed. The following officers were elected: President, M. F. Murphy, Grand Forks; Vice president, A. Bowers, Fargo; secretary, Charles Evanson, Grand Forks.

At a meeting of the Brooklyn Engineers' Club on October 10, a paper was presented by John B. Stein on "The Topographical Bureau of the Borough of Brooklyn, City of New York."

The officers elected at the recent annual convention of the International Association for the Prevention of Smoke are as follows: President, J. P. Brown, city smoke inspector, Indianapolis, Ind.; vice president, J. M. Searles, Pittsburgh, Pa.; secretary and treasurer, John Krause, city treasurer, Cleveland, O.

At the meeting of the American Society of Civil Engineers on October 16, the following papers were presented for discussion: "A Brief Description of a Modern Street Railway Track Construction," by A. C. Polk, and "Construction of a High-Service Reservoir at Baltimore, Md.," by P. A. Beatty.

At a meeting of the Associated Engineering Societies of St. Louis, on October 2, held under the auspices of the St. Louis Association, A. S. C. E., a paper was presented by Carl Gayler, on "The Reinforced Concrete Column."

On October 11-14, an inspection trip was made by the Maine Society of Civil Engineers to the new Aziscohos dam on the Magalloway river, Lincoln Plantation, Me., and a regular meeting of the society was held at the dam on October 12.

At a regular meeting of the Municipal Engineers of the City of New York, held on October 23, a paper on "The Fourth Avenue Subway, Brooklyn," was presented by H. A. Oestreich, M. M. E., N. Y., senior assistant division engineer, Public Service Commission.

Secretary A. D. V. Storey, of the Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment, 1269 Broadway, New York, has issued a circular letter giving the reasons why the meeting was postponed until December. A general desire was expressed by the prospective exhibitors to postpone the exhibition until after the national election. Moreover, owing to the proximity of the date to that of the Denver convention of the International Association of Fire Engineers, leading manufacturers found it impossible to exhibit as much apparatus as they would like.

U. S. Civil Service

The civil service commission will hold examinations as follows:

November 6, 7, 8. Draftsmen (Marine Engines and Machinery), Bureau of Lighthouses; Washington, D. C., $1,300; Tompkinsville, N. Y., $1,500; Division of Revenue Cutter Service, Treasury Department, $1,400.

November 8. Mineral Technologist, field service, Denver, Colo., $3,000 per annum.

November 9. Mine Sanitary Engineer, field service, $1,800 to $2,400 per annum.

November 11. Mechanical Draftsman, Milwaukee, Wis., $900 per annum.

November 20, 21. Heating and Ventilating Draftsman, office of Supervising Architect, Treasury Department, Washington, D. C., $1,200 per annum.

Technical Schools

Prof. E. C. Schmidt, who is in charge of the department of railway engineering of the University of Illinois, has been commissioned by the Japanese government to design a dynamometer car for the Imperial Government Railways. It will be constructed in this country.

Frank B. Moody, assistant state forester of Wisconsin, has been appointed assistant professor of forestry at the University of Wisconsin, at Madison. Prof. Moody is a graduate of the forestry school of the University of Michigan.

Robert M. Black, M. Am. Inst. M. E., formerly instructor in civil engineering at the State University of Iowa, has been appointed assistant professor of mining at the University of Pittsburgh.

Col. R. A. Marr, who has been for the past seven years dean of the engineering department of the Virginia Polytechnic Institute, also occupying the chair of civil engineering, has resigned in order to give his whole time to consulting practice. He will be located in Richmond after November 15.

Wood Block Paving in St. Louis—A Correction

Attention has been called to a statement in the article in the October number of Municipal Engineering, with the above title, which appears in the first paragraph in the second column on page 266. The correct statement is that "the actual expenditure on 50,000 square yards of yellow pine creosoted wood blocks laid on streets in St. Louis in 1903 has been less than two-tenths of a cent per square yard for up-keep for the entire life of the pavements, to the end of 1911."

Mr. Travilla's figures in the table on the same page show that the total expenditures for 1911 for up-keep were but $28.96, or about 0.05 cent a square yard, too small to consider on the yardage basis.

Calendar of Technical Meetings

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT—Annual Convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

AMERICAN CIVIC ASSOCIATION— Annual Convention, Baltimore, Md., November 19-22. Richard B. Watrous, secretary, Union Trust Building, Washington D. C.

FIRE EXPOSITION AND INTERNATIONAL CONFERENCE OF FIRE PREVENTION, PROTECTION AND EXTINGUISHMENT—Madison Square Garden, New York City, December —. A. D. V. Storey, Secretary, 1269 Broadway, New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION—Ninth Annual Convention, Music Hall, Cincinnati, O., December 3-6. E. L. Powers, secretary, 150 Nassau street, New York City.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION —Annual Convention, Philidelphia, Pa., December 5-7. C. A. Prosser, secretary, 105 E. 22d street, New York City.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS—Annual Meeting, New York City, December 9-12. Percy H. Wilson, secretary, Land Title building, Philidelphia, Pa.

NATIONAL ASSOCIATION OF CEMENT USERS—Annual Convention, Pittsburgh, Pa., December 12-18. R. L. Humphrey, president, Harrison building, Philadelphia, Pa.

Personal Notes

James H. Stone, city engineer of Franklin, N. H., has resigned.

M. D. Martin has been appointed superintendent of water works of Clayton, Ala.

William K. Kavanaugh, of St. Louis, has been re-elected president of the Lakes-to-the-Gulf Deep Waterway Association.

John A. Bensel has been renominated for the office of New York state engineer and surveyor on the Democratic ticket.

A. L. Gilmore, civil and landscape engineer, of Binghamton, N. Y., has been appointed resident engineer for the Binghamton Paving Brick Company.

C. A. Tupper, consulting engineer of Milwaukee, Wis., has been appointed a member of the civic committee to investigate the paving conditions of the city.

Henry S. Brinker, of South Bethlehem, Pa., president of Lehigh University, has been appointed a member of the executive committee of the new Water Conservation Commission of Pennsylvania.

L. C. Whittemore has resigned as assistant engineer with the Board of Water Supply of New York City, to accept an appointment as resident engineer with the Sanitary District of Chicago.

W. R. Haynie has been appointed American representative of Carels Freres, Ghent, Belgium, manufacturers of the Carels-Diesel oil burning marine engine. Mr. Haynie has his office in the Hudson Terminal Building, New York.

Kern Dodge, engineer, of Philadelphia, announces the opening of an office in the Morris building, where he will devote himself to the engineering and financing of public service properties. Mr. Dodge was one of the founders of the engineering firm of Dodge & Day.

Willis J. Dean, civil and structural engineer, has opened an office in the Timken building, San Diego, Cal. He was formerly connected with James Stewart & Co., general contractors, of New York, in charge of their office at Portland, Ore., and also occupied the position of state structural engineer of Oregon.

Major W. W. Crosby, consulting engineer, announces the removal of his offices to 1431 Munsey building, southeast corner of Fayette and Calvert streets, Baltimore, Md., where his practice will include engineering administration, arbitration, efficiency and organization, landscape, park and development work, municipal planning, road and street specifications and testing of paving materials, both chemical and mechanical.

W. E. Atkinson has been appointed chief engineer of the State Highway Department of Louisiana. The work of this department has been formerly in the hands of the State Board of Engineers under the direction of Mr. Gervais Lombard, one of the assistant state engineers, who has also been in charge of levees. In connection with the present appointment, the highway work becomes established in a separate department, though still under the supervision of the State Board of Engineers. Mr. Atkinson is a graduate of Louisiana State University in the class of 1900.

MACHINERY AND TRADE

Thomas Steel Reinforcing for Pavements

BY C. G. ALLEN, BUREAU OF ENGINEERING, CHICAGO, ILL.

Concrete road construction has been advancing in favor with a rapidity not generally appreciated. It is no longer new, and the experience with it up to the present time has been largely localized but most county and municipal engineers are willing to give this type of construction a trial when definite information regarding service is furnished. Experience in Wayne county, Mich., and elsewhere has been gained thru a period of sufficient length to warrant the statement that well built concrete roads and pavements are a usual form of construction which merit more extensive adoption. Plain concrete, owing to its inherent tendency to shrinkage during process of hardening, and with the expansion and contraction under different ranges of temperature, will develop cracks in its mass. The tendency to crack is obviated by the proper and scientific distribution of the steel thru the whole mass.

Considerable attention has, of late been directed to the Thomas steel reinforcement for pavements. This system is simple and practical. In it the proper percentage of steel has been properly distributed.

Another phase of the Thomas steel reinforcement, which is made in units, is that it eliminates the personal equation as nearly as can be when the placing of steel reinforcing in concrete pavements is concerned. No part of the reinforcement can be forgotten or omitted, as the frames are made up in the shop and are delivered as a unit.

REINFORCING CONCRETE PAVEMENTS.
The Reinforcement in Place.

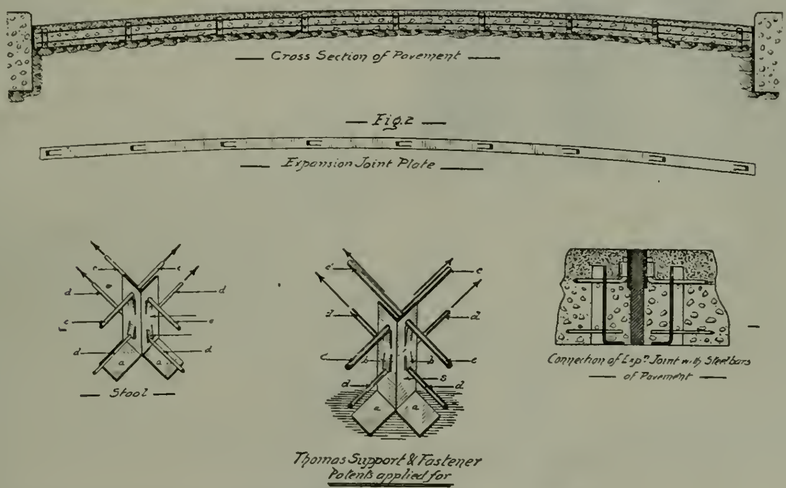
The Thomas steel reinforcement is placed in the following manner: The ⅜-inch round steel bars are placed longitudinally and crossways 2 feet center to center and 1 inch from the top surface of the finished concrete. The ¼-inch round steel bars are placed longitudinally and crossways 4 feet center to center and 4 inches from the top surface of the finished concrete, and both systems are well clamped together at their intersections. The two systems are properly supported in their respective places before any concrete is laid, and in proper lengths and widths so as to be embedded in concrete panels 30 feet long by the whole length of the road. The top and bottom bars are held firmly at intervals of 4 feet by an upright steel member, which will make a positively connected unit of the top and bottom bars thru the whole pavement.

Expansion joints ½ inch wide are placed at right angles to the curb line at intervals of 30 feet. Joints have their edges protected by means of a soft steel plate 3/16 inch by 3 inch rolled to conform to the established crown of the pavement and the steel plates are securely attached to the reinforcing bars of the pavement so that the concrete between

versely and longitudinally (marked "C" "C" and "D" "D") and firmly attached to the vertical support "S" (or stool) by the simple device marked "B," which clinches the bars when engaged in the support "S" or stool.

If expansion joints are used every 30 feet and the street is 24 feet wide, the fixity of these stools, which are generally placed 4 feet on centers, makes a large stone 24 feet wide by 30 feet long, composed of small stones 4 feet by 4 feet, without any joint between the small stones.

Figures 2 and 3 show the only way an expansion joint can be connected permanently with the steel bars in the mass of the pavement—for the whole structure and all its parts must work as a unit. This way of constructing an expansion joint will prevent any possible crack that



REINFORCING CONCRETE PAVEMENTS.
Details of Reinforcement.

the expansion joints works as a unit. Expansion joints without steel plates are also placed along the side of the curb ½ inch wide and the whole length of the paved street, the opening extends to the bottom of the concrete base and the space is filled with asphalt filler.

Generally the top bars are 2 feet center to center and those at the bottom 4 feet center to center, but this may vary according to climatic conditions. The vertical supports or stools are made of light angle iron sheared at the bottom so as to bend the feet, "A" "A" (see figure 1), which give a bearing on the grade surface of the road. It will be readily seen, looking at the perspective drawing of the stools, marked "S," that the two parallel sets or horizontal bars are placed trans-

might occur in the concrete between the reinforcing bars and the plate of the expansion joint.

The Turbine System of Sewer Cleaning

The accompanying photograph shows over two hundred and fifty feet of roots taken out of one block of sewer by the turbine machine at Salt Lake City, Utah, on July 30th of this year. Some of the roots shown are over 22 feet in length. The machine referred to is a water turbine, constructed by the Turbine Sewer Machine Renovating Company, of Milwaukee, Wis.

This turbine is encased in a brass tube

20 inches long, to which is attached a fire hose. The water revolves the cutting blades of the turbine at about the same velocity as an electric fan, cutting and grinding everything to a grout. The displaced matter is carried on down to the

TURBINE SYSTEM OF SEWER CLEANING.

Over 250 Feet of Roots Taken from One Block of Sewers.

outlet with the force of the water. This machine is pulled thru the sewer by a compound geared windlass. A cable is attached to the front end and another is put on the rear end of the machine. On the rear cable a system of clamps around the hose connections takes the strain off the hose. This rear cable also pulls the hose out of the sewer by means of the rear windlass. In connection with this is a forcing jack used to force the machine thru the sewer where the sewer is stopped up.

When the sewer pipe is so completely stopped up it is impossible to run cord or cable thru it, the machine is inserted into the manhole at the low end of the sewer, attached to the hose and water plug, and with the water pressure the machine is allowed to work for a few minutes, in this manner cutting the matter ahead of the machine. The machine under these conditions is connected with the turbine special coupling rods and they are attached to the turbine forcing jack, which, by the operating of the handle, forces the machine ahead. The matter cleaned in this way is ground up into a grout and together with the water is allowed to flow back past the machine and is carried away, leaving the sewer in a clean and sanitary condition.

The Sanitary Street Flusher

At the present time there is no one particular subject in municipal government receiving more scientific consideration than that of cleaning paved streets. Too much cannot be said on the subject of sanitation. Tuberculosis, and the whole range of zymotic or filth diseases, are often caused and always aggravated by dirty streets. The dust of the street, moreover, has a strong influence on the general life of the city.

The illustration on this page shows two machines of sanitary automatic type of street flusher in operation on the streets of St. Louis. These machines drive the heavy accumulation of dirt into the gutter, from whence the light portion is taken into solution and carried off by the water, the heavy part precipitates into the gutter, after which it is loaded into carts for removal.

The machines are all built of one size. The tank is made of the best boiler steel, and is so constructed that the necessary air pressure is automatically obtained from the fire hydrants when filling with water. No auxiliary machinery, such as engine, pump or air compressor is required; the pressure of the city water mains does the entire work. The outlet valve is controlled by lever at driver's seat, adjusted so that the operator has perfect control over water issuing from the flushing nozzle when in use. Sarven patent type wheels are used, 2½-inch axles, springs are of special design, tubular steel doubletrees; all valves are made of brass. Its compact and symmetrical construction insures lightness of draft.

These machines are made by the Sanitary Street Flushing Machine Co., of St.

THE SANITARY STREET FLUSHER.

Wagons in Service.

Louis, Mo., and are used quite extensively by such cities as Los Angeles, San Francisco, Denver, Washington, Chicago, Des Moines, Kansas City, Louisville, New Orleans, Detroit, Duluth, St. Louis, Butte, Omaha, Rochester, Cleveland, Cincinnati, Philadelphia, Dallas, Salt Lake City, Seattle, Spokane, etc.

Preparing Asphaltic Concrete

BY H. S. ROGERS, SUPERINTENDENT ASPHALT PAVING PLANTS OF SOUTH PARK DISTRICT, CHICAGO.

The ingredients of the aggregate for asphaltic concrete must be thoroly mixed, to furnish uniformly a minimum percentage of voids. The aggregate must be entirely dry, to be rid of one of the greatest enemies of pavements, moisture. The aggregate must be uniformly heated, to drive off the moisture, and to avoid chilling the binder. The binder (whose melting point is high enough to furnish a firm and impervious cement to stand all weather conditions) must be heated to a perfectly liquid state in a receptacle whose temperature is entirely under control, to avoid waste and ruin, which comes from "flashing" or "burning."

The exact proportions of the aggregate and binder to produce best results must be rigidly maintained by accurate measuring devices. The aggregate and binder must be thoroly mixed.

The mixing should be done in individual batches, to secure uniformity. Economy requires that the succession of the delivery of these batches shall be so frequent and regular as to form a practically continuous operation, which will keep all the men profitably busy all the time.

We use Twentieth Century Portable Asphalt Paving Plants in our work and are, at present, using three of these machines at Forty-seventh and Grand avenues. We can move and set up in ten minutes' time. Our machines are complete, self-contained plants mounted on broad tired wheels. They are operated on the street where the paving is to be done, and are moved forward from time to time as the work progresses. All the working parts are driven from a main shaft receiving power by belt from a traction engine which accompanies the machine at all times and is used in moving forward at intervals.

We use two sizes of these machines, their rated capacities being 800 and 500 square yards of 2-inch thick asphaltic concrete pavement per day of nine hours. These capacities are guaranteed under normally favorable conditions, and will usually be exceeded in actual practice. Under able management of the work and with advantageous conditions, the large machines will lay 1,000 to 1,200 square yards per day.

The stone and sand are hauled separately to the streets ahead of the machine, there to be mixed in proper proportions and heaped in piles at the machine settings. Shoveled into a hopper at the front, the mixture is fed by spiral conveyor into horizontal revolving drum

PREPARING ASPHALTIC CONCRETE.
Laying Asphaltic Concrete of Grand Avenue, Chicago.

dryer, directly over the furnace, the materials being thoroly mixed as they pass slowly toward the rear and where, at a proper temperature, they trail out into the boot of the elevator which delivers them to a storage hopper at the top and rear of the machine.

Beneath the storage hopper is a measuring hopper, the discharge gates of both being operated by levers so interlocked that only one can be opened at a time. The measuring devices for materials are exact, and when the proportions are determined, each batch must come out exactly as wanted. The operator cannot vary the proportions by carelessness or intent.

THE ATLANTIC PUMPING ENGINE.

The Atlantic Diaphragm Pumping Engine

Contractors often look upon labor saving equipment as expensive in first cost or high in maintenance cost so that the possible saving claimed by the manufacturers seldom works out in actual practice. In the case of the Atlantic Diaphragm Pumping Engine, manufacturer by Harold L. Bond Company, 383 M. Atlantic avenue, Boston, and 78 M. Beach street, New York. In a pamphlet recently issued by the manufacturer it is shown by actual figures that this equipment, costing less than $200 and requiring an operating expense of only about 25 cents per day, is capable of affecting an actual saving in labor of more than $13 per day. It is shown that the equipment pays for itself in about two weeks.

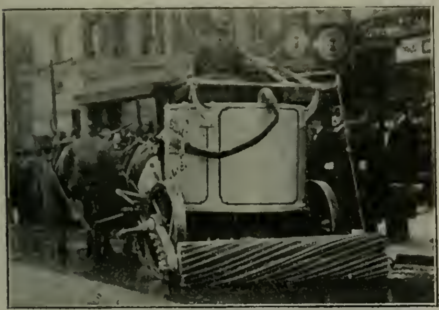
The Atlantic diaphragm pumping engine is designed for use in trench, foundation and other classes of excavation work, where water is not only expensive to handle by ordinary methods, but is frequently responsible for expensive delays.

The outfit consists of a gasoline motor, direct connected to a diaphragm pump, all mounted on a channel iron frame with low cast iron wheels and swivel front axle and drawing handles. The engine is 3½-inch stroke, normal speed 500 revolutions per minute. Speed may be changed while in operation from 300 to 700 r. p. m. without injury to any of its parts. This gives a speed to the pump from 30 to 50 strokes, as may be desired. Capacity, 3,500 gallons per minute. Fly wheel is 14 inches in diameter. Jump spark ignition. Lunkenheimer special generator valve. Ratio of back gear crank to engine shaft, 13½ to 1. All gears have cut teeth. Pinion of steel. Cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frost-proof, and no serious damage can follow, even tho water was allowed to freeze solid in the water jacket. The engine is provided with a special and original speed regulating device which operates on the governor by increasing the tension on the spring on the governor weight, and at the same time advancing the timing of the spark.

The pamphlet above referred to gives full information as to prices, construction and operation.

The "Squeegee" in New York.

It is safe to say that 95 per cent of the cities and towns of this country are behind the times in the matter of street cleaning. About as far as most of them get in summer is to keep the dust wet down so it does not blow; nevertheless, it tracks into buildings, stores and offices.



THE SQUEEGEE STREET CLEANER.
The Machine in Action in New York.

"In 1910 we made a complete test of the squeegee machine, under the various conditions in this city," states Wm. H. Edwards, Commissioner of Street Cleaning, New York City, "and found that in the congested districts where the conditions are particularly foul, it was able to do 21,247 square yards per machine per day and with the use of 404 gallons of water per 1,000 square yards and in the residence district and under excellent conditions, it did 75,161 square yards per machine per day with the use of 91 gallons of water per 1,000 square yards. In all during the test we found that the average day's work, taking into consideration all classes of neighborhoods, the machine averaged 51,977 square yards per machine per day with the average use of 148 gallons of water per 1,000 square yards. The result of our test convinced me that this machine was a valuable one to be used in the city's work and we are now operating a number of them.

"These machines wash and clean at the same time and are most successful on brick, asphalt and wood block pavements. They are of great service in removing oil and grease from the streets and the cost of operation is exceedingly low."

The machine consists of a four-wheeled gear with platform springs on front wheels. It can be arranged with pole for two-horse team or shafts for three-horse team. A heavy sheet iron circular shaped tank is mounted on springs on rear axle, with front of tank resting on the springs of the front axle. A suitable driver's seat is placed upon top of the tank.

Directly back of the rear wheels and suspended from and at an angle to the rear axle is a spiral revolving rubber brush. This brush can be removed from the surface by the driver from the seat. The two levers for the center sprinklers are on the right side of the driver, and the side sprinklers are operated by the foot levers, one on the right and the other on the left.

The machine is manufactured by the Kindling Machinery Co.,, 348 Broadway, Milwaukee, Wis.

Fire Equipment to Fit Chassis

The accompanying illustrations represent equipment for motor fire apparatus, all ready to attach to the chassis.

One illustration shows a hook and ladder truck and the other a combination chemical hose and squad wagon. Both of these types are built in all sizes and can be built to fit any chassis. They are all ready to attach to chassis and all that is necessary is the drilling of a few holes in the chassis frame and bolting the equipment on and they are ready for service.

This makes it a very simple matter for any manufacturer of motor vehicles to build a motor propelled fire wagon, as they will not be bothered with the fire equipment end of it. Peter Pirsch & Company, of Kenosha, Wis., are now making

FIRE EQUIPMENT FOR TRUCKS.
Hose Car Equipment.

FIRE EQUIPMENT FOR TRUCKS.
Ladder Truck Equipment.

a specialty of the building of these equipments to fit any chassis. This will also help to reduce the cost of motor apparatus to the city itself, to a considerable extent, as they can now buy a suitable chassis for this purpose and then get the equipment from this firm and a local man can do the rest.

Collapsible Steel Culvert Forms

The accompanying photographs show a culvert constructed on the German, or Deitz road, near Rice Lake, Wis. This culvert was constructed over a Fife-Coleman collapsible steel form having a 48-inch arch, side walls 16 inches high and a length of 20 feet.

Following is the cost of constructing this culvert:

Hauling 10 cu. yds. sand	$ 6.00
Hauling 4 cu. yds. small field rocks	1.50
Hauling forms and cement	2.00
7½ bbls. cement, @ $1.35	10.12
9½ days labor, @ $1.75	16.62
Total	$36.24

These forms are made of 16-gage steel covering, reinforced by steel on the inside. The forms are constructed in three pieces, the top (which is semi-circular) and two side plates. The working parts of the form are very simple and easy to operate. The top, setting between the two side plates, is held in position by arms attached to the side plates by bolts which allow the arms to be lowered by pulling the draw rods which are attached to them. By pulling the draw rods the arms are lowered and the support of the top is removed allowing the top to be lowered. The side plates are held in position by swinging braces, so that when the top is drawn the swinging braces are then unlocked and the side plates are easily removed.
locked, the sides are immovable. End plates are made which fasten to the top and side plates by keys so that they may be easily removed.

The first operation in the building of a

COLLAPSIBLE CULVERT FORMS.
Completed Culvert After Removal of Forms.

culvert is the digging of a trench; this, if in hard earth such as clay soil, will not need boarding up, while in sandy soil planking must be used. The trench should be dug at least 4 inches deeper than the water level and this filled with grout and packed down. The width of the trench will depend upon the size of culvert form used and the thickness of the side walls should be 8 to 10 inches. The forms are then erected in the center of the trench, with the end plates on, and covered with grout. The grout extending to the top of the end plates will give a smooth face at each end of culvert over which the dirt from the roadway will not sift and stop the flow of water. This face or abutment also prevents water from washing around sides of culvert, as the face extends 10 or 12 inches beyond culvert walls. After

COLLAPSIBLE CULVERT FORMS.
Forms in Place.

When the width of the highway or the roadbed demands a longer culvert it can easily be made by resetting forms at the end of the finished culvert and repeating the process heretofore described. Where there is a large water supply and low roadbed to contend with, a double culvert may be placed. This is built in the following manner: The first culvert is built in a manner described before and a trench is then dug along this culvert laying bare one side wall. The forms are again reset against this and covered with grout. This gives a center pier and saves one side wall. This operation may be repeated any number of times, giving a series of culverts.

The Fife-Coleman collapsible steel culvert forms are manufactured under patents owned by the Concrete Form & Engine Company, of Detroit, Mich.

All Steel Dump Wagons

The accompanying views of the MacKinnon Steel King Dump Wagon illustrate three sides of the type of wagon which is being used very extensively for hauling asphalt, etc., for paving purposes.

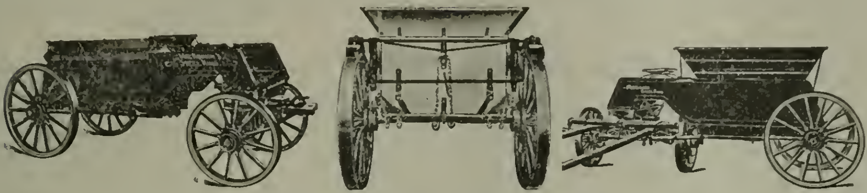
These wagons are furnished with wheels made with the MacKinnon metal covered hub. This hub, being entirely covered by malleable iron, which also projects up the sides of the spokes, will last for years and will withstand the severest strains and wear and cannot be injured by exposure to weather. The wagon being made entirely of steel and with this hub is practically indestructible.

The axle is wood combined with iron—the iron made in the shape of an I-beam strengthened by wood on either side. This method of making an axle was found to support a greater weight than any wood axle that could be employed.

This dump wagon is especially suited

are revolved about a central shaft, within

The mixer is guaranteed (under favorable conditions) to give a yardage equal a drum, by a crank driven gear system. Three turns of the crank makes one complete turn of the mixing arms; and requires less than three seconds. This means that the three mixing arms and the seventeen paddles pass thru the mixture every three seconds.



ALL STEEL DUMP WAGONS.
Three Views of the Wagon, Showing Details of Construction.

to the use of contractors—municipal, garbage, ashes, concrete, sand, gravel, asphalt, etc. It has an all-steel box, that is made light enough to keep the weight down to that of the best wooden dump wagon, but it is at the same time reinforced and braced in the gooseneck, also trussed in the bottom grates. The flare sides are braced at four corners, and in the 3-yard wagon, have an additional angle iron riveted across the center of the flare sides to stiffen and give additional strength.

The driver simply pushes the lever with his foot to dump a load of material. The gates at the bottom dump are made in pairs, two gates on each side which open in the center and swing one behind the other right and left, so that when full open they are 18 inches in the narrow track and 14 inches in the wide track clear of the ground. The gates are closed by a lever. The driver has no occasion to leave his seat. Wagons are arranged so that a three-horse hitch can be attached to any wagon.

The Northfield Hand Mixer

The Northfield Iron Co., 422 Water street, Northfield, Minn., has placed on the market a hand concrete mixer which promises to be of great service to the small contractor. It is built on an entirely new principle. Three mixing bars are bolted adjustably to the mixing shaft, and seventeen mixing blades or paddles are in turn bolted to these bars, after the manner of the shovels on gang plows. These mixing bars and attached blades

The mixer is guaranteed, under favorable conditions, to give a yardage equal to the following table.

The minimum yardage is based on batches charged with 3-foot barrows and the maximum yardage is based on batches charged with 4-foot barrows, and assuming that conditions are so favorable that each wheeler can load and

THE NORTHFIELD HAND MIXER.

wheel up and dump his barrow into the mixer drum every two minutes, and that these laborers be paid 25 cents per hour for a ten-hour day; batches to be discharged directly into forms:

Size of Crew	Average time per batch	Average cu. yds. per day	Average cost per cu. yd.
2	3 min.	20 to 27 yds.	25 to 18¼ cts.
3	2¼ min.	30 to 40 yds.	25 to 18½ cts.
4	1½ min.	45 to 60 yds.	22 to 17 cts.
5	1 min.	67 to 90 yds.	19 to 41 cts.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bedford, Ind.—Nov. 5, 1 p. m. Constructing the Bedford-Bloomington gravel road. Ezra W. Edwards, auditor.

Corydon, Ind.—Nov. 6, 2 p. m. Constructing two gravel roads. Wm. Taylor, auditor.

Crown Point, Ind.—Nov. 7, 12 m. Constructing two gravel roads. Chas. A. Johnson, auditor.

Hartford City, Ind.—Nov. 4, 2 p. m. Constructing a macadam road. James A. Cronin, Jr., auditor Blackford county.

Huntington, Ind.—Nov. 4. Constructing the Geo. W. Young road. Harold Guthrie, auditor.

Indianapolis, Ind.—Nov. 12, 10 a. m. Constructing a gravel road. W. T. Patten, auditor Marion county.

Logansport, Ind.—Nov. 6, 10 a. m. Constructing three macadam roads. J. E. Wallace, auditor Cass county.

Marion, Ind.—Nov. 6, 2 p. m. Constructing several gravel roads. E. H. Kimball, auditor.

Peru, Ind.—Nov. 7, 12 m. Constructing a gravel road. Frank K. McElheny, auditor.

Richmond, Ind.—Nov. 4, 11 a. m. Constructing a gravel road. Lewis S. Bowman, auditor.

Shelbyville, Ind.—Nov. 4, 11 a. m. Constructing a road in Moral township. Frank W. Fagel, auditor.

Tipton, Ind.—Nov. 4. 10:30 a. m. Constructing a gravel road. J. H. Tranbarger, auditor.

Cincinnati, O.—Nov. 8. 12 m. Constructing a retaining wall on Indian Hill avenue, under Specification No. 402. Certified check, $500. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Houston, Tex.—Nov. 11, 12 m. Grading and paving the following streets: Austin street, bitulithic pavement on 5-inch concrete; Fannin street, creosoted wood blocks on 5-inch concrete; Lamar street, creosoted wood blocks on 5-inch concrete. Certified check, 5 per cent on each bid. H. B. Rice, mayor.

CONTRACTS AWARDED.

San Bernardino, Cal.—Paving B street, to the Highway Construction Co., $13,962.

Galesburg, Ill.—Paving Ferris street, to J. B. McAuley, $17,798.

Mattoon, Ill.—Constructing paving in the Tenth street district, to Bresee and Brown, $22,643.

Pontiac, Ill.—Paving ten blocks of brick pavement, to Keys & McNamara, $37,000.

Springfield, Ill.—Constructing 1¼ miles of paving, to the J. S. Wood Construction Co., $15,000.

Marion, Ind.—Paving several streets, to the Cleveland Trinidad Paving Co., $22,600.

Baltimore, Md.—Constructing several sewers, to E. F. Sweeten & Son, $160,000.

Grand Rapids, Mich.—Paving South Market street, to Carpenter and Anderson, $39,-999.

Laurel, Miss.—Constructing creosoted wooden block paving, to the Southern Paving & Construction Co., Chattanooga, Tenn., $47,793.

Buffalo, N. Y.—Paving Bidwell boulevard, to the German Rock Asphalt Co., $18,890.

Caldwell, O.—Constructing a mile of Sharon road, to Glover and McElfresh, $15,-000.

Portsmouth, O.—Paving Home avenue, to Monroe & Son, $12,849.

Salem, O.—Paving the Wellsville-Salineville road, to Patterson & Gasten, Wellsville, $17,740.

Greenburg, Pa.—Constructing the Greenburg-Mutual road, to Rhinehart Brothers, $19,000.

Pittsburgh, Pa.—Constructing the Glassport and Elizabeth extension road, to John Connelly, $20,203; constructing one mile of the Chartiers road, to A. Ancomi, $14,101.

Salt Lake City, Utah.—Paving Second street with asphalt, to G. A. Heman, St. Louis, $21,504.

Bellingham, Wash.—Paving Elk street, to C. G. Burnett, $18,372.

Wheeling, W. Va.—Constructing a river road from Warwood to Short creek, 4.3 miles, to R. L. McNabb, Wellsburg, $23,000.

CONTEMPLATED WORK.

Los Gatos, Cal.—A $35,000 bond issue for street improvement has been voted. A. E. Winning, city clerk.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

South Haven, Mich.—A $25,000 bond issue for road improvement has been voted. Geo. W. Matthews, township clerk.

Hilton, N. J.—A $23,000 and a $10,000 bond issue for park improvement has been voted.

Trenton, N. J.—A $15,000 bond issue for road improvement has been voted.

Dansville, N. Y.—A $43,400 bond issue for street paving has been voted. Harry Rowan, city clerk.

Wappingers Falls, N. Y.—A $12,000 bond issue for road improvement has been voted.

Cleveland, O.—A $225,000 bond issue for park improvement has been voted. W. J. Springborn. director of public works.

Hamilton, O.—A $25,000 bond issue for street improvement has been authorized.

Martins Ferry, O.—A $12,000 bond issue for park improvement has been voted.

Cleveland, O.—A $500,000 bond issue for street and sewer improvement has been voted, W. J. Springborn, director of public service.

Norman, Okla.—The construction of a city park is contemplated.

Philidelphia, Pa.—A $600.000 bond issue for park and playground improvement has been authorized.

Philadelphia, Pa.—A $500,000 bond issue for resurfacing asphalt streets has been authorized.

Philadelphia, Pa.—A $300,000 bond issue for road improvement and a $200,000 bond issue for street repair have been authorized.

Susquehanna, Pa.—A $15,000 bond issue for street paving has been voted. D. J. Lynch, boro secretary.

Devine, Tex.—A $40,000 bond issue for road improvement has been voted.

Fairmount, W. Va.—A $400,000 bond issue for Marion county roads has been voted. John T. Phillips, county clerk.

SEWERS.

BIDS REQUESTED.

Clinton, Ia.—Jan. 15, 1913. Constructing a new system of city sewers. Iowa Engr. Co., engineers.

Houston, Tex.—Nov. 11, 12 m. Constructing sanitary sewers in the Second ward, including about 37,900 lin. ft. of sewer pipe and appurtenances. Certified check, $6,800. H. R. Rice, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Constructing complete sanitary sewer system, including 10,000 lin. meters of sewer pipe. Plans and specifications can be obtained of "Municipal Engineering," Editorial Dept., Indianapolis, Ind. M. Rodrigues, mayor.

Installing gas engines complete in sewer
Larendo, Tamaulipas, Mexico—Nov. 14.
system and water supply plant. Plans and specifications can be obtained at the Editorial Dept. of "Municipal Engineering," Indianapolis Ind.

CONTRACTS AWARDED.

San Bernardino, Cal.—Constructing a sewer on I street, to Chas. McElvaine, $11,050.

Gary, Ind.—Constructing sewers in District No. 11, to the Cain Construction Co., $10,671.

Harper, Mo.—Constructing a sewer system, to Bash & Gery, Joplin, Mo., $22,085.

Jefferson City, Mo.—Constructing several sewers, to Joseph Pope, $11,354.

Kansas City, Mo.—Constructing a large sewer, to W. W. Cook & Son, Junction City, $95,078.

Springfield, Mo.—Constructing sewer extensions, to Plummer Construction Co., $55,601.

Urbana, O.—Constructing a sewer system, to Boyd & Cook, Dayton, $110,000.

Pittsburgh, Pa.—Constructing a relief sewer on Thirty-third street, to John F. Casey Co., $109,359.

CONTEMPLATED WORK.

Russellville, Ark.—Will advertise for bids for construction of city sewers. Estimated cost, $28,000. Street commissioners.

Fowler, Cal.—A $20,000 bond issue for sewer improvement has been voted. M. H. Minier, city clerk.

Los Gatos, Cal.—A $300,000 bond issue for sewers has been voted.

Lawrenceville, Ga.—A $15,000 bond issue for sewers has been voted. J. H. Britt, city clerk.

Kingsley, Ia.— A $12,000 bond issue for sewer construction has been voted. Rey E. Rieke, city recorder.

West Point, Nebr.—A $14,000 bond issue for sewer extensions has been voted. Augusta Hanft, city clerk.

Cleveland, O.—A $200,000 sewage disposal plant is contemplated at Newburg Heights.

Cleveland, O.—A $500,000 bond issue for street and sewer improvement has been voted. W. J. Springborn, director of public works.

Portland, Ore.—The construction of sewer extensions in East Glisan street, to cost about $154,299, is contemplated.

Philadelphia, Pa.—An $800,000 bond issue for main and branch sewers has been authorized.

Clarksburg, W. Va.—A $22,000 bond issue for water works and sewers has been voted. M. E. Henderson, mayor.

Bangor, Wis.—A $14,000 bond issue for sewer system has been voted.

WATER WORKS.

BIDS REQUESTED.

Laredo, Tamaulipas, Mexico—Nov. 14. Erecting water supply plant complete, including 18,283 lin. meters of cast iron water pipe. Plans and specifications can be obtained of the Editorial Dept., "Municipal Engineering," Indianapolis, Ind. M. Rodriguez, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Installing centrifugal pumps in water supply plant. Plans and specifications can be obtained of the Editorial Dept., of "Municipal Engineering," Indianapolis. M. Rodrignez, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Constructing two reinforced concrete tanks and an elevated steel tank. Plans and specifications can be obtained at the Editorial Dept. of "Municipal Engineering," Indianapolis. M. Rodrignez, mayor.

CONTRACTS AWARDED.

Logan Ia.—Constructing improvements to the water works system, to the Des Moines Bridge & Iron Co., $17,100.

CONTEMPLATED WORK.

Fowler, Cal.—A $25,000 bond issue for water works improvement has been voted. M. H. Minier, city clerk.

Tulare, Cal.—A $100,000 bond issue for water works system has been voted.

Ocala, Fla.—A $100,000 bond issue for water works has been voted.

Byronville, Ga.—A $10,000 bond issue for water works construction has been voted.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

Marshalltown, Ia.—A $15,000 bond issue for an electric light plant has been voted.

Redfield, Ia.—A $15,000 bond issue for an electric light and water works improvement has been voted.

Saline, Mich.—A $30,000 bond issue for water works system has been voted.

Chester, Mont.—A $22,000 bond issue for water works has been voted.

Doniphan, Mo.—An $18,000 bond issue for water and light plant extensions has been voted.

Greenfield, Mo.—A $16,500 bond issue for water works has been voted. L. A. Wetz, city clerk.

New Brunswick, N. J.—A $135,000 bond issue for a filtration plant has been authorized.

Jamestown, N. Y.—A $150,000 bond issue for water works extensions has been passed. Clement B. Jones, city clerk.

Enderlin, N. D.—A $10,000 bond issue for water works has been voted.

Lima, O.—A $100,000 bond issue for water works extensions has been voted.

Springfield, O.—A $170,000 bond issue for the construction of a reinforced water works main has been authorized.

Zanesville, O.—The construction of a $361,000 filtration plant is contemplated.

Philadelphia, Pa.—A $300,000 bond issue for water supply in West Philadelphia has been authorized.

Hurley, S. D.—A $16,000 bond issue for water works has been voted.

Clarksburg, W. Va.—A $22,000 bond issue for water works and sewers has been voted. M. E. Henderson, mayor.

Burlington, Wis.—A $15,000 bond issue for water works improvement has been voted.

Waterford, Wis.—A $15,000 bond issue for water works system has been voted.

BRIDGES.

BIDS REQUESTED.

Eutaw, Ala.—Nov. 6, 11 a. m. Constructing six steel bridges. Certified check, $400 on each bid. W. S. Keller, state highway engineer.

Chandler, Okla.—Nov. 8, 2 p. m. Constructing two steel and concrete bridges. Certified check, 10 per cent. J. E. Rea, county clerk.

Huntsville, Tex.—Nov. 11. Constructing two steel bridges. A. T. Randolph, county clerk.

CONTRACTS AWARDED.

Rush, N. Y.—Constructing a bridge across the Genesee river, to the Owego Bridge Co., $22,000.

Brigham City, Utah.—Constructing twelve bridges, to the Omaha Structural Works of Omaha, $29,000.

CONTEMPLATED WORK.

San Francisco, Cal.—Will build a steel bridge across Suisun Bay. Estimated cost, $1,650,000.

Lewiston, Ida.—A $35,000 bond issue for bridge construction has been voted. C. F. Leland, city clerk.

Trenton, N. J.—A $13,000 bond issue for bridge improvement has been voted.

Brooklyn, N. Y.—The construction of a $500,000 bridge in Twenty-fifth street is contemplated. Frand Lander, county commissioner.

Hamilton, O.—A $12,000 bond issue for bridges has been authorized.

Philadelphia, Pa.—A $200,000 bond issue for bridges has been authorized.

Fort Worth, Tex.—A $600,000 bond issue for bridge construction has been voted.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Cleveland, O.—A $50,000 bond issue for a garbage plant has been voted. W. J. Springborn, director of public works.

STREET LIGHTING.

CONTEMPLATED WORK.

Avilla, Ind.—The installation of an electric light plant is contemplated.

Marshalltown, Ia.—A $15,000 bond issue for an electric light and water plant has been voted.

Redfield, Ia.—A $15,000 bond issue for an electric light plant and water works improvement has been voted.

Clara City, Minn.—A $5,000 bond issue for electric light plant construction has been voted.

Doniphan, Mo.—An $18,000 bond issue for water and light plant extensions has been voted.

Binghamton, N. Y.—Will order twenty-one boulevard standards for the court house square. Supervisor Kilmer.

Canistota, S. D.—The installation of an electric lighting system is contemplated.

FIRE APPARATUS.

CONTEMPLATED WORK.

Fort Smith, Ark.—A $12,000 appropriation for an aerial auto has been made.

Little Rock, Ark.—Purchase of a motor car, to cost about $2,000, for the fire chief, is contemplated.

Tulare, Cal.—An $8,000 bond issue for fire apparatus has been voted.

Americus, Ga.—The purchase of motor road machinery is contemplated by the board of county commissioners. A. F. Hodges, commissioner.

Atlanta, Ga.—The city will purchase five or six auto fire apparatus immediately. The autos are to cost about $10,000.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

Springfield, Ill.—The purchase of a seven passenger auto for the police department is contemplated.

Atlantic City, N. J.—The purchase of four autos for use of city officials is contemplated. Commissioner Bacharach.

Cleveland, O.—A $75,000 bond issue for auto fire apparatus has been voted. W. J. Springborn, director of public works.

Cleveland, O.—The purchase of nine autos for battalion chiefs and three auto tractors for ladder trucks and water tower and four new engines is contemplated. Fire Chief Wallace.

East Liverpool, O.—The city council is contemplating the question of completely motorizing the fire department.

Harrisburgh, Pa.—The purchase of an auto for the park commission is contemplated.

Pittsburgh, Pa.—The purchase of motor fire apparatus is contemplated. Wm. A. Magee, mayor.

MUNICIPAL ENGINEERING

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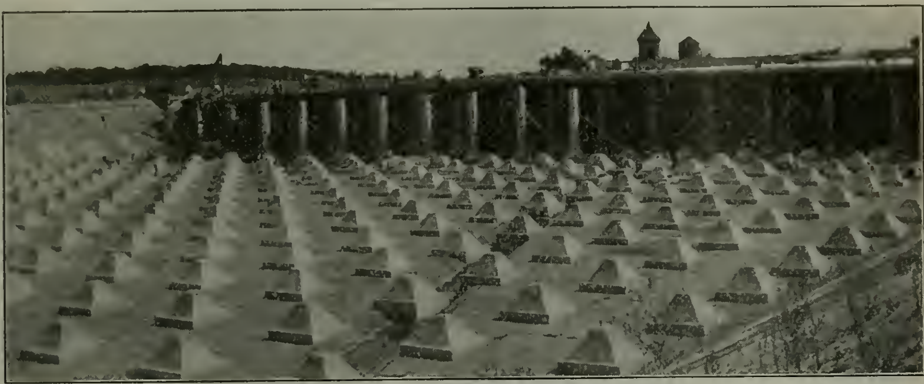

CONCRETE PEDESTALS FOR COLUMNS.
Minneapolis Water Purification Plant.

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All works of quality must bear a price in proportion to the skill, time, expense and risk attending their invention and manufacture. Those things called dear are, when justly estimated, the cheapest; they are attended with much less profit to the artist than those which everybody calls cheap.

A composition for cheapness and not for excellence of workmanship is the most frequent and certain cause of the rapid decay and entire destruction of arts and manufactures. *Ruskin.*

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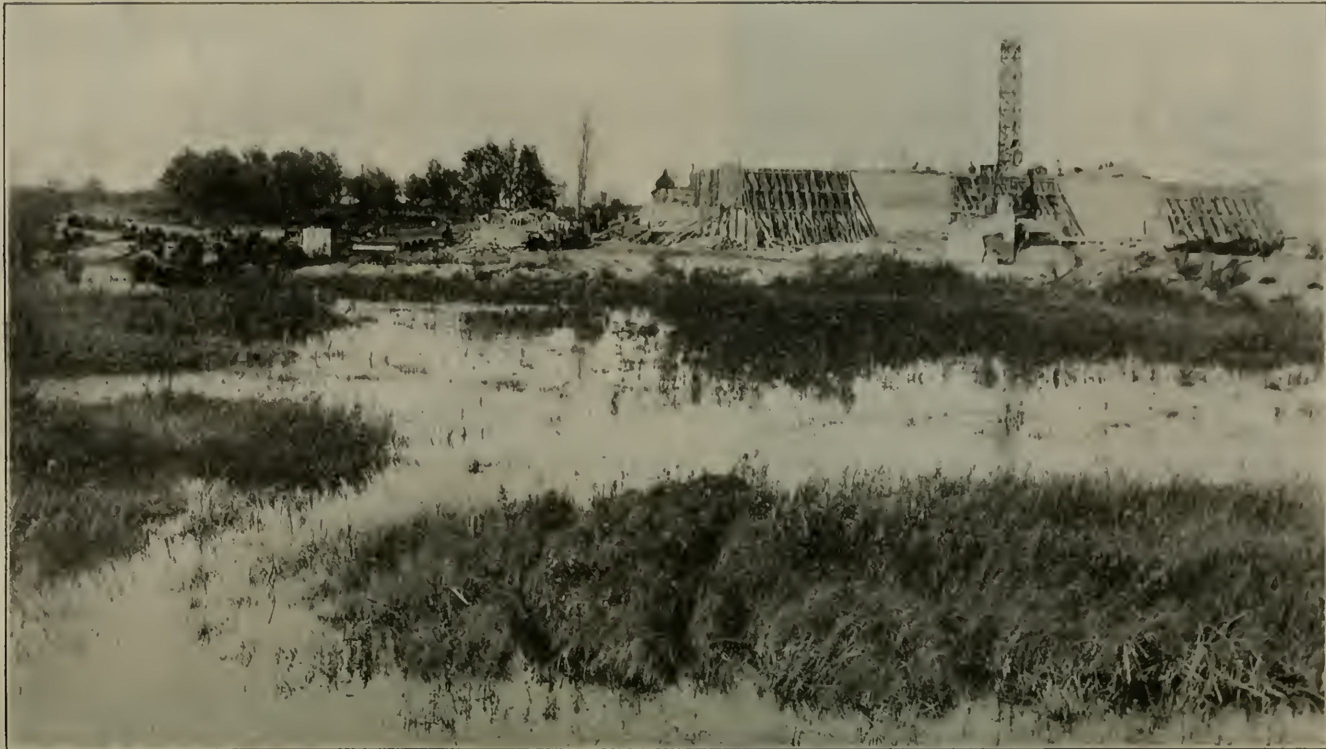


Filters During Construction—Looking North.

WATER FILTRATION
IN MINNEAPOLIS

BY
A. W. ELLSON FAWKES

CHIEF ASS'T ENGINEER
OF CONSTRUCTION

FOR some years there has been a keen contention in Minneapolis for a pure water supply, and in the early part of 1910 two definite schemes were before the council; viz., mechanical filtration and the piping of water from Mille Lacs, a distance of eighty-one miles. The vital points were, pure water, quantity, character of project and cost. The present average consumption of water in Minneapolis is twenty million gallons daily with a population of 316,000, a per capita consumption of sixty gallons per day. Quite a low figure at a glance, but a study of the analyses of the Mississippi water is explanatory. On account of the evaporation, run-off and shrinkage of the water on Mille Lacs, also the estimated cost of $3,913,414, approximately $48,915 per mile, the Mille Lacs scheme was abandoned in favor of the mechanical filtration scheme, by this means utilizing the existing pumping stations with an increased pumping capacity of 80,000,000 gallons per day. The mechanical filtration system having been decided upon, various analyses of the water were taken to determine the extent of the mechanical scheme. Briefly, the water of the Mississippi was analyzed for the following elements:

Chemical Analyses (sanitary)—Free ammonia, chlorine, alkalinity, hardness.

Physical Analyses—Suspended matter, (a) mineral, (b) organic; rate of sedimentation, color, suspended and dissolved, (a) organic, (b) inorganic.

Biological Analyses—Bacteria, plankton.

Mud Analyses—Mineral, clay, silica, organic (dead and living).

Chemical Analyses

Free albuminoid and ammonia varies from .430 in May to as low as .059 in October.

The average total hardness reaches a maximum of 173 and a minimum of 139. The maximum is during the months of December, January, February. The minimum is during April.

Chlorides vary greatly with the height of water, and follow directly the alkalinity and total hardness. During the past ten months the chlorides have varied in about the same relative amount as the permanent hardness.

Physical Analyses

The Mississippi river varies greatly in color at different points along its course. These changes in color are caused by the confluence of tributary streams. Along some of the highly-colored tributaries are large swamps, the water of which shows a color as high as 700 to 800. This color is derived from macerated vegetable matter, and persists as a considerable factor in the total color of the Mississippi at Minneapolis. The greatest reduction of color occurs during the months of August and September, and there is very little in the winter. This is coincident with the greatest and least amount of plankton. When copper-sulphate was used to destroy plankton the bleaching process at the reservoirs was interfered with.

The organic residues are greater in the summer months. The inorganic residues follow the alkalinity and chlorides. The mineral residue varies from 113 to 162. The organic from 62 to 75.

The turbidity of the Mississippi river water at Minneapolis is usually low, so low, in fact, that it has been regarded as a negligible quantity in the earlier analyses. In occasional instances it has for a short time risen to 25 or 30, but quickly subsides. It is safe to assume that in 350 days of the year it is in the neighborhood of 10.

WATER FILTRATION IN MINNEAPOLIS
I. Top of Filters Showing Walk Ways and Forms for Roof Columns, Under Construction.

The Mississippi water deposits on an average .13 cubic yards of sediment per million gallons of water during the period of a four-days' sedimentation. In the process of sedimentation, the algae and diatoms are the first to be deposited; at the end of twenty-four hours, only fine clay remains suspended in water, and at the end of ninety-six hours but 36 per cent. of the original turbidity remains. The following is an analysis of deposited matter taken from the city reservoir recently:

Organic matter	19.3%
Alumina	13.6%
Silica	50.3%
Iron (ferric-oxide)	6.5%

Biological Analyses

The most objectional feature of the Mississippi river water at Minneapolis is the bacterial content. Colon bacilli are constantly found in the water. This indicates the presence of animal contamination. The high rate of typhoid fever in Minneapolis among the users of the river water of the Mississippi goes to prove this. The fact that the typhoid bacillus has been isolated from the waters of the Mississippi at Minneapolis, and the fact that above Minneapolis are situated several large towns contributing sewage directly into the river, indicates the dangerous character of the raw Mississippi river water. It is a fact that typhoid fever germs will live in the same water for ten days. The Mississippi water passes several towns, such as Grand Rapids, Anoka, St. Cloud, Little Falls and Brainerd. The water that passes these towns reaches Minneapolis in less than eight days. The contamination of the Mississippi at Brainerd is sufficient to give colon bacilli in every centimetre of the water throughout the course of the stream as far as Minneapolis. The absolute numbers of bacteria in the water at Minneapolis vary according to the season; the greatest in July and August, 3,000 per c. c., and lowest in January, 150 per c. c.

WATER FILTRATION IN MINNEAPOLIS
II. Forms of Concrete Roof of Transept Arch of Filters.

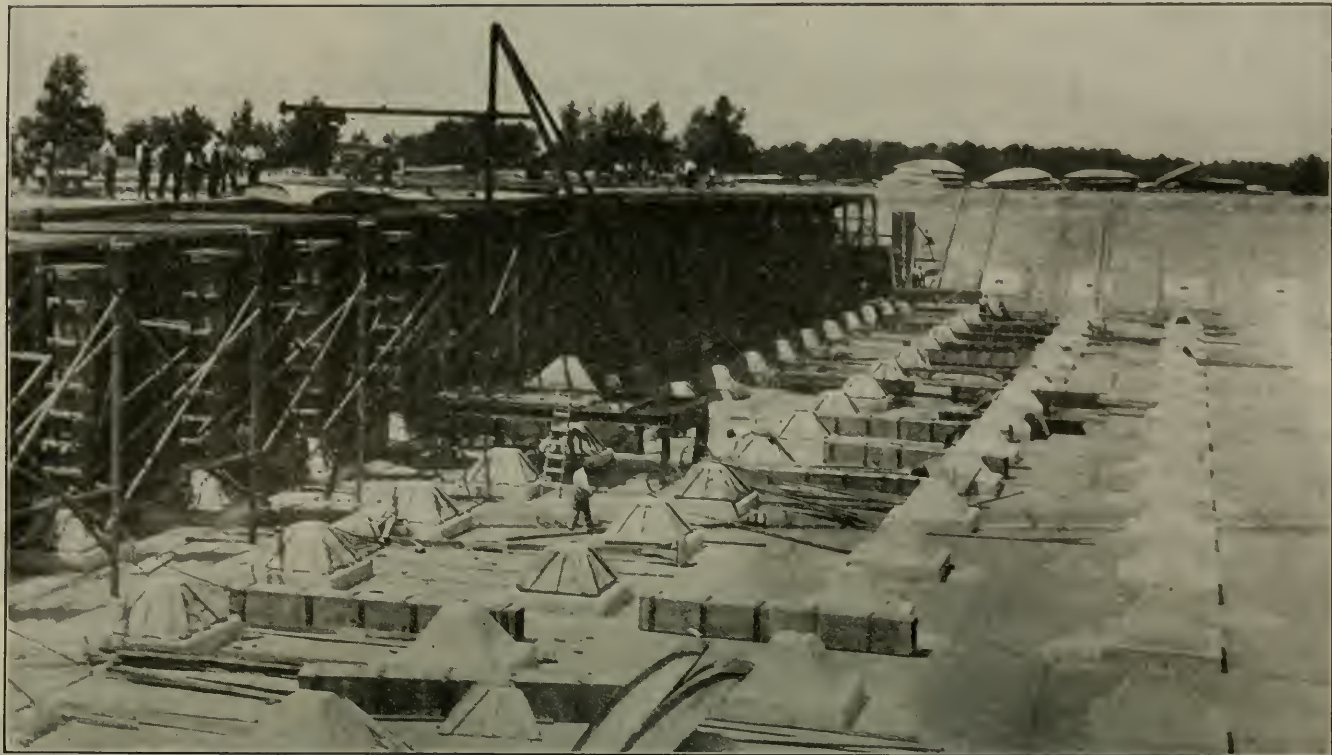
The greatest percentage of reaction occurs in the reservoirs also during the months of July and August. These are the months of the maximum of plankton, when the range is from 400 to 1,200; in January 75 is an average.

Constructional Layout

The satisfactory purification of the Mississippi river water at Minneapolis requires the accomplishment of two objects: First, the elimination of the pathogenic bacteria, and second, the removal of turbidity and color, so as to render the water palatable and attractive in appearance. Mechanical filtration and sterilization were selected as the best means of securing the desired results. The problem of purification of the Mississippi water having been solved, and the amount and kind of purifying mediums to be administered having been determined, the constructional part of the scheme started late in the fall of 1910, and has progressed very rapidly, the work being done on the day labor plan, the city of Minneapolis being the contractors.

WATER FILTRATION IN MINNEAPOLIS
III. Increasing Height of Settling Basin.

The layout is as follows: The raw water is pumped into the south reservoir, which will act as a settling basin. After sedimentation it passes thru a 60-inch c. i. pipe into the controlling chamber, where the volume is measured by a venturi



IV. Form Work for Groined Arch Covering Over Clear Water Basin, Showing Pedestals and Column Forms.

meter situated near the floor of the controlling chamber and is entirely submerged when the plant is in service. Under ordinary conditions the water flowing out at the end of the meter enters the mixing chamber, where the purifying mediums are introduced. The construction at this point is such that, if for any reason it is necessary to by-pass this mixing chamber, the water can be passed thru a 42-inch by 60-inch gate into the lower portion of the center passage and thence into the coagulation basins, or thru the upper portion of the center passage directly into the filters, thus cutting out both the coagulation basins. The water is carried into the filters thru a 60-inch pipe from the end of the center passage with branches at each filter. The water passes thru a 30-inch bed of sand and an 8-inch bed of gravel into the two clear-water basins situated below the filters, and thence into the clear-water storage reservoir, or directly into the city distributing mains to the city.

South Reservoir or Settling Basin

This basin is of concrete construction to within ten feet of the top, this space being filled with lining stones with a 4-foot coping which supports an ornamental railing enclosing the reservoir. The original capacity of this reservoir was 47,000,000 gallons, but to overcome and provide a working head for the filter system, this basin was raised another ten feet, thus making a storage capacity of 75,000,000 gallons. This is shown in progress in Plate III. The water is pumped into this reservoir for a distance of about four miles thru a 50-inch steel main.

Venturi Meter

This meter is of concrete with a cast iron throat 30 inches in diameter, increased to 60 inches at the ends. Brass tubes are connected with the throat of this meter that are connected to the registering meter in the head house which records the flowage.

Mixing Chamber

The mixing chamber is of reinforced concrete construction, 35 feet wide, 175 feet long and 17 feet deep. Inside wooden baffles of round-the-end type, spaced three feet apart, deflect the water back and forth across the width of this chamber, thus causing a thorough mix of the coagulant solutions with the water. There are four gates in this chamber for drawing off the water into the center passage, as condition requires. The roof to this chamber is of concrete on the T-beam construction principle, with a top covering of earth two feet thick.

Coagulating Basins

The coagulating basins are two in number, each measuring 96 feet by 120 feet. They are of reinforced concrete construction, the roof being of the T-beam construction supported by 126 concrete columns. Concrete baffles are placed the long way of the basins to give the desired effect, as in the mixing chamber. These basins are two separate units to facilitate the cleaning out of the precipitate and other matter. This is accomplished by a 20-inch flushing line. The floor of basins being on a 1 per cent. grade, this matter is carried to the drains in connection with the sewer, which is situated along the east side of these chambers.

Center Passage

The center passage is of concrete situated between the mixing chamber and the coagulating basins, and runs the whole length of these basins. This center passage consists of two compartments, the water passing thru the lower compartment into the coagulation basins and over skimming weirs into the upper section from the same source, thence into the 60-inch influent pipe to the filters.

Mechanical Filters

The mechanical filters are twelve in number, situated either side of the pipe gallery. These filters are of reinforced concrete and were poured monolithic, except the lateral gutters, which were poured at a later date. Each filter is divided into two sections, 52 feet by 11 feet 6 inches, with a central wash-water gutter, 2 feet 6 inches wide, to which are connected the eight lateral gutters. The top portions of the filters are laid out with walkways. The tops of filters are shown in Plate I, and the groined arch forms for the floors in Plate V. Each filter is designed to filter normally 3,250,000 gallons daily, giving a total capacity of 39,000,000 gallons. The rate of filtration with 360 square feet of filtration surface per million gallons of daily capacity will be 125,000,000 gallons per acre daily. These filters are capable of carrying an overload from 25 to 50 per cent. for short periods.

The washing of the filters is accomplished by back-flushing with filtered water at a high rate of about 15 gallons of wash water per minute per square foot of sand area.

Ridges of concrete spaced one-foot centers run in parallel lines across the filters, 13 inches high. A strainer plate takes a bearing five inches up on these ridges, thus forming a water course beneath the filter gravel. These strainer plates are of bronze, perforated with holes 1-32 of an inch in diameter, and also support the four grades of gravel that come flush with the top of the ridges. Over the top of these ridges and gravel is placed a wire screen securely anchored down to the ridges by ¼-inch brass bolts. A layer of sand 30 inches deep is placed above this wire screen.

WATER FILTRATION IN MINNEAPOLIS
V. Groined Arch Forms and Specials for Floor of North Range of Filters.

Wash Water Tower

The wash water tower is circular in construction, 46 feet in diameter, built of concrete from grade 296 to grade 369. Elevation 296 to 340 is for storage rooms, and elevation 340 to 353 is a concrete storage tank of 135,000 gallons capacity. The outside of the tower from grade 327 is faced with red brick work. This wash water tower is for the purpose of water storage, with sufficient pressure for an upward wash to the filters. This tower is shown in the left-hand cut on the title page of this article.

Filtering Mediums

The filtering mediums consist of four grades of gravel and one grade of sand. The bottom layer of gravel is three inches thick, composed of pebbles. These pebbles pass thru a screen of one-inch mesh, and are retained on a screen of ⅝-inch mesh. The second layer is two inches thick. The grains pass thru a screen of ⅝-inch mesh and are retained on a screen of ⅜-inch mesh. The third layer is 1¾ inches thick, passing thru a screen of ⅜-inch mesh and retained on a screen of 5/16-inch mesh. The top layer is 1¼ inches thick, passing thru a screen of 5/16-inch mesh and retained on a screen of No. 20 wire having ten meshes per lineal inch. This gravel is of hard and durable rounded particles, with a high specific gravity, free from thin or flat pieces, washed and screened, and free from sand, loam, dirt and organic impurities. This gravel, without being ground or crushed, is digested for twenty-four hours in cold, strong hydrochloric acid, and 95 per cent. remains insoluble.

The filter sand is placed above the gravel separated by a wire screen to a depth of 30 inches, and is of a hard and durable kind, free from clay, loam, organic matter and flat particles and stands up to a similar test to the gravel above. This sand has an effective size of not less than .35 nor more than .44 of a millimeter, and a uniformity coefficient of not more than 1.65. Not more than 1 per cent. is finer than .25 of a millimeter and 90 per cent. is finer than .8 of a millimeter. The diameter of the sand grains is computed on the spheres of equal volumes, and all percentages are calculated by weight.

Pipe and Operating Galleries

The pipe gallery situated between the filters is 18 feet wide and contains the influent pipe, wash water pipe, hydraulic valves, ¼ h.p. motors in connection with the sample pumps, float tubes and simplex controllers. There is a sewer running thru the length of the pipe gallery, into which the wash water from the filters is carried. A principal feature of this pipe gallery is the free and clear passageway from end to end. This was accomplished by suspending the 60-inch influent pipe from I-beams under the operating floor, the wash water pipe being suspended from the influent pipe in a similar manner. It is shown under construction in Plate VI.

The operating gallery is situated above the pipe gallery and on a level with the walkways to the filters, in which are situated the twelve operating tables which control the hydraulic valves in the pipe gallery below, and motors to the sample pumps. The head gage and loss-of-head gages are situated on these operating tables, and are of the rotary chart type, the pens being connected with the floats in the respective float tubes, so that at a glance the chart can be read as to the head of water, also when the filter requires washing, the pen having reached a predetermined line on the chart. The scale beams that control the simplex controllers are situated on this floor, in line with the operating tables.

Clear Water Basin or Storage Reservoir

The clear water storage basin is a large concrete tank, 880 feet long, 440 feet wide and about an average depth of 24 feet. This basin is covered with a concrete groined arch roof supported by 960 20-inch columns at 19-foot centers. These columns are supported on pedestal bases, 7 feet by 7 feet at base to 20 inches at the top. The floor and roof under construction are shown in Plate IV.

The method of construction was as follows: The whole of the pedestals were poured first, next followed the columns in the following manner: The forms to the groined arches were made in four sections in such a manner that they could be dropped and carried forward, and they were used about ten times. The column forms were constructed in a like manner; i. e., a sufficient number of forms were made for the groined arches and columns to complete 120 sections. The column forms were first erected and braced, these forms supporting the noses of the groined arch forms. Center or table posts with 4x6-inch stringers supported the other portion of the groined arch forms. The concrete was mixed in a one-yard mixer, shown in the title, and dumped into dump cars, and these cars were hauled over a temporary track placed between the centers of the columns on the groined arch forms, thus enabling the pouring of the concrete to the columns and the concrete to the groined arches without hav-

WATER FILTRATION IN MINNEAPOLIS
VI. Pipe Gallery Between Filters, Under Construction.

WATER FILTRATION IN MINNEAPOLIS

Bottom of Coagulation Basin and Embankment of Settling Basin.

ing to move the track. It was thought advisable to pour the concrete to the columns a day ahead of the groined arches, and this system was carried out until the completion of the roof. The forms to the groined arches were dropped in about ten days and carried forward and placed in position ahead, so that there were always three rows of forms ahead of the concrete. The cost of these groined arch forms was $20 per set of four, which, at a glance, appears high, but after being used ten times the cost came out at about 2 cents per square foot. During the construction of this concrete roof no fracture of any kind took place. An extensometer was used to take the deflection of the concrete arches with a moving load of about 5,000 pounds. This gave a deflection of about .06 of an inch. The total amount of concrete in this roof is 15,000 cubic yards. The mixture used was 1 part cement, 2 parts sand, 4 parts broken stone. The following is a fair average of cost, being the medium of a near and far haul:

Cement	$2.00
Crushed stone	1.35
Sand	.28
Mixing, transportation, placing	.82
Form building, 2c a square foot	.10
Wrecking and placing forms	1.40
Total per cubic yard	$5.95

The concrete roof was covered with about 24 inches of earth at a cost of 45 cents per cubic yard. The first start to pour the concrete to this roof was June 2, 1911. The last arch was poured on October 28, 1911. The earth fill was completed on December 2, 1911. The approximate amount of fill or covering was 52,000 cubic yards.

Head House and Filter Building

The filter building is situated on and covers the whole of the filters and operating gallery, the roof being of cinder concrete, built in the form of a transept arch, and joining the roof of the head house. This building from grade 327 is of red brick facing with sand-lime inside the building. The head house is of concrete construction from grade 298 to 328, and consists of various operating floors, in which are placed the various devices in connection with the operation of the plant. At floor 300 are situated the two large centrifugal wash water pumps with an 8-inch discharge, having a capacity of 1,800 gallons per minute against a 50-foot head. This water is taken from the clear water basins and pumped into the tower. These pumps are intermittent in action, and each is controlled by an electrical apparatus which will automatically stop it when the water reaches a certain elevation in the wash water tank. These pumps are driven by two 40 h.p. motors. The bases of the hypo, alum and lime tanks are at this elevation. Plate II shows location of these buildings and roof under construction.

Appurtenances

The alum tanks are of concrete construction, reinforced with ¾-inch steel rods, both vertically and longitudinally. They are 12 feet by 13 feet by 12 feet high. The concrete to these tanks was put in to a 1-2-4 mix at a cost of about $7 per cubic yard. Above these tanks are situated 3-h.p. motors to drive the agitating device, which consists of a propeller blade at the end of a shaft at the bottom of the tank, to keep the chemicals in motion. There are two pumps in connection with these alum tanks of the single suction type, with 2-inch discharge, having a pumping capacity of 40 gallons per minute against a 45-foot head, including friction. They are operated by two single 2-h.p. motors. These pumps have bronze shells, runners and diffusion vanes and monal metal shafts with especially designed packing to resist the action of the acid solutions.

The hypo tanks are similar to the alum tanks, except that they have a concrete cover over them.

The lime tanks are of steel plate construction, three in number, 12 feet 6 inches in diameter and 13 feet high, with an agitating device and pumps of like capacity.

There are a lime crusher and two lime mixers, and a trolley for conveying the various chemicals to their respective mixers.

Flushing pumps of the two-stage, 50-h.p. centrifugal type, capacity, 500 gallons per minute against 100 pounds pressure; pressure pumps discharging 30 gallons per minute against an 80-foot head, started and stopped by means of floats operating Cutler-Hamer series relay self-starters; twelve sample pumps, capacity of two gallons per minute against a 20-foot head; a sump pump of the vertical submerged type with capacity of 200 gallons per minute against a 15-foot head and a suction of six feet, are required in the operation of the control.

Storage bins are of concrete heavily reinforced with steel and were poured monolithic at a cost of $9 per cubic yard. They are twelve in number and are 10 feet by 10 feet by 18 feet deep, with a spout at the lower end to deposit the various chemicals into movable buckets. Their purpose is for the storage of alum, lime and hypochlorite. Their reinforcement is shown in the right-hand cut on the title page.

Chemical feed tanks are also of concrete, two each for lime, hypochlorite and alum.

The handling of the chemicals has been worked out in a very comprehensive manner to minimize the cost. The head house is constructed with two side entrances for the purpose of enabling the teams to dump their loads down chutes to the chemical chamber below, in which are two 10-inch pipes, one leading to the crusher for the lime, the other leading to a bucket elevator. A chute also leads from the bottom of the crusher, so that the lime is conveyed to the bucket elevator, which takes this material to the top of the tower and dumps it into a hopper connected with an extension spout that will reach to all the storage bins. The chemicals pass out at spouts at the bottoms of the bins into buckets attached to scale dials and then travel along a trolley track to their respective chemical solution tanks.

A fill is placed around the head house, filter building, wash water tower, coagulating and mixing chambers with one to one and one-half slope with a six-foot crown, from grade 304 to 321. This embankment is a precautionary measure to prevent the water freezing in winter.

Quantities

The quantities are approximately as follows:

35,000 cubic yards of concrete.
100,000 cubic yards of excavation.
250,000 cubic yards of fill and embankments.
600 tons of reinforcing and structural steel.

Design and Supervision

The plant was designed by Hering & Fuller, consulting engineers, New York. The whole of the constructional work was done by the city of Minneapolis on the day labor plan, under the supervision of W. N. Jones, filtration engineer; A. W. Ellson Fawkes, chief assistant engineer of construction, and water works engineer Arthur Jensen.

The completion of this work is six months ahead of the time that the city had dared to hope for pure water, also the work has been executed $70,000 below the estimated cost. From the general tone of all concerned, this work has been a decided municipal success. The cost of the project is one and one-half million dollars.

Mr. A. W. Ellson Fawkes, chief assistant engineer of construction for the city of Minneapolis, Minn., on the construction of its mammoth filtration plant, now nearing completion, has had an experience which amply fitted him for his position. Born a British subject, he began his training with Chivers & Sons, engineers and contractors, Devizes, England, passing thru the carpentry, brickwork, masonry and general construction departments in six years. He kept up his technical studies, and is a graduate of Heriot-Watt College and the College of Science and Technology, Edinburg, both in Scotland.

His professional engagements have included work as assistant engineer for the British Government in construction of bridges, forts, etc., in Scotland and for Vickers' Sons and Maxims, England, where the work controlled amounted to $1,600,000; as engineer on the Derwent Valley water scheme in England; as chief engineer of dam and electrical power development at Middle Falls, Ontario, Can.; of the city of Peterborough, Ont., in construction of concrete dam and pumping station on the Otonabee river, which was completed nine months ahead of contract time. He has also been consulting engineer for the town of Millbrook, Can., and engineer on concrete bridge construction for the Chicago, Milwaukee and St. Paul Railway.

His professional standing is further atttested by his position as a member of the Institution of Civil Engineers of England.

The Use of Concrete in Sewers.

THE design of concrete sewers has not yet been reduced to standard practice, and a comparison of a few designs may be of interest as showing the tendencies and the variations made by engineers working independently and with their special conditions in mind. The accompanying Table I shows the dimensions used in designs of the larger sizes of sewers in several cities, and contains quite a full set of standards for sewers from 2 feet to 8 feet in diameter and their equivalents in other sections than circular, from Portland, Ore. These standards cover both plain and reinforced concrete, and in form of cross-section and other dimensions cover the requirements of most conditions to be met.

Standards in Portland, Ore.

The general features of the design used in Portland, Ore., for plain concrete sewers are shown in Fig. 1, which is a sectional drawing of a 24-inch sewer. The

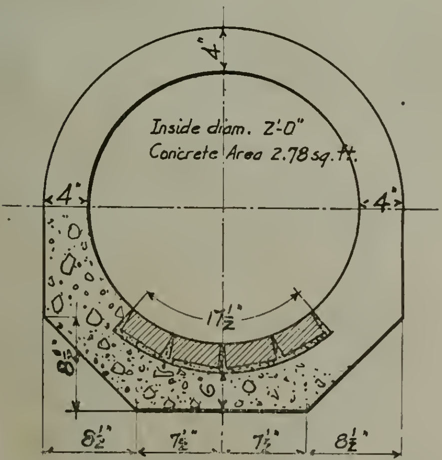


FIG. I. PLAIN CONCRETE SEWER, PORTLAND, ORE.

arch ring is of uniform thickness. The bearing of the concrete on the bottom of the trench is in plane surfaces, with some excess of concrete on account thereof and some additional thickness at the bottom. Part of this additional thickness is occupied in some of the standard designs by vitrified brick paving, which, in the 24-inch size, has the bricks laid on their sides. Other designs for larger sizes have the bricks set on edge, have stone blocks, or 1 inch of cement plaster, or have no lining, the plain concrete surface taking the wear.

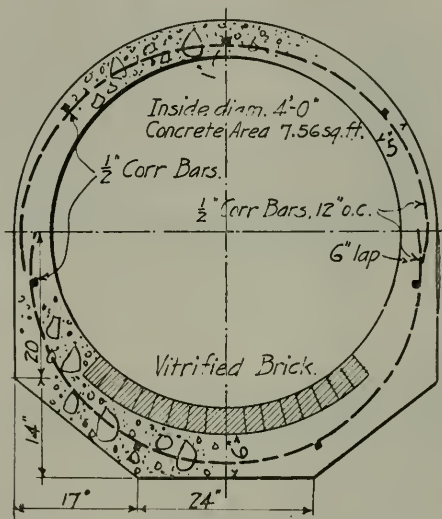


FIG. 2. REINFORCED CONCRETE, PORTLAND, ORE.

The table gives the details of the standard series of designs on file, and they are variable as to these and other details according to requirements of grade, volume, velocity, character of drainage, etc.

The thicknesses shown in the table are those shown in the figures at crown, springing line and bottom; the character of the lining over the lower part of the section is stated in one column, a blank indicating that no lining is required. The width of the lining is shown in another column and shows the judgment of the engineer as to the area subject to specially hard wear on account of rough and heavy materials rolled or pushed along the sewer invert by the flow of the sewage or storm water.

Some of the Portland designs show a horizontal bearing on the bottom of the trench, which has a width nearly equal to the diameter, and the sides are brought up on straight lines tangent to the outside circle of the section. This would require a form for the outside of the bottom, which has circular arcs for a short distance below the springing line, but probably approximates quite as near-

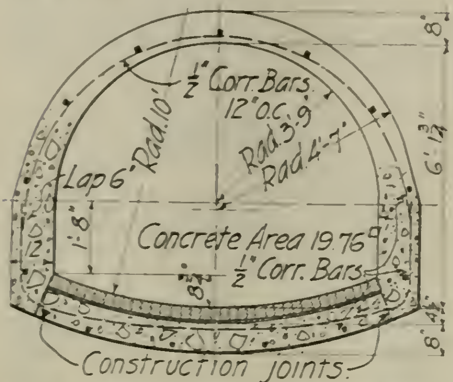


FIG. 3. REINFORCED CONCRETE SEWER, PORTLAND, ORE.

ly to the surface of the trench bottom, no form being used for the outside of the bottom, as the design shown in Fig. 1. The lined 24, 30 and 72-inch sewers are similar to Fig. 1 in cross-section. The unlined or 30 and 39-inch sections and the cement-plaster lined 33-inch section are modified as described.

Plain concrete is also used in sections of sewer in tunnel. These sections are similar in form to that shown in Fig. 3. The invert is of concrete 8 inches thick, with an additional paving of stone blocks 5 inches thick. It is laid on a circular arc of 8 feet radius and a span of 6 feet. The side walls are of concrete, 12 inches thick, and of height required for the conditions, approximately 2½ feet. The arch is semi-circular, 1 foot thick at the springing line and 10 inches thick at the crown, the inside radius 3 feet and the outside 4 feet, with its center down 2 inches to give the proper crown thickness.

The general design of reinforced concrete sections is shown in Fig. 2, dimensions varying with sizes as shown in the table. Sections A, B and C vary mainly in amount of reinforcement, as shown in the table, Section C being the one shown in Fig. 3. The 60, 78 and 96-inch sewers have the modified bearing on the bottom of the trench above described. The character of lining is shown in table I.

The prices given in the last column are the contract prices paid for construction.

Plain Concrete in Kalamazoo

The design of plain concrete sewer used in Kalamazoo, Mich., is shown in Fig. 4, with dimensions. The cost of the 33-inch section shown is proportional to that of $1 per foot for 30-inch and $1.75 for 40-inch sewers of similar section.

Outfall Sewer in Rochester

The 7-foot section of the outfall sewer at Rochester, N. Y., is shown in Fig. 5. A design for the 8-foot section is similar, except that a hollow invert block is used and the 8-inch drain pipe is omitted. The dimensions are given in the table. The entire sewer is lined with a course of brick, the lower third being selected extra hard burned or vitrified brick.

Sections for Special Services

A design for a concrete sewer used in Albany, N. Y., for a special service in a stream bed is shown in Fig. 6. It is of plain concrete, with one exception, and the general dimensions vary as shown in

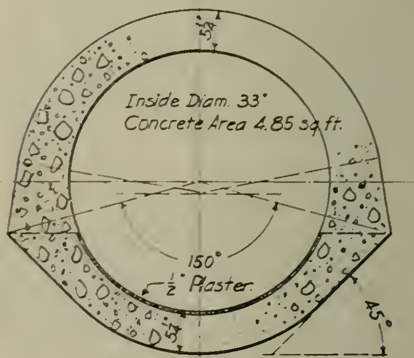


FIG. 4. PLAIN CONCRETE SEWER, KALAMAZOO, MICH.

the table, the equivalent circular sewers for the four sections listed being 57, 54, 45 and 39 inches, respectively. The only reinforcement used is in the form of

TABLE I.

Elements of Designs of Concrete Sewers.

Diam. in.	Thickness Crown in.	Spring in.	Bottom in.	Reinforcement lbs. bars per lin. ft.	Bottom Lining of	Width of Lining in.	Area of Concrete Section sq. ft.	Cost per lin. ft. $
PORTLAND, ORE., PLAIN CONCRETE.								
24	4	4	6	.....	Brick	17½	2.78	1.50
30	5	5	5	.....	....	....	4.13	2.00
30	5	5	9	.....	Brick	24	4.59	2.00
33	5	6	6	.....	Cem. Plas.	27	5.40	2.50
39	6	6	6	.....	....	....	6.34	2.75
72	12	12	12	.....	Stone	56½	26.19	11.05
72x72*	12	12	13	.....	Stone	72	21.09	9.38
72x71*	10	12	13	.....	Stone	72	20.98	9.00
PORTLAND, ORE., REINFORCED CONCRETE.								
48	5	5	10	19.7	Brick	39	7.56	4.36
60	6	7	7	27.2	Cem. Plas.	47	10.80	5.05
72†	8	8	14	42.0	Stone	57	21.06	9.60
78	7	8	8	30.6	Cem. Plas.	61	16.20	7.05
96	9	10	10	38.2	Cem. Plas.	75½	25.38	10.45
A	10	10	12½	38.8	Brick	93	21.69	9.00
B	10	10	12½	36.6	Brick	93	20.92	8.90
C	10	10	12½	35.7	Brick	93	19.76	8.50

* Tunnel sections.

† Section on pile foundation with base 7 ft. 4 in. wide. A, B, and C differ in vertical height, being 6 ft. 8¾ in., 7 ft. 1⅜ in., and 6 ft. 1¾ in., respectively.

Diam. in.	Thickness Crown in.	Spring in.	Bottom in.	Reinforcement lbs. bars per lin. ft.	Bottom Lining of	Width of Lining in.	Area of Concrete Section sq. ft.	Cost per lin. ft. $
KALAMAZOO, MICH.								
40	....	....	....	.....	....	....	.....	1.75
33	5¼	5¼	5¼	.....	Cement	75	4.85	.....
30	....	....	....	.....	....	....	.....	1.00
ROCHESTER, N. Y.								
84	12	13	10	.....	Brick	....	.....	.....
96	13	9	9	.....	Brick	....	.....	.....
ALBANY, N. Y.								
51x60 equals 57 in. cir.	8	9	8	0.94	....	....	16.03	4.03
51x53 equals 54 in. cir.	8	9	8	0.94	....	....	13.63	3.50
51x40 equals 45 in. cir.	8	9	8	0.94	....	....	11.50	2.90
51x32 equals 39 in. cir.	8	12	8	0.94	....	....	10.76	2.71

½-inch twisted steel bars about 10 inches long, set vertically in the junction between side walls and invert. These bars are spaced 18 inches apart along the sewer. The larger sizes of this sewer secure their additional area by extending their side walls vertically. The largest has walls 2 feet 3 inches from junction, with invert to springing line. The thickness of these walls at the springing line is 9 inches and at the junction with the invert is 18 inches.

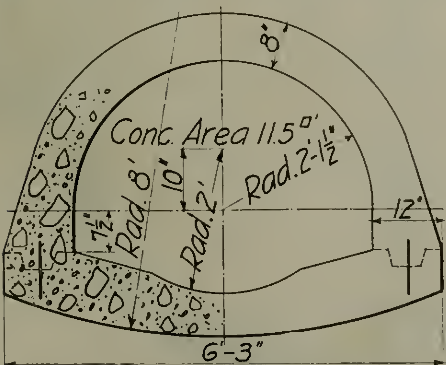


FIG. 6. CONCRETE SEWER WITH SLIGHT REINFORCEMENT, ALBANY, N. Y.

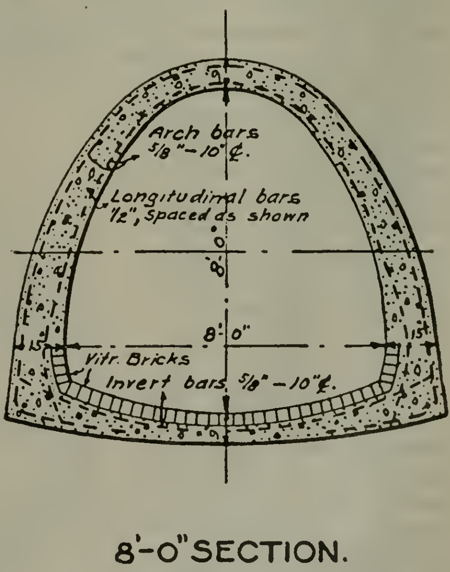


FIG. 9. REINFORCED CONCRETE SEWER, LOUISVILLE, KY.

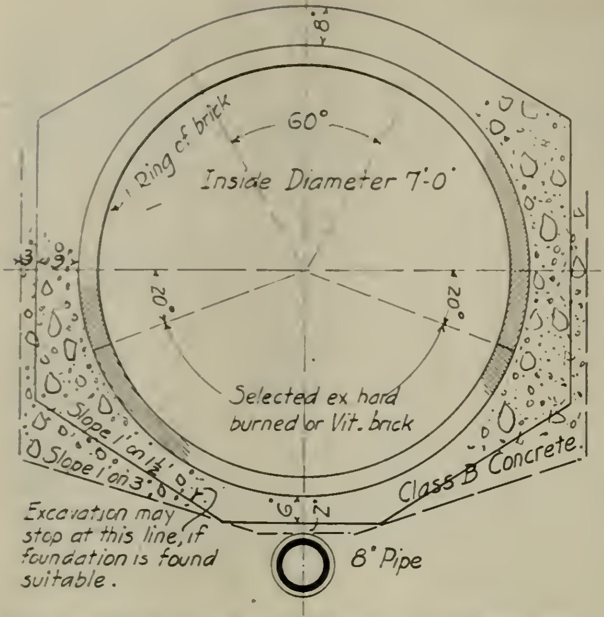


FIG. 5. PLAIN CONCRETE SEWER, ROCHESTER, N. Y.

Figs. 7, 8 and 9 show special designs of reinforced concrete sewers for special purposes, and will serve to indicate the variations which are possible in reinforced concrete designs and the flexibility of the system. Fig. 7 shows a Kansas City sewer under railway tracks and the method of making the arch and its bearings strong enough to carry the weights and the vibrations. Figs. 8 and 9, from Louisville, show outlet drains to take the place of small open streams.

Use of Plain Concrete.

Table II gives some characteristics of practice regarding use of plain concrete in sewers. When the sewer pipe is made in lengths on the surface and is then laid in place in the trench, it is classified as pipe. When the sewer is made in place in the trench it is classified as continuous, no matter how close or how far apart the joints incident to the method of construction may be. In some cases the thickness of the concrete ring and the cost of the sewer are compared with brick and the word "less" in both these columns means that the cost of plain concrete is less than that of brick. The notes following the tables give data which could not be tabulated.

Concrete is used for sewers so generally that no attempt is made to list all the cities using it. Among those using plain concrete generally in sewer construction, not reported in detail in the table, are Phoenix, Ariz.; Monrovia, San Bernardino, Cal.; laid at intervals between 1879 and 1907; Denver, Col.; Bridgeport, Conn.; Decatur, Ill., of 36 to 60 inches diameter; Indianapolis, Plymouth, of 8 to 30 inches diameter, some over twenty years old, Richmond, Wa-

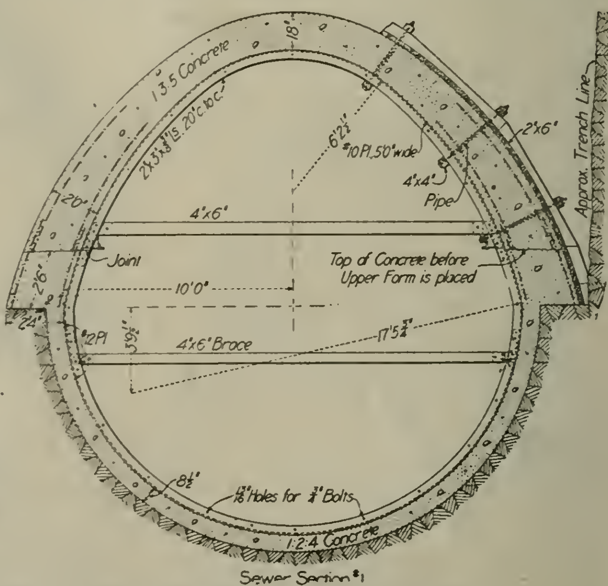


FIG. 7. SECTION OF O. K. CREEK REINFORCED CONCRETE SEWER, KANSAS CITY, MO.

bash, Ind.; Jackson, Mich.; Butte, Mont.; Concord, Dover, N. H.; Newark, N. J.; Buffalo, Richmond boro, Rochester, N. Y.; Cleveland, O.; Muskogee, Okla.; Portland, Ore.; Erie, Philadelphia, Reading, Pa.; Pawtucket, R. I.; Lenox, S. D.; Galveston, Tex.; Seattle, Tacoma, Wash.; Milwaukee, in use thirty years, Oshkosh, laid in '80's, Superior, Wis.

Use of Reinforced Concrete.

Table III gives similar data regarding reinforced concrete for sewers, classified in the same way. Some cities using considerable quantities of reinforced concrete in sewer construction, which did not give full details in responses to requests for information, are Birmingham, using concrete for an 8 by 12-foot outlet sewer, Mobile, Ala.; Los Angeles, Cal., which lines its concrete sewers with brick; Denver, Col.; New Haven, Conn.; Jacksonville, Fla.; Atlanta, Ga.; Waukegan, Ill.; Bremen, Elkhart, Gary, Indianapolis, Wabash, Ind.; Wichita, Kans.; Greenfield, New Bedford, Winchester, Worcester, Mass.; Ford, River Rouge, Wyandotte, Mich.; St. Joseph, St. Louis, Mo.; Asbury Park, Atlantic City, East Orange, N. J.; Albany, Haverstraw, Queens boro, N. Y.; Lorain, Newburg, Toledo, O.; Muskogee, Okla.; Portland, Ore.; Harrisburg, Philadelphia, Siverly, Pa.; Pawtucket, R. I.; Chattanooga, Tenn.; Austin, Houston, Tex.; Richmond, Va.; Spokane, Wash.; Parkersburg, W. Va.; Green Bay, La Crosse, Wis.

TABLE II.

Plain Concrete.

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Clearing, Ill.— (railroad work.)				
	..	66	..	5.20
	..	63	..	4.41
Savanna, Ill.— (cost of pipe only.)				
	24	..	2	1.00
	18	..	1½	0.65
	12	..	1	0.31
	8	..	¾	0.20
Boone, Ia.— (cost of pipe only.)				
	24	..	2¼	0.50
	22	..	2	0.45
	20	..	1¾	0.40
	18	..	1½	0.35
	16	..	1½	0.25
	15	..	1¼	0.22½
Iowa City, Ia.—				
	18	..	..	0.80
Bay City, Mich.— (cost of pipe only.)				
	36	..	4	0.85
	30	..	4	0.80
Coldwater, Mich.—				
	42	..	6	3.00
	36	..	6	3.18
	24	..	..	2.10
Kalamazoo, Mich.—				
	..	42	..	1.75
	..	30	..	1.00
Kansas City, Mo.—				
	24	..	2	.....
	21	..	2	.....
	18	..	1¾	.....
	15	..	1½	.....
Kansas City, Mo. (Cont'd)—				
	12	..	1¼	.....
	10	..	1	.....
	8	..	⅞	.....
	6	..	¾	.....
South Omaha, Neb.— (Haunches 2 in. to 4 in. thicker over 96 in. diam.) (deep cut.)				
	..	132	13	22.80
	..	126	12	18.88
	..	105	11½	12.50
	..	96	11	15.20
	..	84	10	9.58
	..	78	9½	9.39
	..	78	9½	10.27
	..	72	9	7.75
	..	72	9	8.39
	..	66	9	7.65
	..	54	8	5.37
	..	48	7	4.40
	..	42	6½	3.37
	..	42	6½	4.69
	..	36	6	2.80
	..	30	6	2.70
	..	30	6	3.92
	..	24	4	1.70
Dispatch, N. Y.— (not including trench.)				
	..	12	..	0.10¼
	..	8	..	0.07
Brooklyn Boro, N. Y.— (15 in. and over, egg-shaped.)				
	24	..	2	.....
	18	..	1⅝	.....
	15	..	1⅜	.....
	12	..	1 1-16	.....
	9	..	⅞	.....
	6	..	¾	.....
Cincinnati, O.— (brick.)				
	..	72	9	7.00
	..	72	13	10.00

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Dayton, O.—				
	..	84	..	6.00
	..	72	..	5.00
	..	60	..	4.00
	..	54	..	3.25
	..	48	..	2.50
	..	42	..	2.00
	..	36	..	1.75
	..	30	..	1.50
Columbia, S. C.—				
	..	48	6	2.93
	..	48	6	4.50
	..	42	..	4.50
	..	36	..	2.44
	..	36	..	3.50
	..	30	..	3.00
Austin, Tex.— (cost of pipe only.)				
	30	..	..	0.55
	24	..	..	0.47
	20	..	..	0.40
	18	..	..	0.35
	15	..	..	0.30
	12	..	..	0.25
Bellingham, Wash.— (cost of pipe only.)				
	20	..	..	0.90
	18	..	..	0.75
	15	..	..	0.60
	12	..	..	0.40
	10	..	..	0.32
	8	..	..	0.22½
	6	..	..	0.16½
	4	..	..	0.11

TABLE III.

Reinforced Concrete.

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
San Francisco, Cal.—				
	..	108	9	25.00
	..	24x36	3	6.00
Wilmington, Del.—				
	48	..	..	1.96
	36	..	..	1.37
	30	..	..	1.06
	24	..	..	0.82
Paris, Ill.— (cost of pipe only.)				
	48	..	4.4	3.60
	44	..	4	2.70
	42	..	3.8	1.90
	36	..	3¼	1.50
	30	..	2.7	1.45
	27	..	2.4	1.00
	24	..	2.2	0.80
	20	..	1.8	0.55
Gary, Ind.—				
	..	72	..	4.07
Mishawaka ,Ind.—				
	42	..	..	5.34
	36	..	..	4.16
	36	..	..	4.25
Richmond, Ind.— (cost of pipe only.)				
	54	..	5	1.35
	48	..	5	1.08
	42	..	4	0.91
	36	..	4	.....
South Bend, Ind —				
	30	..	3½	2.85
	27	..	3	2.65
Sioux City, Ia.— (Second and fourth lines show cost of vitrified pipe sewers.)				
	..	36	..	3.80
	36	..	..	4.29
	..	33	..	2.84
	33	..	..	3.61
Topeka, Kans.— (use 2-rings for brick sewers.)				
	..	60	..	5.04
	..	48	..	3.60
Everett, Mass.—				
	36	..	3	1.70
Grand Rapids, Mich.— (cost of pipe only.)				
	48	..	5	2.65
	30	..	4	1.85
	27	..	3	1.50
	24	..	3	1.00
Jackson, Mich.— (cost of pipe only.)				
	48	..	5	3.00
Kansas City, Mo.— (In column headed "Continuous" is given pounds of reinforcement per square foot of surface area of sewer.) (See Fig. 7 for special section.)				
	84	1.5	8	.....
	78	1.5	7½	.....
	72	1.0	7	.....
	66	0.9	6½	.....
	60	0.8	6	.....
	54	0.8	5½	.....
	48	0.6	5	.....
	42	0.6	4½	.....
	39	0.6	4	.....
	36	0.6	4	.....
	33	0.5	4	.....
	30	0.4	3½	.....
	27	0.3	3½	.....
	24	0.3	3	.....
Billings, Mont.—				
	96	..	6 to 18	19.00
South Omaha, Neb.— (see notes.)				
	..	126	15	32.67
	..	96	11	22.99
Newark, N. J.— (Prices for Parmley block sewers. Continuous also used.)				
	42	..	3½	3.00
	42	..	3½	4.25
	36	..	3	3.76
	27	..	2½	2.60
Plainfield. N. J.— (Parmley block.)				
	33	..	3	3.60
Niagara Falls, N. Y.— (Sewers 20 ft. deep with much rock excavation at $2.50 per cu. yd. Cost of concrete same as brick sewers.)				
	78	..	8	13.50
	72	..	7	12.00
	60	..	6	.....
	48	..	5	.....
	42	..	4½	.....
	36	..	4	.....
	30	..	3½	.....
	24	..	3	.....

City	Pipe Diam. in.	Continuous Diam. in.	Continuous Thickness in.	Cost $ per lin. ft.
Watertown, N. Y.—				
(Prices given are for two kinds of reinforced pipe and Parmley block.)				
	36	..	..	8.58
	36	..	..	8.33
	3C	..	..	8.09
	33	..	..	5.64
	33	..	..	5.39
	33	..	..	5.20
	30	..	..	3.90
	30	..	..	3.65
	30	..	..	3.60
	27	..	..	2.82
	27	..	..	2.56
	27	..	..	2.53
Chillicothe, O.—				
(cost of pipe only.)				
	30	..	..	1.60
Cincinnati, O.—				
(see notes.)				
	..	96	8 to 14	12.00
Cleveland, O.—				
(Prices on Parmley block, use mainly continuous reinforced concrete) (see note.)				
	39	..	..	2.90
	33	..	..	3.96
	30	..	..	3.49
	27	..	..	2.78
Columbus, O.—				
	36	..	4	2.00
	24	..	3	1.20
Dayton, O.—				
	60	..	8	2.50
	54	..	7	1.98
	48	..	6	1.53
	..	108	12	6.38
Lancaster, O.—				
	60	..	6	2.50
	48	..	5	2.00
	36	..	4	1.95
	30	..	3½	1.85
Sandusky, O.—				
	24x36	..	3	1.50
	27	..	2½	1.15
	24	..	2½	1.00
Columbia, S. C.—				
	..	60	less	5.50
	..	42	..	4.00
	..	36	..	3.00
	..	30	..	2.20
Lake City, S. C.—				
	60 to 27	..	..	less
Aberdeen, S. D.—				
(cost of pipe only.)				
	36	..	4	1.75
	24	..	2½	0.80
Knoxville, Tenn.—				
	36	..	4	2.50
Salt Lake City, Utah—				
	40	..	7	3.15
	36	..	6	3.07
	30	..	5	3.80
Seattle, Wash.—				
(Pipe used also.)				
	..	144	..	51.00
	..	42	..	13.00
Charleston, W. Va.—				
(No excav. for 72-in. concrete and brick.)				
	..	72	..	6.16
	..	54	..	8.89
	..	48	..	4.95
Janesville, Wis.—				
(cost of pipe only.)				
	48	..	5	2.00
	36	..	4	1.80

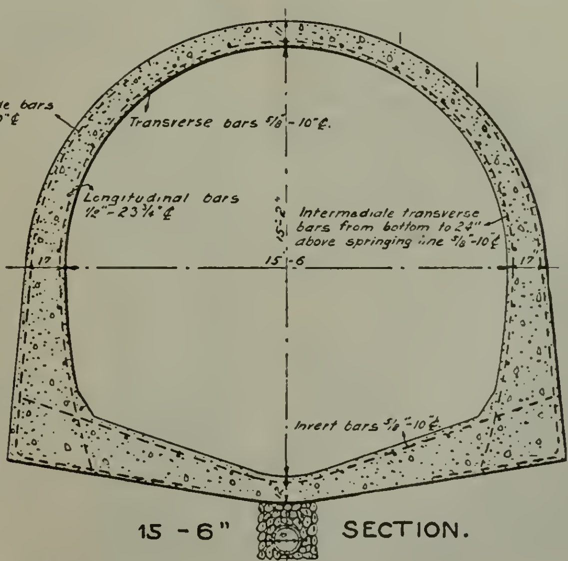


FIG. 8. REINFORCED CONCRETE SEWER, LOUISVILLE, KY.

Laboratory on Wheels.

LABORATORY ON WHEELS.
Side View of "Laboratory on Wheels," showing air intake and rain gage on roof.

Used in atmospheric tests by smoke abatement experts.

By Hugh Pattison,
Electrical Engineer of "Committee on Smoke Abatement and Electrification" of the Chicago Association of Commerce.

No work of the Chicago Association of Commerce is of greater importance than that in which its committee on smoke abatement and electrification is engaged. This work includes a determination of the present conditions and a study of methods of improving them. The word electrification in the title of the committee shows that the association has in mind the possible electrification of the steam railroads within the city limits. Locomotive smoke is one of the most prolific sources of nuisance and at the same time one which is most difficult to reduce and keep within reasonable limits except by absolute prohibition of smoke-producing motive power.

A Laboratory on Wheels

The committee is conducting its survey of atmospheric conditions in all parts of the city by means of a "laboratory on wheels," which is a novel and efficient application of the automobile to a special service.

William Hoskins, the consulting electrical engineer of the committee on smoke abatement and electrification of railway terminals, has written for us the following description of the traveling laboratory:

"In order to carry on a proper study of this problem, it was found necessary to make numerous chemical analyses of the city atmosphere in various portions of the city, and with the use of sufficient volumes of air to insure average conditions at the point investigated as well as to permit of an accurate determination of those constituents existing in minute quantities. It was impracticable to take samples of sufficient size which might be subsequently analyzed in the laboratory, and it was also impracticable to establish testing stations at sufficiently numerous points to ascertain the facts desired. It therefore was finally decided to design a portable laboratory which could be moved from place to place and which would so far as possible contain all the required apparatus for conducting analyses of the atmosphere at any desired point, and which would enable the employment of large volumes of air and be independent as to the time during which the tests might be carried out.

"A well-known form of automobile delivery wagon was selected with a specially designed closed body. This car is operated by means of an ordinary two cylinder engine and has a body enclosed 9 feet long, 4 feet 8 inches wide, and 3 feet 3 inches high. The illustrations show the outside appearance very well and the interior arrangement of the apparatus and supplies. In designing the arrangement of the apparatus, reagent bottles, etc., it was necessary to take into account the fact that this apparatus would have to be transported over the rough streets of the city, and the possibility of breakage prevented. It was necessary to devise methods of analyses which were applicable as well as accurate under the conditions of work necessitated by the small available space and because of the exceedingly minute quantities of some of the constituents of the air which it was desired to determine.

"In carrying out this investigation, the runs cover ordinarily about eight hours, and are made both during the daytime and at night. A storage battery is employed for operating an electric motor which is connected with a pressure pump, for drawing the air thru a specially arranged filter and then thru the various absorbing solutions. A barometer and hygrometer, a wind gage and other apparatus are carried, and frequent determinations of the meteorological conditions of the atmosphere are made and recorded.

Determining Condition of Air

"The amount of carbon dioxide is determined every hour and a half thruout the test, the total quantities of sulphur compounds, nitrites, ammonia and chlorine are also determined. The dust collected in the filter is weighed and then microscopically examined to determine the nature of the material collected and photomocrographs of the contents made.

"Photographs of the filters are also made in order to record their relative color, as the color may or may not have a direct relation to the amount of soot in the air and may or may not have a relation to the total weight of dust, etc., collected. It is believed that this is the first time that an attempt has been made to so completely investigate the composition of the atmosphere of a large city, and certainly it is the first time such large volumes of air have been handled for the purpose. The average volume of air passing thru the apparatus during a single test is about 1,000 cubic feet. This insures an exceedingly accurate determination of those constituents which exist in very minute quantities, and an accurate measure of the amount of solid particles in the air and their nature.

"It is believed that the facts obtained from the very numerous tests contemplated during this investigation will throw much light, not only upon the gen-

Taking a sample of smoke from a factory chimney.

eral composition of the atmosphere of Chicago under a great variety of conditions, but will also indicate any special or local contamination in any particular district of the city."

One photograph shows the apparatus set up to take samples of the flue gases from a chimney and determine their character, and thus get valuable information as to the results of the method in use of operating the furnace, as a basis for instruction to engineers and firemen as to proper methods of handling and firing furnaces, and the coal in use.

Measuring Smoke from Chimneys

The first step in this process is the recording of the actual conditions as to

LABORATORY ON WHEELS.
Interior of automobile air-testing laboratory. In addition to the necessary flasks and tubes for conducting the various determinations, the car carries a storage battery, an air pump and an air meter, which maintain and measure a constant stream of air through the testing instruments.

emission of smoke by chimneys. There are some 15,000 stationary smokestacks in the city at manufacturing plants, hotels, apartment houses, central heating and lighting plants. These have been classified as to their essential characteristics, such as steam pressure, kind of coal used, uniformity of load on boilers, and the like, and 1,000 typical stacks were selected, with the same proportion in each class as in the total, for careful observation. Fifty of these have been selected for more detailed study with chemical determinations of furnace and flue gases.

The observer is equipped with the Ringelmann chart, which shows, by proportions of black and white area, six grades of color from white to black, with equal steps of darkening of the gray resulting from the increase in area of black in proportion to white in the four intermediate divisions of the chart. He is supplied with a record chart, with six spaces corresponding with the six grades in the scale on the chart. The observer compares the smoke issuing from the chimney with the scale and puts a dot in the space on the record chart for the grade of smoke observed. The record chart is ruled for observations every minute during the day.

This observer then selects a location within view of two smokestacks whose performances the committee desires to survey.

Starting, let us say, at 8 o'clock, he observes the smoke emitted by the first of these stacks, compares it with a Ringlemann chart and marks down the density indicated by putting a dot in one of six spaces on the chart. These places signify, respectively, zero, 20 per cent., 40 per cent., 60 per cent., 80 per cent. and 100 per cent. of smoke density.

At one-half minute past 8 he observes the second chimney in the same manner and makes a similar record upon the second chart.

At one minute past 8 he observes the first chimney again and makes a second record upon his first chart.

At one minute and a half past 8 he observes the second chimney, and so on thruout the day. Thus he keeps a record of smoke units taken at one minute intervals for a period of one day.

Why the Stack Smokes

At the end of the day he visits the engineer of each plant he has observed. He finds out whether any unusual conditions were present during the day; he inquires searchingly as to the methods of stoking and the features of the equipment used.

He inquires what kind of coal is burned, how frequently the furnace is fired—in short, he gathers all the information which to the practical mind conveys a complete understanding of the conditions existing in that plant.

He also counts up the units of smoke observed thruout the day and reduces his grand total to a percentage representing the degree of "badness" of the chimney's performance.

Scale of Good Behavior

A chimney that shows 2 per cent. of smoke is regarded exceptionally good; a chimney showing 24 per cent., 36 per cent. or even more, is considered exceptionally bad.

Locomotive Smoke

This same method of observation is now being applied to the railroads of the city.

Observers are stationed at intervals enabling them to keep a constant watch upon locomotives moving in or out on a given line.

LABORATORY ON WHEELS.
Front view of car, showing operator making a chemical determination.

As an engine starts out it is observed by the first of the committee's corps, who keep one minute interval records as long as it is within his eye-shot. As it passes beyond, it comes within the range of the second observer, and so on until it passes beyond the field of the committee's investigation.

Magnitude of Records

To cite an instance of the thoroness of the committee's methods, it was estimated that to classify the records which the committee obtains of the train and engine movements on every unit of track within the city limits, would keep busily employed a force of fifty men for four years—the records in question referring to the operations of six typical weeks in a year. The number of records covering a single week's train movement is approximately 110,000.

Facts Analyzed by Machine

To deal with such a mass of figures it is necessary to use a "sorting machine," a device successfully employed by the Census Bureau, mechanically and infallibly classifying the records in any manner desired at the rate of 16,000 an hour.

Chicago in the Lead

While several cities in the Central States have made thoro studies of considerable portions of their smoke problems, notably St. Louis, Cleveland, and Pittsburg, no city has devised so comprehensive a plan for the study of the whole problem, and no city has gone into the details in so thoro a manner.

There is no evidence that the committee is wearying of its work or is failing to obtain the considerable sums of money necessary to carry it on at a reasonable rate of progress, so that within a reasonable time we may expect a report which will clear up many doubtful questions for all cities and will offer a feasible solution of Chicago's most vexing problem in the line of improving its conditions, both as to civic beauty and the health of large numbers of its citizens.

Wood Block Paving in Minneapolis.

BY ELLIS R. DUTTON, ASST. CITY ENGINEER.

THE city of Minneapolis began laying creosoted wood block paving in 1902. Citizens who had seen the creosoted wood blocks laid in Michigan Boulevard in front of the Auditorium in Chicago liked the looks of it so well that they thought it would be a good pavement for Minneapolis. This resulted in the city council awarding a contract for 13,500 square yards of 4-inch yellow pine creosoted blocks treated with 12 pounds of kreodone oil and ordering the pavement on Tenth Street South from First Avenue South to Park Avenue. This street was quite well traveled, and would afford a good test of the value of the creosoted wood block paving. The city engineer was directed to pave this street by day labor, which he did by doing the grading and putting in a 6-inch natural cement concrete foundation, upon which was spread a 1-inch cushion of sand, upon which the blocks were laid. There were no cross expansion joints used, but a 1-inch expansion joint was placed along each side of the street next to the curb. These joints as well as the joints between the blocks were filled with paving pitch, and the whole surface was covered with one-quarter of an inch of sand to absorb the excess of pitch on top of the blocks.

This street has given excellent service and the repairs have been almost nothing —only amounting to about one-tenth of a cent per square yard per year. The surface at the present time, after eleven years of wear, is fine, as may be seen from the accompanying photograph. The wear of the blocks on the street has been about one-eighth of an inch, and there are no signs of decay appearing on the surface, or in any of the blocks which have been taken up from excavations made. Having this street as a sample, there has been laid in the various years to January 1, 1912, about 968,000 square yards of creosoted blocks, as shown in the table below, at a cost of about $2,500,000.

CREOSOTED WOOD BLOCKS ON FOURTH AVENUE, MINNEAPOLIS, MINN.
This view shows the City Hall and County Building on the left; Chicago, Milwaukee & St. Paul Station in the background.

Year.	Square Yards.	Cost.
1902	13,600	$37,700
1903	31,000	78,700
1904	60,000	155,500
1905	45,000	114,200
1906	76,000	199,900
1907	104,000	291,900
1908	167,000	383,200
1909	143,000	396,400
1910	157,000	370,900
1911	163,000	437,500

This was laid on about 93 different streets and the average cost has been $2.52 per square yard for the complete paving, including grading, concrete foundation, blocks, filler, etc. This makes the total length of streets paved with creosoted wood blocks about 61 miles.

During the ten years passed there were laid about 958,000 square yards of all other classes of paving, as follows:

PAVING IN MINNEAPOLIS.
Filling Joints in Finished Pavement.

Kind.	Square Yards.
Brick	220,000
Granite blocks	247,000
Sandstone blocks	286,000
Macadam	206,000

This does not include sheet asphalt, as the area has decreased about 42,000 square yards in this period, having January 1, 1912, 164,000 square yards, the most of which has been resurfaced during this time.

The class of traffic on the creosoted wood block streets varies from light traffic to very heavy traffic for a city of this size, about 180 tons per foot of roadway, and about 4,200 vehicles in 12 hours. The tendency is always to increased traffic on a well-paved street, especially if not all of the parallel streets are paved, and the tendency is also an increase in the use of motor vehicles, especially for the moving of heavy loads. This brings up the thought for the increase of the thickness of the foundation for all kinds

PAVING IN MINNEAPOLIS.
Laying Concrete Foundation.

of pavement. If the use of motor trucks increases, the loads will also increase, and while 4 tons was a big load by teams, 8 tons and more will be carried by trucks. What is this increased loading going to do with a pavement constructed for the team traffic, and what and how shall we build for the increased loading? This is a subject engineers should investigate, both for city streets and also for the good roads in the country.

The maintenance cost on this class of paving is very low, the cost in 1911 being less than one-tenth of a cent per square yard per year, which is a pretty good showing, as same has been in for ten

PAVING IN MINNEAPOLIS.
Traction Grader at Work.

years. Third Avenue South was laid in 1903, and some yellow pine blocks left over from 1902 were put in this street. Blocks were removed in 1911, and showed a wear of one-eighth of an inch for the yellow pine, and one-quarter of an inch for the Norway pine blocks, under absolutely the same conditions of traffic, being contiguous blocks.

Our specifications for blocks used in 1903 and 1904 were 12 pounds of "kreodone" oil per cubic foot. In 1905 we made a definite specification for the oil, which was for specific gravity of 1.09 at 20 degrees centigrade; water allowed in oil, 2 per cent.; distillation centigrade:

150 degrees......	0 per cent.
170 degrees......	0 to 2 per cent.
210 degrees......	6 to 8 per cent.
235 degrees......	20 to 30 per cent.
315 degrees......	40 to 50 per cent.
355 degrees......	60 to 80 per cent.

Amount of oil per cubic foot, 16 pounds.

In 1907 the specifications were changed, requiring an oil of a higher gravity, as follows: Specific gravity, 1.12 at 20 degrees centigrade; water allowed, 2 per cent.; distillation centigrade:

150 degrees....	0 per cent.
170 degrees....	0 to 0.5 per cent.
210 degrees....	3 to 6 per cent.
235 degrees....	10 to 20 per cent.
315 degrees....	35 to 45 per cent.
355 degrees....	45 to 55 per cent.

In 1910 the specifications were again changed, as follows: Specific gravity, 1.12 at 20 degrees centigrade; water allowed, 2 per cent.; distillation as follows, centigrade:

150 degrees....	0 per cent.
170 degrees....	0 to 0.5 per cent.
210 degrees....	2 to 4 per cent.
235 degrees....	6 to 16 per cent.
355 degrees....	40 to 55 per cent.

We are using the same specifications for 1912, except the gravity is 1.10 at 38 degrees centigrade, which is the same almost as before. We are still using 16 pounds of oil per cubic foot, and think that it is sufficient, and we have had no trouble from bleeding or buckling.

There is one point in our specifications which is different from most of the specifications at the present time, and this is the retention of the distillates at 210 degrees and 235 degrees, and I think that these are a very essential part of an oil, as it makes an oil which is not altogether a pitch or tar oil.

All of our work is done by day labor, except sheet asphalt paving, which we could not do, as we have no asphalt plant. All materials are purchased on competitive bids under specifications, and con-

CREOSOTED WOOD BLOCKS ON DOUGLAS AVENUE, MINNEAPOLIS, MINN.
This view shows intersection of Douglas Avenue with Hennepin Avenue, in one of the best residence sections of the city.

tracts are awarded by the city council. All of the labor is hired through the city engineer's office. This method of doing work has been very satisfactory, and I think that we get better work for less money than under the contract system. Take, for instance, the creosoted wood block paving, with an average price of $2.52 per square yard for a 4-inch block complete paving, and I do not know of any other city that gets as much for its money. Under the day labor system we get better work, as there is no reason for slighting the work in any manner. Wages have been increased from $1.75 for ten hours twelve years ago to $2.40 for eight hours at this time. The day labor system is the proper thing, provided you can keep out politics.

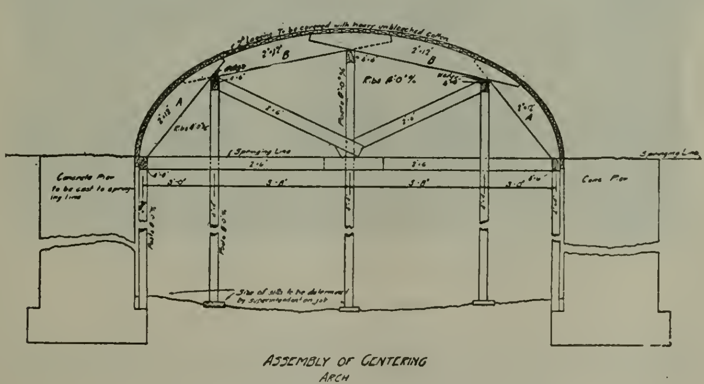
We have at the present time about 61 miles of creosoted wood block streets, and there is no better paving laid or can be laid at the present time.

Concrete Bridge at Methuen, Mass.

The recently completed "New Broadway Bridge," which spans the Spicket river on the road between Lawrence and Methuen, Mass., is an interesting example of what may be accomplished in bridge design with concrete when both utility and esthetic appearance are of importance. The bridge is a gift to the town of Methuen from Edward F. Searles, its most prominent citizen.

In designing the bridge the Aberthaw Construction Company of Boston, Mass., who also built it, followed the suggestions of the donor. It was desired to erect a structure that would serve the traffic needs of the town to the best advantage and at the same time add as much as possible to the appearance of that section. Mr. Searles did not desire anything elaborate or ornate, so the bridge was designed with almost severe plainness. It is to its very severity of architectural treatment that much of the attractiveness of the bridge is due.

The bridge is 80 feet long from the end of one abutment to the other, and 74 ft. 2 ins. overall width. It has three arches, each 18 ft. wide, placed on 22-ft. centers. The forms for these arches were detailed at the contractors' office, so that there was no confusion nor delay on the job. The details of these forms are shown in the accompanying cut. The concrete footings are 5 ft. wide and the piers themselves 4 ft. thick. A 1:2:4 mix was used.



ASSEMBLY OF CENTERING ARCH

CONCRETE BRIDGE AT METHUEN,

Across the central portion of the bridge run the double tracks of the Bay State Street Railway Company. On either side of the car tracks is a roadway, and flanking the roadways are two sidewalks 8 ft.

wide. The width of the roadway from one sidewalk curb to the other is just 50 ft. The road is of macadam, and between it and the concrete bridge floor is a 3-ply waterproofing of felt and asphalt.

As will be seen from the photograph, the parapet on either side of the bridge is without ornamentation, being simply a wall with plain capping. The parapet was chosen in preference to an iron railing, as it added enough to the artistic appearance of the bridge to pay for the extra expense. At either end of the piers is a small buttress of uniform cross section which, despite its plainness, adds considerably to the appearance of the bridge. The surfaces of the spandrel and parapet walls are picked, while the edges of the arches, the floor, and the parapet capping were rubbed smooth.

Provision has been made for four electric light posts, one at each buttress. When these are installed they will add to the general attractiveness of the bridge.

In putting in the piers a small coffer dam of 3-in. matched sheeting was sunk into the gravel bed of the river, and the pier centering was hung from the horizontal sheeting braces.

A 16-in. water main that crossed the river at the bridge was provided for in the following manner: The pipe was carried on a 4-in. I-beam which rested on two trench braces at each pier. The braces, placed side by side, were expanded until the pipe was brought to the proper level. Then the concrete was poured around the braces and a permanent support at this level was assured.

CONCRETE BRIDGE AT METHUEN.

THE CHICAGO SUBWAY POLICY.

The committee on downtown streets of the Association of Commerce of Chicago, after a study of traffic conditions and the service of utilities, is unanimously of the opinion that the ultimate goal to be aimed for in the betterment of transportation facilities and the improvement of street conditions in Chicago is the construction of a comprehensive and universal system of subways.

It believes that with moneys now available plans can be devised for beginning the system in the downtown district; such a subway to be eventually extended.

A further belief is stated that any subway system which, in order to alleviate congestion, does not provide for the removal of many of the surface cars and of the elevated loop in the downtown section and which also omits utility galleries, will fail to give an adequate measure of relief.

An immediate revision of car routings in the loop district, and the establishment of ample thru routing of surface and elevated cars is to be given consideration.

Temperature Strains in Brick Pavements.

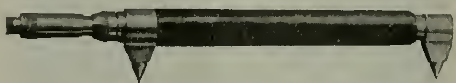
By James E. Howard, Engineer-Physicist, U. S. Bureau of Standards, Washington, D. C.

THE United States Bureau of Standards has made an investigation of the strains in brick pavements caused by changes in temperature, which has added considerable to our supply of information as to the reasons for certain defects which appear in brick pavements whose joints have been filled with cement, and so may lead to improved methods of construction. The investigation was made by James E. Howard, an engineer-physicist of the bureau, and in a recent paper he has described the method of making the measurements and has given the course of reasoning depending upon his observations and results.

He defines an ideal street pavement as one which presents a smooth surface of such hardness and rigidity that the tractive effort of moving vehicles is reduced to a minimum; having a surface smooth, without slipperiness; of adequate frictional properties for the safe footing of men and animals and against the skidding of motor-driven vehicles; durable against abrasive wear, and of sufficient compression strength or sustaining power against concentrated wheel and toe calk loads; one in which the physical properties are not materially modified by the usual range of atmospheric temperatures and which is practically non-absorbent and impervious to moisture. These conditions are generally met in a pavement of vitrified brick of monolithic construction, the continuity of which is attained by means of cement-filled joints.

If not confronted with destructive tendencies incident to changes in dimensions caused by changes in temperature, there is apparently no reason why a well-constructed brick pavement should not maintain a state of integrity and successfully endure traffic conditions for many decades of years.

Referring to the physical properties of vitrified paving brick, the crushing strength commonly ranges from 10,000 to 15,000 lbs. per sq. inch, and not infrequently reaching and exceeding 20,000 lbs. per sq. inch. The compressive modulus of elasticity is found to range ordinarily from 2,500,000 to 8,000,000 lbs. per sq. inch, with a value as high as 10,000,000 lbs. per sq. inch occasionally observed. The compressive strength and modulus of elasticity increase as the weight per cubic foot of the bricks increases, while the porosity or rate of absorption of moisture decreases. That is, the more material there is in a given space the stronger and more rigid it is and necessarily less porous. These are features which should be considered in a paving brick, and they are features which are controllable in the process of manufacture, at least the ap-



1. STRAIN GAGE USED IN MEASURING THERMAL EFFECTS ON STREET PAVEMENTS.

parent modulus of elasticity is modified by the conditions of burning the brick, while the crushing strength and density certainly can be controlled within limits.

Expansion of Brick Pavement

As regards the value of the coefficient of expansion of brick, data are not as complete as desired. The values frequently seem to be in the vicinity of .0000040 per degree F., with some examples, however, approaching the values for steels, or above .0000060.

A value of .0000040 has been accepted for the time being in considering some of the phenomena attached to the expansion of pavements, since this corresponds well with the observations which have been made on the behavior of the pavements.

In regard to the significance of the relation between the modulus of elasticity and the coefficient of expansion in respect to the force which the confined material would develop when raised through a range of temperature of 100 degrees F., taking for example four mud bricks selected from different parts of a down-draft kiln, the following table is presented:

Location in kiln.	Modulus of elasticity. (Lbs. per sq. in.)	Crushing strength.	Weight per cu. ft. Lbs.	Lbs. per sq. in. Confined Stress
Top	10,000,000	19,170	144.3	4,000
1/4 down.	7,692,000	15,670	136.4	3,076
2/3 "	5,263,000	10,420	130.6	2,105
Bottom..	4,545,000	10,870	125.4	1,818

That is, bricks of these moduli of elasticity would be expected to develop, when confined and strictly prevented from expanding, compressive stresses ranging from 1,818 to 4,000 lbs. per sq. in.

Behavior of Pavement Under Heat

The bearing which these figures have upon the behavior of cement-filled brick pavements is this: the pavements will develop certain compression stresses when the temperature is raised, which stresses will be greater with brick of high crushing strength with high modulus of elasticity in comparison with those of a lower modulus of elasticity. Only a portion of the possible maximum confined stress will, however, be realized, but the relative expansive force exerted should be proportional to the moduli of elasticity, and since the highest values pertain to the strongest brick, those pavements constructed of the strongest material will be capable of exerting the highest stresses which are incident to rise of temperature.

It would in some cases relieve the magnitude and severity of thermal effects to restrict the brick to a grade sufficient to provide adequate abrasive resistance for traffic conditions of a particular street. The endurance of brick pavements against abrasive wear has been found from experience to be so great that no trouble is ordinarily apprehended in that direction. It is believed, therefore, that the selection of the bricks and modifications in the manner of laying the pavement, tending to ameliorate thermal effects, are matters deserving consideration.

The observed expansion of cement-filled pavements, in a direction crosswise the roadway, has corresponded closely to a coefficient of expansion of .0000040 per degree F. In the following table, however, the computed expansion of roadways of different widths is given for a range of temperature of 100 degrees F. for assumed coefficients both of .0000040 and .0000060.

COMPUTED EXPANSION OF CEMENT-FILLED BRICK PAVEMENTS FOR A RANGE OF TEMPERATURES OF 100 DEGREES F.

Width of Roadway.	Assumed Coefficient of Expansion. .0000040	.0000060
4 feet 8 in..........	".0224	".0336
14 feet	.0672	.1008
25 feet	.1200	.1800
30 feet	.1440	.2160
40 feet	.1920	.2880
50 feet	.2400	.3600

The table gives the total computed expansion, one-half of which might be taken as occurring at each side of the street.

Enormous Stress in Brick

Although the maximum stresses which the confined material could display would range in round numbers from 25,000 to 50,000 pounds per individual brick, yet the street curbing could not ordinarily afford any such reaction. Curbing which is backed up by earth filling yields to moderate pressures when they are long sustained, and in a crosswise direction pavements would not be expected to develop forces of very great magnitude in the absence of substantial buttresses. The fact that the middles of roadways rise during the period when the bricks reach a high summer temperature is occasioned and facilitated by the crowning of the roadway. The usual pavement is, in transverse section, a bent column, of very slender proportions, which easily rises, increasing the crowning of the arch, and may result in the formation of longitudinal cracks.

Observations on Pavements

Referring to observations which have been made on pavements in Cleveland, Ohio, and vicinity, covering a period of a few months over a year, they have embraced measurements on thermal effects, in which attention has been directed to changes in lengths taken both lengthwise and crosswise the roadways. Reference lengths of 20 inches each were established and defined by means of small bronze plugs inserted in the pavement. The tops of the plugs were about ⅜ inch below the surface of the pavement and protected against traffic by paper washers and putty. These plugs had in their upper ends small drilled and conically reamed holes, from center to center of which measurements were made.

Strain Gage

A strain gage of the style shown by figure No. 1 was used for measuring purposes. Generally the readings of the gages checked to a ten-thousandth of an inch, altho that degree of accuracy will not be claimed for the work. It is believed, however, that changes in the reference lengths were measured reliably within two ten-thousandths of an inch. A steel reference bar is used in connection with the strain gage. The comparatively short gaged lengths of 20 inches each are preferred instead of longer ones for inquiries of this kind, where specific and detailed information is sought on the behavior of the pavements.

Depression of Tracks by Cars

In addition to the measurements with the strain gage on changes in dimensions due to changes in temperatures, the work at Cleveland included a number of observations on the elastic depression of loaded pavements and the depression of trolley tracks under the weights of cars. Figure No. 2 illustrates the method of measuring the depression of trolley tracks by means of a levelling beam. One end of the beam rested upon the track, the other end, 4 or 7 feet away, upon the pavement. The beam is provided with a sensitive level and micrometer elevating screw. There is a general depression of the pavement and roadbed in the vicinity of a car, but slight in amount when compared with the depression of ordinary trolley track. The depression of trolley track usually takes place to such an extent as to make it undesirable to bond the pavement to it. When a very sensitive level bubble was used the depression of the pavement could be detected some ten feet from a trolley car in the direction of the curbstone. This was found on a tar-filled pavement.

At an intersection the approach of a man when 12 feet distant was indicated by this sensitive level. Monolithic brick pavements are very elastic. They depress locally under loads and spring back when released.

Formation of Cracks

In conjunction with the measurements of changes in the 20-inch reference lengths there were observations on the incipient formation of transverse cracks in freshly grouted pavements. Dark lines developed in a freshly grouted pavement before the street was opened to traffic. These dark, hair lines are taken to represent cracks in an early stage of development. The first 24 to 48 hours after grouting is a critical period in the laying of a cement-filled pavement. The grout during the first few hours after applying has very little strength, and, like cement structures in general, it cannot safely be disturbed during the period of setting.

2. MEASURING DEPRESSION OF TROLLEY TRACKS BY MEANS OF LEVELING BEAM.

A drop in temperature of the brick work of 30 degrees from day to night is not uncommon. An uncovered pavement can hardly endure this drop in temperature without starting incipient cracks. A thin layer of sand on the pavement aids somewhat against the joints being put into a state of tension by the lower temperature of the night. It is probably quite impracticable to use a sufficiently deep layer of sand entirely to protect the pavement against this drop in temperature, while the grout is acquiring strength. Incipient cracks appear at first as fine dark lines, darkened apparently by the presence of moisture. Later the lines are white, caused probably by the lime in the cement of the grout going into solution and then being converted into the carbonate. These phases have been observed, altho they may not be conspicuous in all cases.

It would seem that a period of favorable weather conditions would be met, for monolithic pavement construction, when minimum diurnal changes in temperature prevail, immediately following the time of grouting. Cement users are all aware of the necessity of keeping the cement quiescent during the period of setting, and the same necessity exists in the case of grouted pavements as in other kinds of cement work. The extent of the surface exposed in a pavement precludes the adoption of means which would be practicable and adequate to avoid excessive thermal strains in certain other engineering examples. It is safe to say that thermal cracks must be recognized as a probability and their presence expected, and that they may have their origin in point of time prior to the opening of the street to traffic.

POWER FROM SANITARY DISTRICT.

THE board of trustees of the Sanitary District of Chicago, at its recent meeting, approved of the proposal of the Dearborn Street Improvement Association to have the district install, at its expense, one hundred and seven trolley poles on Dearborn street, from Lake to Polk streets.

With the final approval of the sanitary district ends a long battle waged jointly by the committee on downtown streets of the Chicago Association of Commerce and the Dearborn Street Improvement Association to secure an adequate lighting system upon one of the most important streets in the downtown district of Chicago.

For several years the Dearborn Street Improvement Association has attempted to arouse the property owners on the street to the necessity of good street lighting. The city has been unable financially to give more lights to Dearborn street than at present installed without discriminating against other districts where more lights are constantly being demanded. It remained for the committee on downtown streets of the Chicago Association of Commerce by an aggressive campaign of education to demonstrate to the property owners on the street that, aside from other considerations, an adequate street lighting system was a good investment.

The engineer of the committee, L. A. Dumond, personally called upon each property owner and secured his signature to an agreement providing that the cost of installation and maintenance of the proposed lighting system was to be paid for on a front-foot basis.

The lighting system to be installed contemplates the mounting of one Lynn flaming arc lamp of 1,100 candle power upon each trolley pole on the street. The lamps will be suspended from a bracket adopted by the city, and which will fit by means of a collar to the top of the trolley pole. An idea of the wonderful lighting effect of the proposed system may be obtained when it is considered that the present twenty-three lamps upon the street give less than 11,000 total candle power, while the new system will give a total of 117,700 candle power.

The cost of installation of $.50 per front foot was assessed upon each property owner. It is expected, however, that the actual cost of installation will permit the refunding of part of this amount. The Sanitary District of Chicago will do the construction work as a part of the existing contract between the city and the sanitary district for the mounting of 10,000 arc lamps in Chicago. The city of Chicago will operate a new system, using power from the sanitary district, and bill the Dearborn Street Improvement Association for the actual cost of operation.

December, 1912.

EDITORIAL COMMENT

GOOD ROADS PROPAGANDA.

This is the season of good roads conventions, and, fortunately, most of the organizations which existed solely for the benefit of individuals or special interests have been exposed and have gone out of business.

The American Highway Association held a very successful convention at Atlantic City in October, at which many valuable papers were presented and a large and instructive exhibit of road materials, machinery and methods was made. National aid in road building was a very prominent subject of consideration, and the campaign to induce Congress to grant such aid may be said to be launched. MUNICIPAL ENGINEERING has never advocated the general engagement of the national government in road construction, still less the distribution of sums of money among the states for their expenditure upon their own road building, but is heartily in favor of liberal appropriations in support of educational work, by means of which local authorities and their constituents can be shown the advantages of good construction and the economy of the same can be demonstrated. This will require some expenditure on road construction, either independently or in conjunction with the local authorities, but if this expands into general road construction by the national government a monumental error will have been committed. Likewise, it may be proper to construct occasional roads, which might be termed National Highways, but they can be promoted locally and constructed locally, as is now being demonstrated, and should not be aided directly by the national government. If the nation desires to build a highway for any particular purpose, it should be done independently, but, again, if this is but the entering wedge to start a stream of appropriations for general road construction with national funds, the driving of this wedge should be prevented.

The American Road Builders' Association meets in Cincinnati the first week in December to discuss problems of road construction and maintenance. It is unfortunate that this association did not join forces with the American Highway Association, and the general tendency toward conservation of time and effort will doubtless bring about the consolidation hereafter. Meanwhile the latter association will do well to confine itself strictly to administrative and constructive features, including especially the subjects of maintenance and operation.

Indiana is the first state met on the way west from the Atlantic which does not have a state highway commission, and its eastern boundary is on the line which separates the states which make appropriations in aid of road building from those which do not. It bids fair to be surrounded by the states making appropriations for building roads, for states as far west as California have joined the progressive band and the fashion is extending eastward. The Indiana Good Roads Association will hold a convention following that in Cincinnati, to inaugurate a campaign in the new legislature for legislation to improve the roads of the state. The principal subjects for discussion will be national aid and the proposed Indiana state road laws, including one providing for a highway commission. At least one session will be devoted to problems of construction, maintenance and repair. This is a local convention to disseminate information and arouse enthusiasm over the right treatment of local problems, but national aid system seems to be in favor with the officers of the association and to demand a hearing. Indiana has more miles of road which have been improved for local purposes than any other state, but it has no roads suitable for through traffic and none which are adequate for use as main roads to the markets in the various counties. It has attained its present position in the good roads column by means of the district system, county and township, with little co-operation between the two classes of corporations, but it seems to be impossible to meet the modern situation by the same agencies. Hence the agitation for a state organization which can unify the work upon these main roads, at least, to which is added the very appropriate proposition that the state shall pay a part of the cost of the main roads. Material advancement in road legislation is expected of the legislature which meets in January.

MUNICIPAL SANITATION.

The field of municipal sanitation is now so large that the progress in it cannot be covered in an occasional number of a magazine, even if it were devoted entirely to that subject. This number of MUNICIPAL ENGINEERING gives some statement of the present state in a few lines in which advancement has been most rapid or in which it is most needed.

Fifteen years ago it was hard to find a city which would confess that it had concrete sewers in use, altho a few cities had such sewers which had been in use more than thirty years. When Portland cement became plentiful and reasonable in price its use was gradually extended into the field of sewer construction, until now it is in such common use that cities boast of the amount of such construction installed, and those which built the early pipe sewers point to them with more or less pride, unless they were made with natural cement, in which case they may have failed and been replaced with better materials.

The adaptation of cement to sewer construction has been at the expense of some failures because the proper use of the new material was not understood, but in the main it has been successful in the larger sizes. Concrete is usually able to compete with brick in cost, and is more adaptable to special designs and peculiar forms of intersections and other special structures, and so its use will doubtless extend still further. For the smaller sizes the old stand-by, vitrified clay pipe, still holds its own in both service and cost, and concrete has a more serious competition.

The article on "Concrete in Sewer Construction," elsewhere in this number, notes a few cases in which alkali, acids and sewage have caused concrete to disintegrate, and some abrasions from rapid passage of rough materials along the bottom are noted, but these seem to be of no more frequent occurrence than in ordinary brick sewers, and the custom of lining the inverts of brick sewers with vitrified brick, which has developed of late years, has been extended to concrete sewers.

The data given in the article referred to, and in others, are only samples of what are available, but are sufficient to give a good idea of what is being done in the development of concrete sewer construction.

STANDARD SPECIFICATIONS.

The American Society of Municipal Improvements has brought its sets of standard specifications for street pavements and sewers almost to their ultimate form during the past year. This organization and the Society for Standardizing Paving Specifications have been working on parallel lines, with many men as members of the corresponding sub-committees of the two societies. As a consequence, very close agreement of the two sets of specifications has been reached.

The A. S. M. I. has a somewhat broader field because its general committee on standard specifications is prepared, through its sub-committees, to consider and prepare specifications for any construction in which municipalities may engage. This year it has adopted a very full and complete set of sewer specifications prepared by a committee composed of sewer experts of the highest reputation, and thus one of the few gaps in the list of standard specifications has been filled adequately.

There is good prospect of the two societies mentioned joining forces during the following year, thus saving the duplication of the past three years and removing the possibility of conflict which might arise if the two organizations were not so harmonious in their feeling toward each other.

THE QUESTION DEPARTMENT

Automobile Ordinances

I will thank you to give some ordinances relative to automobile regulation for a city of 30,000 population, as I want to go into the matter fully and get up an ordinance covering all features of the auto traffic.

R., City Attorney, Idaho.

The city of Cincinnati has produced what is probably the most complete set of vehicle ordinances, including automobiles.

The following are simpler and seem to cover nearly if not quite all the ground. The ordinances are given below continuously, and the divisions between them can be distinguished readily. Having been passed at different times, there is some duplication and there are some slight conflicts. The provision requiring owner to carry his initials has been abrogated by a State law requiring all motor vehicles to carry State numbers and prohibiting cities from requiring additional distinguishing numbers or letters:

It shall be unlawful for any person to drive or operate upon or along any street, alley or public place in the city of ——— any automobile, motorcycle or similar vehicle, unless the person in charge or control thereof shall have first procured a license so to do from the city controller of said city, for which the sum of $—— shall be paid. The city controller is hereby authorized to issue such license only upon the presentation of a permit properly signed by the board of public safety.

For the purpose of this ordinance the terms or names "automobiles," "motorcycles" and "other similar vehicles" wherever and whenever used in this ordinance shall be held to embrace and mean, and are hereby defined to mean, any vehicle driven or propelled upon or along the streets, alleys or other public ways of the city of ———, the motive power of which is electricity, compressed air, naphtha, gasoline, kerosene or steam. Provided, however, that nothing herein shall apply to the operation of any locomotive, trolley car or other vehicle used by any steam or street railway upon or along any track or tracks owned or lawfully used by any steam or street railway company.

Any person desiring a license as an operator of such vehicle shall file a written application therefor with the board of public safety, stating his name and address, and shall present satisfactory evidence of his ability and capacity as such operator. If the board be satisfied that he is a proper and safe person to act as such operator, a permit for such a license shall be issued: Provided, that no such permit shall be issued to any person under the age of 17 years. Any such operator shall, within 5 days, notify the board of public safety of any change of address, and such operator shall, whenever requested by the police authorities, disclose and furnish his name and address and the number of his license.

Any person violating any of the provisions of this ordinance shall, upon conviction thereof, be fined not less than $1 nor more than $100, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse; and the court finding any person guilty of violating any statute of the State or ordinance of this city relating to automobiles or motor vehicles, as herein defined, may revoke said person's license: Provided, that when any person shall be found guilty for a third time of violating any statute of this State or ordinance of this city relating to automobiles or motor vehicles, as herein described, said third conviction shall operate to revoke the license taken out by such person under the provisions hereof, and if such person shall thereafter be found guilty of violating any of the provisions of this ordinance, he shall be fined not less than $25 nor more than $200, and shall also be imprisoned in the county jail or workhouse not less than 15 days nor more than 6 months.

It shall be unlawful for any person, firm or corporation to leave standing in a public street, alley or highway within the limits of the city from one-half hour after sunset to one-half hour before sunrise, any automobile, motor vehicle or other conveyance, carriage, wagon, engine or machine, the motor power of which shall be electricity, steam, gasoline, or any source of energy other than human or animal power, unless there shall be kept burning on the front of said vehicle at least one white light visible for a distance of not less than 200 feet, and on the rear of said vehicle at least one red light visible for a distance of not less than 200 feet.

No person, driver or operator in charge of any automobile or motor vehicle or carriage described in the preceding section shall permit the machinery of said vehicle to run while such vehicle is standing in any street, alley or public highway within said city without an attendant for a longer period of time than 5 minutes at any one time.

No person, firm or corporation shall use upon the streets, alleys or public highways of the city any automobile, motor vehicle, or other conveyance, carriage, wagon, engine, or machine, the motor power of which shall be steam, gas or gasoline, or any like source of energy, unless such vehicle shall be equipped with a sufficient modern and improved muffler to prevent noise from the exhaust of the engine or engines of such vehicle, and said muffler shall be kept and remain closed by the person operating or in charge of such vehicle at all times when such vehicle is in motion.

No person under 17 years of age shall operate upon the streets or public highways of the city any automobile, motor vehicle or other conveyance, carriage, wagon, engine or machine, the motor power of which shall be electrity, steam, gasoline or any source of energy other than human or animal power.

Any person, firm or corporation violating any of the provisions of this ordinance shall, upon conviction, be fined not less than $1 nor more than $100, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a second conviction for such offense said person, firm or corporation shall be fined not less than $25, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a third conviction for such offense said person, firm or corporation shall be fined not less than $50, to which shall be added imprisonment for a period of not less than 30 days in the county jail or workhouse.

It shall be unlawful for any owner or operator of any automobile or other motor vehicle to maintain or use any searchlight or blinding light on said automobile or other motor vehicle using any of the streets, avenues, alleys or public places within the corporate limits of the city: Provided, that nothing herein contained shall apply to any automobile used by the police for the city when in the performance of their duties.

Any person or persons violting any of the provisions of this ordinance shall, upon conviction thereof, be fined in any sum not exceeding $20.

It shall be unlawful for any person or persons to drive or cause to be driven any automobile through the streets, alleys or public driveways of the city faster than 8 miles per hour inside of the territory bounded by ———, or faster than 12 miles per hour in any portion of said city outside of the above described territory.

All automobile drivers or owners shall register with the city controller their full names and residences, together with a brief description of their automobile or automobiles, and said automobile or automobiles shall be provided by the owner thereof with his or her full initials in white or aluminum Roman letters not less than 3 inches high arranged in a horizontal line with a space not less than ¾ inch nor more than 2 inches between the nearest adjacent points of the several letters, and placed upon the rear of such vehicle or vehicles: Provided, however, that this section shall not apply to nonresidents of the city not remaining in the city a longer period than 5 days.

All automobiles shall be provided with an alarm bell or horn, and shall carry a lighted lamp from half an hour after sunset until half an hour before sunrise.

All operators of automobiles must slow up in turning corners of streets. (The Cincinnati ordinance requires slowing to half the legal speed.)

Any person or persons violating any of the provisions of this ordinance shall, upon conviction thereof, be fined in any sum not less than $5 nor more than $50.

Ordinances Fixing Rates for Electric Current

Will you kindly send me copies of electric current rate ordinances of other cities?
F., City Attorney, ———, Neb.

The ordinance for Taylorville, Ill., will be found in MUNICIPAL ENGINEERING for November, vol. xliii, p. 322. Lighting rates for Johnstown and Gloversville, N. Y., are given in vol. xli, p. 305. An article on "Specifications for Electric Lighting Contract," vol. xl, p. 37, gives references to a number of articles having considerable information about electric current rates and contracts, franchises and ordinances governing them. One of these, in vol. xxxix, p. 50, gives the form of contract with the consumers for operating ornamental street lamps in Indianapolis, Ind.

Rate for Water in Small Municipal Plant

We are about to complete a water works plant in our village of about 1,000 people. We expect to pump with water power, with a

90-h.p. gasoline engine for emergency in case of low water. We have two good 8-inch wells and pump into a 200,000-gallon tank that is 50 feet higher than any building in the village. The mains are 8-inch, and we have about 4½ miles of pipe. Our pumps and engine are installed in the same building with our light station, operated with the same labor. Now, I would like to ask if you would give us a rate with or without meter. We expect to install meters, but would like a flat rate. L., Mayor, ———, Mich.

Theoretically, the rates for water ought to be determined with reference to the cost of furnishing it. It will be the merest guesswork if a rate is adopted without some careful study of the expense of maintaining and operating the plant and paying capital charges and the probable income, and even then the probable growth of the use of water must be estimated. The range of rates charged by small plants in Pennsylvania is given in an article in MUNICIPAL ENGINEERING, vol. xlii, p. 190, on "Rates for Water." An article in vol. xli, p. 131, on "Water Rates in Small Cities," gives both flat and meter rates in both municipal and private plants in cities and villages of 3,000 to 10,000 population in Indiana, Kentucky and Ohio. Information about rates in all parts of the country can be obtained from the "Manual of American Water Works" ($1.50).

Book Giving Statistics of Water Supplies

I am wanting a book or pamphlet which gives the statistics of water supply in the cities of the United States, or as many of them as are obtainable.

I would like the cost of the plant, distance of the supply from the city, miles of mains in the city, amount of consumption per capita, and population of city at the time the report was made, and the cost per 100 gallons to the consumer. Also, whether or not the city owns plant or a private corporation. Further, if possible, the cost per 100 gallons of pumping the water.

I want to get at what would be a fair price for delivering water by a private corporation in mains a distance of 15 to 20 miles, to a standpipe, from which the city will distribute to the consumer.

I am one who believes a city should own its water supply, if possible.

I suppose, if the statistics I want are published, they will show how much of the water shed is owned by the city, to prevent the supply being contaminated, and the cost of acquiring this land, which I know in some cities has been very large. I take it for granted that where the city owns a settling basin and purification plant the cost of this will be given. F., ———, Tex.

Is there any place, to your knowledge, where the water pressure in the different cities in this country can be obtained, and also what is the probable cost of same? I would appreciate any information you can give me on this subject.

Z., Chicago, Ill.

The book giving the largest part of the information desired is the "Manual of American Water Works" ($1.50). As the last edition of the book was published in 1897, it is far from being up to date, but it gives many of the items desired as they existed at that time.

The volumes of "Statistics of Cities" issued by the U. S. Census Bureau give some of the items. Thus, that for 1907, giving statistics for cities of over 30,000 inhabitants owning their own water works, gives mileage of mains, millions of gallons supplied, population, earnings, and cost of service in total, per capita and per million gallons.

Some articles in MUNICIPAL ENGINEERING will be of value, such as the articles on water rates in vol. xli, pp. 131 and 291, vol. xl, pp. 103 and 344. Some data for small cities are given in vol. xlii, pp. 118 and 190. Much of the information asked for is given regarding a number of cities between 25,000 and 50,000 population in vol. xxxvii, pp. 258, 330 and 400.

These, and such other data as may be obtained, give only the results in the cities for which they are given, and are of no special advantage in a particular case. It would seem that the proper mode of procedure would be to make a preliminary rough estimate of the cost of the project as a basis for a decision as to whether the city and the citizens could afford to pay for the service rendered. Then, if it is decided that the project is feasible, a careful estimate based on completed surveys and plans should be made and the price for the water fixed so as to meet all expenses, interest and depreciation or sinking fund charges on all the actual cash capital required, whether represented by bonds or stock. Or an agreement can be made by which the city will have the opportunity to keep account of proper cost of construction, and the price to be fixed after the cost is ascertained upon an agreed basis of capital charges and profit on cost of maintenance and operation. The latter is the most equitable method, and when the city purchases the water outright and makes the distribution of the water to consumers in its own system of pipes, is very easy to keep in satisfactory condition. Contracts for water can be made between the city and the company each year, or can be made for definite terms of years, and by having the books open to both the parties to the contract the price of the water can be fixed for each new contract so that the water company will get full return for its investments and services and the city will know that it is not paying inordinate profits upon the cash capital actually involved.

Effect of Hypochlorite on Health of Water Consumers

Will you kindly inform me, through your question department, whether there is any evidence or reason to believe that the continued use of hypochlorite of lime for water purification is or may be injurious to health?
E. R. W., ———, Mich.

There has been some question raised as to the possible effect of hypochlorite of lime upon the consumers of water treated with it. Doubtless it would have an injurious effect if it were in sufficient quantity, but, like alum in the coagulation method of treating water, the supposition is that the amount added to the water is only sufficient to perform the required duty, and that it all disappears before it reaches the consumers, therefore there is nothing left to affect their health. What have our readers to say?

Methods of Garbage Collection

I am in search of information relative to systems of garbage collection in cities of about 7,000 population.

I would like to get copies of ordinances and any further data that would assist in installing a good system in this city.
M. M., ———, Wis.

In vol. xlii, p. 252, will be found a full list of articles which have appeared in MUNICIPAL ENGINEERING upon the subjects of garbage and refuse collection and disposal, in which can be found all the information desired. Articles which have appeared since the date of the above list are "Private Collection and Disposal of Waste," vol. xlii, p. 468; brief reports of methods in use in a number of cities in vol. xlii, p. 320; "Collection and Disposal of City Wastes," vol. xlii, p. 385, giving an abstract of a report on the subject by the Ohio State Board of Health; "An Individual Garbage Destructor," vol. xliii, p. 257.

Some data on the subject will be found in this number, and still more information is in preparation for early publication.

Assessment of Part of Bridge Cost on Street Railway Company

We are confronted with the necessity of building a new bridge across a river on our principal business street. The old bridge carries a double-track street car line, which occupies practically all of the roadway, which is 18 feet wide. The bridge was originally designed for highway traffic only, and the floor system was later strengthened to carry street cars. Heavy interurban cars are now being run over the line, and the bridge has deteriorated considerably from rust, and is no longer considered safe. Moreover, the city has more than doubled in population since the bridge was built, and has outgrown the old bridge, and desires to construct a modern bridge of suitable width and design at an estimated cost of about $70,000.

Now, it is necessary to build this bridge much stronger and heavier than would be required without the street car line, and we think the street railway company should be willing to bear a proportionate share of the cost of the bridge. This they refuse to do, however, holding that the city, in giving them permission to cross the old bridge, undertook the obligation of maintaining a crossing for them.

It seems to me that this same question must come up in many other cities, and that there must be some better way than a fist fight to make the railway company stand its portion of the cost. I presume we might shut them off the bridge, but this would immediately deprive half the city of street car service, and would amount to a "fist fight."
CITY ENGINEER, ———, Mich.

The solution of this problem depends so much upon the terms of the franchise of the street railway company that no definite opinion can be expressed. Equity would demand that the street railway company pay part of the cost of the bridge, and unless the franchise definitely prevents this there would be a good chance of getting a court decision to this effect. Modern franchises and recent legislation take care of the question, and court decisions on such matters almost always follow the equities of the cases, if not absolutely prohibited by the letter of the contracts or franchises.

Ordinance Regulating Dance Halls

I would like to get copies of one or more ordinances prohibiting and punishing indecent forms of dancing in the common dance halls of a city.
M., City Attorney, ———, Mont.

Will any of our readers supply what our correspondent needs? The following ordinance leaves the matter in the hands of the police for regulation, aside from the prohibition of public dances, and is the usual method of handling the matter, this being somewhat more strict than most of the ordinances:

No person, firm, corporation or association shall keep a public dance hall within the city of ————, which shall be open promiscuously to the public, either upon the payment of an admission fee or otherwise; nor shall any person visit or attend any such public dance house or public dance held therein.

No person, firm, corporation or association shall knowingly let or lease to another any room, house or building for the purpose of having carried on or maintaining therein any public dance house, to which the public are invited promiscuously to visit or attend, either upon the payment of an admission fee or otherwise.

It shall be unlawful for any person, firm, corporation, club, society or association to give or hold any dance in any room, hall or building, other than a private residence, without a permit or license first obtained from the city controller, for which the sum of $1 shall be paid. The city controller is hereby authorized to issue permits or licenses for dances only upon the presentation of applications properly signed and approved by the chief of police.

Any person violating any of the provisions of this ordinance shall be fined in any sum not less than $10 nor more than $500.

Specifications for Bituminous Macadam Roads of Low Cost

I should esteem it a favor if you would oblige me with a specification for tar macadam road. The authorities of the country municipality in which I live contemplate resurfacing the existing o rdinary macadam road with tar macadam. This will probably entail laying from three to four inches on top of the present roadbed. The proposals submitted by the bitulithic company and the tarvia people are too expensive to be entertained. If I succeed in obtaining a reasonable specification through your kindness, I propose, as mayor of the municipality, to call for tenders through the press for the work required.

P. R. W., Mayor, ———, Can.

Possibly the need will be filled by the specification for tar macadam in the last volume of proceedings of the Society for Standardizing Paving Specifications ($5), of which J. B. Hittell, City Hall, Chicago, Ill., is the secretary. These specifications will make a good pavement. If this is still too expensive, the specifications for making tar roads by the penetration method or for oiling roads may be used. These are cheaper than the constructions named, but their quality and durability are reduced in like proportion, or even more than the reduction in cost.

The following articles in recent numbers give descriptions of methods, figures of cost or specifications, and may supply all the data desired:

In vol. xlii: "The Park Heights Experimental Road, Baltimore," p. 83, giving brief statements of materials and methods used and results; "Bituminous Macadam Construction," p. 92, giving descriptions of methods of laying and specifications for materials; "Bituminous Roads," p. 20, giving brief descriptions of specifications for various kinds; "Road Asphalt in Birmingham, Ala.," p. 129, an informal specification for an inexpensive treatment; "Cost of Tar Binding and Water Binding of Roads," p. 259, a report of English experience; "Some Methods of Preventing Dust on Macadam Streets," p. 397, a rather detailed description of the application of tar to streets; "Macadam Roads," p. 436, specifications for the penetration method; "Construction of Asphalt Macadam in Webb City, Mo.," p. 444, a full specification and description of materials and methods of construction and statements of cost in great detail.

In vol. xli: "The Automobile and the Road," p. 155, giving three Tarvia specifications of different cost; "The Ohio State Experimental Road," pp. 179 and 286, brief abstracts of specifications of sections laid with various materials and statements of results; "The Barrington, R. I., Experimental Road," p. 439; "Bituminous Surfaces for City Macadam Streets," p. 285, devoted mainly to oiling processes.

In vol. xl: "Oiling Highways," p. 42, giving specifications; "Oiling Unpaved Streets of a Small City," p. 136; "Cost of Surface Oiling and Asphalt Macadam Roadways," p. 226; "Bituminous Materials in Road Construction and Maintenance," p. 329, giving a general outline of specifications using the mixing method; "The Tarvia Modern Pavement," p. 456, giving specifications for the use of the various brands of this material.

There are still other articles in earlier volumes.

Can Public Service Commission Law Abrogate Existing Franchises

In the year 1880 a water franchise was granted a certain water company, and in it the terms or rates were established and defined and agreed upon by the city and the company. They were not to exceed a certain rate per thousand gallons. The franchise was granted for a term of years, say fifty. Everything pertaining to the granting and acceptance of the franchise was lawful. Thirty years later the state passes a law creating a corporation commission, with powers to fix rates and adjust other matters pertaining to municipal corporations. Could that commission have any jurisdiction over the rates of the company holding such franchise until the fifty years had run out, other than to make the company charge every like consumer a like price under like condition?

JOHN SMITH, Reno, Nev.

There is much difference of opinion as yet concerning the conditions described. The State of Wisconsin solved the problem by making the acceptance of the new law optional with the companies and the terms of the law so favorable that most of the public service corporations in the State have accepted its terms, one of which is that they give up their limited franchises obtained from the municipal corporations and accept an indefinite permit under the State's public service commission. The question has never been definitely decided by a court.

Have our readers any information or any opinions which will aid our correspondent in his study of the question?

FROM WORKERS IN THE FIELD

Manhole Covers With Creosoted Wood Blocks Set to Conform With Pavements

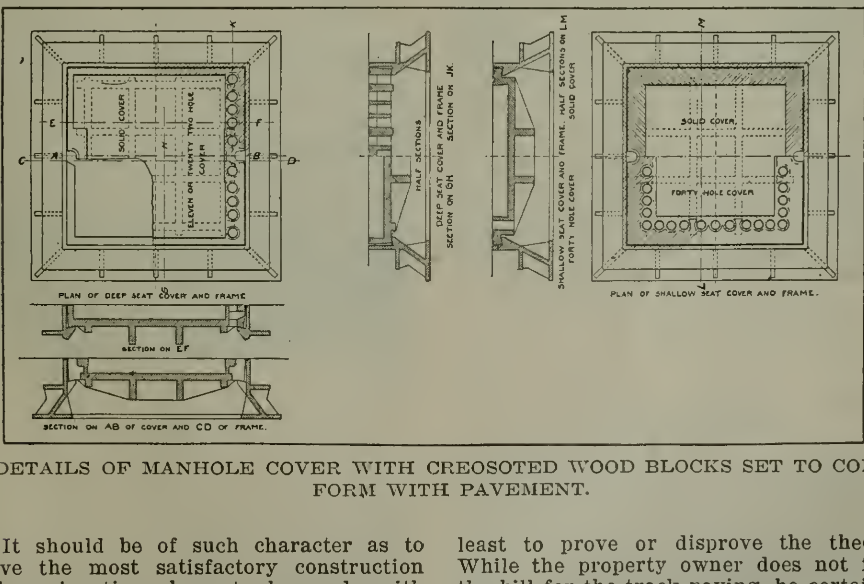
Editor of MUNICIPAL ENGINEERING:

Sir—The ideal pavement for heavy traffic should meet the following requirements:

It should have a smooth, even and uniform surface, of such character as to offer the least resistance to vehicle traction. It should be durable and possess uniform wearing qualities. It should be noiseless from the effect of hoof strokes, the wheel contact on pavement itself or induced rattle and vibration set up in vehicles passing over it. It is desirable that it should not only be clean itself, but easily cleaned of any refuse or litter coming upon the roadway. It should require a small amount of crowning, and form a waterproof surface. It should be durable, easy to repair and the cost of maintenance small.

now being used very extensively "inside the loop" district in Chicago, fills the above requirements; but, in my opinion, creosoted wood blocks should be uniformly used on manhole covers and between car tracks, in order that the streets be uinform thruout.

It is believed that more satisfactory results might be had in the track paving if the tie rods were turned flatwise and thoroly bedded in mortar, so as to form a part of the paving bed. With a three or three-and-one-half-inch paving block the tie rod space or break could be eliminated by laying the blocks continuously over the tie rods. The greater portion of the wear in track laying comes from the calking in the transverse joints. By laying the blocks lengthwise of the track, the number of tranverse joints would be reduced by fully one-half. In addition to that, those that do occur would be broken. I know of no case where these expedients have been tried. It is believed that some such method should be given a test, at



DETAILS OF MANHOLE COVER WITH CREOSOTED WOOD BLOCKS SET TO CONFORM WITH PAVEMENT.

It should be of such character as to give the most satisfactory construction where junctions have to be made with such obstacles as street railways, manhole covers, etc. Creosoted wood block,

least to prove or disprove the theory. While the property owner does not foot the bill for the track paving, he certainly has a vital interest in the character of the roadway as affected thereby. The depth of block used in track paving in New York is three inches.

On streets which have street car lines, every reasonable effort should be made to get the pavement changed so as to have a uniform pavement over the entire roadway; that is, have the same pavement used inside the tracks as is used outside.

Fig. 1 is a sketch of a proposed plan for a manhole cover and frame. The cover is designed to be set with creosoted wood blocks to form the wearing or roadway surface.

The two types shown embody the following features:

First. The deep seat cover. In this the cover seat is well down in the frame, allowing the cover to rest on its base. That allows the maximum amount of surface to be set with wood block. With a solid cover, only about an inch and a half of cast iron is brought to the surface, around the outside of the cover.

Second. The shallow seat cover. In this the cover seat is near the top of the frame, the cover resting on a flange outside of the recess wall and the cast iron surfaces surrounding the outside of the cover comes to the road surface, being a little over three inches wide, for a solid cover. This type will be less liable to freeze down in winter. It can be adopted so that new covers can be set in the old frames.

For both types ventilating holes are provided where necessary. Instead of being at the center, as in the recessed asphalt covers now in use in some of the boulevard roadways, they are placed around the outside edges, so as to leave the wood block surface continuous. With the deep seat cover and ventilating holes the cast iron surface is about five inches wide. With the solid covers the two "bar holes" would give a small amount of ventilation. If greater ventilation area is required, one or more sides of the cover can be provided with holes. Traffic passing over these rough cast iron surfaces of the present type of cover adds greatly to the total volume of noise and clatter.

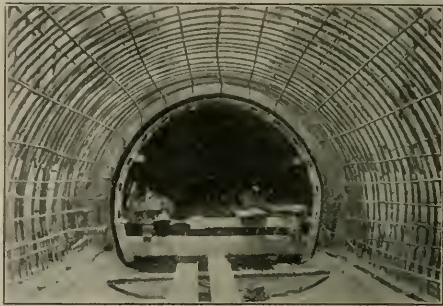
CHARLES K. MOHLER,
Consulting Engineer, Chicago, Ill.

Intercepting Sewer System for New Bedford, Mass.

The Editor of MUNICIPAL ENGINEERING:

Sir—The city of New Bedford is located on two arms of Buzzards bay, known as Clarks cove and the Acushnet river. At the present time all the sewage from the city is emptied directly into the river or cove. These waters have only a small movement, the average tide being about four feet, and the dumping of sewage for many years so close to the city has resulted in a very objectionable and unhealthful pollution.

The intercepting sewer, which will take in all the present outlets, is designed to run from the extreme north end of the city southerly along the shore of the Acushnet river for about half its length, thence crossing to the shore of Clark's cove and continuing to the extreme end



REINFORCEMENT OF OUTLET SEWER, NEW BEDFORD, MASS.

of Clarks point, where it enters submerged pipes and runs to an outlet 3,300 feet from land, emptying under 40 feet of water in Buzzards bay. This outlet is so located and is such a distance from land that the prevailing currents and winds will diffuse the sewage and prevent any pollution near the city.

The size of the intercepting sewer will be equivalent to a three-foot diameter cir-

HANDLING 48-FOOT SECTIONS OF OUTLET PIPE SUBMERGED IN BAY, NEW BEDFORD, MASS.

cular section at its northerly end and will be increased in section, as required, for a distance of about four miles, when it will reach a section 7 feet by 7 feet 8 inches of horseshoe shape. This size will be continued for two and one-half miles to the outfall in the bay, the outfall being constructed with two lines of 60-inch cast iron pipe 3,300 feet in length. All the sewer, except the outfall, will be concrete, reinforced as conditions require. In addition to the main intercepter there will be a 48x50-inch branch intercepter for a short distance on River street, as shown on the accompanying plan.

A small part of the city is too low to be taken directly into the sewer. This section will be accommodated by a separate sewer system which will have its outlet at a pumping station on Cove road.

The pumping station will be equipped with four electrically-driven 8-inch centrifugal pumps, which will pump the sewage up into the intercepter.

The outfall pipe in the bay will connect with the land work at a junction chamber where suitable sluice and tide gates will be installed for governing the flow. The elevation of the sewer is such that high tide will back the sewage up for about two miles along the line, but in no place except at the extreme low end is the land section likely to be under head.

Near the outfall end of the sewer a screen house and grit chamber will be built to take out of the sewage all material which would be likely to settle in the outfall pipe. A screen will also be installed at the pumping station to rid the sewage of foreign material before it goes to the pumps.

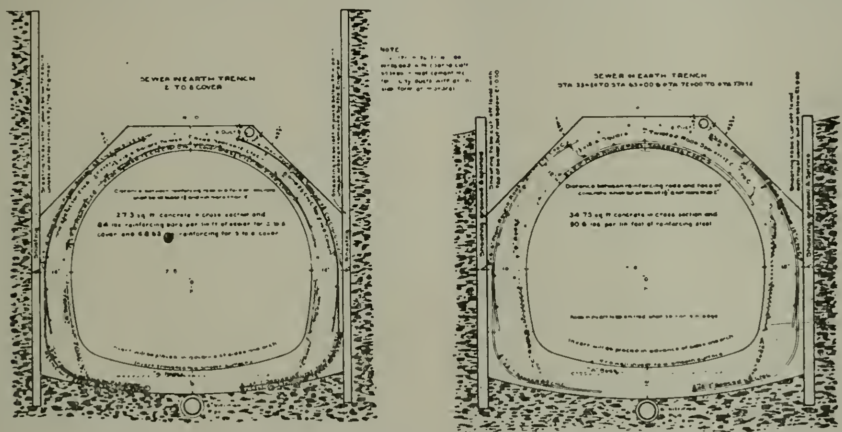
About three miles of the lower end of the work is already under way, consisting of four sections, three being built under contract and one by the city itself. The outfall pipe and outlet in Buzzards bay are nearly completed; the pumping station is about half finished, and about a mile of the 7-foot by 7-foot 8-inch section of sewer is completed.

This 7-foot by 7-foot 8-inch section is built as shown on the accompanying drawings and photograph and is reinforced with ⅝-inch rods transversely and longitudinally. The concrete is all 1:2:4 and is mixed in portable mixers. The side walls are 12 inches, the arch 9 inches and the invert 9 inches thick. The invert is placed first and screened to shape and finished with 1:1 mortar. Blaw collapsible forms are being used for the arches. Very little water is being encountered, and 2-h.p. gasoline pumps are found sufficient to handle it.

One section of work is being carried on by a cableway, one with a Carson machine, and the rest with derricks.

The total work is estimated to cost about $1,600,000. Of this amount the Cove road pumping station will cost about $15,000 and the screen chamber about $50,000.

The work was designed and brought to its present stage by William F. Williams, formerly city engineer of New Bedford. Mr. Williams has recently been appointed chief engineer of the Massachusetts Harbor and Land Commission, but will continue to have a supervision of the sewer work as consulting engineer for the city.



CROSS SECTIONS OF OUTLET SEWER, NEW BEDFORD, MASS.

WALTER N. CHARLES,
Assistant City Engineer,
New Bedford, Mass.

A Study of City Planning

A specially appointed committee of the National Conference on City Planning is to conduct this year a study in city planning, taking an area on the outskirts of a growing city of 200,000 to 300,000 population. A description of the area and the details of the study may be had on application to the secretary of the conference, Flavel Shurtleff, 19 Congress street, Boston, Mass.

MUNICIPAL MATTERS IN COURT

Decision in Grand Rapids Bitulithic Case

The U. S. District Court for the western district of Michigan, southern division, C. W. Sessions, district judge, has just decided the case of Warren Brothers Company vs. The City of Grand Rapids and Edward W. Seamans, enjoining the latter from carrying out their contract for the construction of the Barclay street pavement.

The specifications call for a bituminous macadam pavement, and in the judgment of the court infringe the Warren patent, whose "basic idea is the so-called inherent stability of the mineral aggregate in its composition, which consists of the two elements of density or absence of voids and stability or resistance to displacement, existing independently of the plastic binder." This court, not long before the making of the contract now enjoined, entered a consent decree in Warren Brothers Company vs. The City of Grand Rapids, John Kloote and Henry Vanderveen, declaring that the performance of a paving contract with specifications very similar to the present ones would necessarily be an infringement of the Warren patent. The court expresses the opinion that the difference in the specifications in the two contracts "is more of phraseology than of substance. In the one a resultant product is described, while in the other the process of producing and the constituent elements of substantially the same product are described. Both call for substantially the same mineral elements graded in the same way, except that in the one maximum sized stone of 1¼ inches are to be used to construct a wearing surface 2½ inches in thickness, while in the other maximum sized stone of ¾ inch are to be used to construct a wearing surface 2 inches in thickness. The comparative difference in the maximum sizes of stone to be used thus appears to be slight. Under the evidence it cannot be doubted that by following the process and complying with the requirements set forth in the one, the mineral aggregate having 'A maximum degree of density and low percentage of voids' described in the other will be produced."

Decisions of the Higher Courts of Interest to Municipalities

Incorrect Monthly Estimate Does Not Constitute Grounds for Damages For Contractor. —Under a municipal contract for the construction of a public improvement, providing that the city engineer each month should make a partial estimate of the amount due the contractor, 80 per cent. of which should be paid the contractor at that time, the engineer is the arbiter of how much should be paid as the work progresses, and the contractor cannot recover damages because such estimates are incorrect. Manerud et al. v. City of Eugene (Ore.) 124 P. R. 662.

Responsibility of City for Defect in Street —Sufficiency of Notice.—A city's duty to repair defects in a street arises only after actual notice of their existence, or after such a lapse of time as would justify the imputation of negligence, if the defect had not been discovered. A police officer's knowledge of a defect in a city street is not notice to the city, unless it is his duty to report or make provisions for the correction of the defect, or to look after or control the making of repairs or the removal of obstructions. Under Ky. St., Sec. 2885, providing that it shall be the duty of police officers in cities to remove all nuisances in the public streets, parks and highways, it was the duty of a policeman, on obtaining knowledge of a dangerous cave-in in a street, to guard the same in order to prevent injury thereby, and hence the policeman's knowledge thereof was notice to the city; the word "nuisance," as there used, not being limited to a physical obstruction placed in a street, but including anything that "worketh hurt, inconvenience or damage."—City of Louisville v. Lenehan, 149 S. W. 932.

Municipal Corporation is Not Liable in Its Governmental Capacity for Misconduct of Its Officers.—A municipal corporation, when engaged in the preservation of the peace, public health, maintenance of good order, and the enforcement of the laws for the safety of the public, exercises governmental functions, and is not liable for misconduct of its officers, but where a municipal corporation is exercising those powers and privileges peculiarly for its benefit it is liable.—Smith's Adm'r v. Commissioners of Sewerage of Louisville (Ky.) 143 S. W. R. 3.

SEWERS AND SEWAGE DISPOSAL

Reports of Experience with Concrete for Sewers.

Following are some notes of experiences with concrete for sewers, which include also some data not reducible to tabular form:

Alameda, Cal., has had concrete sewers in use for from fifteen to twenty-five years and has had some disintegration and some failures, especially in the older sewers.

Colton, Cal., reports some disintegration in concrete sewers.

Los Angeles, Cal., reports some disintegration in old pipe sewers, having used concrete at intervals since 1875.

San Francisco, Cal., uses monolithic concrete construction for sewers, as shown in Table III, and has several types for large storm sewers, some of which cost as much as $75 a foot. Brick sewers have not been used in recent years on account of the high cost of brick. One concrete outfall sewer reinforced with expanded metal on a wooden pile foundation extending into the bay in about 6 feet of water, was shaken by the earthquake and broke transversely in about ten places within 100 feet. The reinforcement is considered to have been inadequate.

New Haven, Conn., has built some wide and shallow sewers with heavily reinforced covers, and two 36-inch circular and egg-shaped overflow sewers. Natural cement concrete sewers were built generally from forty to fifty years ago, but this use was abandoned forty years ago because they were unsuitable. There has been no trouble with the recent concrete sewers.

In Atlanta, Ga., concrete sewers by contract cost more than brick sewers, but most concrete sewers are built by county jail prisoners, the city furnishing the materials. Sewers have velocity of flow of 10 to 12 feet a second, and are thus kept perfectly clean. There is no appreciable leakage or abrasion as yet.

There has been much comment over a concrete pipe sewer some forty years old at the stockyards in Chicago, Ill., which was found to be almost wholly disintegrated when dug up recently.

Indianapolis, Ind., has used continuous plain and reinforced concrete and reinforced concrete pipe for sewers. The plain concrete was observed to have heavy, irregular coating of efflorescence, obstructing the flow, which formed when only ground water was flowing in the sewer. There was much leakage into this sewer in pipe sections, due to heavy pressure of ground water and joints not sufficiently strong to resist it.

South Bend, Ind., has used concrete sewers for many years, with no failures reported.

Vincennes, Ind., has concrete pipe uniformly 2⅞ inches in thickness, reinforced with triangle mesh and tongue and bevel joints filled with cement mortar. The rule for thickness is 1 1/12 inches per foot of diameter, with minimum above stated.

Sioux City, Ia., reports concrete sewers satisfactory, but requiring closer inspection to get good material and finish and to keep forms in place long enough.

Louisville, Ky., uses plain monolithic concrete in sewers 24 to 60 inches in diameter and reinforced concrete in sewers 39 inches to 15 feet 6 inches in diameter. In the only pipe sewer contract the pipe was required to be surrounded with additional concrete and was finished monolithic. The commission has constructed no brick sewers. All leaks were remedied or reduced to satisfactory minimum before expiration of guarantees. An inconsiderable amount of efflorescence has been observed.

New Orleans has some plain concrete sewers, 4 to 6 feet in diameter, of same section as brick and costing slightly less. Thin concrete is feared in the local soil, but thick sections are used without hesitation. Large drainage canals are lined and covered with reinforced concrete. The surface of the concrete has softened at one point where the soil through which it is laid is supersaturated with gas plant wastes; sewer eight years old. No other trouble anywhere.

Bangor, Me., reports crushing of some concrete pipe not properly seasoned before laying.

Portland, Me., reports some 1,000 feet

of disintegrated concrete pipe replaced.

Cambridge, Mass., uses plain and reinforced concrete in sewers, both continuous and in blocks, and various combinations with each other and with brick. Concrete usually costs less than brick. A sewer laid in 1895, recently examined, is as perfect as when laid. Used in sewers as small as 18 inches diameter.

New Bedford, Mass., reports satisfactory experience with concrete sewers, and will build an intercepting sewer, with an outlet three-quarters of a mile from shore, in 40 feet of water.

Springfield, Mass., uses plain concrete in sewers with 8-inch walls, the cost being about $6 to $7 per cubic yard.

West Newton, Mass., has nearly 5,000 linear feet of 16x24 to 20x30-inch plain and reinforced concrete sewers, constructed prior to 1908, most of them having brick inverts.

Worcester, Mass., uses both plain and reinforced concrete sewers, laid continuously, with shells thinner than brick sewers. These sewers are of large size where acids from factories are largely diluted, and no disintegration of concrete has been observed.

Kalamazoo, Mich., builds all its sewers through its engineering department, and they cost less than by contract. Most concrete sewers are for storm water only, but one sanitary sewer was built last year. Plain concrete is laid continuously, as shown in section, Fig. 4. About a mile of 42 to 30-inch reinforced concrete is in use.

Duluth, Minn., uses concrete only in outlet sewers. It has some concrete drains over twenty years old, in which no failures have been reported.

In Minneapolis, Minn., concrete sewers cost 25 to 60 per cent. less than brick sewers. There are sixteen miles of them in use, some thirty years old, of 33 to 120 inches diameter. There have been no failures and there is less leakage than in brick sewers.

St. Paul, Minn., has used reinforced concrete pipe, but is now using monolithic reinforced concrete, which is somewhat cheaper than other materials. There have been some failures on account of poor materials and workmanship, but no disintegration from external action worth mentioning.

Kansas City, Mo., has opened its specifications to vitrified clay and plain concrete pipe in sizes below 30 inches, and to monolithic concrete and reinforced concrete pipe in sizes above 30 inches. Each class of material has been used by low bidders, competition being keen. Brick cannot compete in cost with the other materials. Reinforced concrete sections of special shapes and strength are used, one such being shown in Fig. 7, as used on O. K. creek in railroad yards.

In South Omaha, Neb., cost of concrete sewers runs 10 to 20 per cent. less than brick in sizes 24 inches or over. One failure destroyed 120 feet of 6-foot sewer with 9-inch shell. It was caused by poor foundation and an earth fill not anticipated when design was made. There is slight disintegration of sewers carrying discharge from meat packing plants, and there is a slight growth in the same sewers.

Dover, N. H., reports failure of some poorly made concrete pipe sewers less than fifteen years old.

Niagara Falls, N. Y., uses reinforced concrete pipe and monolithic concrete at about same cost as brick.

Rochester, N. Y., lines its intercepting sewers with brick, to avoid action of sewage, etc.

Cincinnati, O., has constructed but one plain concrete sewer, and one reinforced concrete sewer is about to be constructed. Three-ring brick is used, and a thickness of 8 to 14 inches in reinforced concrete. The plain concrete sewer, 6 feet diameter, has 9-inch shell. The 8-foot brick sewers average $1.57 per linear foot per foot of diameter, the average being based on ten contracts and twenty bids, with sizes varying from 2½ to 13 feet diameter. An 8-foot sewer cost $12, or $1.50 per linear foot per foot of diameter, and a 6-foot sewer cost $1.67. The 6-foot plain concrete sewer cost $7 a foot, or $1.17 per linear foot per foot of diameter.

Cleveland, O., constructs continuous plain and reinforced concrete sewers and has a small amount of Parmley reinforced block sewers. Reinforced concrete is a little cheaper than brick, though some contractors bid lower on brick than on concrete on the ground that there is less risk in the use of brick.

Dayton, O., has adopted a rule to use concrete in storm water sewers only in diameters of 30 inches or over. Vitrified pipe is used up to 15 inches and double-strength vitrified pipe from 15 to 30 inches, with 3-foot lengths. Two sanitary trunk sewers were built of plain concrete and one large storm sewer of reinforced concrete. There has been some slight attrition in flow line of storm sewers, due to scour, and all new concrete sewers have 120 degrees of the invert lined with vitrified brick. A 9-foot reinforced concrete sewer cost $6.38 per linear foot, exclusive of trenching and appurtenances. There have been some unimportant failures in arches of old two-ring brick sewers. Plain concrete sewers have shells of thickness one-eighth of diameter, with minimum of 6 inches.

MOTOR VEHICLES

The Minneapolis Specifications for Fire Engine

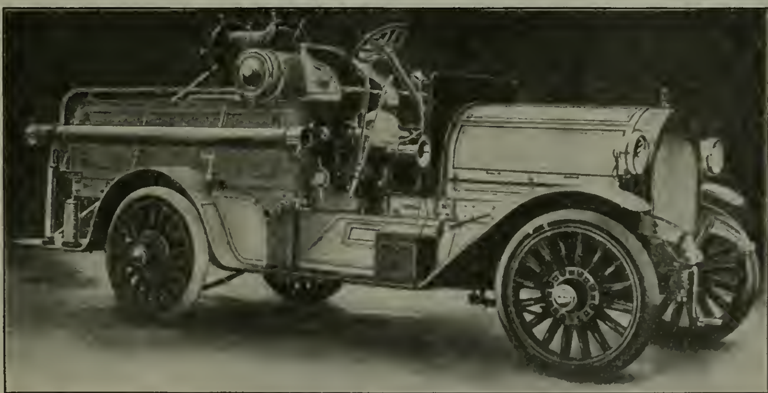
The illustration of this article shows a self-propelled, four-cylinder, 90-h.p. combination motor pumping fire engine with chemical equipment and hose carrier as used by the city of Minneapolis, and made by the Nott Fire Engine Company.

This engine exceeded the severe test required by the city.

H. Tuttle, who has spent twenty-five years as master mechanic of the fire department, was probably the first master mechanic in the United States who demanded the same efficiency of the gasoline pumping engine as of the steam fire engine.

Embodied in the specifications, under the head of "Pump Capacity," was the following:

"Rated capacity of pumps to be not less than 500 gallons per minute, as per pump requirements. Pump may be of the maker's own design, but its rated capacity must be governed by the horsepower of the engine computed at 1,000 feet piston speed per minute by the A. L. A. M. rating standard horsepower formula, and said rated capacity to be ten gallons per minute for each horsepower, which is found by computing the power of the engine by said formula minus 5 per cent. for power consumed in slip. The rated capacity thus obtained must be delivered at a net pressure of 120 pounds per square inch at the pump, or its equal, by which is meant that the product of the gallons pumped and the pressure of the pump are equal to the rated capacity multiplied by 120. The number of gallons pumped to be determined by Pitot gage at the nozzle and computed by the standard formula of the National Board of Fire Underwriters, which must be done during a continuous run of not less than fifteen minutes and Pitot gage reading to be taken every thirty seconds, and the average of all readings to be computed to determine the number of gallons delivered; also the average of all tests to be taken to determine the actual efficiency of work done. Pumps of the rotary design must be constructed so as to automatically take up the space between the circular part of the case and rotating parts which so rapidly increases in volume when dirt or sand is in the water."



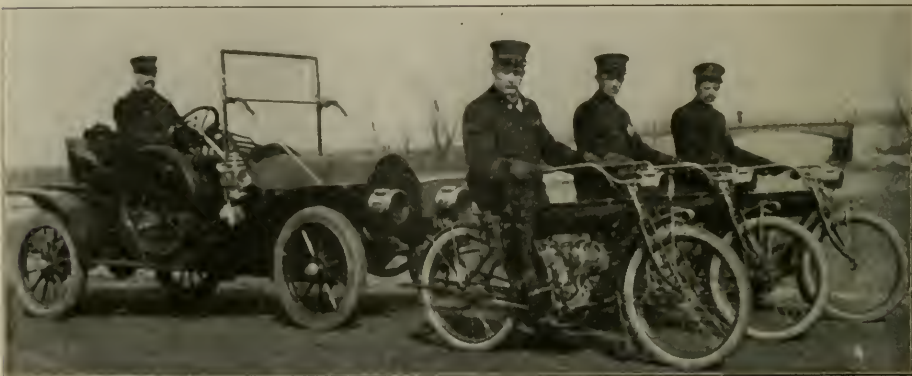
MOTOR DRIVEN FIRE ENGINE
Owned by the City of Minneapolis.

The test was made, drafting water 12 feet thru 20 feet of 4½-inch suction hose.

The duration of each test was fifteen minutes. Average of all pressures taken to determine the actual amount of work done, and the average of all tests computed to find the actual efficiency of all work done, as is shown by the following table giving results of the tests:

Test No.	No. and Length of Lines.	No. and Size of Nozzles.	Av. Engine Pressure.	Av. Nozzle Pressure.	Gals. Pumped.	Units of Efficiency.
1	......1—300 ft.	2—1 in. S. B.	130.5	75.4	514	67,077
2	......2—300 ft.	2—1⅛ in. S. B.	113.	52.6	544	61,472
3	......1—500 ft.	1—1¼ in. S. B.	186.9	57.5	350	65,415
4	......1—500 ft.	1—1⅛ in. S. B.	191.	65.5	303	57,873

Average units of efficiency more than required, 10,397.



MOTOR CYCLE SQUAD, NORTH SIDE PARK POLICE, CHICAGO.

Motor Cycles in Police Service

The accompanying photograph shows three of the five men in the motorcycle squad of the police department of the Lincoln Park commissioners.

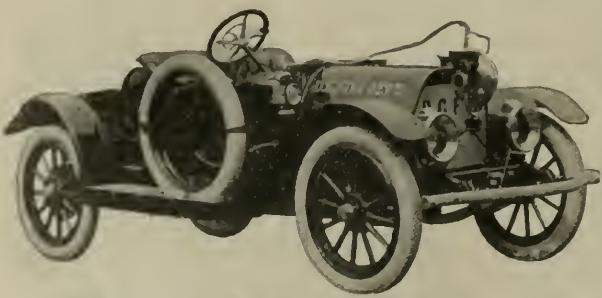
These machines patrol the entire length of the North Side boulevards and parks, principally to regulate the speed and other violations of motor vehicles, such as smoking lights and defaced number plates.

The machines are the two-cylinder 7 h. p. Indian type and capable of a speed of 70 miles on the road.

The experience of Captain Chas. E. Shaw has been that this is the most effective way of handling the classes who violate the law.

Deputy Chief's Car in Washington's Fire Department

The fire department of Washington, D. C., has recently added a new Warren car for one of its deputy chiefs, which is a 12-40 special roadster with special body, Firestone demountable tires, Stewart speedometer, muffler cutout, searchlight gas tanks, water-jacketed Stromberg carbureter, extra heavy bumper, Hanna gas lighter, combination side and tail lamps, with Exide storage battery and switches convenient to each passenger. The car has a large gasoline tank and leather trunk and a 14-inch New Departure gong with rope pull, being the only car in the department using this bell.



FIRE DEPARTMENT, WASHINGTON, D. C.
Car for Deputy Chief.

CIVIC BEAUTY

EDITED BY MYRON H. WEST

Waterproofing of Swimming Pools

BY LINN WHITE, ENGINEER, SOUTH PARK COMMISSION, CHICAGO.

Public swimming pools are receiving increasing attention thruout the country. Park boards, during the past year, have installed hundreds of public pools, and plans are under way calling for the construction of fully twice as many public bathing pools and natatoriums for the year 1913.

The South Park Commission, of Chicago, has many of these pools in operation and will construct more during the coming year. At the pools listed in the following table are available 65,000 free bathing suits and 85,000 free towels for the use of the public.

The swimming pool is constructed of terra cotta and "Ceresit" waterproofed concrete. The requirements for a perfect means of preventing the penetration of water thru the walls and bottom of a swimming pool are not only that the waterproofing material used in the concrete mass absolutely prevents the penetration of any moisture whatever, but that the waterproofing material used shall not affect the original strength of the cement. In the construction of the swimming pools in the South Park District, we do not merely waterproof surfaces as was formerly the universal custom, but we waterproof the entire concrete mass, so that, in event of the surface being chipped or scratched, the waterproofing material still keeps any moisture or water from penetrating thru the mass. We do not use a waterproofing powder but a white Ceresit paste. The concrete mass is in all cases tempered quite wet. The amount of Ceresit mixed with the gaging water is increased or decreased according to the water pressure. Where the latter is high, 12 parts of water are mixed with one part of Ceresit. Where the water pressure is low, 16 or even 20 parts of water may be used. When the concrete mass is waterproofed, of course, a waterproofed cement

		DEPTHS		EQUIPMENT			
	Dimensions Feet	Maximum	Minimum	Dressing Booths	Shower Baths	Spring Boards	Diving Towers
Mark White Square..........	65.5x107	9 feet	3 feet	192	10	2	1
Armour Square..............	50 x 88	8 ft. 6 in.	3 feet	90	8	2	1
Cornell Square..............	76 x 60	9 feet	2 ft. 6 in.	85	8	2	1
Davis Square................	70 x100	8 ft. 6 in.	3 feet	125	8	2	1
Russell Square..............	45 x 86	9 feet	3 feet	...	10	2	1
Sherman Park...............	80 x150	9 feet	2 ft. 9 in.	209	20	2	1
Ogden Park..................	80 x150	9 feet	2 ft. 6 in.	224	10	2	1
Bessemer Park...............	94 x140	9 ft. 6 in	2 feet	133	16	2	1
Palmer Park.................	92 x140	9 feet	2 ft. 6 in.	228	12	2	1
McKinley Park...............	34,800 sq. ft.	8 feet	0	206	16	3	..
Calumet Park................	Lake Michigan Beach.		....	100	..	..	Raft

The swimming pool of Park No. 4, or Fuller park, at Forty-fifth, Forty-sixth and Princeton avenue, was designed by D. H. Burnham & Co. and is said, on good authority, to be one of the largest and most carefully planned public swimming pools in the world.

This pool is built on an elevated terrace, and the footings, walls, piers, columns, steps, platforms, floors, fountains, approaches, balustrades, parapet walls and pedestals are made of stone concrete.

mortar is not required, which means the saving of labor for applying a cement mortar coat and also the cost of material for the same.

The small circular islands and brick border in connection with the cement paving around the swimming pool are paved with selected, vitrified standard size red brick set on edge in pattern and bedded in Portland cement mortar with the joints filled with cement grout. The concrete floors, staircases, steps, platforms, gutters, curbs, borders, etc., are finished with a granolithic top dressing or wearing surface one inch in thickness.

The gymnasiums, men's and women's toilets, shower rooms and lobbies are all faced with white enameled terra cotta. The ackroters on the east and west gable ends of the main building are made of terra cotta, with a green sand blasted enamel surface finish which matches the roofing tile. The inner court pergolas adjacent to the main and gymnasium buildings have an open timber roof consisting of beams and purlins.

The assembly hall has a paneled ceiling between the two upper purlins. The concrete walls of this hall are wainscoted with flush red birch wood. The gymnasium balconies are built and suspended from the trusses and purlins by suspension rods. The lunch room counter is of combination wood and marble construction.

FULLER PARK SWIMMING POOL, CHICAGO.

Landscape Beautiful: A Town Asset

BY GEORGE BLACKSTONE IRVING.

While in an Illinois town of less than 2,000 inhabitants, the writer met a business man who had recently moved into the community. Inquiry as to what influenced him to do so drew from him information that he accidentally came to a Fourth of July celebration, and while attending it was so favorably impressed with the beauty of the town's landscape that he moved his own family and that of his son to the place and purchased at once.

For centuries the city of Paris has been accepted as the world's playground. Some of its chief attractions are its public parks and gardens, its boulevards and pleasure grounds, its architecture and landscape vistas. Paris has learned well the lesson of the industrial value of civic beauty as an investment. Napoleon rebuilt Paris with inhabitants objecting, but the present citizens now appreciate that the landscape charms of that city bring a trade worldwide, worth millions of dollars, annually. As a result of this appreciation the municipality has been authorized to borrow $175,000,000 for further beautification as an investment. A part of this, $47,000,000, contemporaneous with the recent labor troubles of Paris, was oversubscribed thirty-nine times.

The towns of the United States have recently awakened to the importance of this great asset. The federal government in Washington has endorsed the elaboration of George Washington's plan for beautifying the city named after himself, and it is spending millions of dollars to realize it; Boston is busy with its city plan; Chicago has one which startled Europe when displayed at the City Planning Convention in London; Oklahoma City bonded itself recently for $400,000 for boulevards, Cleveland and Cincinnati likewise for millions of dollars, and Portland, Ore., recently accepted plans prepared by a landscape architect, which will cost millions to execute. Redlands, Cal., has voted $80,-

000; San Diego, $1,000,000; Houston, $150,-000, all to be expended for landscape schemes.

The next step is to consider how to realize an industrial investment of this sort for one's home town.

First, there must be an educational campaign organized, not only with able men and women, but for a long siege if necessary. The work of converting the citizens of the community to the great value of a landscape plan is not insignificant and must not be ignored.

Educational work in the papers is admirable. The work other towns are doing must be described; for example, such as that of Kalamazoo, Mich., which for a long period endeavored to get factories, but un-

GEORGE BLACKSTONE IRVING.

successfully along old lines, and therefore decided to make Kalamazoo a better city to live in. Within two years thirty-two new industries located there without a dollar of bonus.

A public holiday for town cleaning will pay. Prizes for the removal of pasteboard advertisements on buildings and telegraph poles cleaned up the city of Red Wing, Minn. Bay City, Mich., realized results by the ladies publicly announcing a tour en masse of alleys and by-ways. Photographs of undesirable spots reproduced in the newspapers turn the trick often. Spokane, Wash., decided to do this. A newspaper representative approached the owner of one of the beauty spots (?) with a request to be allowed to take a photograph, and when the owner said he didn't care, the newspaper representative replied that, if he didn't care, he would reproduce a half-page of the undesirable yard. Then the owner exclaimed, "O, don't do that; I will clean it up."

Prizes for clean back yards bring results, as also for gardens and lawns. Renting vacant lots and planting is the plan of Los Angeles. Arbor day, when the Commercial Club gives away trees, flower seeds and bulbs, should not be overlooked. Chicago, on its Arbor day, sold 300,000 mulberry sprouts for one cent each to the school children.

A garden school arouses the children very successfully. Information can be secured on this subject from the Fairview Garden School, High street, Yonkers, N. Y. A junior civic league has awakened the children of Morristown, N. J.

An attractive business section is always an advertisement. So far as possible, teams should be prohibited hitching on the main business street, and when such an ordinance is passed facilities should be otherwise provided. The National Humane Alliance, Charities Building, New York City, will give a bronze-trimmed, red granite fountain to any town paying the freight and set-up. The town that first prohibits horses on certain streets, allowing automobiles, will secure advertising and a clean street.

Electroliers or chandelier lighting of the business section is worth a great deal more than it costs. Des Moines, Iowa, has almost five hundred of these chandelier lights, the downtown district all night glowing brilliantly. But these lights might well be turned out Sunday evening. Flushing Main street is also advisable. A wide-awake town not only paves its business section, but also its downtown alleys (and keeps them clean).

Roadside landscape work should be more generally encouraged. America is years behind Europe in this regard. Rural landscape gardening deserves immediate encouragement by state and nation, and costs very little money.

The town planning act in England has made town landscape work compulsory in that country. France also has such a law.

It remains for a commercial club to promote a local landscape plan. Ask your state agricultural college for a landscape professor to visit your city. Then a professional landscape architect should be employed. Boulder, Col., which continuously employs one landscape gardener and sometimes has two, paid Mr. Olmsted, of Boston, $1,000 for a few days of his help. A few hundred dollars spent by a town for a landscape plan will hasten the bonding of the community for the means to execute the plan.

While the larger landscape scheme is being sought, a lesser one may be attempted in shade tree culture under the auspices of a shade tree commission operative by city ordinance, which gives their exclusive care to this commission, planting, pruning, spraying, watering, protection, removal, etc. East Orange, N. J., affords a good example.

The suggestion is offered at this time of a municipal nursery to supply the proper shade trees for a given locality. This department would be practicable under a landscape gardener or shade tree commission. When neither is available, such a department in connection with the public schools would be a form of manual training, while also a landscape asset.

A criticism is offered that shade trees are planted indiscriminately and without knowledge of soils. In general high and low soils obtain. Following nature's planting is advisable. Typical of lowland shade trees are hard maple, white elm, American linden or basswood, sycamore, yellow birch; of upland are oak, hickory, etc. The box elder is in disfavor. For ornamental trees use the hawthorn, European alder and white birch, Norway spruce, European larch, silver and white spruce, and for general planting, the white pine. The mulberry is a friend of birds, and birds are friends of men. For southern states the magnolia, cypress and Carolina poplar are popular.

City Planning

BY JENS JENSEN, MEMBER OF SPECIAL PARK COMMISSION AND CHAIRMAN OF CITY CLUB COMMITTEE ON CITY PLANNING, CHICAGO.

Every village and every city has some natural features which, if we have eyes to see, can be developed so as to produce individuality and character. But usually generations pass before we discover the fact that there has really been something beautiful that should have been incorporated in the town to give it the individuality and character which we prize.

I call your attention to the wonderful opportunity of the city of Seattle, Wash., surrounded by the most beautiful environment that perhaps has been given to any of our American municipalities. And this wonderful environment was not considered at all in laying out the city.

Each city with its good and bad expressions should stand as a true expression of the character of its people. Each city should have its peculiarities, its own interests, its own expressions, rather than become a copy of some other town, developed on a cut-and-dried plan.

Just now city planning is rapidly rising on the wave of popular enthusiasm. It has taken our cities by storm. A new profession has come into life. Plans are rapidly being made and the zealous public, gazing upon their depiction of gayly colored parks, wide boulevards and ornate bridges, are fired with the desire to make all American municipalities such pleasing pictures as the clever draughtsman has represented on paper.

To cut a broad street thru a city is one thing, to have the sides of it lined with buildings of harmonious facade is another; and on this last depends a satisfactory working out of the plan.

To build civic centers and magnificent boulevards, leaving the greatest part of the city in filth and squalor, is to put on a false front, which vitiates the whole atmosphere of the town.

A city should first of all be homelike. May not this be secured by a system of regulation?

Such regulation of the city might be in the hands of a new department—a department of civics, or civic beauty. Such a department might be made up of an engineer, an architect, a good business man, a sculptor, a landscape gardener, etc. The members should be appointed for a period of not less than six years, one member

JENS JENSEN,
Member Special Park Commission.

retiring each year, and their removal from office should be subject to judicial inquiry.

Such a department should pass upon the transportation facilities, depots and freight terminals, harbor and river development, etc. Designs for all municipal buildings, building sites, and bridges should be submitted to it for approval.

Thru conference with the civic board of control, each new public building erected would be constructed with a view to improving the city as a whole. One of the most important duties of this board would be to develop the school as a neighborhood center.

ORGANIZATIONS & INDIVIDUALS

American Society of Municipal Improvements

The American Society of Municipal Improvements held one of its most satisfactory conventions at Dallas, November 12 to 15. Several familiar faces from the North and East were missing, but the Southern and Southwestern attendance was large enough to make up.

The principal subjects for discussion were the specifications presented by the sub-committees of the committee on standard specifications, particularly the new set of specifications for sewer construction, presented by a committee consisting of E. J. Fort, Rudolph Hering and A. J. Provost, Jr., and the proposed Amalgamation with the Society for Standardizing Paving Specifications. The latter was presented in the form of a resolution of the S. P. S. on the subject and a tentative report of a committee from that organization whose membership includes several members of both associations. The convention was unanimously in favor of amalgamation, but not altogether on the lines of the report, and a committee, all three members of which are members of both societies, was appointed to attend the meeting of the S. P. S. at Pittsburgh and develop a plan for consolidation. Pending the result of these deliberations, and in the absence of the chairmen of the general and several of the sub-committees on standard specifications, the adoption of the specifications presented was postponed until the next meeting.

An excellent list of papers and committee reports was presented, including papers on "Effect of Traffic on Bituminous Pavements" and on "Testing Bitumens," by Isaac Van Trump, engineering chemist, Chicago; "The City Economic," by Louis L. Tribus, consulting engineer, New York; "The City Engineer and Health Board," by James N. Hazlehurst, consulting engineer, Atlanta, Ga.; "Imhoff Tanks," by Prof. Henry N. Ogden, Cornell University, Ithaca, N. Y.; "The Durability of Grouted Granite Pavements," by W. A. Howell, engineer of street department, Newark, N. J.; "Sewerage and Sanitation," by E. L. Dalton, Dallas, Tex.; "Thermal Effects on Cement-Filled Brick Pavements," by James E. Howard, of the U. S. Bureau of Standards; and others.

Committee reports of note were those on "Standard Method of Traffic Recording," J. W. Howard, chairman; "Sewerage and Sanitation," A. F. MacCallum, chairman; "Standard Forms for Municipal Utilities," A. P. Folwell; "Municipal Legislation and Finance," Maury Nicholson, chairman. President E. A. Kingsley presented a valuable annual address.

Membership of all classes is now over 400.

The officers elected are: President, Benjamin E. Briggs, city engineer of Erie, Pa.; vice-presidents, Edward H. Christ, of Grand Rapids, Mich.; W. A. Howell, of Newark, N. J., and A. F. MacCallum, of Hamilton, Ont.; secretary, A. P. Folwell, of New York; treasurer, E. L. Dalton, of Dallas, Tex. Wilmington, Del., is the next convention city.

The Municipal Art League of Chicago

At a recent meeting of the Municipal Art League, Chicago, Henry Ericsson, commissioner of buildings, city of Chicago, outlined a plan for the separation of business and residential territory.

Mr. Ericsson believes that the streets where the car lines are located are the logical normal streets for business development, and that the alleys immediately back of these streets should be the recognized boundaries between the residence and business areas of third classification of territory. Such boundaries, when once established and fully recognized, would give the residents security against unwelcome encroachment of business, and would insure the business houses along the car line having permanently contiguous to them a population which would be adequate for their support. The principle involved in this plan is far reaching and seems to be the only logical method by which homes can be maintained on a satisfactory basis within the city limits of Chicago.

The Municipal Art League was organized to initiate and support opportune movements for civic improvement, and to anticipate and oppose such influences as threaten to check civic art. The league is at present devoting itself to the following matters:

1. Better street lighting.

(a) Maximum use of underground conduits in place of unsightly overhead wires and poles.

(b) Use of new official design lamp-posts, which the league has helped to secure.

(c) Exhaustive experiments on different methods of street lighting, and the adoption by the city of their results in future contracts.

2. Tree planting in the streets of the city and the extension of the power of the city forester.

3. Enforcing the smoke ordinance by co-operation with the smoke inspector.

4. Enforcing the bill-board ordinances regulating street signs.

5. Consolidation of other improvement organizations, and consequent co-ordination and centralization of activities.

6. Beautification of public school grounds and buildings.

7. Great powers for the official art commission.

8. Commencing on parts of the midway plan.

9. Construction of sections of river and lake-shore driveways.

10. Exemption from taxation of the Ferguson sculpture fund by act of legislature.

11. Erection of an out-door theater in the south parks.

12. Festivals and pageants in the parks.

The officers are: President, Ralph Clarkson; vice-president, Lorado Taft; secretary, Kenneth Sawyer Goodman; assistant secretary, Louis A. Damon; treasurer, Charles L. Hutchinson.

Minneapolis Business Association.

The Minneapolis Civic and Commerce Association has now got so far along in its practical development as to be able to issue a report of the first ten months of its public service. This report is an outline of work done up to October 8 last.

The Minneapolis Civic and Commerce Association was organized December 9, 1911, as a result of the consolidation of the association and Publicity Club, public affairs committee of the Commercial Club, and the Minneapolis Traffic Association. A summary of the work of the new body, which started with a membership of over 2,000, shows activities in smoke abatement, trade extension, improved paving, bridges and street lights, reduction in assessment of the working class section of the city, improvement of local health conditions, promotion of industrial development, participation in national convention service, and establishment of service for investigation of charities.

The president of the Minneapolis Civic and Commerce Association is Arthur R. Rogers. Its secretary is Howard Strong.

Technical Associations

Strenuous efforts are being made to bring out the greatest possible attendance to the Pittsburgh cement show, Exposition hall, December 12 to 18. In addition to the elaborate displays by exhibitors, special exhibits will be installed by the Carnegie Technical Institute of Pittsburgh, as well as by the University of Pittsburgh. These exhibits will be educational in nature and based upon the courses offered by these two institutions in concrete construction, and will also show the results of tests and investigations conducted. In addition to these two displays there will be elaborate educational exhibits by the Association of American Portland Cement Manufacturers, the Bureau of Standards of the Department of Commerce and Labor, and by the Pittsburgh Chapter of the American Institute of Architects in co-operation with the Pittsburgh Architectural Club.

The American Institute of Architects will hereafter issue its journal monthly instead of quarterly, and will extend its field to cover articles and discussions beyond those pertaining to the proceedings of the organization. Glenn Brown, secretary, Octagon Building, Washington, D. C., will have the assistance of committees in obtaining and preparing the additional material required.

On November 14 John A. Britton, vice-president and general manager of the Pacific Gas and Electric Co., and member of the executive committee of the National Electric Light Association, delivered an illustrated lecture on the systems and service of his company, and the remarkable developments in electrical power transmission on the Pacific coast, before the national and local electrical engineering societies, at the Engineering Building, New York City.

The committee on down-town streets appointed by the Chicago Association of Commerce has outlined a subway improvement policy, and proposes to begin in the congested business center of the city with funds of the municipality now available for that work, being its share of the profits of the local traction companies, these central subways to be so constructed as to form a link in a larger system to be developed later as recommended by Bion J. Arnold. The committee lays stress upon the need for utility galleries, that the tearing up of street pavements for repair work on pipes and wires may be diminished. It further urges that immediate revision of car routing in the loop district and the establishment of ample through routing of surface and elevated cars be given consideration.

The Chamber of Commerce of the United States is rapidly developing its plans for co-ordination of the business organizations of the country and relating them to like organizations in other countries. Its by-laws governing initiative and referendum of questions arising in the affiliated organizations have just been issued and meet the demands thoroughly well.

Technical Schools

The following non-resident lecturers in highway engineering at Columbia University have been appointed for the 1912-1913 session: John A. Bensel, New York state engineer; William H. Connell, chief bureau of highways and street cleaning, Philadelphia; Morris L. Cooke, director department of public works, Philadelphia; C. A. Crane, secretary the General Contractors' Association; W. W. Crosby, chief engineer to the Maryland Geological Survey and consulting engineer, Baltimore; Charles Henry Davis, president National Highways Association; A. W. Dow, chemical and consulting paving engineer, New York City; Walter H. Fulweiler, engineer research department, United Gas Improvement Company; John M. Goodell, editor-in-chief *Engineering Record;* D. L. Hough, president the United Engineering and Contracting Company; Arthur N. Johnson, state highway engineer of Illinois; Nelson P. Lewis, chief engineer board of estimate and apportionment, New York City; J. C. Nagle, professor of civil engineering and dean of the school of engineering, Agricultural and Mechanical College of Texas; Harold Parker, first vice-president Hassam Paving Company; H. B. Pullar, assistant manager and chief chemist, American Asphaltum and Rubber Company; J. M. F. de Pulligny, ingenieur en chef des Ponts et Chaussees, et directeur mission Francaise d'Ingenieurs aux Etats-Unis; John R. Rablin, chief engineer Massachusetts Metropolitan Park Commission; Clifford Richardson, consulting engineer, New York City; Philip P. Sharples, chief chemist Barrett Manufacturing Company; Francis P. Smith, chemical and consulting paving engineer, New York City; Albert Sommer, consulting chemist, Philadelphia; George W. Tillson, consulting engineer to the president of the borough of Brooklyn.

Personal Notes

Arthur C. Freeman, Jr., consulting engineer, Norfolk, Va., is making survey to show and mark by concrete monuments the right-of-way of the Chesapeake and Albemarle canal, one of the most important links of the inland waterway system connecting Albemarle sound and Chesapeake bay.

Oscar Sanne, formerly structural engineer in the bridge department of Chicago, is now in private practice at 1633 Monadnock Block, Chicago, as a bridge and structural engineer.

Hubert A. Stevens, of Joliet, Ill., will supervise the extensive new paving work of Corpus Christi, Tex.

Charles L. Dunford, of the Toronto city engineer's office, has been appointed assistant city engineer of London, Ont.

William F. Morse, 90 West street, New York, consulting sanitary engineer, is also consulting engineer for the Atkinson-Morse Co., which installs Morse garbage and refuse destructors, and for the Griscom-Russell Co., which is introducing the English Sterling destructor in American cities on the strength of its excellent record abroad. Mr. Morse is author of the most complete American book upon "The Collection and Disposal of Municipal Waste."

David White has been promoted to the position of chief geologist of the U. S. Geological Survey, to succeed Waldemar Lindgren, who goes to the Massachusetts Institute of Technology. He is succeeded by Dr. F. L. Ransome in his former position as chief of the section of economic geology of metalliferous deposits.

Sanford E. Thompson, M. Am. Soc. C. E., consulting engineer in structural steel and concrete, has opened offices at 141 Milk street, Boston, Mass., but he will retain his main offices and laboratory at Newton Highlands, Mass. Mr. Thompson is well known also for his excellent work in the organization of construction and industrial operations.

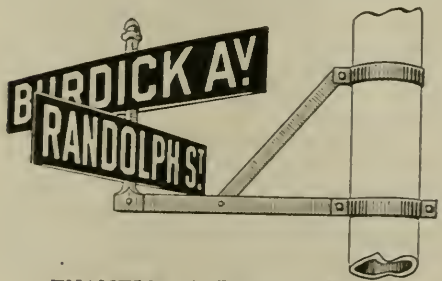
Wynkoop Kiersted has resigned as chief engineer of the Kansas City water works to devote himself entirely to his practice as consulting hydraulic and sanitary engineer, at 640 Midland Building. Mr. Kiersted has had much experience, especially in water supply and power installations, power stations, drainage, and appraisal and adjustment of rates of public utilities.

MACHINERY AND TRADE

Enameled Street Signs

We are illustrating herewith the Burdick vitreous porcelain enamel street sign and post as installed on the downtown streets of Chicago by the Chicago Association of Commerce. These signs were bought by the Chicago Association of Commerce and manufactured by the Burdick Enamel Sign Company, of Chicago.

These street signs measure 24 inches in length and 5 inches in height. The letters are of white on a background of blue enamel and are 4 inches in height. These signs are made of a high grade of English charcoal rolled iron, No. 18, U. S. standard sheet metal gage. Five coats of the best vitreous porcelain enamel is



ENAMELED STREET SIGNS.

fused on the metal with 1,800 degrees Fahrenheit of heat and are guaranteed not to fade or tarnish from the effects of the weather for a period of ten years.

The posts are made with cast iron ring base, 10 inches in diameter at bottom and 30 inches in height, with 7 feet of 2-inch iron pipe welded 1 foot into the casting.

On August 13th, of this year, the city of Chicago advertised for approximately 32,000 of these street signs.

Enamel signs are used for street sign purposes in such cities as Cleveland, O.; Detroit, Mich.; Milwaukee, Wis.; St. Louis, Mo.; St. Joseph, Mo.; Peoria, Ill.; Atchison, Kan.; Butte City, Mont.; Baton Rouge, La.; Cincinnati, O.; Decatur, Ill.; Dallas, Tex.; Evansville, Ind.; Eagle Pass, Tex.; Galesburg, Ill.; Jacksonville, Fla.; Ft. Worth, Tex.; Joplin, Mo.; Jackson, Mich.; Janesville, Wis.; Nashville, Tenn.; Portland, Ore.; Racine, Wis.; Savannah, Ga.; Saginaw, Mich.; Terre Haute, Ind., and hundreds of other smaller towns all over the United States.

Model of Erie Roller

The Erie Machine Shops of Erie, Pa., have adopted an unusual and especially effective means of advertising and calling attention to the details of construction of their steam roller for paving work. The manufacturers are sending out a model of their roller which is made of metal and stands about 3½ inches high. The model makes an attractive desk ornament and serves to illustrate details which could not be explained by literature or descriptive matter. Control levers, steering arrangement, gages, gears and other details are carefully carried out in the small model, and the proportions are practically exact. The model machine has frequently been used as an advertising novelty, but usually it is lacking in detail to such an extent as to make it almost worthless as an accurate miniature of the product itself. The model of the Erie roller is different and will certainly attract the attention of those who may be interested in this class of equipment.

The Erie Machine Shops have been manufacturers of road rollers for nearly a quarter of a century, and their equipment is recognized as one of the highest grades on the market.

The Morse Destructor

The business of designing and constructing furnaces for the disposal of municipal and private waste by inceration, heretofore personally conducted by W. F. Morse, of New York City, has increased in such degree that it has been found necessary to undertake the work on a larger scale, and for this purpose the Atkinson-Morse Destructor Company, with offices at 90 West street, New York City, has been incorporated under the laws of the State of New York.

Beginning in 1889, Mr. Morse has been

engaged in the designing and constructing of garbage disposal plants for public institutions, cities, towns and private establishments. He has made many installations in the United States and foreign countries. Mr. Morse was one of the pioneers in this industry, and built one of the first examples of the British high temperature refuse destructors in this country.

The Atkinson-Morse Destructor Company has acquired the patents owned by Mr. Morse, which cover approved forms of design and construction.

The Morse destructor is built in many sizes to meet the demand for combustion of every class of refuse matter. Some of the points included in this destructor may be noted:

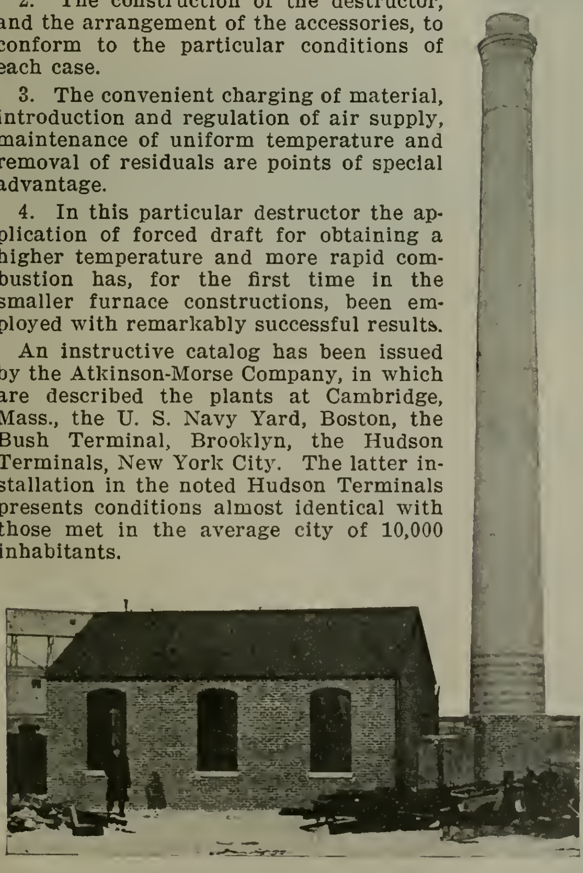
1. A destructor that develops and maintains the high temperature necessary to dissociate and destroy the gaseous compounds thrown off from burning animal and vegetable matter.

2. The construction of the destructor, and the arrangement of the accessories, to conform to the particular conditions of each case.

3. The convenient charging of material, introduction and regulation of air supply, maintenance of uniform temperature and removal of residuals are points of special advantage.

4. In this particular destructor the application of forced draft for obtaining a higher temperature and more rapid combustion has, for the first time in the smaller furnace constructions, been employed with remarkably successful results.

An instructive catalog has been issued by the Atkinson-Morse Company, in which are described the plants at Cambridge, Mass., the U. S. Navy Yard, Boston, the Bush Terminal, Brooklyn, the Hudson Terminals, New York City. The latter installation in the noted Hudson Terminals presents conditions almost identical with those met in the average city of 10,000 inhabitants.



THE MORSE DESTRUCTOR.
A Typical Plant.

Squeegees in Washington, D. C.

BY ROBERT E. DOYLE, ACTING SUPERINTENDENT OF STREET CLEANING, OF THE ENGINEERING DEPARTMENT, DISTRICT OF COLUMBIA.

On January 24, 1910, the Street Cleaning Department was transferred from the charge of Commissioner John A. Johnston to the charge of Commissioner William V. Judson, and then became a division of the Engineering Department.

The acts of Congress approved March 2, 1911, making appropriation for the expenses of the District of Columbia for the year ending June 30, 1912, authorized the commissioners to perform certain work previously done under contract, namely, street sweeping and cleaning alleys and unimproved streets, and provided $40,000 to be immediately available for the purchase of new equipment to be used in this service, and also provided for the purchase of a site or sites and for the erection of a building or buildings thereon for a stable and storerooms for this division, and appropriated $128,600 to be immediately available for these purposes.

J. W. Paxton, C. E., superintendent of street cleaning, in an official report stated that the Kindling squeegee machines were first placed in regular operation in the hand patrol section of the city, which, in October, 1910, comprised an area of about 1,877,000 square yards. Each gang of squeegees consisted of one sprinkler with three or four squeegees. The sprinkler operated some distance ahead of the squeegees to allow dirt which had become baked and stuck to the pavement to be softened by the absorption of moisture and easily dislodged by the squeegees. Each machine averaged 56,269 square yards per day of 8 hours. On April 26, 1911, the hand patrol area was enlarged to about 2,005,000 square yards, without increasing the hand patrol force, and a gang of one sprinkler and four squeegees operated over this area for 16 hours per day, each squeegee averaging 64,212 square yards per day of 8 hours. By this method the hand patrol area was cleaned by squeegees about one and one-half times per week.

The hand patrol section consists largely of sheet asphalt or asphalt block pavement, smooth enough to allow the operation of the squeegee machines to an advantage. Under the above system of street washing it is found that the streets are almost entirely free from dust. Any dirt which may accumulate does not have time to be pulverized, and the particles are too heavy to be disturbed or blown about by an ordinary wind. Under the

THE KINDLING SQUEEGEE MACHINE.

old methods of sweeping these heavier and coarser particles were removed, but most of the dust remained, to become a source of annoyance when disturbed by the wind or rapidly passing vehicles, although the streets might have appeared to the eyes to be clean.

The cost of squeegee operation per thousand square yards for the year ending June 30, 1911, and for the days ensuing between October 14, 1910, and June 30, 1911, was arrived at in the following manner:

SQUEEGEE.

Number of days worked........	195
Area cleaned, square yards.....	50,012,859
Total cost....................	$5,814.57
Cost per thousand square yards.	$0.1162

FLUSHING.

Number of days worked........	132
Area cleaned, square yards.....	5,589,367
Total cost....................	$1,765.12
Cost per thousand square yards.	$0.3157

One-Horse Dump Wagons

The illustration herewith shows one of the eighteen one-horse dump wagons owned by the West Chicago Park Commission and used for hauling leaves, shrubbery, waste paper, picnic debris, small tools and other light-weight materials.

"It was formerly our custom," says one of the members of this commission, "to use our regular two-horse dump wagons for light usage. In other words, we were using two heavy park draft horses in work where one horse would be sufficient. We soon decided that this was not good business economy, particularly when there is a rising market for well-bred draft stock, and then again we had enough work in our different departments to keep all our animals busy.

"In light work we find that with these one-yard-capacity dump wagons we can get over the ground quicker, accomplishing a great deal more actual work per day, thus getting more work units per man as well as per horse. The more work we can do for every dollar expended, the better we are satisfied. A certain appropriation is set aside for each division of park work each season, and it is the consequent aim and ideal of every park superintendent and foreman, to produce the maximum in real accomplishment. These one-horse dump wagons, of which we now have eighteen, are becoming a great factor in our park development.

"These wagons were made for us by A. Streich & Bro. Co., Oshkosh, Wis."

ONE-HORSE DUMP WAGON, FOR GATHERING LEAVES, AS USED BY THE WEST CHICAGO PARK COMMISSION.

The Meter System

"A large amount of water used and wasted in different cities," states S. Y. High, superintendent Department of Water Works, Kansas City, Mo., "could in a large measure be avoided were the water departments in these cities on a strictly meter basis. A large amount of water is wasted in summer, as well as in winter. I believe all the water above an average of 25 million gallons per day, in Kansas City, is wasted. Were the water department on a strictly meter basis throughout the amount of water wasted would not be so large, although had the same conditions existed and the water wasted, the department would have received the additional revenue. The flat rate, in my opinion, is an incentive to the property owners to put in cheap plumbing, without proper precaution being taken to protect it during cold weather.

"The waste of water is estimated by competent authorities to be 60 per cent. of the pumpage; in other words, but 40 of each 100 gallons of water is actually put to some good use and paid for. Of course, it is possible to control this waste of water, and there are two ways of doing it. The first is by rigid rules absolutely enforced, and thorough, frequent inspection; the other method, the more sensible plan of asking each consumer to pay for the water he uses or wastes.

"There certainly can be no such thing as free water unless perhaps when a man takes his bucket, goes to the source of supply and helps himself, and even then if his time is worth anything the bucket of water has an appreciable cost. There can be no such thing as free water when it is delivered through pipes, as in a city's water works. Some one must pay for the cost of delivering each and every gallon; and if some one has free water, it must follow that some users pay more than they ought, or else the plant will be run at a loss.

"Leading officials emphatically declare that the water meter system must now be considered an essential part of modern water works equipment. To fully appreciate the economy to be secured from the employment of the water meter system, it is necessary to consider the results which it accomplishes, and which can be expressed in a general way by saying: 'The water meter system prevents the many losses which must occur whereby water is sold by any other method than by meter measurement.' The water meter system operates to (1) prevent water waste; (2) provide an adequate supply without requiring additional machinery, pumps, reservoirs, filters, mains, etc., in face of an increasing demand; (3) reduce operating expenses by lessening pumping, filtering, fuel consumption, labor, etc.; (4) detect unsound plumbing and prevent loss by leakage; (5) determine the exact consumption of each consumer; (6) secure payment for all water delivered; (7) prolong the life of the entire water works plant by preventing unnecessary overburden and greater depreciation.

"That the water furnished should be pure goes almost without saying. Water contaminated with sewage is well known to be a source of disease. Where the natural source is not of quality that fits it for domestic purposes, filtration by the slow sand or more rapid chemical process will fit the water for almost any use.

"The water supply of Kansas City, Missouri, is taken from the Missouri river about five miles above Kansas City, at the Quindaro Station in Kansas. The water is pumped directly from the river into settling basins. The water is then treated with lime and sulphate of alumina. After leaving the basins through the back flow or suction pipe, the hypochlorite solution is introduced before the water gets to the pump, the pump agitation making a thorough mixture of the hypochlorite with the water.

A DELIVERY OF BADGER WATER METERS TO KANSAS CITY, MISSOURI.

"The water is pumped from the river to the first or raw water basin, of fifteen million capacity, where a large part of the heavy material is precipitated before reaching the first weir. At this weir, about six feet wide, the sulphate of alumina is first introduced on the raw water side, and the lime in the second basin, or about ten feet from and after the sulphate of alumina solution. This method precipitates the remainder of the material to be precipitated. After passing over the second weir and entering the third and fourth basins the water is in a first-class condition to be pumped to the city. The 2 per cent. hypochlorite solution is introduced into the suction line to the pump, the pump agitation making a thorough mixture. Kansas City, Missouri, to-day has pure and wholesome water."

Destructors for Cities or Battleships

The wide range of adaptability and efficiency of the Morse-Boulger destructor is impressively illustrated by the fact that these destructors have been built for a range of capacity from one hundred and thirty tons per twenty-four hours, for use in the city of Manila, P. I., to a capacity of one-half ton per twenty-four hours for use on the U. S. battleship "Minnesota."

DESTRUCTOR BUILT BY MORSE-BOULGER CO., OF NEW YORK CITY.

Not only has this type of plant been adopted by numerous cities and towns that have had difficult garbage and refuse problems to solve, but it has been installed by the U. S. government in about forty different army posts, naval stations and on battleships, after a rigid examination and inspection of many methods of disposal; also by various hospitals, hotels, office buildings, mercantile houses, colleges, etc., in many parts of the country where exact results are necessary.

The designers of this type of destructor have spent many years in the study of efficient and practical incineration methods, the result being that today the Morse-Boulger destructor is an incinerator of patented design containing features of value that highly recommend its use for many varying conditions.

Aside from a few of the features that have been noted, there have been incorporated in this type of plant essentials such as convenience of arrangement for efficient receiving, charging and stoking of refuse, and removal of ashes; the use of forced drafts in large plants, which insures economy and rapidity in operation; highly efficient consumption of gases and smoke; and, in the course of construction, a faithful adherence to the use of materials of high durability and quality.

The manufacturers have installed numerous plants to be operated under special conditions, where the use of gas or oil has been one of the specifications, for the disposal of medical and organic waste in the most complete and sanitary manner.

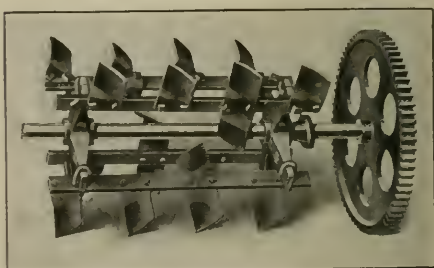
The Hand Batch Mixer

BY C. L. BROWN, MANAGER,
NORTHFIELD IRON CO., NORTHFIELD, MINN.

There is a rapidly developing field for small concrete mixers. I refer not only to small jobs, but to large work, and verify this opinion by the statement that twenty-seven of the largest contracting concerns in Cleveland, Ohio, are using small mixers of our design on all their work.

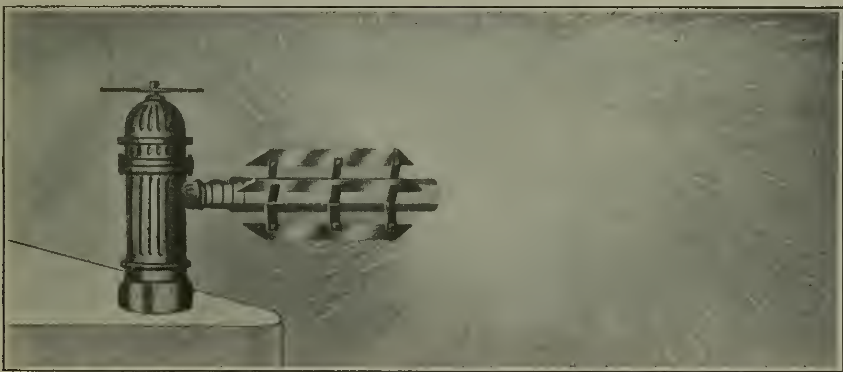
A small hand mixer can always be loaded into one end of an ordinary farm wagon, and also leave plenty of room for a big tool box. The cost of hauling or transporting it does not amount to that of a contractor's ordinary large tool box. On the job the mixer can easily be shifted about so as to always discharge directly into forms. This saves over one-half the wheeling time. The same staging required for wheeling wet mixture to the forms is sufficient to set up the little mixer on runway, thus saving the wheeling of all wet mixtures.

Under favorable conditions it is possible to average nine cubic yards of slush concrete per hour with this mixer, or ninety cubic yards per ten-hour day.



MIXING SHAFT OF NORTHFIELD HAND MIXER, SHOWING MIXING BARS AND BLADES.

There are cases on record where much better speed was obtained. In one case four men charged, mixed and discharged 12 cubic yards per hour and kept it up for over four hours. This would have equalled 120 cubic yards per day had they kept it up for ten hours. But, of course, such cases as this are not a fair average. From 8 to 9 cubic yards per hour is a fair average under favorable conditions. On foundation jobs and similar work it is easily possible to average from 30 to 60 cubic yards per day, depending on the conditions and how often it is necessary to shift the position of the mixer. On concrete floor work, which is best done by shifting the mixer about every third or fourth batch, so as to discharge the concrete direct into place, about 30 cubic yards per day is a fair average for four men. On a High School job at Cannon Falls, Minn., the contractors, Huschka & Drake, had three men who laid the entire basement floors of that building in two working days, working only 9 hours per day. These floors equalled over 6,500 square feet and contained over 60 cubic yards of concrete. The aggregate had to be wheeled in through doorways, etc., at a great disadvantage, and yet the average was fully 30 cubic yards of concrete per day.



TURBINE SEWER CLEANING MACHINE UNDER PRESSURE. THE SPRAYING AND SCRUBBING ACTION RENDERS SEWERS AS CLEAN AS NEW.

Clogged Sewers a Menace

BY C. E. M'MILLAN, MAYOR, SPARTA, WIS.

That clean sewers are a health safeguard for any community is best attested by a report of an analysis of sewages recently taken in one of our Western cities which has been given wide circulation in the daily press. The bacteria emanating from clogged sewers are equally as detrimental to public health.

I consider clogged sewers as one of the greatest menaces to health in American municipalities.

The city of Sparta was confronted with a serious problem last spring. A number of our sewers had become badly clogged, so that they were causing serious trouble, and our sewer committee was almost convinced that a number of the older sewers would have to be taken up and relaid. However, our attention was called to a number of cleaning machines, and we postponed action until investigation could be made.

The sewer-cleaning machine which we used cleaned two hundred and forty feet of this badly clogged sewer in thirty-five minutes, and we found that our sewers were not only clogged up with roots, but with sand, fecal matter, decomposed organic and vegetable matter and a fungus growth.

Our experience has therefore been that it pays to keep sewers clean rather than tear them up when they become badly clogged. We have experienced no trouble at all in operating our machine, and we are thoroughly convinced that it will save the city thousands of dollars in the future, as nothing seems to stop the progress of the turbine after the water pressure is applied.

I trust our experience will be of some benefit to other cities, as I consider sewer trouble to be as serious a matter as the ordinary city has to contend with.

Perfected Vitrified Sewer Blocks

The American Sewer Pipe Company, of Akron, Ohio, have made a sufficient number of practical tests of their new vitrified sewer block to establish this new type of sewer as a permanent method of construction. The blocks are made in various sizes from 30 to 108 inches, and in three types with various designs of interlocking and sealing devices. The thicknesses of the walls and webs are accurately estimated to meet the heaviest duty to which the respective sizes can be subjected.

Lewis McNutt, of Brazil, Ind., a well-known manufacturer of clay products, is in position to supply to the trade this new type of sewer block.

Hampton Sedimentation Tank

Mr. Alfred E. Snape, A. M. Inst. C. E., Royal San. Inst., in a recent paper before the Royal Sanitary Institute of Great Britain, enumerated certain basic principles of sewage disposal. These principles, set forth by Mr. Snape, are so carefully maintained in the Hampton sedimentation tank that, preparatory to describing this type of sewage clarifier, Mr. Snape's conclusions have been summarized:

"1. The elimination of the suspended and colloidal solids from the sewage. These are then termed sludge.

"2. The proper and hygienic disposal of the sludge.

"3. The oxidation of the remaining organic matter and ammonia so as to be harmless. And, therefore, the proper function of the tank in sewage disposal works should be the elimination of the suspended solids and the colloidal matters from the liquid. * * * The principle of the sedimentation tank is to obtain all the sludge it can as quickly as it can."

Shortly after the original tank at Hampton, England, was put in operation, an effort was made to operate it without this flow thru the reduction chamber, but the results were unsatisfactory; the deposited solids accumulated on the sloping bottom of the sedimentation chamber and at the slots, and had to be pushed thru the slots into the reduction chamber, while the effluent showed a decided increase in suspended solids. A similar trial has been recently made with the large Hampton tanks at Norwich, England, and has shown equally unsatisfactory results.

There is such a wide variation in both the volume and composition of sewage, not only as between that of different localities, but even from hour to hour, that it is practically impossible to pre-determine the exact proportion of flow thru the reduction chamber required to produce the best results. For this reason the outlet from the reduction chamber is provided with means for regulating this flow. It is to be expected that the reduction chamber effluent will carry some finely divided suspended matter, and it is therefore passed thru small up-flow filters of the Scott-Moncrief type before being added to the effluent from the sedimentation chambers.

The American rights for this type of tank are held exclusively by the Sterilization Co., Newark, N. J.

The Collection of Refuse.

BY E. W. STRIBBLING, SUPERINTENDENT DEPARTMENT OF PUBLIC SERVICE, COLUMBUS, OHIO.

Garbage, rubbish and manure are collected and disposed of by the Department of Public Service according to up-to-date business methods. Accurate and minute records are kept concerning each division of collection. We know the daily cost of horse maintenance as well as the total cost of collection per load and per yard.

An accurate record is kept of the performance and cost of each horse; each horse has a page in the ledger, which is designated by the mark appearing on the hoof of the horse. His cost, maintenance and earnings can be ascertained at a glance. His costs are debited and the worth of his work is credited to him.

In our tables we maintain a daily average of 115 head of horses, 14 barn helpers and a night watchman. The daily average cost of hay, straw, corn and oats is $52.36, and the labor will average $30. Consequently the average daily feed cost per horse amounts to 72 cents.

Prior to May, 1911, the only refuse which we collected was pure garbage, but since that date this department has attended to the removal of all garbage, rubbish and manure.

Our buildings consist of a loading station and stable. The loading station is a suitably constructed two-story brick building, with railway tracks extending thru its entire length. The dump wagons empty their contents from the second floor into the cars on the first floor.

As regards the collection of pure garbage: We have subdivided the city into thirty-one districts, which are so grouped as to give each team an equal number of miles per day. We use the "long and short haul" method. By this method no team travels more than sixteen miles per day, while the average daily saving in travel per team is about 1½ miles per day. Each team collects two loads daily, except that those collecting from hotels collect three. The loads must average 1½ tons.

All rubbish is disposed of by hauling to dumps. For this department of collection we have subdivided the city into eight districts, each being in charge of a foreman who has under his control about four teams, four drivers and one helper. There are about thirty-two teams employed regularly. To collect once in two weeks would require about forty teams the year round.

The amount and cost of dry refuse and manure collected for the months of January, February, March, April and May of 1912 are as follows:

DRY REFUSE AND MANURE COLLECTED IN 1912.

	Dry Refuse				Manure			
Month.	Loads.	Yds.	Labor and Teams.	Other Labors.	Loads.	Yds.	Tons.	Labor and Teams.
January	1,735	5,205	$3,095.00	$275.32	463	2,315	926	$1,053.00
February	2,186	6,558	3,352.25	272.50	433	2,165	866	1,061.50
March	1,973	5,919	3,036.75	272.50	374	1,870	748	924.35
April	3,967	11,901	5,482.97	272.50	192	960	384	360.80
May	2,950	8,850	4,292.50	272.50	234	1,170	468	591.00
Total	12,811	38,433	$19,259.47	$1,365.32	1,696	8,480	3,392	$3,990.65

Dry Refuse.

Cost of teams and labor	$19,259.47
Superintendence, inspection, etc	1,365.32
Supplies, repairs, etc	270.00
Total	$20,894.79
Cost of Collection per load	1.64
Cost of collection per yard	.54

Manure.

Cost of teams and labor	$3,990.65
Superintendence, inspection, etc	482.00
Supplies, repairs, etc	135.00
Total cost	$4,607.65
Received from the sale of manure*	2,216.75
Actual cost	$2,390.90
Cost of collection per load	2.72
Cost of collection per load, receipts deducted	1.41
Cost of collection per yard	.55
Cost of collection per yard, receipts deducted	.28

*Price received, 50 cents per ton f. o. b. city tracks, or $1.25 to $1.50 per wagon load, depending on length of haul.

BAIN TYPE OF DUMP WAGON USED BY CITY OF COLUMBUS.

The dump wagons used for the collecting of dry refuse and manure are of the Bain type. Having but one lever for closing the doors and dumping the load, the driver need only lift the dog and push the lever forward. Because of the large drum on which the chain is wound it is necessary to move the lever forward and back only a few times. Only one chain is used. The doors are hung by heavy loops instead of rigid hinges. This allows them to be raised about 8 inches and prevents them from being torn off when moving forward after dumping. The doors close almost water-tight. The steel axles are reinforced by heavy hickory bed pieces, securely clipped on, which strengthens the axles and prevents springing or breaking.

The amount and cost of equipment maintained by this department is:

Loading station site	$10,136.40
Loading station	14,101.64
Collection stables	42,260.81
Trestle and driveway	2,153.10
Grading, fill, electric wiring	2,379.54
Railway siding	3,161.60
Garbage cars	7,564.00
Garbage wagons	7,151.10
Manure wagons	1,238.93
Dump wagons	3,466.50
Dead horse wagons	300.00
Small animal wagons	185.00
Coal wagons	625.00
Tree wagons	90.00
Buggies	305.00
Horses	24,000.00
Harness and stable supplies	5,484.31
Office equipment	522.51
Steel lockers	310.00
Total	$125,435.44

Harder Motor Driven Combination Chemical and Hose Wagon

The city of Chicago has recently installed a combination chemical and hose wagon built of special design in such manner as to withstand the severe strains which it is necessary for fire fighting apparatus to undergo. The highest grade of material was used throughout. The construction in every wearing part and every point of stress was thoroughly reinforced or braced.

The dissatisfaction which has been caused by so many pieces of cheap or poorly constructed apparatus has led city officials generally to a realization of the fact that fire fighting apparatus cannot be too strongly built if it is to render efficiency in the service required of it. City officials have begun to realize that an inefficient piece of apparatus, liable to break-downs of any sort, is not only expensive but positively dangerous. Fire fighting apparatus must be dependable.

City officials will, therefore, be interested in the specifications under which this new combination wagon was built. Copies of the complete specifications can be obtained from the manufacturers, the Harder Auto Truck Company, 162 W. 62d street, Chicago, Ill.

Nashville Man Describes Good Roads Covered on Auto Trip

One of the most enthusiastic boosters for Nashville, Tenn., is W. E. Jordan. On July 12 Mr. Jordan, accompanied by members of his family, left Nashville on a pleasure trip that, for distance and the number of points made, breaks the local record. In talking to representatives of the Good Roads Department of the Board of Trade, upon his return, Mr. Jordan gave this account of his trip:

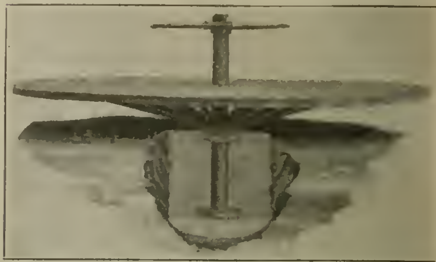
"Our party left Nashville on the morning of July 12, and made a number of cities, stopping at each place long enough to see the points of interest and to pay a visit to friends. In many respects," said Mr. Jordan, "this was a very remarkable trip. One of the things to be mentioned is that we traveled a distance of 3,857 miles.

"The best roads on the trip were found in New York and Pennsylvania, and I would like to state just here that too much praise cannot be said for the Warrenite roads in Allegheny county, Pennsylvania, of which Pittsburg is the county seat. In passing through this county it was a pleasure to notice how well these roads were built. At one point I coasted my car for a distance of 5⅛ miles, which in itself was a remarkable feat."

The National Rol-A-Gig.

The National Amusement Construction Co., Toledo, O., is manufacturing an extremely popular amusement device for use in parks and playgrounds. It is a play machine which is not monopolized by a few children, but easily affords fun for as many as 100 at a time.

The construction of the Rol-A-Gig is most substantial. The platform or tableland is 16 feet in diameter, made of the best seasoned siding firmly held with 2x4 girders securely bolted and sectional. The base of the machine is set in concrete or solid earth to a depth of five feet. It is fitted with ¾-inch ball bearings



THE NATIONAL "ROL-A-GIG."
Showing Details of Construction.

in the best of tubular iron and steel and is built to accomodate as many as the Rol-A-Gig will comfortably contain.

There are no cog wheels or other dangers to encounter. The speed is at all times under control and can be regulated to please the most exciting turn of any child.

The Tractor Service in New York.

The city of New York is employing a number of Martin tractors in combination with heavy trucks, such as is shown in the accompanying photograph, to handle garbage on long hauls. The trucks are drawn from house to house by horses until the collection is finished. They are then jacked up at stations provided for the purpose and the tractor is coupled on for the long haul to the dump. It was found that the horses were more efficient where frequent stops are necessary, but on the long hauls the tractor is much quicker and can haul a much greater distance.

One tractor handles six wagons over an average haul of from 4 to 6 miles. Two and one-half miles is the shortest distance covered. The wagons are in each case covered and water tight. A ring is provided at the front of the truck, so that upon arriving at the dump, a crane lifts the truck complete and swings it suspended from its forward end until it is over the garbage barges. A trip is then thrown and the garbage is dumped thru the back end of the wagon bed.

The Martin tractor used may be briefly described as a motor mounted on a frame, supported from the front by a single wheel, by which it is steered, and at the rear by two wheels which form the front wheels of a four wheeled heavy vehicle. The combination makes a five wheeled motor-drawn truck, where the power is applied in pulling instead of in pushing the load.

The tractor has proven out in practice. It has drawn nine tons 20 miles in an hour, climbed a 14 per cent grade at 8 miles an hour, worked perfectly on slippery pavement and in sand and mud. It has turned a piece of apparatus 57 feet long over all completely around in a 30-foot street. It has drawn a 5,500-pound ladder truck 2,500 miles at an average speed of 20 miles per hour—(making as high as 30 miles per hour on good roads) without developing a weakness in either ladder or tractor. The ladder truck is iron-tired and is fifty years old. This test was made to prove that the iron-tired vehicle would stand the strain of high speed. It has climbed a wet cobblestone paved hill with a 12 per cent grade, drawing behind it a loaded motor truck. The total load in this test was 18,000 pounds and only 21 per cent was on the steel-tired traction wheels.

New Filtration Plant for St. Louis Water Works

St. Louis is to have a new $12,000,000 city water filtration plant to take the place of a coagulant plant now in use at Chain of Rocks, the home of the present city water-works, three miles north of the business district, and located on the Mississippi river.

Recommendations of Water Commissioner Edward H. Wall, made in a report recently submitted, were favorably received by Mayor Frederick H. Kreismann, and by members of both branches of the municipal assembly. A bill has been introduced in the lower branch of the assembly providing for an appropriation, and it is thought it will be passed.

In his report Commissioner Wall predicted a severe water famine within five years' time, unless the present intake system were extended.

The capacity of the new water-works is to be 150,000,000 gallons, an increase of 25,000 gallons over the present limit. The coagulant plant now in use can accommodate only 100,000,000 gallons, and it is proposed to enlarge this to meet all demands until 1935.

There are 107,500 service connections with city water mains, and the average daily consumption for the last fiscal year was 83,600,000 gallons. The highest for one day was 112,000,000 gallons.

Considering the natural increase in population and the consequent demand upon the water department, Water Commissioner Wall estimates 1923 will see St. Louis with a population of 843,000 and the demand for water will be 113,000,000 gallons as a daily average.

The new intake plant may be located on the Missouri river, in St. Louis county, near where that tributary meets the Father of Waters.

It is planned to have water meters installed generally not later than 1918, in order to reduce the consumption of water, figures of which are said by water experts to be illustrative of excessive use.

Calendar of Technical Meetings

American Road Builders' Association, Cincinnati, Dec. 3-6. Secretary, E. L. Powers, 150 Nassau Street.

American Institute of Chemical Engineers, Detroit, Mich., Dec. 4-6. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

National Society for the Promotion of Industrial Education, Philadelphia, Dec. 5-7. C. A. Prosser, Secretary, 105 East Twenty-second street, New York City.

Engineering Association of the South, Nashville, Tenn., Dec. 6-7. W. Harwell Allen, 930 Stahlman Bldg., Nashville, Tenn.

Association of American Portland Cement Manufacturers, New York, Dec. 9-12. Percy H. Wilson, Secretary, Land Title Bldg., Philadelphia, Pa.

Indiana Good Roads Association, Better Roads Convention, Indianapolis, Dec. 10-12. C. A. Kenyon, President, Indianapolis.

National Association of Cement Users, Pittsburg, Pa., Dec. 10-13. R. L. Humphrey, President, Harrison Bldg., Philadelphia, Pa.

American Society of Engineering Contractors, Dec. 12. Paper by Geo. C. Warren, "Development of the Modern Country Roadway." J. R. Wemlinger, Secretary, 21 Park Row, New York.

Municipal Engineers of the City of New York. Annual dinner, at Hotel Savoy, Jan. 11, 1913, 7 p. m. Geo. A. Taber, Secretary, 29 West Thirty-ninth street.

Trade Notes

The Knox Automobile Company, of Springfield, Mass., have contracted with the Canadian General Electric Company to handle their entire commercial and fire vehicle line throughout Canada.

A recent announcement by the Atlas Portland Cement Company, 30 Broad street, New York City, calls attention to the fact that 5,000,000 barrels of Atlas Portland cement have been supplied for the construction of the Panama canal, without the rejection of a single barrel. The United States government has placed orders for a sufficient additional supply to complete the work in the entire canal zone.

Queen-Gray Company, Philadelphia, Pa., a new company, has purchased the business of Queen & Co., well-known manufacturers of engineering, electrical and scientific instruments.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Fernandino, Fla.—Dec. 18, 1912, until 3 p. m., for doing the work and furnishing the material required for laying approximately 11,000 square yards of vitrified brick pavement on Center street, between Fifth and Eleventh streets. G. L. Baltzell, city clerk.

Rome, Ga.—Dec. 9, 1912, for the paving of Fourth avenue, East Fourth street and Avenue A. Estimated cost, $40,000.

Rome, Ga.—Dec. 9, 1912, until noon, for grading, curbing and paving with either wood block, vitrified brick, Hassam compressed concrete, asphaltic concrete, sheet asphalt or bitulithic material. The work will embrace approximately furnishing and setting 8,900 lineal feet of granite curb, or concrete curb and gutter, foundations and surfacing 19,000 square yards pavement. W. M. Wilson, city engineer.

Pikeville, Ky.—Dec. 9, 6 p. m. For the construction of about 25,000 square yards of street paving with vitrified brick on a 6-inch concrete base, including combined curb and gutter. P. J. Preston, mayor; Amick & Haynes, engineers.

Columbus, O.—Dec. 10, 1912, until 11 a. m., for grading and paving with brick for heavy traffic, the No. 3 Improvement Richmond road. State Highway "D" Pet. No. 374, in Euclid township, Cuyahoga county. Estimated cost of construction, $71,442.50. Length, 5,544 feet or 1.32 mile. Width of pavement, 14 feet. Draft or certified check, $1,000. The successful bidder will be required to give bond equal to the contract price. Date set for completion, Aug. 1, 1913. James R. Marker, state highway commissioner.

Ambridge, Pa.—Dec. 29, 1912, until 7 p. m., for furnishing material and constructing a concrete wall along First street. Certified check, $50. M H. Allen, secretary Ambridge council.

CONTRACTS AWARDED.

Corona, Cal—The contract to improve Grand boulevard was awarded to O. F. Easley, of Alhambra, for $50,000, by the city council.

Los Angeles, Cal.—The Barber Asphalt Company was awarded the contract for the asphalt paving of Alameda street, between Seventh and Twenty-first streets. Price, $71,635.63.

Sacramento, Cal.—The following road contracts have been awarded: Constructing a macadam road in Santa Clara county, to the City Street & Improvement Co., $41,905; constructing an oiled concrete road in Sonoma county, to Richard Keating & Sons, San Francisco, Cal., $61,396; constructing an oiled road in Los Angeles county, to Rogers Bros., Los Angeles, Cal., $33,043; constructing an oiled concrete road in Santa Clara county, to A. Teichert & Son, Sacramento, Cal., $30,688.

Huntington, Ind.—On a bid of $11,990, contract for the Young road in Polk township, was let to Jackson & Gordon, of Wells county.

Marion, Ind.—Contracts have been awarded as follows: The P. A. Daley gravel road, on the Mill-Monroe line, to Matthews Nelson, at a contract price of $8,873; the Daniel W. Rouse stone road with Tarvia binder in Mill township, to the Garver Construction and Transfer Co., of Hamilton, O., for $21,542.50; the Alvin J. Thomas road in Mill township, for $24,848.50; the Don Daily road in Mill township, at the contract price of $10,649, to Drock & Co.

Iowa Falls, Ia.—The $91,353.86 contract for paving streets in this city was awarded to Wm. Horrabin, of Iowa Falls.

Hamilton, O.—Joseph Garver was successful in landing a $50,000 contract for the macadamizing of a road near Marion, Ind.

Salem, O.—Joseph T. Smith has been given the contract for paving with brick one mile of the Ellsworth road. Price, $15,825.

Tulsa, Okla.—A $120,000 street paving contract was awarded on the majority of the streets to the Eureka Construction Co. and on the balance to the E. P. McCormick Co.

Portland, Ore.—The contract for paving the approaches of the Broadway bridge has been awarded to Giebish and Joplin. Price, $13,589.

Philadelphia, Pa.—Gibbs & Co. have been awarded contracts for the construction of the following roads: Blackwood turnpike, from City line to Bellmawr, on a concrete base with "Amiesite" top, $72,569.62; Cuthbert road, from the Haddonfield turnpike to the White Horse road, with "Amiesite," $19,890.15; Blackwood to Clementon, $59,638.80. On the Clementon end of the road, 4,000 feet is to be "Amiesite," and on the Blackwood end, 4,500 feet is to be "Amiesite," and between these points the construction will be of macadam.

Dallas, Tex.—The contract for paving of Pennsylvania avenue, from Colonial to Oakland avenue, has been awarded to the Texas Bitulithic Co.

Fort Worth, Tex.—The General Construction Company has been given the contract for the pavement of Bessie street, between Cromwell street and the International tracks.

Sherman, Tex.—The Parker-Washington Co., of Kansas City, Mo., has been awarded the contract for the brick paving in the business section. The Creosoted Wood Block Paving Co., of New Orleans, was given that of the wood block.

Walla Walla, Wash.—L. Lanning, at his bid of $38,900, secured the contract for five miles of road to connect the state line with state aid road No. 99.

CONTEMPLATED WORK.

Chicago, Ill.—The construction of sidewalks (cement) in North Hamlin avenue, Wentworth avenue, South State street, West Sixty-third place, West Twenty-second street, South Fifty-second avenue, Gladys avenue, Greenwood avenue, Canal Port avenue, Deming place, and cinder sidewalks in Addison street, West Ninety-fourth street and Bishop street, has been ordered. Board of local improvements.

St. Paul, Minn.—The city is contemplating the paving of the following streets: Kent street, from University avenue to Minneapolis street, at an estimated cost of $11,563 for macadam, to $35,004 for granite; Jackson, from Seventh to Ninth, at a cost ranging from $2,257 to $4,910; Arundel street, from Marshall avenue to Rondo street, at an estimated cost of from $6,502 to $12,569; Dayton avenue, from Victoria street to Chatsworth, at an estimated cost ranging from $6,510 to $15,006

Nevada, Mo.—An election here resulted in favor of issuing road construction bonds to the amount of $20,000.

St. Joseph, Mo.—Rackliffe & Gibson Construction Co. were awarded the contract for resurfacing the brick pavement on King avenue, from Sixth street viaduct to Missouri avenue, with asphalt. The bid was $1.44 per square yard, and the aggregate cost will be about $27,000.

Rochester, N. Y.—A $50,000 bond issue for good roads was carried by a vote of 10,629.

Canton, O.—The repaving of West Tuscarawas street, from the Square to Harrison avenue, is contemplated, at an estimated cost of $80,737.75.

Cincinnati, O.—A $60,000 bond issue for the improvement of many streets and sewers has been authorized by the city council.

Dayton, O.—The improvement of Brightwood avenue, by grading and graveling the roadway, setting combined curb and gutters of cement with boulder border and paving the streets and sidewalks with cement, is contemplated. Wm. D. Huber, president of council.

Dayton, O.—The improvement of Creighton avenue, from Wyoming street to Getch street, by grading and graveling the roadway, setting combined curb and gutters of cement with boulder borders 2 feet wide and paving the sidewalks is contemplated. Wm. D. Huber, president of council.

Dayton, O.—The improvement of Whitmore avenue, from National to Kennard avenue, by grading and graveling the roadway, setting combined curb and gutter of cement with boulder border 2 feet wide and paving the sidewalks with cement is contemplated. Wm. D. Huber.

Lancaster, O.—A resolution ordering sidewalks, curbs and gutters on both sides of Sixth street, from Broad street to Garfield avenue, has been passed.

Massillon, O.—Contracts will be advertised for early next year for the improvement of about four miles of Wooster road between the end of the present paving in West Brookfield through East Greenville to the Wayne county line. Stark county commissioners.

Youngstown, O.—An ordinance determining to proceed with the improvement of Pine street, between Woodlawn avenue and Fairmount avenue, from Haesley street to South avenue, by paving the same, has been passed.

Zanesville, O.—Grading and paving of Wheeling avenue, from Greenwood avenue to the corporation line, with vitrified brick and the construction of concrete curb has been authorized. John H. Schofield, mayor.

Pittsburg, Pa.—An ordinance has been passed authorizing the grading and paving and curbing of Sixth avenue, from Beach avenue north to the northern boundary line of Palmer avenue.

Rochester, Pa.—An ordinance providing for the subgrading and paving of Deer lane, between Connecticut avenue and Virginia avenue, has been passed.

Tarentum, Pa.—An ordinance authorizing the grading, paving and curbing of East Ninth avenue, between the west line of Wood street and the east line of Ross street, has been passed. Borough engineer.

Seattle, Wash.—The board of public works will advertise for alternate bids for brick or bitulithic paving on West Fremont avenue.

Moundsville, W. Va.—An election here resulted in favor of issuing road improvement bonds to the amount of $150,000.

Burnaby, B. C.—The election here resulted in favor of issuing the following bonds: Road improvement, $25,000, and street improvement, $50,000.

SEWERS.

BIDS REQUESTED.

Tipton, Ia.—Jan. 15. Construction of sewers. P. D. Ketelsen, city clerk.

New Orleans, La.—Dec. 20, 12 m. Furnishing and erecting a mechanical draft apparatus. F. S. Shields, secretary, sewerage and water board; Geo. G. Earl, general superintendent.

Fort Stevens, Ore.—Dec. 10, 1912, until 11 a. m., for the construction of approximately 2,400 feet of 4-inch pipe line at Fort Canby, Wash. Augustus Norton, first lieutenant, C. A. C. Q. M.

CONTRACTS AWARDED.

Washington, D. C.—The contract for the construction of water works and sewerage system in Bridgewater, Va., has been awarded to the Newport News Construction Co., Newport News Va. Price, $22,704.

Nashville, Ga.—The contract for the construction of a sewer system has been awarded to the J. B. McCrary Co., Atlanta, Ga. Price, $10,500. The system comprises about three miles of sewers.

Kankakee, Ill.—The National Drain Tile Co., of Terre Haute, Ind., was awarded the contract for eighteen miles of sewer. Price, $60,000. The contract requires 200 car loads of tile.

Quincy, Ill.—The contract for the South Side sewer has been awarded to Henry Rees. Price, $77,000.

Summit, Ill.—The Nash-Dowdle Co., 95 La Salle street, Chicago, Ill., has been awarded a contract for construction of sewers.

Kokomo, Ind.—The construction contract for the Pete's Run sewer has been awarded to Michaels and Minnich Construction Co., for about $27,000.

Grand Rapids, Mich.—The contract for the construction of the Wealthy sewer extension has been awarded to Joseph Rushe. Price, $27,013.

Kansas City, Mo.—Contract for a district sewer was awarded to A. D. Ludlow. Price, $32,366. The sewer is to be constructed of vitrified clay pipe.

Libby, Mont.—The contract for several sewers was awarded to Rose & Reynaud. Price, $14,520.

Lorain, O.—The contract for the construction of a sewer in Broadway has been awarded to G. F. Randall, of Lorain. Price, $12,313.

Waco, Texas.—Newman B. Gregory, of Greenville, has been awarded the contract for the construction of a storm sewer on Mary street, from Eleventh street to Brazos river. Price, $42,327.70.

CONTEMPLATED WORK.

Taft, Cal.—A $25,000 bond issue for a sewer system has been voted.

Gastonia, N. C.—A $12,500 bond issue for sewer improvement has been voted.

Canton, O.—Engineer L. E. Chapin has submitted plans for two sewage disposal plants on the Howerstine site at an estimated cost of $477,500 and $342,000, respectively. Service Director Harbert.

Cleveland, O.—An ordinance providing for a $2,000,000 bond issue for a sewage disposal plant or plants has been voted.

Columbus, O.—Ames Brothers were given the contract for the construction of the Glenwood Heights sewer, on their bid of $22,-081.98.

Mansfield, O.—An ordinance has been passed to construct an 8-inch sewer in Reba avenue, from Marquis street to Main street, with all necessary manholes and flush tanks. G. H. Lowery, president of council.

Mansfield, O.—Construction of sewers on both sides of Purdy street, on East street, Blecker street, Wayne street and on both sides of Perry street, together will necessary manholes and flush tanks has been authorized. G. H. Lowery, president of council.

New Philadelphia, O.—Construction of a trunk sewer from Tuscarawas river to the old storm sewer at B. & O. R. R. crossing, near the ice plant on West High street, Ray street, with necessary appurtenances has been authorized. G. M. Earle, president of council.

Youngstown, O.—Ordinances providing for the following sewers have been passed: Construction of a sewer in Morgan street, between Hillman street and the present end of sewer in Kendall avenue; also constructing a district sewer between the northerly city limits and the Mahoning river. Sol. S. Davis, president of council.

Sulphur, Okla.—A $17,500 bond issue for sewer construction has been voted.

Clearfield, Pa.—Construction of an 8-inch sewer on West Fifth avenue with necessary manholes, etc., is contemplated. C. E. Roseberg, president of council.

Canonsburg, Pa.—Construction of an 8-inch sanitary sewer with 4-inch lateral connection on South Jefferson avenue has been provided for. A. Sheldon, chairman of council.

Jessup, Pa.—C. E. Beland has been awarded the contract for the construction of a storm sewer basin. His bid was $11,002.

S. Bethlehem, Pa.—A $130,000 increase in the indebtedness of the borough to build a sewage disposal plant has been voted.

WATER WORKS.

BIDS REQUESTED.

Sioux City, Ia.—Dec. 14, 1912, for the construction of a reinforced concrete reservoir, 143 feet inside diameter, 33-foot high walls, average 17 inches, also reinforced concrete addition to present reservoir. D. H. Maury, 1125 Monadnock building, Chicago, Ill., has plans and specifications. G. B. Healy, city clerk.

Yankton, S. D.—Dec. 16, 1912, for the furnishing of all tools, labor, material and equipment for the construction of and finishing complete, ready for operation, the new water works. John W. Summers, city auditor.

CONTRACTS AWARDED.

Stockton, Cal.—The Pacific Gas and Electric Co. was awarded a franchise for extending water mains into the McCloud addition.

Appleton, Wis.—The contract for a filtration plant has been awarded to the Jewell Water Improvement Co., of Chicago, $49,869.

Waco, Texas.—The Pittsburg Filter Co. awarded the contract for installing a water filtration plant. Proce, $85,000.

Reading, Pa.—H. L. Campbell, of Hazelton, has been awarded the contract for the repair of the reservoir of Shenandoah.

Huntington, W. Va.—John R. Day was awarded the contract for extending the water service in Colis avenue, from Twenty-sixth to Twenty-eighth street.

Grand Rapids, Mich.—Verhey & Kloote were awarded the contract for laying of the water main in Tamarack and Eleventh streets.

Summit, Ill.—W. T. Ryan, Lyons, Ill., has been awarded the contract for extending the water works system of Summit, Ill. This work includes the laying of 2,786 lineal feet of 6-inch cast iron pipe, erection of six double nozzle fire hydrants and six 6-inch double gates.

Dayton, O.—At a bid of $14,200 the Chicago Bridge and Iron Works was awarded the contract for installing the steel tank and tower which will furnish an auxiliary supply of water to Dayton View and Riverdale next year.

CONTEMPLATED WORK.

Los Banos, Cal.—A $27,000 bond issue for a water plant has been voted.

La Grange, Ga.—A $150,000 bond issue for water works has been voted.

Kamiah, Ida.—The election here resulted in favor of issuing water works bonds to the amount of $12,500. J. B. Hurle, village clerk.

Chicago, Ill.—The construction of water service pipe lines in Wallace street, North Ridgeway avenue, Hutchinson street, North Forty-sixth street, North Sawyer avenue, Lowerill avenue, Galt avenue, North Forty-seventh avenue, Syracuse avenue, North Springfield avenue, Pensacola avenue, North Lawnsdale avenue, South May street has been authorized. Board of local improvements.

Bedford, Ind.—Water works improvement bonds of this city to the amount of $25,000 have been voted.

Logansport, Ind.—A $60,000 appropriation for a filtration plant carried in this city.

Ramsey, N. J.—A $65,000 bond issue for water works has been voted.

Nyack, N. Y.—Village Clerk Henry E. Smith informs us that the amount of reservoir and water works bonds voted Nov. 7 was $25,000.

Cincinnati, O.—The Eden Park reservoir will be relined with Portland cement and waterproofing at an approximate cost of $15,000.

Geneva, O.—The election here resulted in favor of issuing water works improvement bonds to the amount of $10,000. W. E. Morgan, village clerk.

Lima, O.—A $100,000 bond issue for water works improvement has been voted.

Lorain, O.—The city will readvertise for bids for furnishing 500 or more water meters to be used by the water works department.

Pleasant City, O.—A $15,000 bond issue for water works system construction has been voted.

Pittsburg, Pa.—The election resulted in favor of issuing water extension bonds to the amount of $1,620,000.

Bowdle, S. D.—Engineers Wells and Easton, of Aberdeen, have completed plans for a water works and electric light plant. Estimated cost, $22,500.

Dallas, Texas.—The construction of a filtration plant has been awarded to the American Water Softener Co. Price, $200,000.

BRIDGES.

BIDS REQUESTED.

Steubenville, O.—Dec. 10, 1912, for the necessary labor and the material for the construction of the sub-structure of Bridge No. 15 in Knox township, over Croxton's run. Sherman M. Floyd, clerk of the board.

CONTRACTS AWARDED.

Marysville, Cal.—The Portland Concrete Pile Co. has been awarded the contract for the construction of the bridges in Yuba county. Price, $12,750.

Napa, Cal.—The contract for the construction of the new stone bridge across Trancas creek, north of Napa, was let to H. W. Wing, on his bid of $15,972.

Denver, Colo.—The contract for the construction of the Downing street bridge over Cherry creek has been awarded to the C. P. Allen General Contracting Company, 312 McPhee building. The company's bid of $13,091.50 was the lowest of the six submitted.

Tampa, Fla.—The Edwards Construction Co. has been awarded a contract for the construction of a temporary bridge over the river from Jackson street on the east side to Eagle street on the west side. Price, $5,800.

Augusta, Ga.—Contract for the construction of the Archibald Butt Memorial bridge has been awarded to the Concrete Engineering and Construction Co., of Birmingham, Ala., at $20,852.

Chicago, Ill.—The lowest bid submitted for constructing the sub-structure of a double leaf bascule bridge over the Chicago river at Chicago avenue was that of Byrne Bros. Dredging and Engineering Co., 72 West Adams street, for superstructure complete, including machinery, electrical equipment, steel work, concrete work, iron ornamentation, light appliances, floors, railings, etc., $105,346.

Springfield, Ill.—Frank R. Miller, of Springfield, was granted a contract for building a bridge at Salisbury. His bid for erecting the 200-foot steel span across the Sangamon river was $12,000.

Watseka, Ill.—W. H. Shons, of Freeport, Ill., has been awarded the contract for the construction of a town line bridge in Ashgrove township, Iroquois county, at $4,600.

North Auburn, N. Y.—The Groton Bridge Co., North Auburn, N. Y., has been awarded a contract at $9,649 for the construction of a new steel bridge encased in concrete, over the Owasco river.

Cleveland, O.—The contract for all secondary piers for the new high level bridge has been awarded to the Great Lake Dredge & Dock Co. Price, $497,000.

Lisbon, O.—Contracts for the construction of five bridges in Washington township have been awarded to the Canton Concrete Construction Co., of Canton, O., at an aggregate cost of $25,000.

Fort Worth, Texas.—The contract for the construction of Main street concrete viaduct was awarded to Hannon Hickey Bros. Construction Co. Price, $373,948. Contract for the Seventh street bridge was awarded to Tarrent Construction Co., $106,773.

CONTEMPLATED WORK.

Des Moines, Ia.—The election here resulted in favor of issuing bridge bonds to the amount of $100,000.

Columbus, O.—The following bond issues have been voted: $80,000 to build a bridge over the creek in Alger road, and $30,000 to build one in Schrock road, near Westerville.

Findlay, O.—An election here resulted in favor of issuing bridge bonds to the amount of $25,000.

GARBAGE DISPOSAL.

CONTRACTS AWARDED.

San Diego, Cal.—J. W. Walton has been given the contract for erecting a 6-unit McGuinn incinerator at a cost of $16,000.

Sharon, Pa.—The contract for the construction of a garbage disposal plant has been let to J. P. Simon. Price, $6,508.

LIGHTING, STREET AND OTHER.

CONTEMPLATED WORK.

Tipton, Ind.—The installation of enough cluster lights to illuminate the business portion of the city to replace the electric arches over the streets is contemplated by Mayor Compton and the Business Mens' Club.

Corydon, Ky.—The bond proposition of $8,000 for electric lights for Corydon, this county, carried.

Corydon, Ky.—The election here resulted in favor of issuing electric light bonds to the amount of $10,000.

Owatonna, Minn.—The election here resulted in favor of issuing electric light bonds to the amount of $10,000. C. J. Servatius, city clerk.

Alliance, O.—A $15,000 bond issue for the erection of a municipal lighting plant has been voted. L. L. Lower, councilman.

Columbus, O.—Cluster lights to cost approximately $83,000 are to be installed in the streets. H. E. Eickhorn, superintendent municipal light plant.

BUILDINGS.

BIDS REQUESTED.

Cleveland, O.—Dec. 16, 1912, for the structural steel work for the new municipal electric light plant. F. W. Ballard, superintendent.

Defiance, O.—Bids will be received until Dec. 14, for the construction of a new postoffice, to be completed June 1, 1914. Plans and specifications are now on file with C. J. Thompson, postmaster.

CONTRACTS AWARDED.

Menominee, Ill.—Contract for the construction of a new court house has been awarded to the Herman Construction Co., of Antigo, Wis., at their bid of $14,000.

Monticello, Miss.—The Little-Cleckler Construction Co., of Anniston, Ala., has been awarded the contract to build a $45,000 court house.

Wilkinsburg, Pa.—Grant McCargo has been awarded the contract for building a new four-story fireproof steel and concrete postal station for this city.

Cleburne, Texas.—The contract for the construction of a new court house has been awarded to the American Construction Co., of Houston, Texas. Price, $200,000.

CONTEMPLATED WORK.

Chicago, Ill.—The election here resulted in favor of issuing the following bonds: County home, $1,000,000; hospital, $500,000.

Des Moines, Ia.—The election here resulted in favor of issuing a juvenile home bond in the amount of $12,000.

Oskaloosa, Ia.—The proposition to build a new $135,000 court house in Calhoun county was carried.

Murray, Ky.—This county has voted in favor of issuing court house bonds to the amount of $40,000.

Paducah, Ky.—A $40,000 bond issue has been voted for the erection of a new court house.

Shelbyville, Ky.—The election here resulted in favor of issuing court house bonds to the amount of $75,000.

Billings, Mont.—The election here resulted in favor of issuing jail bonds to the amount of $50,000.

Omaha, Neb.—The election here resulted in favor of issuing fire house bonds to the amount of $100,000. Thomas J. Flynn, city clerk.

Stanley, N. D.—The election of Nov. 5 resulted, by a vote of 834 to 770, in favor of issuing court house bonds to the amount of $50,000. W. C. Gibb, county auditor.

Cincinnati, O.—A bond issue of $90,000 has been voted for a new city hall at Norwood.

Cleveland, O.—The expenditure of $50,000 for the erection of comfort stations at street intersections has been authorized.

Cleveland, O.—A $2,000,000 bond issue for a new public library has been voted.

Dunkirk, O.—Dunkirk to-day voted approval of a $15,000 bond issue for an auditorium.

Springfield, O.—A $250,000 bond issue for the construction of a county memorial hall and a public auditorium has been voted. Memorial hall commission.

Pittsburg, Pa.—Bond issues for the following buildings have been voted: City home improvement, $840,000; market house, $300,000; comfort station, $90,000; hospital improvement, $90,000.

Horkville, S. C.—The election here resulted in favor of issuing 4½ per cent. 20-year court house bonds to the amount of $75,000.

FIRE APPARATUS.

BIDS REQUESTED.

Defiance, Ia.—Jan. 1. Furnishing hose cart and fire hose. Town council.

CONTEMPLATED WORK.

Taft, Cal.—Fire apparatus bonds to the amount of $16,000 have been voted.

Lakewood, O.—An $8,500 fire apparatus bond issue has been voted. B. M. Cook, city auditor.

Dallas, Tex.—The purchase of 2,000 feet of Paragon fire hose, at $1.10 per foot, 1,000 feet of Adamant fire hose at 90 cents per foot and 1,000 feet of Overall fire hose at $1 per foot, has been approved by the commissioners.

STREET SIGNS.

CONTEMPLATED WORK.

Lockport, Ill.—An ordinance has been passed providing for the placing of street signs at all corners of the city streets.

PARKS.

CONTEMPLATED WORK.

Gary, Ind.—A 20-acre school park for Tolleston at Fifteenth avenue and Taft street is being planned.

Buffalo, N. Y.—A $994,000 bond issue to acquire lands for dock and park purposes has been authorized.

Toledo, O.—The purchase of property for parks and playgrounds has been authorized. John N. Babcock, clerk of council.

Zanesville, O.—City council has authorized the setting aside of "Water Works Hill," a tract lying between Harvey street, on the south, Main street, on the north, and lying east of Ninth street, for park purposes. P. A. Carb, president of council.

Bartlesville, Okla.—The election here resulted in favor of issuing park bonds to the amount of $25,000.

Pittsburg, Pa.—An addition of 15 acres to Lincoln Park, in the early spring, is contemplated.

AUTOMOBILES AND MOTOR EQUIPMENT.

CONTEMPLATED WORK.

Louisville, Ky.—The purchase of a modern auto truck to replace the hook and ladder apparatus of the fire department has been decided upon by the board of public safety.

Louisville, Ky.—The board of public works will purchase a five-ton truck in the near future. This vehicle will be used for the hauling of broken rocks and bricks to be used in making streets.

Elmira, N. Y.—This city has decided to buy a motor hook and ladder truck. The machine will cost $6,000 and will be equipped with a 70-horse-power engine.

New York, N. Y.—The expenditure of $210,000 for motor trucks, to be used for the removal of refuse, and also of $200,000 to purchase motor equipped street sweeping machines, is contemplated.

Cincinnati, O.—A $5,000 bond issue for purchasing a police telephone system and auto patrol has been provided for by the city council. Fire Chief Burkhardt.

Cleveland, O.—Automobile tractors of a type which will permit attachment to a steamer truck or hose wagon may be purchased for the fire department with the $7,000 recently authorized by council. Safety Director Stage.

McKeesport, Pa.—The city is contemplating the purchase of an auto patrol. David Rosenberg; police committee.

New Brighton, Pa.—The purchase of a $4,500 machine for use by the fire department is contemplated.