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NEW YORK, MAY 23, 1896

the Jetties at galveston HARBOR.
by walfred wilson.
There are four places on the Gulf coast of Texas that have each been trying for years to be designated as the harbor of the Gulf, by acquiring and maintaining deep water at their ports. For but one of the places, however, has the United States appropriated a sufficient sum of money to build jetties long enough to extend beyond the outer bar, that the action of the tide flowing in and out through the jetties may wash away the jetties may wash away
this bar of sand and thus this bar of sand and thus
maintain a sufficient depth of water to admit the entrance of the largest vessels afloat. This place is Galveston, for which the government has appropriated $\$ 7,000,000$, made a contract with J. H. O'Conner and E. H. Smoot, of Dallas, Texas, and the work is now Texas, and the work is now
being pushed to completion being pushed to completion
as fast as money and labor as fast as m
can push it.
can push it.
The obstructions to deep water navigation at the har-


THE GALVESTON JETTIES-LOOKING TOWARD LAND.
bor of Galveston have been the outer and inner bars. On the former the natural depth was 12 feet and on the latter about 13 feet, both at mean low tide. The present project for the improvement at this locality was adopted in 1874, modified in 1880 and again modified in 1886, the object being to deepen the channel so as to admit seagoing vessels of the deepest draught. The projects prior to 1874 related to dredging operations on a small scale only. The projects of 1874 and 1880 contemplated the constructing of two jetties to extend into the Gulf of Mexico, to concentrate the ebb flow upon the outer bar in the Gulf, and also effect deepening on the inner bar at the entrance to Galveston channel, these jetties to have their origins respectively at Boliver Point and Fort Point The project of 1874 was with a view of obtaining a depth o 18 feet. More or less work was done under these pro (Continued on page 327.)


CONSTRUCTION OF JETTIES AT GALVESTON TEXAS

## Srientifir Ammerican.

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thickness. -2 illustrations.
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XI. TECHNOLOGR-Acetylene for Domestic Lighting. Hillustra-


THE DECADENCE OF THE APPRENTICESHIP SYSTEM We, who are privileged to live in the closing year of the nineteenth century, are for ever telling our selves what a magnificent age it is; and we never weary of hearing and repeating the count of our numbers, our wealth, and our wisdom. More often than not, this self-satisfied recital is rounded off with a contrast between what our forefathers were and what we have grown to be. In the main, the comparison is a just one, for as a matter of fact man, individually and collectively, is to-day better clothed, better fed, has more money in his pocket, and is cleaner in morals and person than he was fifty or one hundred years ago. In the midst of this general advance, and in some measure as the result of it, the student of social economics can detect here and there the signs of a decided retrogression. Happily such cases are few but they exist, and no amount of material prosperity should be allowed to blind us to the fact. Among the many customs of our forefathers that have fallen into disuse, there are some whose lapse can only be regarded as a misfortune, and whose revival would prove ence, and that they were prowpted by solid wisdon
There was a time in this country when the entrance door into every trade was strictly guarded, and the boy who aspired to the dignity of being ranked as a journeyman carpenter, machinist, or builder could only hope to do so by becoming bound in an apprenticeship of greater or less duration. His instruction, which was carried out with the characteristic thor oughness of former days, commenced with the very alphabet of his trade; and each department was fully mastered before he was passed to the next. He attained at once manual dexterity and a knowledge of detail; and incidentally he acquired also a thorough respect for his trade, efficiency in which could only be gained after so many long years of training. At the close of his apprenticeship he was entitled to be called a skilled workman, and could command a journey man's wages.
But to-day as the French would say, "we have changed all that." Apprenticeship is no longer the invariable rule-it is the rare exception. The careful, detailed instruction of the apprentice by the master mechanic has given place to a "hit-or-miss," "get there" system, or, rather, lack of system, in which the boy's instruction is dependent upon the caprice of the journeymen whom he is told off to assist. In place of the regular day-by day instruction of the appren tice, who, by virtue of his articles of agreement, wa entitled to continuous employment. the boys of to-day have to take their chance of picking up knowledge and acquiring manual skill at the odd times whe they may be so fortunate as to secure employment.
Under the old arrangement. the boy was sure of re ceiving instruction-his master was pledged to give it with a joh which was a little beyond his powers. It was taken for granted that he would spoil some of his work; and to a certain extent he in this way offse the profit accruing to the master from his unremu nerated labor.
Under the present system there is no obligation, and certainly no disposition, to give the boy helpers any work which they are likely to spoil. They are en gaged to do menial labor, and it is only in rare case of emergency that they get an opportunity to try their hand at a more important class of work. A green" hand in a machine shop is never regarded a pupn. He is judged from the standpoint of prof making, and the tendency is to keep hin it work in-
definitely at the machine with which he is familiar. The apprentice was moved from drilling machine to shaper; from shaper to lathe; from lathe to vise ; and by this varied experience he acquired an all round knowledge and efficiency. But the specialization of work in these days has limited the range of a boy's opportunities to such an extent that he can never hope to gain much knowledge or execution outsid
It must be admitted, however, that excellent as were the results under the old apprenticeship system, it would be impossible to carry it out under the present industrial conditions. The apprentice was "bound to his master, lived under his roof, and ate at his board. Modern social conditions and the moder temperament would not lend themselves to a compac in which the position of the boy was one of very pro nounced servitude; and the keen competition in the va riousindustries, the close margin upon which the maste mechanic has to figure in competing for a share of the trade, the speed and thorough system which are nec essary in a modern workshop, all render the carefu training of green hands in the shops a practical impossibility. Neither the master mechanic nor the jnurnesmen can spare the time for such personal over sight; and work which has been contracted for upon the smallest margin of profit cannot
clumsy, if willing, hands of a beginner.
But if the old system, good as it was, is impractica ble to-day, and the methods of to-day are so faulty what, it will be asked, is to be the remedy? We think
that will be found in an arrangement which shal embody the best features of both systems, and which shall be supplemented by that admirable institution nown as the trade school.
The idea of oversight was an excellent one ; and, so far as it can be exercised without interference with shop routine, it should be encouraged-at the same time the term of service should be very much re duced, and the relation of the boys to the master me chanic rendered more elastic.
The National Association of Builders has recom mended that a lad who wished to enter a trade should go first to a trade school, and discover in which direc on his tastes and aptitude lay. After passing an ex mination by a committee of master mechanics at the close of his course, he should enter the workshop as a junior. Here he would acquire speed and execution, and by the time he was capable of doing a "full day's work" he would be subjected to a second examina tion, the passing of which entitled him to be ranked as a journeyman. "Proof of ability, not length of service, is the test of what constitutes a mechanic in this system."
These suggestions are excellent, and they are thor oughly practical. The hope for the future of the American workman lies in the hearty co-operation of the master mechanics and the journeymen with the rade school system. If the American boy is to have any chance of holding his own against the incoming ide of skilled foreign labor, some radical change must be made in existing conditions. As we have shown, it s now well nigh impossible for him to attain the al ound efficiency which marks the foreign journeyman and enables him to secure work almost at the first ap plication. If the master mechanics would follow some uch scheme as was outlined by the national associa ion, the inefficient, or, as he is expressively known the "botch" workman, would cease to exist.

## THE SPEED TRIALS OF THE BROOKLYN AND

 THE OREGONDuring the past week two notable ships of the new avy have had their speed trials, and in each case the ontract requirements have been exceeded by ove knot an hour. On May 11. the Brooklyn, an im proved and enlarged New York, during a builders rial of three hours duration, using forced draught uaintained an avera re speed of 21.07 knots an hour which is 1.07 knots above the contract speed. The average revolutions of the screws were 132 , and the steam pressure averaged 155 pounds. It is gratifying to learn that there were no signs of distress either in engines or boilers. As compared with the New York the Brooklyn is of 670 tons greater displacement measuring 9,150 tons against the New York's 8,480 tons She is 400 ft long, has 64 ft .8 in beam, and 24 ft mean draught. She is armed with eight 8 in . guns-two mor than carried by the New York-ten 5 in. guns, and sixteen 6 pounder rapid-fire and machine guns. She is protected by a complete steel deck, 3 in. thick on the flat, and 6 in . on the slope, and by a water-line belt of 3 in . steel plate backed by a double thickness o hull plating over the whole length of the "vitals." Moreover, the 8 in. guns are protected by 10 in . and the in. guns by 4 in . of steel.
The performance of the Brooklyn on the Atlantic was excelled, relatively speaking, by that of the first class battle ship Oregon, in Pacific waters, a few days later. The Oregon is a sister ship to the Massachu setts, which we illustrated in a recent number. Th atter ship, it will be remembered, broke the record for her class by steaming 16.15 knots for four hours; but on Thursday, May 14. the Oregon exceeded this speed ly $\frac{63}{100}$ of a knot, maintaining the high rate of $16 \%$ knots on a four hours continuous trial. This is mor than $13 / 4$ knots above the contract requirements, an unless there are tidal deductions to be made from he peed, she will earn a bonus of $\$ 175,000$ for her builders, the Union Iron Works, of San Francisco.

## Platino-cyanids.

Arnulf Schertel describes, in the last Berichte, a new method of preparing platino-cyanids. Platinum chlorid is precipitated by hydrogen sulfid at $60^{\circ}$ to $70^{\circ}$ and the well washed platinum sulfid is dissolved in warm solution of potassium cyanid. On evaporation the potassium platino-cyanid, $\mathrm{K}_{2} \mathrm{Pt}(\mathrm{CN})_{4}, 3 \mathrm{H}_{2} \mathrm{O}$ crystallizes out, and equal parts of potassium sulfid and potassium thiocyanate remain in the mother liquor. If a solution of barium cyanid is used, the barium platino-cyanid is obtained. With commercial potassium cyanid containing large quantities of sodium cyanid. Schertel obtained the beautiful double salt $\mathrm{KNaPt}(\mathrm{CN})_{4}, 3 \mathrm{H}_{2} \mathrm{O}$, described by Martius. In view of the fluorescence of the barium and other salts of the platino cyanids under the Roentgen rays, this simple method of preparation is of considerable inter-est.-Science.

AT a recent meeting of the Paris Academy of Sciences M. Balland presented a memoir describing an analyis of a sample of rice over a century old. He found the rice only slightly deficient in fat.

## Intensifying Platinotype Prints. <br> B7 E. J. WALL, f.r.P.s.

The following notes upon this subject are written in response to a question addressed to the "Consulting Room," but to answer thoroughly there would take up too much space.
Platinum is one of the most intractable of metals, and cannot, therefore, be converted into any form suitable for redevelopment without partially or entirely destroying the paper support. There are three distinct methods of intensification, not counting the so called toning processes with uranium and iron and Packhan's organic solutions, all of which, though described as toning, are really intensification processes. Silver Intensification.-The most satisfactory formula for this is an acid hydroquinone solution :

| 1. Hydroquinone....................... ............... 2 grains. |  |
| :---: | :---: |
| Citric acid .... | . 20 |
| Distilled water. | 1 ounce |
| 2. Silver nitrate | 48 grains. |
| Distilled w | 1 oun |

The prints, after development and clearing, must be thoroughly freed from acid and placed in a clean dish, a porcelain or glass dish for preference. Add 10 drops of No. 2 to 1 ounce of No. 1, and the solution, which inmediately turns white and cloudy, should be well stirred and immediately applied to the wetted print and the dish rocked. Gradually the solution will begin to turn dark and dirty, but before this stage is reached the print will be seen to gain considerably in depth, and, when the desired intensity is reached, the solution should be poured off, the print thoroughly washed and fixed in hypo, and again well washed and dried. The image now consists partly of platinum and partly of silver. By treatment with a platinum toning bath such as-

| Chloro-platinite of potash. | 1 grain. |
| :---: | :---: |
| Citric acid. | . 20 grains. |
| Salt. |  |
| Water | . 2 ounces |

the silver may be replaced by platinum, the result being almost a pure platinum image. Or, if slightly bluish tones are preferred, then the ordinary sulphocyanide gold bath may be used instead of the above platinum bath

Platinum Intensification.-Dr. E. Vogel suggested the use of a very weak ferrous-oxalate developer, to which some platinum salt was added, but in my hands this is comparatively a failure. Miethe's process is rather more satisfactory, but is liable to give coarse granular images, and it is somewhat difficult to keep the whites pure. The print, after development and before clearing, is placed in a clean dish, and flooded with as little of the following as will cover it :
Solution of neutral oxalate of potash................... 1 ounce.
"
sulphate of iron........................ 90 minims.
sulphate of iron........... ... ........... 90 minims.
potassium bromide ( 10 per cent)........... 90 minims.
The first two solutions are those used for ordinary ferrous-oxalate development. When sufficiently intensified it must be treated with acid as usual.
A much more satisfactory intensifier is that suggest ed by Hubl :


For use add to 1 ounce of water 15 drops of No. and 15 drops of No. 2. The well washed print should be placed in a clean dish and flooded with this solution, and intensification will be complete in about fifteen minutes, when the print should be well washed teen minutes, when the print should be well washed
and dried. Prints which have been dried take much and dried. Prints which have been dried take much veloped.

Sodium formate is not in general use, but can be obtained by any dealer to order, as it is a well known salt. It must be noted that platinum perchlorideknown also as platinum bichloride or platinic chloride, not the potassium chloro-platinite-must be used.
Gold Intensification.-The following process suggested by Dollond is very satisfactory. The well-washed print should be soaked in water, laid on a sheet of glass face upward, and excess of water removed by
clean blotting paper. Pure glycerine should now be spread all over the print with the finger or a soft camel-hair brush. Now take a solution of chloride of gold one grain to the half drachm of water; add chalk to neutralize; filter, and then add one drop of strong hydrochloric acid. Drop about ten drops of this on to the print, and distribute at once all over with a camel-hair brush. and keep on brushing the print, which will gradually intensify. When suf print, which will gradually intensity. When suf
ficiently strong, rinse quickly and well, and sponge ficiently strong, rinse quickly and well, and sponge
back and front of print with equal parts of the followback
ing:

> Metol.............. .................................................. 1 gounce.
Sodium sulphite .
Water...................... ..... .............. 10 ounces.
> Potassium carbonate

wash tine print for half an hour and
The rationale of all these processes is very simple. The intensifying metal, silver, gold, or platinum, is mixed with a reducing agent which gradually reduces
actual separation the metallic platinum of the image attracts the intensifying metal while it is in statu nas cendi-that is, in the process of formation. This is n-
tirely analogous to the development of a wet collodion tirely analogous to the development of a wet collodion
plate, and is called physical intensification.-Pbotoplate, and is
graphic News.

## Artificial Flight Successfully Achieved by Prof. Langley's Aerodrome.

Artificial flight, corresponding very closely to the soaring of birds, has been at last successfully accomplished, and this, not merely for a short spurt down a hillside or along the level, but for a distance of half a mile, during a part of which distance the machine was actually soaring upward against the pull of gravitation.
The aeronautical world in general will be gratified that the first really practical solution of the problem should have been made by Prof. Langley. There is no experimentalist in this field of science who has labored harder to solve its problems than the secretary of the Swithsonian Institution; and it is noteworthy that the solution of mechanical flight should have been found in the direction in which his efforts have been persistently applied.
Prof. Alexander Bell, who was associated with Prof. Langley in the test recently made public, describes the successful experiments, which were carried out near Occoquan, Va., on May 6, as follows :
"Last Wednesday, May 6, I witnessed a very remarkable experiment with Prof. Langley's aerodrome on the Potomac River. Indeed, it seemed to me that the experiment was of such historical impor
tance that it should be made public.
"I should not feel at liberty to give an account o all the details, but the main facts I have Prof. Langley's consent for giving you, and they are as follows:
"The aerodrome, or 'flying machine,' in question was of steel, driven by a stean engine. It resembled an enormous bird, soaring in the air with extreme regularity in large curves, sweeping steadily upward in 100 yards, until it reached a height of about 100 feet in 100 yards, until it, reached a height of about 100 feet in
the air, at the end of a course of about a half mile, when the steam gave out and the propellers which had moved it stopped.
"Then, to my further surprise, the whole, instead of tumbling down, settled as slowly and gracefully as it is possible for any bird to do, touched the water without any damage and was immediately picked out and ready to be tried again.
"A second trial was like the first, except that the machine went in a different direction, moving in one continuous gentle ascent as it swung around in circles like a great soaring bird. At one time it seemed to be oin danger, as its course carried it over a neighboring wooded promontory, but apprehension was immediately allayed asit passed twenty-five or thirty feet above the tops of the highest trees there, and, ascending still further, its steam finally gave out again, and it quarter of a mile from the point at which it arose.
"No one could have witnessed these experiments without being convinced that the practicability of mechanical flight had been demonstrated.
"Alexander Graham Bell."
PROF. LANGLEY'S EXPLANATION.
Prof. Langley also made public a supplemental statement, giving some important data regarding recent experiments. It is as follows :
"The aerodrome, or flying machine, has no gas to lift it, as in the case of a balloon, but, on the contrary, is about 1,000 times heavier, bulk for bulk, than the air on which it is made to run and which sustains it somewhat in the way in which thin ice supports a swift skater.
"The power is derived from a steam engine through the means of propellers, but owing to the scale on which the actual aerodrome is built, there has been no condensing apparatus to use the water over and over Enough can be carried for only a very brief flight, a difficulty which does not belong to larger machines han the present example, in which the supporting "res are but about fourteen feet from tip to tip.
"The distance flown each time was about one-half mile. The rate of speed depends (as in the case of any vehicle on land) on whether it is going on a level or uphill. In the case of this last trial of May 6 the machine was ascending, that is to say, it was going uphill all the time, and went through a distance of one-half mile or more in one and one-half minutes. or at the rate of a little more than twenty miles an hour."

At the last session of the Illinois legislature an appropriation was made for the erection and equipment of an observatory for the State University at Champaign. The contract for the instrument equipment includes a 12 inch equatorial, a 3 inch combined transit and zenith telescope and a chronograph. The optical parts by Brashear, the fittings, etc., by Warner
\& Swasey. Prof. Ira O. Baker will be in charge of the $\&$ Swasey. P
observatory.

## Science Notes.

Acetylene gas is attracting considerable attention in the north of Italy and we have received a copy of a new journal devoted to it, L'Acetilene e le sue Applicazioni, published in Milan. So far as we know this is the only paper given up to the new illuminant. One of the illustrations, which is credited as an American invention, is a lamp post in the base of which is a cylinder of liguefied acetylene gas. When the cost of the gas shall be materially lessened, some such scheme would furnish an ideal light for the grounds of country residences.
At a recent meeting of the Meteorological Society Mr. W. Ellis, F.R.S., read a paper on the "Mean Amount of Cloud on Each Day of the Year at Green wich for Fifty Years, up to 1890," from which it ap peared that a principal maximum occurs in winter and a principal minimum in autumn, with a secondary much less pronounced maximum in summer, and a secondary minimum in spring. Cloudless days are most numerous in spring and autumn, and least numerous in winter and summer. Days of "much cloud" erous in winter and summer. Days of "much clou
are nearly equal in amount in all parts of the year.
Lecturing at the Institution of Civil Engineers on atmospheric dust, Mr. Fridlander said that observations show that at an elevation of 6,700 feet there are 950 dust particles in a cubic centimeter, while at 8,400 feet there are only 513 , and at 13,600 only 157 dust particles. Over the Indian Ocean the average number of dust particles a cubic centimeter was less than 500 for seven out of nine days, and on five days was less than 400. During a thick fog in the Atlantic, the air contained 3,120 dust particles a cubic centimeter, while in the clear region just beyond the fog there were only 280 dust particles.
As to the nature of the poison engendered by fatigue, some recent experiments have been made that are replete with interest. Maggiori and Mosso, as well as Wedensky and others, find that if the blood of a atigued animal be injected into another animal that is fresh and unfatigued, all the phenomena of fatigue will be produced. Wedensky has made a chemical analysis, and finds the poison to be similar to the analysis, and finds the poison to be similar to the
vegetable poison curare, into which the Indians used to dip their arrows, and a most deadly poison it proved to be. The poison engendered by fatigue is of the same chemical nature, and is as truly a deadly poison. In case it is created more rapidly than can be carried off by the blood, the organism suffers seriously.
A new prize has just been added to the long list of those awarded by the Paris Academy of Medicine. The prize is of the value of 24,000 francs $(\$ 4,800)$, the interest on a capital sum of 800.000 francs $(\$ 160,000)$ bequeathed by Mdme. Audiffred for the purpose. It s to be called the "Francois Joseph Audiffred Prize," and is to be awarded to any person, of whatever nationality and of whatever profession, who shall within twenty-five years from January, 28, 1896, dis cover a remedy, curative or preventive, recognized by the Academy as efficacious and specific for tuberculosis. In the meantime, the interest accruing from the bequest is to belong to the Academy, and can be applied in any way which that body may think proper. As the result of his prolonged study of those striking phenomena, the thunder storms of Madras, Prof Smith informs the Scottish Meteorological Society that the first remarkable fact observed by him was that of certain seasons of the year when sheet light ning appeared almost every night, always in a west or south westerly direction, and invariably near the hori zon; it may be, therefore, he remarks, that these discharges occur in the region where the moist and dustless sea winds meet the dry and dusty land wind, one being, perhaps, positively electrified and the other negatively. In these lightning displays, as many as three hundred flashes per minute have been counted, this rate being kept up for an hour or an hour and a half. Another notable peculiarity remarked of this egion is that the heaviest rains are unaccompanied by thunder. while the displays of lightning are not accompanied by any rain.
H. M. Bernard has been engaged for the past ten years in endeavoring to find an explanation of light sensations, and has at last worked out a theory which he considers capable of connecting and explaining most of the phenomena. He hopes also to prove that it is capable of demonstration, and is now engaged in arranging the evidence. Meanwhile, a short abstract is published of the conclusions arrived at, the develop ment of visual organs in the animal kingdom being briefly described as follows: Under the influence of light certain organisms traveling toward the light seek either to leave the Metazoan body altogether or else to discharge their contents at the surface. Such emiration cannot take place without the cognizance of he nervous sýstem, and in the most frequently illuminated parts of the body complications arise between the fugitives and the other tissues, notably the peripheral nerves. Bernard's suggestion, says the Maga zine of Natural History, is that out of these complica tions all the known eyes of the animal kingdom, the most complicated as well as the most simple, have arisen in one way or another.

MODIFIED MILK.
The result of scientific experiment with milk as a The milk. mik as a The usefulness of this machine is not alone in the ood is the successful establishment of laboratories for withdrawal of the fat from the milk; by its great ts modification. The first laboratory for this purpose force it separates dirt and other foreign matter comhat has been established in the world was opened in mon to milk, from the cream and milk, leaving them Boston in 1891. There is another now in New York as nearly clean as they can be. The cream which is City and a third in Philadelphia, while others are to be opened in several Western cities.

## separated is about 30 per cent fat. It is reduced to 16 per cent, which is the stable cream for the modifying

 per cent, which is the stable cream for the modifyingwhirled one or two minutes longer. After this they are filled with more hot water, to about the 7 per cent mark, and again turned for a short time, when the fat separates and its percentage is easily noted on the graduated neck of the bottle
When the modifying clerk is ready to modify the milk, he has before him several pitchers of fluids, arranged in regular order, so that he may readily use whichever one he may need at the moment.

The first contains an mount of the stable ream, procured from the parator which is used to obtain the prescribed percentage of fat. A second pitcher holds the separated milk, which he uses to gain the different percentages of proteids which he physician's prescripion demands. Another is a carefully prepared 20 per cent solution of milk sugar dissolved in distilled water. This is to make up the amount of sugar called for in the prescrip tion.
A fourth pitcher holds a quantity of lime water by means of which the re ction of the food is adjusted.
Distilled water is in another pitcher and is got from a still which stand at one side of the room.
Other vessels contain preparations of oats, barley and wheat, which are add ed to the milk to be used by infants old enough to have starch in their food.
From these fluids he
THE FAT TESTER
makes up the prescription measuring into a large graduate glass the exact num ber of ounces of each called for, and pouring the whole into a pitcher, which he passes to a second clerk. The milk is thus recombined with greater or less per centages of its parts, or constituents, as may be stated in the medical prescription.
The second clerk pours the modified milk into glass tubes devised especially for use as nursing bottles and for transportation, measuring into each tube the num. ber of ounces prescribed to be given at each feeding. When this is done the tubes of milk, which are held in light willow baskets of different sizes, or numbers of light willow baskets of different sizes, or numbers of
compartments, are passed to a second clerk who stopples them. Non-absorbent aseptic cotton is used for this purpose, a wad of which is forced into the neck of each tube and the refuse end cut off neatly with a pair of scissors, thus making a neat stopper. Thi having completed the modifying process, the sealed tubes in their baskets are taken to a room where ther is a large heater, into which they are placed. This heater is so arranged that the steam passing through it can be regulated to produce any degree of heat re quired. This is accomplished lev means of a regulator connected with the steam pipe. A clerk in charge uses


FILLING NURSING BOTTLES

This prevents the growth of bacteria. Here it is kept |umes of milk and commercial sulphuric acid of 188 until it is ready to be used, when it is taken to the specific gravity are put into test bottles having long separating room, where, by the use of a centrifugal graduated necks.
separator, the cream is separated from the milk. This These bottles are then put into the centrifugal ma machine is one of great delicacy and speed, revolving at the rate of six thousand eight hundred times per minute and works with such effect that only a small
rated cream and milk, and kept at $40^{\circ}$ Fah. tempera ture, to prevent the growth of bacteria, as milk that is modified from materials free from bacteria is better for the infant than milk in which the bacteria have been destroyed by heat.
This is then ready for the modifying clerk's use, and when desired is taken to the modifying room. The modifying clerk tests the milk each day in ord to ascertain the percentage of fat, as it in different differ from day to day, as the percentage in different This test is made with the aid of a machine called the Babcock milk tester. It is a centrifugal machine, into which bottles containing acidified milk are placed, and the fat is made to separate quickly and completely by rapid revolution.
The milk is acidified in order that the proteids casein, and fibrin may be changed to soluble acid albumens, which offer less resistance to the rising and aggregation of the fat globules. Nearly equal vo


THE WATER STILL.


MODIFYING MILK.
this to keep the heat at some desired degree, which he is enabled to do by watching the thermometer which is fitted to the heater
The milk is heated to one hundred and sixty-seven degrees when it is to be used within forty-eight hours This destroys any ordinary bacteria common to milk, but does not cook the milk or coagulate the proteids,
and is called "pasteurizing," from the eminent chemist Dr. Pasteur, who claimed this was a sufficient degree of heat for carefully prepared milk. But when the weather is very hot or the milk is to be sent great dis. tances, such as across the continent, or to Europe, and is expected to keep for more than forty-eight hours in good condition, it is heated to $212^{\circ}$ Fah., which sterilizes it. It has been found that to let it remain in the sterilizer forty minutes produces the best result When taken frou the sterilizer the baskets of mik are placed in cooling tanks, where the temperature is reduced to $38^{\circ}$ Fah. The baskets are then placed in wagons and delivered to the consumers in a short time. The returned baskets and tubes are taken to the wash room where they are placed in a special sterilizer and then washed n a solution of soda and water, thus guardin against all possible infection. All tags and stopples that are returned are destroyed.
The work of modifying milk has thus by scientific means become a most important facto in medical knowledge, and of great benefit to all through its utility in promoting the health of children and saving the lives of many who, by improper nourishment, do not survive th early maladies common to children. The work which has been brought to so successful an issue is sure to grow, claiming for its promot ers and originators the gratitude of many parents and the interest which the achievement of science have for most people.

The Carbon Process: Combination Printin Clouds Backrounds, etc by w. ethelbert henry, c.e.
When a beginner first undertakes to tackle arbon printing, he finds his chief troubles arise from the fact of being unable to watch the formation of the image upon the black, leathery tissue.

So far as correct exposure is concerned, a photometer proves a ready and reliable means of registration, but when it comes to printing in clouds or figures from one negative, and a foreground or background from another, the beginner is apt to feel at a loss, simply because he is dealing with an invisible image.
There are several well known plans of securing accurate registration of several imagres upon carbon tissue, all differing more or less one from the other
The method recommended by the Autotype Company is especially useful when one wishes to use part of the sky of a large negative upon a landscape print from a small one, but unfortunately their directions are hardly explicit enough for a novice. For instance, let us suppose that we have a half-plate negative, interesting in its main features, but devoid of sky; suppose, also, that we have a whole-plate negative containing suitable clouds that we wish to utilize by combining part of them upon the half-plate print.
To do this, we must cut a piece of white paper the size of the half-plate negative, and hold them together to ward the light, so that we can distinctly see an outline of the horizon. This outline must be traced in blacklead penci upon the paper.
We must next lay this tracing on a piece of yellow paper (such as thin canary medium-not fabric), and mark the outlines and the horizon line by going over them with a dull point; the outlines must be the exact size of the half plate negative.
We must next place the glass side of the half-plate negative upon the film side of the whole-plate, until the sky part covers that part of the whole-plate sky we wish to use. When the correct position is determined (and great care must be taken to have the horizon line level), the negatives must be held firmly together, while a finely pointed crayon is passed over the film of the larger negative, as close to the edges of the smaller one as is possible. This is to mark the correct position upon the cloud negative, the crayon lines being easily rubbed off with a piece of flannel when we have finished with them.
We must next cut the yellow mask the exact size of the half plate negative, and then divide it along the horizon mark into two pieces; before actually cutting it, it would be well to mark one side of the paper with two small crosses-one at the sky half and one below. This will render it an easier matter to avoid mistakes when fixing the mask in position. We will suppose that these crosses have been made upon the surface of the yellow mask while it is lying upon the film side of the half-plate negative in its correct position as regards the horizon and outlines.

Having now divided the mask into two parts, we must take the lower half and fix it (with its cross still
in view) upon the lower part of the outlined space on the film side of the whole-plate negative; the crayon lines of the bottom and sides being the guides as to correct position. The best way to fasten the mask upon the negative is to give the former a dab of thick India rubber solution upon each lower corner; in a few seconds it will be dry enough to stick where it is pressed. I need hardly add that a light pull will suffice to remove the mask without injuring the negative. We must next take the upper half of the mask and


## applying antiseptic stopper

fix it upon the glass side of the half-plate negative, with its extreme outside edges in register with the ontlines of the negative; in this case the mask (being upon the glass side of the negative) must be fitted with its cross in contact with the glass, and therefore out of sight.
We must now cut a piece of carbon tissue to the exact size of the half-plate negative, put a pencil mark upon the lower part, and expose it in contact with the half-plate negative for the necessary time; this must be done in diffused light, in order to avoid the outline that would inevitably be caused if exposed to the sun. The tissue must then be removed and placed within the crayon outline (and over the yellow mask) that marks its position upon the larger negative.
An exposure to light, more or less brief, must now follow, and in order to prevent a visible line of junction bet ween the sky and foreground, we must move a sheet of cardboard over the horizon line during the whole time. To do this, the card is usually held in one hand and drawn downward until the horizon is just passed, and then slowly moved upward to the top, or nearly the top, of the sky. This up and down

pasteurizing the milk
rate method, I can assure you that it is extremely simple in practice. As I am writing for beginners, I have necessarily described every minute detail-even as to which side of the negative is to be used. My long experience of beginners and their troubles has induced me to do this, as I know how difficult it is for them to follow the brief directions issued by manufacturers, who seem to take for granted that a beginner can divine by instinct a lot of details known to the writer of the "directions for use."
In order to combine a portrait from one negative ith a background from another, we must employ a somewhat different method. First take a print from the portrait negative upon a sheet of printing out paper or albumen paper. The outline of the figure must then be carefully followed with a pair of sharp scissors so that we secure two masks, one of which fits accurately within the other. The two masks are then ex posed to light until printed as dark as possible ; the background part is then stuck (face down) over the film side of the portrait negative with extreme care, so that all, save the figure, is covered. The top edge of the carbon tissue is then smeared with thick rubber solution, so that it will adhere to the top edge of the mask; then the exposure is made for the necessary time.
After exposure, the negative and tissue are taken together (still in contact) from the print ing frame, and a dab of thick rubber solution is put on the bottom (back) edge of the figure cut out. The carbon tissue is then gently raised from the battom, without disturling the top (adhering) edge, until the uncovered space of the negative is visible. The figure "cut-out" must now be carefully adjusted until it covers this space and fits the outer mask exactly; the carbon tissue is then gently lowered and firmly rubbed to make the figure "cut-out" adhere. The top edge of the carbon tissue must next be gently pulled from the negative, when the figure "cut-out" will be found covering that part that has just been printed The tissue, with the adhering cut-out, is now adjusted over the background negative (in a space previously marked, if it is a larger one), and printed for the necessary time. The cut-out is then removed fo future use, and development is conducted in the usua way.-The Amateur Photographer.

Curious Effect of Lightning on a Trolley Car. A case is reported in New Brunswick, New Jersey, of a trolley car being struck by lightning on the after noon of May 5, during a thunder storm. The elec tricity ran down the trolley pole and entered the car part of the current running on to the lighiting circuit burning out the incandescent globes. So intense was the heat in the lamps that the glass globes melted wost of the glass fell on the floor, but other drops went into the laps of women and more fell on their hats. The ladies thought they had cause for com plaint, and demanded that the officers of the company make good the damage to their garments. This singular instance of the effect of a sudden stroke of lightning makes it necessary for some new invention to be devised for the prevention of a similar disaster.

## Percentage of Moisture in

A
According to M. Deplay, green wood when cut down contains about 45 per cent of its weight in moisture. In the forests of Cen tral Europe wood cut down in win ter holds at the end of the following summer more than 40 per cent o water. Wood kept for several years in a dry place retains from 15 to 20 per cent of water. Wood which has been thorougbly desic cated will, when exposed to air under ordinary circumstances, ab sorb 5 per cent of water in the first three days, and will continue to absorb it until it reaches from 14 to 16 per cent as a normal standard The amount fluctuates above and below this standard according to the state of the atmosphere. M Violette found that by exposing green wood to a temperature of
(avement should be continued, more or less slowe be neatly graduated
Of course, it is necessary to use a "safo edge," as in ordinary carion work; the one on the large negative can be a temporary affair made with a few lantern lide binding strips tixed to the glass side. Although the foregoing may seem rather an elabo
$212^{\circ}$ F. it lost 45 per cent of its weight, which accords with observations of M. Deplay He further found that by exposing small prisims of wood one-half inch square and eight inches long, cu out of billets that had been stored for two years, to the action of superheated steam for t.wo hours, they ost from 15 to 45 per cent of their weight, according to the temperature of the steam, which varied from $257^{\circ}$ F. to $437^{\circ} \mathrm{F}$. $\left(125^{\circ} \mathrm{C}\right.$. to $225^{\circ} \mathrm{C}$. $)$

## National Electrical Exposition Notes.

The second week of the exposition finds the whole exhibit in good working order, and the somewhat dim illumination of some of the side aisles, which was noticeable at the opening, has given place to a blaze of light which is fully up to the level of the rest of this excellent display. The great advance which has been made of late in the manufacture of arc lamps is evident from the perfect steadiness of the lighting; and the visitor is also struck with the endless variety of devices for softening and for diffusing the light. Incandescent lamps are shown in soft and pleasing colors, and the display of arc lamps proves how much can be done to render them beautiful, not merely in color, but in the shape of the globe and details of the fittings. The George A. Macbeth Company, of Pittsburg, Pa., exhibit some varieties of what they call the holophane, a glass globe which is cut into a series of concentric angles on its outside surface and on the inside is cut into radial angles. The light is caught and refracted by these angles until the whole surface is brilliantly aglow.
It is unfortunate that a larger percentage of the visitors do not inspect the light and power room on the first flocr. It is now in full running order, and, as an exhibit of the best and latest practice, it is a valuable object lesson for the electrical engineer. The Siemens \& Halske dynamo, with its outside armature, will attract attention. It is a 100 kilowatt machine, direct connected to a 150 horse power Ball \& Wood engine. It is run at 250 revolutions, and the smoothness and silence of the running are remarkable. This engine is built with a telescopic valve, designed to take up the wear. A small model of the valve is shown and explained by the attendant.
Next to this stands a Phœnix horizontal tandem compound engine, direct connected to an 80 kilowatt Walker generator. The high pressure cylinder is in front and the low pressure cylinder is bolted to a subbase. The arrangement is compact and facilitates repairs.

What may be called the popular side of the exposition has been well provided for ; and one of the most popular exhibits is that of the Practical Laboratory, which is under the supervision of Mr. Max Osterberg, of Columbia College. Practical demonstrations are made of the various principles of electricity. An arc light is seen burning under water, and this experiment is shown with the apparatus made by Prof. $\mathbf{R}$. Ogden Doremus, of the College of the City of New York, Bellevue Hospital, and used by him in a lecture at the Academy of Music in 1856. The electrolysis of water and the electro-magnet are popularly explained, and a machine is seen in operation which illustrates the action of Fuco's currents.
On the same floor is an extensive exhibit of machines designed by Elihu Thomson, which has been brought over from the Thomson-Houston factory, Lynn, Mass. This contains, among other objects of interest, an oscillating type watt meter; the original welding transformer; a case of three dozen photographs of past and present transformers; and several examples of electric welds, including 3 feet of $1 / 4$ inch welded chain, there being t wo welds in every link, a welded band saw, and a plate iron lap riveted joint, in which the rivets are practically welded into place. There is also a fine exhibit of Mr. Thomson's are lights of the original T D and K type, and of dynamos built in 1876 and 1878.
Before leaving this floor, a visit will be paid to the exhibit of the electrical wonder of the hour, the Roentgen $X$ rays, which are shown by Mr. Edison by means of his fluorescent screen. The crowd of sightseers is passed in single file into a dark room, where the screen is arranged inside a railing, in much the same way as an ordinary ticket window. The crowd passes one by one, in front of the screen, which is about 18 inches square, and the hand is passed up within the screen and placed against it. The current from the powerful Ruhmkorff coil, of 25,000 volts, is turned on, and immediately the screeu glows with a pale light, upon which is seen the ghostly shadow, or shadows, of the hand, the flesh showing up in faint shadow, the bones in darker shadow, and the ring, if one is worn, showing out in black. One must confess that a result which is merely interesting on paper becomes a little grewsome when seen through one's actual living flesh. The arrangements were so well carried out that, in the course of an hour, some four or five hundred persons must have taken a look at their anatomy.
On the main floor, the latest developments in the manufacture of wire and cable and various improved methods of insulation are shown at the two booths of the Safety Insulated Wire and Cable Company and the Washburn \& Moen Manufacturing Company. A curiosity in the latter exhibit is a coil of copper wire which is $151 / 2$ miles long and weighs only a trifle over 2 pounds. The wire is $\frac{29}{10000}$ of an inch in diameter.
The John A. Roebling's Sons Company show a bi metallic wire-a steel core with a copper jacket-which combines the conductivity of copper with the strength of steel. A wire, $\frac{32}{100}$ of an inch in diameter, has a strength of $5,700 \mathrm{lb}$., and weighs $1,620 \mathrm{lb}$. per mile
Across the way from these booths will be found a
display by the Fort Wayne Electric Company. They show a single phase alternating current motor, of 10
horse power and 16,000 alternations; also a 5 horse power single phase alternating motor driving a 7 kilo watt bipolar 110 volt dynamo.
The attendance at the exposition has been very gratifying and is increasing.

## A NATURAL MOUSE TRAP.

Mr. W. H. Marris sends us the following curiosity ays the Anuateur Photographer:
From time immemorial the mouse has been classed with the pests with which mankind has had to deal. The little animal has three leading and discreditable characteristics, i. e., thief, trespasser and destroyer of property. It is therefore not surprising that human ingenuity has been ever actively employed against the unwelcome creature's life
Besides the chemist with his poisons, and the wood and wire workers with their clever devices, the mouse has had a natural foe in the cat; but notwithstand ing all kinds of snares, mice are not yet exterminated. But since the creation there has surely not been known a more curious enemy to mice than the one that has (Grimsby), on the night of March 28
An oyster was on that day placed on a pantry floor and during the night (feeling thirsty) it opened its shell. Three silly, wandering mice were near too, and smelling fish, all placed their heads just inside for a taste. This intrusion was instantly resented by the occupant of the shell, and hastily yet silently a relent less grab was made, and those foolish mice were sud denly executed prisoners.
Such a thing has been known on oyster boats here


OYSTER AND MICE
s the capture of a single mouse by an oyster, and rats have suffered injuries to legs, etc., but the trapping of three mice simultaneously is a record for an oyster, which I think at present is acknowledged a unique feat.
Has the oyster firmly conspired to oust the cat from the legitimate occupation for which it has so long been enowned?
Thanks to the art of photography, our readers are able to see an exact picture of the captor and the cap tives just as found.

## New Method for Measurement of High <br> Temperatures.

M. Daniel Berthelot has devised a plan for the meas rement of high temperatures which depends on the refractive index of the heated gas. It has recently been ascertained that if you bring a given gas to a given density it will have the same refractive inde whether you reach this result by varying the pressure or the temperature or both, says the Progressive Age Consequently, M. D. Berthelot takes two tubes, along which he passes two beams of light obtained by split ting up a beam of light from a single source. When these two beams are made to fall on the same spot, they produce certain fringes, due to interference. If one of the tubes be heated, these fringes are displaced; but they can be brought back to their original posi tion by varying the pressure in the colder tube. This alteration of pressure then produces exactly the same alteration of density in the colder tube as is effected by the heat in the hotter one; and this enables the temperature in the hotter tube to be calculated. After settling that this could be done, M. Berthelot proceeded to simplify the method by working with only one tube, filled with ordinary air; and he expects to be able to make the method one capable of being readily applied for manufacturing purposes.

## Notice.

A premium of $\$ 250$ is offered by the Scientific American for the best essay on
the progress of invention during the past FIFTY YEARS.
This paper should not exceed in length 2,500 words The above-mentioned prize of $\$ 250$ will be a warded for the best essay, and the prize paper will be published in the Special 50th Anniversary Number of the Scientific American of July 25. A selection of the five next best papers will be published in subsequent issues of the Scientific American Supplement at our regular rates of compensation.
The papers will be submitted for adjudication to a elect jury of three, to be named hereafter
Rejected MSS. will be returned when accompanied y a stamped and addressed envelope.
Each paper should be signed by a fictitious name and a card bearing the true name and the fictitious name of the author should accompany each paper, but in a separate sealed envelope.
All papers should be received at this office on or beore June 20, 1896, addressed to

Editor of the Scientific American,
361 Broadway, New York.

## Sorrespondence.

## The New Hudson River Bridge

To the Editor of the Scientific American
Your beantiful illustration of the proposed new bridge over the Hudson River at New York, in the May 2 number, excites everywhere intense interest.
The central span, 3,254 feet, may, perhaps, be in possible to diminish, but the cost of the bridge itself $\$ 25,000,000$, could certainly be diminished one-half, for it is intended that there shall be six railroad tracks, and the bridge be strong and heavy enough to carry all the tracks, loaded with trains (including, of course, 100 ton locomotives) from end to end, or a total live load equivalent in weight to 30,000 tons.
May I not modestly suggest to the engineering fra ternity that by limiting it to two tracks only (or four at most) with two or four cars to each train and no locomotives, the bridge would be perfectly capable of doing all the work and even more than the system as at present proposed, at the same time the cost could be diminished to within eight or ten millions, and make a much stronger and more beautiful structure.
Strickland Kneass, Esq., the engineer of the Penn sylvania Railroad some seven or eight years ago, deferred recommending such a structure to Thomas A. Scott, then president of the Pennsylvania Railroad Company, because his estimate of eight million dollars for the cost was too stupendous to undertake, and for the cost was too stupendous to undertake, and
that included taking one hundred acres of the southerly end of Central Park for a grand interna tional depot.

Henry Day.
New York, May 8, 1896.

## Valuable Patent

American inventors will have their ambition excited by the recent sale, by the Diamond Match Company of Chicago, Illinois, of patent match making machin ery and rights to European governments. That com pany received $\$ 600,000$ from the French government and $\$ 800,000$ from the Italian government, and it is re ported that they will receive similar sums from Ger many, Austria-Hungary and other countries, says the American Woodworker. Five years ago the science of converting logs into matches was said to be a finished science, incapable of further improvement, but American ingenaity has shown that what was "perfect work" in 1891 will not answer for 1896. Even now the machines used in making matches, wonderful though they are, are not to be left unchallenged, as inventor are working on new ones, whose capacity will, they clain, far excel that of the best machines now in oper ation. He is a bold, or a very ignorant, person who will in these days assert that any process, tool, ma chine or device is incapable of further improvement There may be, there are, many absolute failures in the works of the inventors, but it is an open truth that there are many satisfactory successes also, and that through the labors of these ingenious persons every thing in the shape of machines is gradually coming to a higher plane.

On April 20 Senator Cannon introduced a joint reso ution which if it is enacted into law would give the city of Washington a remarkable attraction. Mr. Cannon proposes to have constructed an enormous map of the United States showing every hill, mountain, valley, river, lake, village, eity and railroad. Al his is to be done in miniature but on such a scale a will give a map about two-thirds of a mile in length by one-third of a mile in breadth. The map is to be constructed on such a scale that one foot of map sur face would represent one square mile of the actua area. The proposition is a serious one, although it is not likely to be received as such. The value of such a map would be very great.

THE JETTIES AT GALVESTON HARBOR. (Continued from first page.)
jects. Under that of 1880 a jetty was built from Fort Point, the east end of Galveston Island, to the crest of the outer bar, but it was not fully completed
The modification of 1886 (now in progress of execution) was with a view to a possible depth of 30 feet, by means of jetties, to be supplemented, if need be, by dredging. These jetties were to be of rock and to be built to a height of 5 feet above mean low tide, extending if necessary to the contour of the 30 foot depth in the Gulf, their sea ends to be 7,000 feet apart, and the south jetty to follow the line of the jetty of 1881. But it was decided to connect the inner end of that jetty with the relatively high ground upon which the city of Galveston is built by a stone dike known as the shore branch
The cost of the modification of 1886 (the present project) was estimated at $\$ 7.000,000$. The total amount expended under the foregoing plans to December 12, 1895 , was $\$ 4,846,105.08$, in addition to which there was expended $\$ 100,000$ subscribed by the city of Galveston in 1883. The total work done since operations began in 1887 is represented by 33,820 feet of south jetty, of which 32,000 feet is completed, and 23,600 feet of north jetty, of which 21,200 feet is completed. Both jetties are beyond the bar, in about 23 feet of water.
The general construction of the jetties has been modified from time to time as the exigency of the work demanded, but in general it has been carried on as shown in the accompanying illustration. The trestle is driven from 600 to 800 feet in advance over the old mattress work and the caps, stringers and rails properly secured by straps, bolts and spikes. Then large sandstone riprap is unloaded on each side of the track. In the center and between the mounds thus formed there is unlcaded small sandstone riprap to the same height as the mound, the whole forming an apron with a base of about 20 feet on top of the old mattress work. The trestle and apron are continued in advance and the work which was be fore an apron is now brought up to mean low tide with large riprap, the small riprap being filled in as before. This riprap slope is straightway pro tected with granite blocks to a little above mean low tide. A bracing gang then comes along and secures the bearing piles above the ravages of the Teredo navalis by a system of bracing, which also acts as an anchor and underpinning. Then the crest between and around the bents and underpinning and underbracing is filled with large and small riprap as before. Then over this riprap crest is laid selected granite block so as to conform as nearly as possible to the required cross section. The spaces between the blocks are then filled with large and small riprap, properly wedging and leveling off the crest, the whole presenting a comparatively smooth and even surface to the waves.
The sandstone riprap has been procured from Ledbet ter, Quarry Station, and Heber stone quarries, Texas, and the granite comes from Granite Mountain, Burnet County, Texas. The minimum weight of the block of granite used is five tons, and on the arrival of the stone in the contractor's yard at Fort Point it is in spected as to its hardness, toughness, weight and du rability. The hardness and toughness is determined by the hammer, the weight by specific gravity, viz., immersing a large sample of stone of known weight dry in a tank filled with water, then catching and weighing the displaced water and reweighing the sample wet, the amount of water imbibed by the sample is also noted; using the specific gravity data and the stone's general appearance, durability is determined, supplemented by immersing samples in sea water and carefully noting disintegration or change of any kind The stone is also subjected to "M. Brard's method" of testing

The jetties when finished will make Galveston the export and import harbor of a large section of country.
I am indebted for data to Major A. M. Miller, U. S A., engineer in charge, Mr. E. M. Hartrick, assistan engineer. and Mr. C. H. McMaster, secretary, Galves ton Chamber of Commerce.

Dr. Fick has shown that winking is more frequent as the retina becomes more fatigued, and it has been found that in reading at a distance of 30 centimeter the number of winks per minute is 1.8 with electrical illumination, 2.8 with gaslight, while with weak illumination which only permits reading at 18 centimeter the number is 6.8 per minute.

jetties at galveston harbor, texas-sectional view

The abortive effort of the old Panama Canal Company to connect the two oceans is marked by a long pany to connect the two oceans is marked by a long
stretch of incompleted work at the Isthmus. It is estimated that of the total sum handled by the com pany, about $\$ 100,000,000$ was misappropriated by the promoters, and that about $\$ 150,000,000$ was spent in the purchase of plant and in actual work upon the canal; while some $\$ 20,000,000$ is held by the French courts and will be available should construction be carried on.
Mr. Robert T. Hill, of the United States Geologica Survey, who has made a personal visit to the cana wo:ks, states that the canal commission has employed about 2,000 men during the past year, and that the plant is being kept in good order and will be available if work should be started. About twenty mile have been completed, and twenty-five miles remain to be cut. To complete the canal with six locks and a dam at San Pablo would cost $\$ 116,000,000$ in addition to the $\$ 266,000,000$ already spent. The work of raising this large sum of money is rendered difficult by the fact that public opinion in France demands that thos who furnish the new capital shall share the dividend of the completed canal in common with the origina shareholders.
Another scheme for the passage of shipping from ocean to ocean is that which proposes to build, a Tehuantepec, a ship railway capable of transporting vessels of 10,000 tons displacement. The advocates o this scheme believe that had it not been for the un timely death of Capt. Eads, who was an enthusi astic believer in the possibilities of the ship railway, it would have been built and in operation by this time. It was unfortunate, moreover, for the success of the Tehuantepec scheme that work on the Chignecto shi railway, from the Bay of Fundy to the Gulf of S La wrence, was shut down when it was within measur able distance of completion. Once the latter schem is in successful operation, it is likely that an effort will be made to construct a sim ilar road at Tehuanrepec. Elmer I Corthell, in recent number of the in a tional Geographic Maga zine, estimates the cost of the ship rail way at $\$ 60,000$, 000 . The relatively smal cost of construction of the railway, and the fact tha it would bring Atlanti and Pacific ports 1,40 miles nearer than the canal, are consideration which make it likely that if the Chignecto railway successful, the building o the Tehuantepec line will be seriously considered.

## Sul the Vital

Sustain the vital forces
dree years showed a mean rainfall of over twenty-two eet, and on the west coast the mean for fourteen eet $n$ ins ine feet five inches, varying ber. In view feet nine inches and two feet eight inches. In view of
the fact that the proposed canal involves "the construction of numerous dams and embankments of struction of numerous dams and embankments of
magnitude, some of them without precedent in engineering practice, and all involving serious hydraulic problems," the necessity for obtaining accurate local ecords of the rainfall is apparent. As an instance of the discrepancy between the figures of the engineers of the company and those of the government engineers, it is sufficient to state that at a point a few miles below the Ochoa dam the former estimated the maximum flood discharge of the river at 42,000 cubic feet per second, whereas the latter estimate this discharge at 150,000 cubic feet.
The great Ochoa dam, in some respects an unprecedented undertaking, is estimated by the company to cost $\$ 977,000$ and by the board of engineers to cost $\$ 4,000,000$; and throughout the whole route, from Greytown to Brito, the estimates of the company ar argely increased by the President's commission.
In concluding, the report recommends that a sum of $\$ 350,000$ be spent in ascertaining by a thorough survey the necessary data for the drawing up of reliable plans and estimates. Such a survey would inspire conf dence in the financial world, and would give a stand ing to the enterprise which it cannot be said to pos sess at present. The Nicaragua Canal Company is requesting that Congress guarantee its bonds to the extent of $\$ 100,000,000$. Before any such sum is pledged to the construction of the canal it is not too much to ask that the nation shall know with some cer tainty what the actual cost of the undertaking will be Taking it altogether, if the final recommendation be carried out, the report should exercise a favorable influence upon the project; and it is likely that, when an exhaustive survey has been made, the commercial and strategic advantages of national control of the canal will lead to its being materially assisted by th government.

After all, this is the key to life. It is the guide to the restoration of health. It is the primary principle in the successful treatment of disease. Talk as you will about the invasion of the human body by bacteria Sustain the vital forces, if you will render them powerless. Bacteria cannot thrive in the physiological field. The unseen enemies of this silent realm are rendered harmless in a body of perfect health. Th ateful germ can only enter when its defenses ar destroyed. Antiseptics may kill the germs or stop thei propagation, but the main thing, after all, is to sustain the vital forces.
The old idea of battling with both nature and disease is exploded. He who depresses the system to get rid of pathological conditions is behind the time.
Germs are always with us, but they can do no harm unless through some breach they enter the sanctuary Even then they are often rendered harmless, except it be some organism whose defensive mechanism is ren dered weak through excesses or disease. Germs may produce disease, but health never produces germs. Deadly germs must live only in a pabulum homogene ous to their character; hence, so long as the strength of vital force is maintained, they are insignificant crea tures.
Sustain the vital forces. In health this means to keep in health. It means good air, thorough cleanliness good food, no excesses, labor in moderation, no menta worry.
In sickness, it means more. The flagging energies wust be revived, stimulated, toned. Air, cleanliness food, must be by special selection. Drugs can only do good when they rid the system of morbific matter and restore the function of organs. We aid in tissu building when we sustain the vital forces. We restore function by sustaining the vital forces. We drive out bacteria and render them harmless by so doing. The whole medical world is coming to this old tenet, which formed at the beginning of our reformation the key stone and head of the corner.-The American Medical Journal.

TYPEWRITING AND ADDING MACHINE.
The accompanying illustration presents a machine intended to cover a substantially new field in typewriting and adding machines. It is the property of and is being manufactured by the Numerograph Manufacturing Cowpany, of Charleston, W. Va., under patents to George W. Dudley, No. 554,993, 555,038 and 555,039, of February 18, 1896.
The object of the invention is to quickly and accurately adid a column or columns of figures and, at the same time and by the same manipulation of the keys, to print upon a sheet of paper or a blank book these figures in the order in which they are added, so as to form a proof sheet which shall verify the correctness of the addition, and which machine, by special adjust ments, may be made to print at the end of the column the sum total of the column, and to do the work in a vertically descending progression or vertically ascending progression or in a horizontal progression.
It verifies, by printing in full sight, each figure to be added at the same time the addition is made, and is so constructed that, if the proper key is struck, the result must be perfect. It works with the ease of a typewriter and its speed is only limited by the skill of the operator. It subtracts by reversing the machine as readily as it adds; in other words, the registering disks run one way as readily as the other. It carrie automatically. The keys all work in the same horizontal plane and have for each figure the same dip or extent of depression. Its construction is simple, considering the variety and extent of work done, and its action in all its parts is positive. It is adapted to print ing on pass books with the same facility as upon the ordinary platen and sheet. Additions can be made either to the right or to the left. It can be used to add without printing or to print without adding. Mistakes, if made, can be seen at once, and corrected as easily as mistakes upon the typewriter. The illustration represents a double machine, upon one side of which can be kept the debts and on the other the credits, and a balance can be struck by deducting the one from the other, as shown in the example given.

OAKLAND, Cal., claims to be the healthiest city in the world, or, at any rate, in the United States The death rate has fallen since 1882, when it was $13 \cdot 56$ a thousand. Last year it was 11.85 a thousand, This approaches near to the sanguine sanitarian's ideal of 11 in a thousand.

AN INGENIOUS TOOL HOLDER ATTACHMENT.
The accompanying illustration shows an ingeniou device for reducing the friction of the tool of a slotting wachine on the return stroke across a piece of work. As ordinarily made, the tool flap is of heavy construc


TOOL HOLDER ATTACHMENT.
tion, and it bears against the work with a greater pressure than is desirable, tending to spoil the edge of the tool. To reduce this pressure and lighten the tool flap, Mr. Johnson, the master machinist at the Watertown Arsenal, has designed the attachment which is herewith shown at work on a slotting ma chine. It will be seen that the slidinghead is provided with a stout, downwardly projecting tool holder, which is held in a vertical pocket. At its lower end the tool holder is provided with a hinged tool flap, which is so arranged that the tool can swing backward, as usual, to clear the work on the return stroke

The tool is held against the work by the action of a small coil spring, which is located in a recess drilled to receive it in the body of the vertical bar. The holder with its tool can be rotated by means of the hand crank and worm gear, carried on projecting lugs at the base of the sliding head.

## On Some Physical Properties of Argon and Helium.

Lord Rayleigh has made a new determination of the specific gravity of argon, using a large volume of the gas separated from atmospheric nitrogen by sparking with oxygen. The result obtained, referred to $\mathrm{O}_{2}$ as 16, was 19.940 . Prof. Ramsay had previously obtained a density of 19.941 for the gas obtained by the magnesium method, so that it is evident that the product obtained by the two methods are identical. The author has also determined the refractivity of argon and helium, with the results that the refractivity of argon is 0.961 , while that of helium is 0146 , compared with air as unity. The result in the case of argon is very unfavorable to the view that this gas is an allotropic form of nitrogen. The refractivity of helium is remarkably low, the lowest previously known being that of hydrogen, which is nearly 0.5 that of air. The results of determinations of viscosity were for helium 0.96 and for argon $1 \cdot 21$, referred to dry air. The latter number is somewhat higher than that for oxygen, which has stood at the head of the list of the principal gases in this respect. The author has found, says the Chemical News, by spectroscopic examination that the gas emanating from the Bath springs contains both argon and helium, with probably less than 10 per cent of the latter in the mixture of the two. Gas from the Buxton springs was found to contain about 2 per cent of argon, while the presence of helium in this gas in very small quantity was probable, but not certain The interesting question concerning the existence of helium in the atmosphere was attacked by allowing the greater part of samples of atmospheric argon to be absorbed by water and examining the residues by the spectroscope. It was expected that helium, since its solubility in water is but about one-fifth that of argon could be concentrated in these residues if it wer present. No helium could be detected in this way and the author concludes that if helium be present in the atmosphere, it must be in very small quantity, probably much less than a ten thousandth part. American Journal of Science.


THE HUNGARIAN MILLENNIAL EXPOSITION OF BUDAPEST.
When a people can look back to the ninth century ngs of its national existence, and trace
of the realm has a village in the grounds, where are $\begin{aligned} & \text { opened with imposing ceremonies on May 2, by the }\end{aligned}$ carried on the daily vocations of home life, thus giv- Emperor Francis Joseph, as King of Hungary; it will ing, for the first time, an ethnographic picture of the ing, for th
kingdom. remain open antil October 31. During the continu ance of the Exposition, there will be an almost uninterrupted series of festivities. In nearly all the towns
and cities of the that it should not only cherish a just pride in its antiquity, but wish to celebrate the thousandth anniversary in such a manner as to attract the attention of the nations of the world. The Hungarians, led by Arpad, established a new natished in the year tion in the year
896 , and now the descendants of descendants of
this intrepid host honor the thousandt anniversary of that event by giving at Budapest a "Millennial Exposition" which is unique in character and extensive in scope. For the ExposiFor the Exposi-
tion, the most beautiful park of Budapesthas been selected, and it has been beautified by the erection of bridges to portions of the port park. From the banks of the natural and artificial
lakes and streams
land monuments and institutions will be inaugurated. Among the rated, Among the most important
of these events will be the laying of the corner ston of the triumpha arch, which will cost 800,000 florins, and the opening of the new Parlia ment House, one of the most mag nificent buildings n the world which has cost $\$ 6,400,000$. The new waterway, built by Hunga rian engineers throught the "Iron Gates" of the Dan ube, will b thrown open to in ternational traffic Some time during September, an historical pageant will be held. More than 2,000 persons will take part in it. Its object is to depict in vivid colors the most important polit cal events, histori cal heroes, etc., al clothed in cos in mitation of those of centuries ago. that may be expected in an exposition which illus- tumes appropriate to the epoch they illustrate. In The directors have wisely planned an educational trates Hungary. It is not an international exposition spectacular effect this gala procession will outdo anyexposition on a gigantic scale. The thousand years of in the sense that all the work of the world is to be thing of its kind yet seen.
Hungary have been divided into eight distinct epochs. shown there, as in Chicago or Paris; it depicts the The Historical building, which we illustrate, is acomTo each of these a separate building of appropriate Hungarian nation, and no other.
architecture has been assigned, and the contents are The Exposition grounds ocupy 129 acres. s. There following description we are indebted to an enterprisillustrative of that period, showing its arts, industries are about 169 buildings and paviions, which were ing American journal, the Hungarian American. The


THE HUNGARIAN MILLENNIAL EXPOSITION AT BUDAPEST-THE HISTORICAL BUILDINGS.
group of buildings is made up of individual elements, each one of which expresses a distinct period of architectural evolution, as Romanesque, Gothic and Renais sance. Segesvár has afforded the model for one tower, while the higher is a union of numerous suggestions found in the famous ruins of the country.
The Vajda-Hunyad castle contributed the balcony, Diakovar the portals, the arch and the coat of arms. The fourteenth century Gothic has been followed in the body of the building. Instead of a king's pavilion, apartments have been prepared in the "Roman" (Romanesque) historical building. This idea is a particularly happy one. The façade of the Romanesque building is one of the most remarkable features of the whole exhibition. It is a copy of the front of the church of Ják, a pearl of the Romanesque period. It is the oldest architectural monument of Hungary. The whole structure of the Exposition is destined for memorial, historical and artistic objects of the oldest Hungarian historical period-the time of the Arpads. Here in the midst of venerable relics the King of Hungary will receive the guests of high rank.
The Hungarians have long been noted for their hospitality, and from all accounts visitors to the Exposition give the citizens of Budapest high praise for their attention to strangers.

## Wonderful Development of the Ele Elevator, and the Cause Thereof.

by william baxter, jr.
The practical application of the electric elevator has progressed in such a quiet and unobtrusive manner that very few outside of those directly interested in the industry have anything like a correct impression of the extent to which it is used at the present
time. When the electric motor first cane into use, and it was demonstrated that it was a substantial and serviceable machine, its use for the operation of elevators was at once suggested, and many were installed for such service. But in all these early applications, an ordinary stationary motor was used to drive a belted elevator machine of the type generally used in factories, where they are driven from the line shaft by an open and a cross belt. To-day there are probably not far from one thousand elevators of this class in New York City that are operated by electric motors.
The real electric elevator, however, did not come into the field until about eight years ago. At that time some of the most progressive elevator builders concluded that a self-contained electric elevator would find a wide field of application in all small buildings where a hydraulic plant could not be installed, eithe on account of lack of space or cost of operation. From time to time since then many of the hydraulicelevato builders have added an electric machine to their list of apparatus. And at present all the prominent concerns are manufacturing them. About five years ago new corporations came into the field as manufacturers of electric elevators exclusively. The older builders have always maintained that for thoroughly first-class installations the hydraulic elevator was the only proper thing, and that the place for the electric was in small buildings, where cost of operation and in stallation constitute important factors.
The manufacturers of electric elevators exclusively on the other hand, insist that the electric is the best for all cases, and that it is only a question of time when it will drive the hydraulic out of existence, as effectually as the latter drove out the steam elevator, which twenty five years ago held almost undisputed possession of the field.
What the final outcome of this contest will be would be difficult to predict. At the present time it looks very much like an unequal fight; for the opponents of the electric elevator as a rival of the hydraulic are really between two fires. They cannot advocate the electric very strongly, as they desire to maintain the supremacy of the hydraulic, and if they endeavor to depreciate its merits too much, they only succeed in creating the impression that their confidence in their own electric apparatus is not very strong, and this they cannot do, as it would give their rivals in the electrical field an advantage.
That the sphere of usefulness of the electric elevator is not confined to as swall and unimportant plants as the builders of hydraulic apparatus have been accustomed to claim can be demonstrated by the character and size of the buildings in which they are now used. Within the past two or three years, a large number of new buildings have been erected in Broadway and the adjoining streets between Canal and Fourteenth Streets.
These buildings are, with few exceptions, modern fireproof structures, from eight to twelve and more stories high. Some are used as manufacturing establishments, and others as show rooms for out of town firms and as office buildings. In outward appearance as well as in interior decoration some of them rival more pretentious structures down town.
An inspection of these buildings will show that nearly all of them are provided with electric elevators.
In most cases only one or two elevators are used, but
n some of the larger buildings as many as four or six In be found.
In all these cases the current is taken from the electric light mains running through the street, and the cost of operation is found by actual experience to be very low. This is due to the fact that the charge for current is based on the quantity used, as indicated by a meter, and as the elevators only use power when in motion, the average amount is very small. In buildings where the elevators are kept in constant use the charges per car are correspondingly high, although they seldom go beyond thirty-five or forty dollars per they seldom go beyond thirty-five or forty dollars per
month for each elevator. But in smaller buildings, month for each elevator. But in smaller buildings,
where the elevators only run in answer to a push but where the elevators only run in answer to a push but
ton call, the monthly current bills run as low in some cases as five or six dollars.
The builders of electric elevators, exclusively, claim that in larger installations, where a generating plant is used, the operating expenses would be less than with hydraulic eievators. Their basis for this claim is that the electric generators can be driven by steam engines of higher efficiency than the ?steam pumps used for a hydraulic system. To offset this the hydraulic men claim that as in their system pressure tanks are used the size of the pumps can be made nearly equal to the average power required to keep the elevators in motion, because the pressure tanks act as a storage reservoir; but as no such energy storing device is used with the electric system, the capacity of the engines must be equal to the maximum demand, and there fore that their average rate of working will be so far below the point of highest efficiency that their actual economy over the steam pumps will be swall, if any at all.
This claim would hold good if a single elevator were used, but in any case where a generating plant would be installed, the number of elevators would probably not be less than four or five, and might be many more Now, when a number of cars are used, the capacity of the generating plant would not have to be much in ex cess of the average, because all the cars would not have to do the maximum work at the same time.
The introduction of an electric elevator plant in buildings of the most pretentious class may not depend so much upon the relative economy of a complete electric system as compared with a complete hydraulic system as the contending factions appear to believe In large buildings heretofore erected, it has been cus tomary to install an electric lighting plant, because under the conditions existing it was found that the cost of lighting could be greatly reduced in that way. A battery of boilers and an engineer and fireman were levarer order to furnish steam for the hydrauli electric generator only increased the operating expenses by the amount expended for a few tons more of coal. The cost of this coal was found to be so small a percentage of the charge of the lighting companies or current as to enable the saving to soon pay for the cost of the electric plant.
Inasmuch as the use of electric elevators operated by current taken from the street mains renders the use of boilers, engines, engineer, and fireman unne cessary, it becomes a question whether even in the largest buildings it would not be more economical and convenient in every way, to discard the generat ing plant. The fact that in some large buildings where electric lighting is used, and where there are a number of electric elevators, this plan has been
adopted would show that in these cases at least such a conclusion has been arrived at.

Harsion of Emery into Corundum.
Mr. Hasslacher has patented an electric process of converting emery into corundum by means of the ar of alternating currents. As heat and not decomposi ion is aimed at, continuous currents would be unsuit able. The furnace is made of firebricks and stands on two bridges; the hollow underneath serves as recep tacle for the fused mass, there being a small hole in the bottom of the furnace. This hole is covered with a glass plate. The electrodes (carbon rods) are ap proached to within one or two inches; the interval is packed with lumps of carbon. The emery, also the finest dust, of little use otherwise, is mixed with pow dered coal, the amount depending upon the iron oxide in the emery; for 25 per cent of oxide 5 per cent of carbon is reckoned. The coal lumps are soon burned by the oxygen of the iron oxide and the arc form under hissing. The inner mass begins to melt, the glass plate gives way and a stream of fused corundum flows out. The hard outer crust is then broken with ron rods and new material thus fed to the arc. This addition stops the flow, which starts again after ten or fifteen minutes. The base plate is strewn with fine mery powder to protect it from the intense heat of he fused mass. The resulting corundum is almos ree of water, of which the emery contains about per cent. It is crystalline, colorless, and then resen bling quartz; pink or blue, fine, small crystals of sap phires have been found in druses. The current is kep at 250 amperes and the pressure is 40 or 60 volts.-The

In order to obtain the opinion of the readers of the Cientific American as to what invention intro duced within the last fifty years has conferred the greatest benefit upon mankind, we publish the accompanying card, which please cut out and return to the editor. Those who preserve the paper for binding and do not desire to deface their files, or who read this notice at a library, will please answer by postal card. It is desired to get as full a vote as possible. The result of the vote will be published in the Special 50th Anuiversary Number of the SCiEntific Ameri Can on July 25.

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Editor of the Scientific American.
        Dear Sir:
        I consider that.
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invented by

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has conferred the greatest benefit upon man kind.
Name.
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How Artificial Monstrosities Are Made.
Prof. J. A. Ryder, of Philadelphia, has recently made esearch of some length into the methods by which the Japanese have produced the race of double-tailed gold fish, Carassius auratus, which are such favorites with fanciers and the owners of aquaria in this coun try; and, incidentally, he has also called attention to ome very interesting facts of a like nature regarding other allied vertebrates. The experiments of Weber, proving that the eggs of the common pike could be caused to produce double monstrosities if the recently fertilized eggs were violently shaken, were the intial discoveries that have led to the present doubling from single volk. This fact is known to our fish commissions, and great care must at first be used to pre vent the almost entire production of monstrosities by ough handling. More remarkable still is the conclu ion reached by Von Ihering that certain armadillos normally produce several young from a single fertilized egg. Dr. Ryder is inclined to regard the double-tailed cold fish as "the actnal realization of an eight-limbed vertebrate," a thing most.contradictory of our present basis of animal classification. These fish have been produced in Japan, he concludes, for at least two cenuries, and they there command high prices among he wealthy classes, the finest or most abnormal vari ations being in great demand. By taking the eggs of he normal species of gold fish and shaking them, or disturbing them in some way, the Japanese get doubl monsters, some with double heads and a single tail and ome with double tails. Naturally the complete double monsters would be unlikely to live, while those with only the duplication of the tail, having the problem of ife in no way complicated for them, would be quite ikely to survive. These monstrosities, being selected and bred, would in all probability hand onward the endency to reproduce the double tail, which in time would become fixed and characteristic, if judicious selection were maintained by interested breeders, as has been the case with the many breeds of dogs, horses, fowls, and pigeons. Barfurth, experimenting upon tad poles, has found the duplication of the tail in them ha much to do with the manner in which it is removed For example, if the tip of the tail were snipped off ex actly at right angles to the axis of the body, the tail was regenerated of the normal form and straight back ward. If removed at an acute angle, regeneration took place so that the new tip was directed either upward or downward, according as the inclined, regenerated cut surface looked upward or downward. These fact cannot be dismissed as useless in connection with the problem of inheritance in general; for while, as w rise in the scale of organization, the tendency to re generate lost parts becomes more restricted, the tend ency to produce monstrosities due to disturbances of development remains in full force, as is illustrated by the disposition to reproduce extra toes in the cat, the same tendency hereditary in the Dorking fowl, or even the disposition to reproduce extra thumbs or toes in the human family.-Dr. Eugene Murray-Aaron, in Popular Science News.

## Central American Exposition.

Minister Arraiga, of Guatemala, has informed the Department of State that a Central American exposi ion will be held at Guatemala la Nueva, the capital of Guatemala, next year from March 15 to July 15 Though the exposition is of a Central American and not of a universal character, it will nevertheless include a foreign section where the exhibiters of other coun tries may show their wares, and a cordial invitation is extended by the Guatemalan government to the citizens of the United States to be represented.

## A NOVEL POCKET CAMERA.

Within the past few years the development of compact, light miniature cameras, easily operated yet capable of producing clear, distinct pictures, has been nearly as remarkable as the perfection of the bicycle. Inventors have studied the problem of making a camera so simple in its working parts that it cannot camera so simple in its working parts that it cannot
readily get out of order, yet will be so easily understood as to enable any person who may have had no previous knowledge of photography to make satisfactory pictures. In presenting illustrations of the little camera named "The Pocket Presto Camera," we show a novelty and simplicity of construction which speaks for itself, and an illusiration of the actual size of one of the pictures made with it. As will be seen in the larger lower view, the camera consists of an elliptical shaped sheet metal body about three inches long, having the front end square. The cover is made of one piece of metal and is put over one side of the camera, occupying the bottom when in position, the outer lip of the cover overlapping the outside of the camera, as may be seen in the illustration, while an inner concentric lip or projection on the inside

THE POCRET CAMERA PICTURE, ACTUAL SIZE. brojection on the inside overlaps the inner edge, thereby forming a joint. By such construction accessible for loading or right hand view) is readily accessible for loading or unloading.

Another feature is that it is a roll holder and plate camera combined; the triangular shaped portion observed in the view just mentioned is made of metal and holds near its apex a wood spool around which the exposed film is wound after passing from a special pocket in which it is placed when loading over the straight or focal plane portion, the arrow indicating the direction of the revolution of the spool. A small hole in the face of the end of the spool engages a pin projecting from the underside of the rotating disk, and the center hole of the spool fits over another pin around which the spool rotates. The rotating disk will be noticed on the rear of the outside of the camera in the larger view and has convenient outward projec tions for the fingers to push against in making a revo lution. It is also provided with four detents which fit over slight projections arranged at each quarter of a circle, so that a slight click is heard as each quarter turn is made. The camera is supplied loaded with sufficient film to make twenty-five pictures, but has a capacity for fifty. In rotating the spool of film the disk is turned half a revolution or until two clicks are heard. If it is desired to use plates, the film holder is removed in the usual dark room and a square shaped metal box holding a miniature glass plate on each side, four in all, is slipped over the same pins that secured the film holder The view of this is seen in the upper left hand corner. Tongue shaped flat springs press the plates outward as they are slipped into the grooves. When in position and the cover replaced position and the cover replaced, the camera is loaded with fou plates, and it is only necessary
to rotate the large disk oneto rotate the large disk one-
quarter of a revolution to bring a fresh plate into the focal plane Located behind the lens is a ver tical plate with a rectancular aperture to cut off the margina rays of the lens. The miniature lens is held in place by a flat spring and is adapted to be easily removed for the purpose of cleaning when necessary. The shutter directly in front of the lens is of a gravity, pivoted, seg mental type, works freely and has no springs to get out of order. The operation of setting the shatter is very simple. The larger illustration shows the method of making the exposure. The rotating diaphragm disk on the front contains three openings for instantaneous and time work, and has detents and projections for stopping it at the right place and for turning similar to the film-rotating disk. The pocket device for holding the film is quite simple and ingenious, but its working need not be explained here.

Suffice it to say there has seldom been a camera made which has such a large capacity confined in so small a space and one that cannot become disarranged by rough handling. In addition to this the price is so
reasonable that any lad or lass can afford to have one, while the pleasure it will give to hundreds who never thought of taking photographs cannot be estimated. The sole manufacturer of this camera is Mr. E. B Koopman, 33 Union Square, New York City.

A Battleship Turret Tested to Destruction. A trial was made last week at the Indian Head proving grounds to determine whether the internal structure of the turrets of our battleships would properly support the 15 inch armor when it was struck by a shot from the heavier guns. When a 13 inch shot strikes a turret, its 36,000 foot tons of energy are partly resisted by the dead weight of the turret, and partly by the clips which hold it down upon the turntable path on which it revolves. The blow also tends to burst in the particular plate upon which it falls, and this has to be resisted by the plate steel framework upon which the armor is built up. The turret, for the purpose of the trial, was placed upon a solid horizontal platform aud rested upon large steel cylinders, repre senting the rollers upon which it rests when on ship.
Three shots were fired, with the following results A 500 pound shot from a 10 inch gun struck the 15 inch plate near the top with a velocity of 1,700 foot seconds penetrated six inches, and broke up. The framing was uninjured.

A 12 inch shot, with 1,700 foot seconds velocity, also broke up, the point remaining welded in the plate The framing to the rear was uninjured, but one bolt holding the armor plate was sheared off, and the plate was cracked from top to bottom. The plate was not moved from its place upon the structure; but the en ire turret was moved seven inches to the rear.
A 12 inch shot with 2,000 foot seconds velocity pierced the 15 inch steel plate, the backing, and the frame work, and passed through the entire turret, smashing the cast iron plate on the rear face. The framework " was torn and twisted in all directions in the vicinity of the place of impact." The whole turret was agai moved bodily to the rear, this time about six inches.
The results are considered to be satisfactory both a regards the 12 inch gun-which is the type to be mounted on the Iowa-and as regards the turret, which is the same as those on the Indiana. It is considered that the turrets would have furnished good protection to the guns and crew within it, and that the holding-down clips which are used in actual serv ice would have proved amply sufficient to keep the turret in place.

Work with the Electric Furnace
Prof. Dewar in a recent lecture at the Royal Insti ution paid tribute to the work of M. Moissan with the electric furnace. M. Moissan was indeed the pioneer in the work of research comprised in the combination
combination of lime and coal in the electric furnace second, the decomposition of the resulting carbide by water; and, third, the transformation into benzine of acetylene gas by means of heat.

## A SUBSOIL AND HARROW PLOW ATTACHMENT.

The accompanying illustration shows a plow atachment, for which a patent has been granted to Tom M. Bowers, of Crockett, Texas. It will be seen that the share and handies may be of ordinary construction. The beam is extended to the rear and bolted to the left handle, where it is provided with a vertically depending portion, at the bottom of which is firmly fixed a laterally projecting wing. From the point of its attachment to the vertical bar the wing projects across the furrow at right angles to the same,


A SUBSOIL AND HARROW PLOW ATTACHMENT.
and it is then inclined rearwardly, as will be seen in the illustration. The beam, with its horizontal and verti cal extensions and the projecting wing, may be made in separate parts, or integrally, as desired. The wing is lotted to receive six teeth. Two of these, which ar intended for subsoiling, are made of extra length and are arranged immediately behind the share and next the vertical extension of the bea:n. They are flattened out at the toe, so that they may the better oosen up the deeper soil, and tend to create underground drains, in which the surplus water may collect and be carried off. In dry weather, moreover, the loosening up of the subsoil will enable it to retain the moisture for a longer period. The harrow teeth are made of different lengths, gradually decreasing toward the outer end of the wing. The object of the invention is to secure the advantages of plowing, sub soiling and harrowing in one machine, and it is claimed that by arranging the devices for the latter work as shown the three operations are thrown into one and the draught upon the plow is but slightly increased as compared with the great gain in time and labor.

Experiments have been carried out by Bruttini on the sub ject of the influence of salts on the sprouting of seeds and the results are thus described by Prometheus: "The experiments were tried in the following manner: Fifteen seeds were placed for twenty-four hours in solu tions of 1 to 2 per cent of different salts, and then compared, in respect to germination, with fif teen other similar seeds kept for the same time in pure water. At the end of four days all these last had sprouted, while the others gave variable results With potassium nitrate the fif teen seeds sprouted in equal degree, while with mercuric chloride not one sprouted. Sodium chloride exercised a mar ked injurious effect, and so did potassium phosphate, while po tassium permanganate had only

## THE POCKET PRESTO CAMERA

 at high temperatures of carbon with various elements. a very weak effect. Chloride of iron in a two perProf. Dewar, referring to the fact that many of the carbides thus obtained are decomposed by water, pointed out that many years ago Prof. Mendeleef peculated that the only way to account for the immense localization of petroleum at Baku and other centers was that it was being continuously generated by the action of water on carbides. This idea was not favorably received at the time, but it has now met with a certain degree of acceptance. Benzine, the product of acetylene, generated by some of the car bides, is the nucleus of all the colors hitherto obtained rom coal tar products. Benzine by the acetylene process is reached in three distinct stages. First, the u
cent solution destroyed all germination : with a one per cent solution only two of the seeds sprouted."

It is expected that Sir William Martin Conway's ex pedition to Spitzbergen will occupy altogether about three months. The arrangements are not settled yet but it is probable that the party will leave this coun try early in June, and return at the end of September This practically implies the period of the year during which Spitzbergen is open to the sea. A good deal of interest attaches to the expedition, for at presen he interior of Spitzbergen is not well known to
recently patented inventions.

## Engineering,

Propelefr.-Nelson W. French Sayre, Pa. This inventor has devised a propeller in
which each padale or blade is four feet long for one foot wide, and about a third longer than the diameter of the propeller. the blades thus having much greater superiare flat, and preferably yrranged at angle of forty-five de grees to the shaft being secured to oval or elliptical shat sections arranged with their longer axes at right angles to each other, the arms being adjustably ciamped along the shaft.
Steamboat Jack.--SamueJ R. Judd, Little Rock, Ark. To raise boatsor vessels when aground, this invention provides for a series of lifting jacks car-
ried on the vessel, and having plungers with rolling supports at their lower ends to be lowered to the bar or reef
on which the vessel lies. Along the sides of the hull of on which the vessel lies. Along the sides of the hull of
the vesselare stanchions forming vertical guides in which the vessel.are stanchion
Coal Charging Hopper. - Donald McDonald, Louisville, Ky. To charge coal or coke into a hot gas generator, against gas pressure, or to charge
limestone into a kiln. this inventor provides a rotary hopper to turn in one direction and register with an opening in the base for the discharge of its contents, an opposit turning closing the base openings and refilling the hopper, which has a close fitting cover to prevent all escape
of gas in both movements, while the lower face of the of gas in both movements, while the lower face of the
hopper has a clearing flange in close eugagement with the upper face of the base.

Railvay Appliances
Car Axle Box Lubricator.-James S. Patten, Baltimore, Md. This is an improvement on former inventions of the same inventor in lubricators
which have oil take-up rollers working in contact with which have oil take-up rollers working in contact with
the axle journals, and relates chiefly to the journal cap the axle journals, and relates chieffy to the journal cap
used in connection with the lubricant receptacle, and which surports the lubricant holde as well as the sprin
in the car axle box
Locomotive Truck Journal Box.-Charles Linstrom, Vicksburg, Miss. This improvement provides for securely fastening the oil cellar in place on
the inside of the journal box, where it will not be liable o get out of order from the jars and shocks of the truck frame. The invention provides for one or more anguarly held pins extending from the journal box into openngs in the oil cellar, the pins being conveniently re
movable to unlock the oil cellar and allow it to be removed.

## Mechanical

A Steam Hammer Hand Tool.-Arthur C. Beckwith, Chicago, Ill. This invention provide other motive agent, a cylinder having at one end a chisel or other tool bearing and at its other end a handle, the or other tool bearing and at its other end a bande, the
cylinder having inlet and exhaust ports and a sliding and
turning piston to strike the tool. The piston has chanturning piston to strike the tool. The piston has chan-
nels and ports registering alternately with the inlet and nels and ports registering alternately with the inlet and
exhaust, and formsitsown valve for controlling the admission and exhaust of the motive agent.
Glass Polishing Wheel Feed. Thomas F. Gilroy, Brooklyn, N. Y. To facilitate polishing the beveled edges of qlass, this inventor has de
vised a machine in which the polishing material is auto matically and evenly spread on the polishing wheel and is maintained in solution. A brust is made to move into and out of the polishing material and have a reciprocating movement on the wheel, the operator holding
class in proper position on the wheel as it rotates.
Automatic Doctor.-Thomas H. Lat imer, Wilmington, Dil. In a calendering machine in paper making this invention provides an improved auto-
matic doctor and feed of simple and durable construction, whereby the pressure of the doctor upon the rolls may be conveniently increased or lessened, and auto-
matic and instant relief will be afforded in case of an accumulation of paper at or on the rolls without danger of the doctor striking the next lower roll.

Miscellaneous.
Glove Case. -- Alfred W. Vess and Henry C. Kenney, Athens, Ga. to prevent their being mussed, wrinkled and discolored by the prospective purchaser desiring to make a selec-
tion. The top and front of the case are of glass, and in tion. The top ${ }^{p}$ and front of the case are of glass, and in
it are tiers of slides, the upper portion of each slide being it are tiers of slides, the upper portion of each slide being
exposed, it being intended that gloves of the same size exposed, it being intended that gloves of the same size
be arranged and held on a slide by clips. The case af ords a regular gradation for size gloves, all removably held on the slides,
tinguished without handling the goods.

Neck Yoke Fastloner. - Thomas Thompson, New London, Wis. For fastening the pole vides a ring to slip on the end of the neck yoke, a slotted projection on one side of the ring forming a keeper to
engage the yoke strap, and the ring having a keyway registering with a projection on the neck yoke. The ring also has slots to receive a removable ring lining. The device enables the connection between the strap and
the yoke to be instantly made or readily released Design for a Rack. - Martin V. B. Pabor, Frederiction, Mo. This invention to racks for supporting hats or other apparel, or to receive
cards, and the design is in the shape of a Maltese cross, with diamond shaped center panel. Ornamental hooks are arranged on the arms of the cross and a shelf is sus pended by chains along the edge of the lower arm.
Pneumatic Matl Collector.-Hans Fleckl, Chicago, Ill. This is an improvement in pneu-
matic apparatus in which a car driven by air pressure is propelled through an underground tube and automatical ly gathers the mail matter deposited in boxes at various points and brings it to a central station. In the inner
walls of the tube are receiving cavities of different sizes
for different stations, and the traveling pistons havesup. plemental pistons to fit the different cavittes. When the is created at the central station and the pistons and mail

Hydrocarbon Burner.-Thomas Brough, Baltimore, Ma. An air mixing oil burner provided by this inventor for burning crude oil for heatng or illuminating without a wick, producing a blue blaze of the greatest heating capacity when used for invention covers a novel cap or deflector designed for pecial combination with a sptral coil of pipe the oil being heated and volatilized in the coils without obstruc tion to the draught.
Stove Damper and Gas Offtake -James A. Carroll and William Brooks, Brooklyn, N. Y. According to this improvement, a gas off-take pipe
extends through the pipe damper into the smoke pipe, the inner end of the offtake having a flaring mouth ove he bed of fire. The device is especially adapted for un feeding, but prevents any gas from passing into the

Hand Treadle Device.-David Cur tin, Indianapolis, Ind. This is a hand attachment in-
tended especially for use with sewing machines. The hand lever is pivoted to a bracket secured on the under pitma readle. The construction is simple and inexpensive and the attachment is easily applied and removed.
Note.-Copies of any of the above patents will be
furnished by Munn \& Co., for 25 cents each. Please end name of the patentee, title of invention, and date

## NEW BOOKS AND PUBLICATIONS.

The Steam Engine Catechism. series of direct practical answers to direct practical questions, mainly in-
tended for young engineers and for tended for young engineers and for
examination questions. By Robert Grimshaw. Tenth and enlarged edition. New York: Norman W. Hen-
ley \& Co. $1896 . \quad$ Pp. 413 . Price $\$ 2$. We have before now had occasion to commend Mr.
Grimshaw's excellent method of presenting mechanical Grimshaw's excellent method of presenting mechanical
subjects. He seems to be able to give life to what would normally be a rather dry subject. The present book,
in the form of questions and answers, consists of two in the form of questions and answers, consists of two
parts, the original Steam Engine Catechism and the Supplement thereto, and in every way justifies our imseems to be peculiarly adapted to practical mechanics at least, this type of book has had a very great vogue, so noted that this is the tenth and enlarged edition of the catechism, and in its over 400 pages of text it contains a vast amount of most useful information. The nex
that we notice is a species of supplement to this

The Engine Runner's Catechism. Telling how to erect, adjust, and run the Urincipal steam engines in use in the author's Steam Engine Catechism. Profusely illustrated. By W. Henley \& Co. 1896. Pp. 366. Price \$2.
Mr. Grimshaw in this book, which is really, as has been said, a species of supplement to his Steam Engine Catechism, takes up the different makes of engines now
on the American market and, one by one, describes on the American market and, one by one, describes
their peculiarities and how they should be manipulated. heir peculiarities and how they should be manipulated.
It is evident that this is precisely the information an engineer needs. Whoever has begun with this book and studied the mechanics of the large number of typical engines it describes will be prepared to cope with any engine that should be put in his hands. But his treatment of special engines is, by no means, all the book
contains. The shipping and receiving of engines, making of foundations, erecting and starting, with detailed instructions as to the adjustment of special makes, are all
treated very fully, and practical usefulness is imparted by the sections devoted to special engines.
A Chord from a Violin. By Winifred Agnes Haldane. Chicago: Laird \& The Maintenance of Macadamized Roads by the Aid of Machinery.
By Thomas Aitken, Assoc. M. Inst. C.E., M.C E., Mem. San. Inst. Civil Engingers of the Inmission of the Council.) Cu par-Fife :
Printed at the Fife Herald and Jourmission of the Council.) ald and Jour-
Printed at the Fife Herald
nal Office, Burnside. 1895. Pp. 28.
Electric Wiring for the Use of Architects, Underwriters, AND Russell Robb Ob New York and Lon-
don : Macmilian \& Company. 1896. don : Macmilian $\&$ Co
Pp. 183. Price $\$ 2.50$.
This book is a republication of a series of articles which, during the last two years, have appeared in the American Architect and Building News. Of the 175 pages of text, over 100 are devoted to an elucidation of
the national code of roles for electric wiring as adopted by the National Board of Fire Underwriters and
amended at New York in 1895. This gives the book standard value for America, and goes to recommend it to the architect and builder, as well as to the electrician.

Few Reasons Why the Storage
Battery Traction
System is Su PERIOR TO ANY OF THE Preseint Known Methods of Propulsion FOR STREET RAILwAYs.
phia: Stern \& Silverman.
Pp. 79 .

Business and Personal. The cinarge for Insertion under this head is one Doluar a line
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in our columns will be furnished with addresses of
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special wititen In (ornination on matters of

Ninierals sent for examination should be distinctly
marked or labeled.
(6849) V. R. L. asks: Can a Bell telephone receiver be made to work all right on a line a mile ong, with microphone transmitters, if a piece of soft iron n inch or so long is used for the magnet, so as to make with one Leclanche or Law battery at each end? Would induction coils be necessary on above line with batteries, line being made of No. 12 iron wire, ends grounded, no adjacent lines to cause induction? Could a call be
worked on above line with above batteries by using a re worked on above line with above batteries by using a re cuit? What would be best to use-carbon dust or Blake make the small make the small telephone, of course, but at a possible
sacrifice of sound-producing qualities. A single cell be wo rather too little for its You can employ ether trans mitter. See our Scientific American Supplement Nos. 142, 162, 163, 191, and 966 , for information on the (6850) A. M. H. says : Will you please inform me through the columns of your paper of a sim
ple process by which a fine white straw hat, which has ple process by which a fine white straw hat, which has
become tanned from the sun, may be bleached? A. On a small scale, with such an article as a straw hat. a bonnet, a basket, etc., the following method may be followed: The straw, having been well washed with weak soda
lye, is rinsed in plenty of clean water, lightly shaken lye, is rinsed in plenty of clean water,
etc.; remove superfluous moisture, and place, supported on a stick, under a large glazed earthenware pan turned upside down. A very small pipkin, capable o hulding about $1 / 1 /$ pint, is now placed on the fire, and
about $1 / 2$ ounce of roll brimstone placed in it. When the brimstone is all melted, a light is applied to it, so as to cause it to catch fire. The pipkin, with the innauch
sulphur, is now placed under the glazed pan in such position as not to scorch the article to be bleached. The spaces between the pan and the table or floor on which it rests must be carefully closed with damp cloths placed
around to prevent the escape of the sulphurous acid gas around to prevent the escape of the sulphurous acia gas
produced by the combustion of the sulphur. In about two hours the pan may be removed, when the straw will two hours the pan may be
be found nicely bleached.
(6851) C. E. C. asks : 1. To what extent gor building up? A. No direct answer can be give to this query. A large dynamo would be apt, owing to its large mass of core metal, to retain residual magnetism
better proportionately than would a small one. 2. I there any difference in voltage between a dynamo with magnets? A. Only that due to higher intensity of fiel magnets? A. Only that due to higher intensity of mag
netic field. In the electromagnet higher intensity is produced. This can be compensated for by using larger per manent magnets, so that the voltage can be brought up magnet to one pole of a dynamo or motor be sufficien to magnetize it? A. No. Pass a strong electric curren through the winding.
(6852) J. J. B. says : Will you please
 . Take $1 / 2$ pound logwoou and sufficient boiling water Strain, and apply the solution, boiling, if possible, twice, allowing the board to $\mathrm{dmy}^{\mathrm{y}}$ in the interval. Then dissolve $1 / 4$ pound of copperas in about 1 pint of boiling water, and apply it boiling, once or twice, according to the degree of blackness obtained. Before using it,
rub it over well with rushes, straw, ferns, or shoemakers' reel ball. It may be a little difficult to rub the chalk off at first, but after a fortnight's use that will disappear. Use unprepared chalk, which writes well. 2. Place $1 / 4$ pound of lampblack on a flat piece of tin or iron on a fire till it becomes red, take it off and leave it until suffi-
ciently cool, when it must be crushed with the blade of a ciently cool, when it must be crushed with the blade of a knife on a flat board quite fine; then get $1 / 2$ pint of mixture with a size brush. If the board is new, it would be well to give it one or two coats of lampblack-not burnt, but mixed with boiled oil-adding $1 / 2$ pound of patent driers. After the board is thoroughly dried, apply
the burnt lampblack and turpentine. The preparation he burnt laid on quickly
(6853) W. E. W. asks: How many cells of dry battery would be necessary to run the motor de-
scribed in SUPPLEmENT, No. 641? Would a soft iron core do for the field magnet instead of the Russia iron strips? A. Dry batteries are not adapted for running
motors. Ten cells would run it, but would soon polarize A soft iron core will answer as well or better than the A soft iron core
barrel hoop one.
(6854) C. C. P. says : You would oblige me very much if you would answer through Notes and be quickly performed, is done by the use of prussiate of potash. This is powdered and spread upon the surface of the piece of iron to be hardened, after the iron is heated to a bright red. It almost instantly fluxes or flows over the surface, and when the iron is cooled to a dull red it is plnnged into cold water. Some prefer a mixture of
prussiate of potash 3 parts, sal ammoniac 1 part; or prussiate of potash 3 parts, sal ammoniac 1 part; or
prussiate 1 part, sal ammoniac 2 parts, and finely powdered bone dust (unburned) 2 parts. 'The application is the same in each case. Proper casebardening, when a deep coating of steel is desired, is done by packing the
article to be hardened in an iron box with horn, hoof, article to be hardened in an iron box with horn, hoof, and heating to a red heat for from one to three hours, hen plunged in water.
(6855) A. B. B. asks: What size wire would be necessary to build a private telephone line about
50 miles in length out in the Rocky Mountains. Would the ordinary Bell set do 9 How many batteries would be necessary? How would you ring the stations ? Would
the magneto do it, and any other data that I have for gotten to ask for that would be necessary? A. Special
telephone line wire is often used, but any telegraph wire will answer. Yot will require a microphone transmitter and four or five cells of battery. A good magneto would do for the ringing up. There are many details to be con-
sidered. For information on the construction of simple electric telephones, call bells. etc., see our Scientific American Supplement, Nos. 142, 162, 163, 191 and 966.
(6856) W. H. P. writes: Dealers in draughting materials are advertising a positive, black toating, so that the print is developed and fixed by simply washing in water. Can you give anyformulæ for the preparation of paper of this kind ? A. Our Supplement, Nos. 584 and 679 , contains valuable articles on process
paper, to which we refer you for an answer to your (6857) J. D. says: Please give me some simple remedy in your newspaper for hair that is turn-
ing gray. Something that will stand its color for awhile. ing gray. Something that will stand its color for awhile.
A. Where, from some personal idiosyncrasy, the color of the hair has disappeared and canrot be restored, a dye may be considered necessary, the following will be of
service; but the nitrate of silver dyes should be avoided, and the use of any dye for prolonged time is detrimental to the hair.

1. Brown
Walnut skins beaten to a pulp........... 4 oz.
Rectified spirit...................... 16 "
The above is perfectly innocent in its character. The
2. Black.

Sulphate of iron.......................... 10 grn.
Glycerine
Water.
.10 grn.
1 oz.
1 pt.
The hair must be thoroughly washed with this, dried, ing should be once daily for three days, comb, butit should not be allowed to touch the skin if the other prepara tion has done so, as a temporary stain would result. 3. Gallic acid..
Tannic acid.

## Tannic acid Water

4 ".
After the first application of formula 2, the hai should be allowed to dry, and then be brushed. Subse
quently, both formulx may be used once daily at an in quently, both formulæ may be used once daily at an in-
terval of an hour or so, until a black color is produced. (6858) P. T. says: Will you please tell me in your valuable paper how to mount albumen
prints on glass without the use of a paddle, not leaving prints on glass without the use of a paddle, not leaving
air bubbles or without showing streaks of the adhesive And what is the adhesive made of? A. First coat the glass with dammar varnish or else with Canada balsam mixed with an equal volume of oil of turpentine, and let it dry until it is very sticky, which takes half a day or more. The printed paper to be transferred should be prepared glass, after removing surplus water with blot ting paper, and pressed upon it, so that no air bubbles or drops of water are seen underneath. This should dry a whole day before it is touched ; then with wetted fingers begin to rub off the paper at the back. If this be skillfully done, almost the whole of the paper can be re moved, leaving simply the ink upon the varnish. When the paper has been removed, another coat of varnish wil

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| NDEX OF INVENTIONS <br> Por which Letters Patent of the |  |
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