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 NEW YORK, MARCH 30, 1895


## THE MANUFACTURE OF PORCELAIN.

The manufacture of porcelain and earthenware is one of the most interesting of the technical processes. The illustrations we present in this issue were taken in the works of the Knowles, Taylor \& Knowles Company, East Liverpool, Ohio, the parent company of that city and the largest manufacturing concern of its kind in the United States, its business dating back to the year 1854.

Porcelain and earthenware are made from clay, which, while moistened with water so as to be of doughlike consistency, is shaped and is then baked or partially vitrified by firing in a furnace. On removal from the furnace it may be coated with a fusible glaze and refired so as to fuse the glaze. This completes it, unless it has to be decorated by painting, which, if done, involves a third firing to fix the color. sand are the principal constituents which enter into the composition, all being finely ground and the feldspar sometimes being calcined. The different ingredients are weighed so as to secure the proper proportions and are then mixed in a pug mill, which is a cylinder containing a vertical shaft carrying mixers, which shaft rotates and forces the thoroughly and forces the thoroughly tom in a long prism. One tom in a long prism. One
of our cuts shows this maof our cuts shows this ma-
chine at work. Mixed with a quantity of water, the material from the pug mill is introduced into a large tank containing a grinding apparatus. After grinding, the material is run off into a large tank, and is then passed through bolting cloths, termed by


THE PORCELAIN AND EARTHENWARE INDUSTRY.
the workman the "lawn." It is finally passed through a filtering press.
As a majority of pottery articles are circular in section, the turning process in one form or another enters largely into the manufacture. One of our illustrations shows a thrower making a vase on the historic potter's wheel. This apparatus is a horizontal table kept in rapid rotation. The mass of clay for the article is weighed out, is placed on the center of the table, and by the fingers of the workman is rapidly brought to the required shape. This is almost pure handwork, but in another phase of operations special shaping tools are used, as shown in the cuts, representing "battering out" and "jollying." These processes are shown as applied to plates. A mould representing the contour of the one side of the plate is laid upon the table and on it the clay is placed. The workman, or
"batterer," then brings down upon the clay an approximate mould of the other side of the plate and passes the partly shaped article to the "jollier." The latter places it on a potter's wheel, a profile mould or scraper is brought down upon it as it rotates, which shapes the surface to the exact contour required. The cut is self-explanatory.
Another phase of the shaping process is shown in the cut representing "turning," where the clay is turned off on a species of lathe. The operation of "pressing," another phase of the system, is also shown in one of the cuts as applied to the manufacture of pitchers Here sectional moulds are employed, in which the object is made in three or more pieces. The workman then rolls a lump of clay between the palms of his hands so as to form it into a cylinder and, laying this along the joints, brings the moulds together to form the completed article. Another very ingenious way of forming articles of complicated shape is the casting process. It should be said in advance that plaster of Paris is used universally for the moulds. This substance being very absorbent, the surface moisture is removed from the clay by capillarity, and this action is especially invoked in the casting process The moulds for a pitcher corresponding to its exterior surface are placed together and held by a strap. The workman uses a mixture of clay and water of the consistency of cream. After thoroughly mixing it, he pours it into the mould; as the latter absorbs the moisture from the clay a film is soon formed which thickens gradually, and when the workman finds the operation is complete, the surplus material is poured out of the mould, leaving in it the proper thickness of clay dried by capillarity, of the precise shape of the interior, reproducing every detail.
The articles have now to be filed, and kiln placing is the next operation. The articles are put in proper receptacles called saggers, and are stacked up in the kiln, which is a dome-like receptacle connected with which is a furnace. When the kiln is full it is closed and the furnace is started, and for a number of hours, the period depending upon the goods to be produced, the firing is continued. When cold, the ware is removed from the furnace, and is then termed biscuit ware.
Before the glazing is applied all rough pieces are removed from the goods by an operation termed "fet tling." Each piece is carefully inspected and smoothed over if required. It is at this stage that it may be ornamented in relief. This is done by an India rubber bag syringe. The bag is open at one end and has a nozzle at the other. It is filled with mixed clay and water of proper consistency, and the workman ejects it by squeezing upon the surface of the object, producing various designs, as shown in one of the illustrations

The glazing process comes next in order. The glaze consists of a special glass pulverized to the utmos degree of fineness, and mixed with water to a cream like consistency. The articles are dipped into this and are removed with a quantity adhering. They are put into a glazing kiln in saggers and are heated until the glaze enters into a perfect fusion. After cooling, they are removed and are complete, unless they have to be decorated.
Decoration consists in painting or imprinting de signs upon the glazed surface with special paints
After the decorating, the article is again fired, so a to fuse the paints into the enamel, and the article is finished.

The Knowles Works have been selected by ou special artist, owing to the fact that they are the largest works of the kind in the United States

They have 19 regular kilns in operation, in addi tion to 12 decorating kilns, which, with other kilns, bring up the total to 93 kilns. Over 700 employes ar oecupied at the works.

## Preserving the color of Flowers.

The following method of preserving the colors of dried Howers, applicable to even the most delicat poppies, has been discovered by Herr Nienhaus. Ammonia in the air is the main cause of flowers losing their tints; so Herr Nienhaus presses his specimens between paper which has been previously saturated witb a solution of one per cent of oxalic acid in water

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TABLE OF CONTENTS OF
SCIENTIFIC AMERICAN SUPPLEMENT
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## A New Strawberry.--i iilustration


 CHEM1STRY--Acetylene for Gas Purposes.-An important
pader on the enew process of making acetylene from calcium car-
 The Preparation of Litmus Solution

## Tiqe Preparation of of Liten The Dairy.-The Preser



. GeOLOG P.-Fossil Land Surfaces of the Silurian.-By w. R.

VIII. MISCELLAANEOUS.-The
stallmeut of an interesting historical paper.......................
 Francis H. HERRICK....... ............................. ${ }^{-.}$
GidNANCE.-The New Elswek Eight Quck Fre Gun. -A I. PHOTOGRAPHY. Mercury Frames for the Photography of
Colors.-2illustrations.....
16050 II. 'TRAVEL AND EXPLORATION.- Interesting Diseoveries in
Arrica. An acount of Lieut. Von Gotzen's expedition across
ind


THE ELECTRIC TRANSMISSION OF ENERGY.
The complexion of the world and the phases of our existence, oving to the astonishingly rapid progress in the arts, are uldergoing grave changes. The cruder animal powers are being putaside in favor of mechanical ones. A few years ago ferryboats were propelled across the rivers about New York City by horse power as commemorated by Fitz Greene Halleck in one of hi poems. To-day a horse boat, as they were called would appear as much of an anomaly and as archaic as a horse car will to our descendants. The introduc tion of the trolley has almost abolished what was per haps the greatest single field for the employment of horses. And lately man has found that he can, on a bicycle, propel himself far better than any horse can The bicycle is possible simply because of the mechani cal perfection of the machine.
Coal is now the great source of power. A ton of coal represents eight or ten thousand man powe hours, and perhaps over one thousand horse powe hours. It can be produced for so small a price that in the regions of its production it is the smallest ele ment in the expense of power production. Ther would be little choice in the Pennsylvania coal region between a steam plant or a water power plant for the production of power. But given the power, the ex pense only begins. The turbine or steam engine is the first step that costs; the subsequent ones involving the distribution of the power require the expenditur of money for their maintenance. Shafting and dis tribution apparatus in general have to be kept up belting wears out, lubricating material has to be used buildings must be kept in repair, and the labor and material charge for all this counts up rapidly.
The phenomenal success of the trolley system of electric railroads is due to the electrical distribution of power, and only incidentally to any cheapening in its original production. It is perfectly true that stean can be produced more cheaply in large than in small units, but the soul of the trolley system is in the trolle wire. A mechanical substitute for it, and the only one in extensive use to-day, is the cable in its subway con duit. The contrast in simplicity between the two and in the requisite capitalization is most striking. It is fair to say that electricity depends for its greates operations on its adaptability to simplify distribution power.
This being the field of electricity's triumphs, and a field as yet imperfectly explored, it would appear tha it would give great scope to experiment and invention. 'The dynamo builder prides himself on turning out a generator of ninety-eight per cent efficiency. The electric motor has its efficiency tested just as rigor ously. But how much do we hear of the efficiency of the transmission processes? An immense quantity of power is lost between station generators and car mo tors on all trolley lines and between the station and consumers in electric lighting systems. The price o copper is so high that a balance has to be struck be tween the interest charge on conductors and the loss incurred by different sizes, in order to determine how large or how small the conductors should be. The problem is made more tantalizing by the fact that with a high enough potential small wires could trans mit a comparatively great power, while the great dan ger of high potentials prohibits their use in most cases. Accordingly the process of producing power in sta tions by the best steam plant and of there converting mechanical energy into electric energy with scarcely any loss goes on, and is coincident with the transmis sion of power over a circuit of resistance high enough to destroy the original economy, which, at the same time, is a circuit of high original cost and high interest charge. To reduce this cost the rails are used as a re turn, and a branch circuiting of the current follows, in some cases to the injury of neighboring water mains and gas pipes.
In nearly all cases of electric distribution, althougl the conductors may be insulated, there is inevitable waste and a balancing of interest account on the origi nal cost of conductors against the absolute waste of power. There is obviously a chance for some of the greatest improvements yet effected in the electrical science in the development of a radically new, or a least radically improved, system of delivering electrical energy to the distant motor or lamp.

## Interesting Rifle Test.

An interesting test of the new Krag-Jorgensen rifle has been made recently at the United States enginee ground at Willets Point. In order to determine the penetrative power of the gun a number of pine boards were fastened together till a thickness of fifty inches was obtained. Two of the shots fired at this target a short range passed entirely through it and none of the bullets fired penetrated less than three feet. The same test tried with oak planks also gave highly gratifying results, the penetration in this case being thirty-two inches Iron plates two-thirds of an inch thick were also pierced. A very curious result was obtained by firing a bullet at a series of thin iron plates placed an inch apart. The bullet was found to pass through one plate after another till it melted.

## Frederick E. Sickles.

By the death of Mr. Sickles a vacancy occurs in the engineering world of no small consequence. The following interesting tribute to the deceased inventor and engineer, from the Engineering Record, will recall to the minds of our older readers the excitement created at the time Mr. Dickerson was endeavoring to induce the Navy Department to introduce the Sickles cut-off on all the government vessels :
Mr. Sickles was an inventor of world-wide reputation, and who for the past seven years was the chief engi neer of the National Water Works Company, of Kansas City, Mo. He died of heart failure March 9, at the age of 76 years. Born in 1819, on a farm near Camden, N. J., after receiving a common school education young Sickles started in his professional career as a rodman for the Harlem Railroad, and then, at the age of 17 years, was apprenticed to the Allaire Machine Works in New York City. He showed at this time his taste in New York City. He showed at this time his taste
for mechanics by close attention to the study of physics, for mechanics by close attention to the study of physics, and while in the Allaire shops noticed a defect in a
small stationary engine. In devising a means of oversmall stationary engine. In devising a means of over-
coming this he invented, in 1842, the well known Sickles cut-off, which was the first drop cut-off to be practically successful.
Although Sickles has been given the credit of inventing the drop cut-off and dash-pot principle, now one of the principal features of the so-called Corliss gear, Mr. Works, informed us that Sickles was antedated by a Works, informed us that sickles was antedated by a leasing gear and employed a dash pot to catch the valve as it descended. Barber's valve was actuated by a single eccentric, and hence the cut-off could only take place bet ween zero and one-half stroke. The mechanism Barber employed was crude and gave little satisfaction. Mr. Rowland said that Mr. Sickles then improved the Barber cut-off by introducing what he called a " wiper," which, operated by a separate eccentric or by attachment to a pin on the working beam, allowed the cut-off to occur at any point from zero to full stroke. Corliss, at a still later date, improved the Sickles cut-off by making it automatic by connecting it to a governor.
From other sources we learn that Corliss was said to have infringed upon the paitents of Sickles, and then began one of the most famous suits in history and after years of litigation Sickles obtained a favorable decision. Mr. Sickles then asked for injunction against the users of the engines, but it was denied by the courts on grounds of public policy.
In connection with the right of Sickles to claim the invention of the drop cut-off it will be of interest to know that Sickles, who had a very interesting exhibit of his inventions at the Centennial, was recommended to receive an award for his invention of the drop cutoff by the board of jadges, of which our informant on this point, Mr. Charles T. Porter, was a member. This recommendation, the only one so treated of the vast number handled by the judges, was not passed upon by the committee on revision, and of this committee Mr. Corliss was the chairman.
The first marine engine to operate with the Sickles cut-off was, Mr. Rowland states, on the steamer Champion, a vessel belonging to Commodore Van bilt and plying upon Long Island Sound in 1844.
Mr. E. N. Dickerson, a patent lawyer of considerable reputation, who had always keen interested in steam engines and their improvements, associated himself with Mr. Sickles about this time for the purpose of ex ploiting such inventions as either might make, Mr. Dickerson being an inventor of no mean consequence. Some time in 1850 the steamer Bay State was constructed for the Fall River Company, and the Novelty Iron Works, under the direction of its president, Iron Works, under the direction of its president,
Horatio Allen, made some changes in the valve gear of Horatio Allen, made some changes in the valve gear of
her engine that were decided to be an infringement on Sickles' patent. Messrs. Dickerson \& Sickles thereupon sued the Fall River Company for infringement, and the suit, which attracted the greatest attention because of Mr. Dickerson's ability, was decided in favor of Dickerson \& Sickles. It was not so much for the mone-
tary interest to Sickles that the suit was begun, as to tary interest to Sickles that the suit was begun, as to tion.

About the time the Collins Steamship Company had constructed the Adriatic, Horatio Allen, of the Novelty Iron Works, applied some patented valve gear of his own invention. These valves were ordinary plug cocks, but of massive proportions. These proving a failure, Sickles was engaged by Allen to remove the Allen gear and steam chests and replace them with his own in ventions. This work Sickles gave to the Allaire Works, of which Mr. T. F. Secor was then president and Mr. Rowland the chief of the draughting room and in charge of the mechanical details. After the changes were made in the valve gear the Adriatic started on her maiden trip, during which her engines worked very successtully.

Some time in 1856 Dickerson \& Sickles contracted with the city of ctroit to furnish a pumping engine in which a duty of 100,000 foot pounds was guaranteed.
Although the engine was not a success, it was a move
in the right direction, for Sickles expected to obtain this duty, which was high for those days, by carrying a high steam pressure, 115 pounds, and by expanding
ten times. Mr. Warren Hill, who was present at the ten times. Mr. Warren Hill, who was present at the time of the trial, states that the pump failed to take commissioners, who had assembled to witness the start ing up of the engine. The city of Detroit then sued ing up of the engine. The city of Detroit then sued
Dickerson \& Sickles to recover the money paid them Dickerson \& Sickles to recove
for the pump, but was beaten.

Between the years 1840 and 1842 Sickles received six patents, the most famous of these being granted for the theory of what is now known as differential motion, and which was applied to steam hammers and to steau steering gear, the latter being the first steering gear to be operated by steam, and which, moreover, is in use in almost all of the large steamers at the present day This patent, as well as that on the cut-off, was extensively infringed upon, and failing to get relief through the courts, Mr. Sickles turned his attention to civil engineering. Going West, Mr. Sickles helped to build the Union Pacific Railway and the large bridge at Omaha. At about that time he patented a device for anchoring bridge piers.
Mr. Sickles was a member of the Engineers' Club of Kansas City, and was beloved by all for his modes and gentle bearing and his charity toward all.

They are produced by the rotation of the earth and by the land, with its peculiar formation; by the tidal wave, with the trade winds.
If the earth were a true sphere and evenly covered with a layer of water, the tide would follow the moon around the earth with a broad, gentle swell and not exceed thres feet in height directly under the moon, and there would be no Gulf Stream or any other ocean currents.
Now, if there were a narrow belt of land reaching from pole to pole, it would act on the principie of a dam, and would stop the natural course of the tides, and would raise them from three to twenty feet at least. To cause a very high tide, form a bay one hundred miles long and fifty miles wide at the mouth and gradually coming to a point at the extreme end located on this belt of land that reaches from pole to pole, directly under the moon. The tide would rise at the extreme end of the bay one hundred feet at least This forma tion gives the tide a very good opportur wo enter the bay and force the water upward. To make this better understood, I call your attention to the Bay of Fundy. It is the principle that causes the tide to rise sixty feet or more at the head of that bar; it is the form of the bay that causes the tide to rise so high. Now let us change ends of the bay and see what the effect will be, the location being the same and the
mouth of the bay only fifty feet wide and one hundred miles long and fifty miles wide at the extreme end or head, there would be no tide at the extreme end, the opening being so small at the mouth and the demand for water so large, as it made its way up the bay, tha But every flood tide would make a fall into the bay and every ebb tide would make a fall into the ocean. There would be no possible chance for a sufficient quantity of water to get into this bay to make a tide at the extreme end. The Gulf of Mexico is a representation in part of this formation, so much so that the tide is quite small on the west shore.
The course of the Gulf Stream could be changed by cutting across at the Isthmus of Panama a channel of sufficient size to admit the passage of the water form ing it. The stream would then flow into the Pacific Ocean and no longer cross the Atlantic to warm the shores of Europe, at it now does. The Gulf Stream is an equalizer of water as well as heat. If the water re mained equally distributed, there would be no ocean currents. The land, with its varied formation, together with wind and tide, the great forces which move or displace the water of the sea, is continually causing in equalities of water. The moon and sun, by their attraction, draw the water from the poles to the center
directly under the moon at the tropics, and is brought by the tide waves from the east to the west shore, where it is held by the moon, sun, and trade winds, and forced along the shores north and south. The islands forming the Caribbean Sea act on the principle of a breakwater or dam. They hold the water that has been forced into the Caribbean Sea by the tides and trade winds, which causes the water to be higher in that sea and turn it into the Gulf of Mexico, which becomes the reservoir or fountain head, and whence the Gulf Stream flows like a river from a lake. It is the qualizer of water as well as heat, and makes its ment.

The warmth of the stream is accounted for by the fact that its waters are supplied from the tropics, the tide waves acting on the principle of an eddy, so it has counter currents also. This theory rests upon the as-
sumption that the water is higher on the east than on sumption that the water is higher on the east than on
the west side of $t . e$ Isthmus of Panama. The continent
of America is the great dam in the ocean that forms the Gulf Stream. Place the continent of America so it will lie east and west, there would be no Gulf Stream. If there were no other land on the globe than America there would be no ocean currents except those connected with America; but such is not the case. Africa has her nose in the way, Australia and New Zealand intervene, and Asia is there to stop tides and make ocean currents in the Pacific Ocean. So when we find large bodies of land directly in the path of the tides, we find ocean currents also. All large oceans have their counter currents or eddies. The water that has been carried west by the tides has to return as current to supply the deficiency, thus imparting the eddy no tion. The tides and the winds, with the land and its formations, will produce every circumstance connected with the ocean currents.
The peculiar formation of the land has a good deal to do about getting up the Gulf Stream.
Some of the trade winds are caused by the rotary motion of the earth. The sun constantly warming the air at the surface of the earth, making it lighter by day, while the night cools it and makes it heavier, so the cool air follows the sun around the earth, and that is the cause of its keeping one direction. We have some proof to establish this theory taken from the United States coast survey. Perhaps the most valuable item is the discovery that the stream changes in velocity daily and monthly, and that prediction can bemade of the time of those changes. It will be remembered that the tides rise and fall daily, and the motion of the stream depends chiefly upon the position of the moon in its revolution around the earth, and in the same manner the current change takes place, which follows the moon in its journey north and south of the equator. When it was first proposed to open the Panama Canal the scheme was strongly opposed on the ground that it would endanger millions of lives. It was asserted that the waters of the Pacific were more than one hundred feet higher than those of the Atlantic, and that if they got headway in the ditch they would drown the country all around on the Atlantic side. It now turns out that the Atlantic is the higher of the two, and that the difference is about six and a half feet.

John P. Whipple.
Milwaukee, Wis.

## Sodium in the streets.

A very remarkable discovery has been made by Major Cardew, the Electrical Adviser of the Board of Trade, in connection with the recent street conduit box explosions in the St. Pancras district; and it has been communicated to the newspaper press. The state of the St. Pancras electrical distributing plant had already been adversely criticised by Major Cardew and now he finds that the deposit on some of the in sulators, suspected of being instrumental in causing the recent explosions, contains "a considerable quan tity of the metal sodium." The gravity of this dis covery is obvious. The Board of Trade think that " the presence of this metal, which is highly inflammable by contact with water, appears to be so grave a source of danger, and to afford so reasonable an explanation, in connection with the accumulation of escaped coal gas, of the several explosions which have recently occurred," that the department must look recently occurred," that the department must look
into the whole matter forthwith, in conjunction with into the whole matter forthwith, in conjunction with
the Royal Society and the Institution of Electrical Engineers. In the meantime, the Vestry are urged to take practical steps to reduce the risk of explosions The Electricity Committee of the Vestry had a special meeting to consider the statement of the Board of Trade; and they offered sundry observations there upon, concluding with an expression of the "hope that the Board of Trade would bring pressure to bear on the gas company to remedy the defective state of gas mains and services in this district, and thus re move the primary cause of the explosions." Of course the vestrymen know very well it is impossible for either themselves or the Board of Trade to increase the sense of responsibility felt by the gas company for the condition of their mains and services. If the gas distributing plant in the St. Pancras district is old, and open to suspicion of general weakness, the company will doubtless have it relaid at the earliest possible moment. But it is beyond human power to prevent occasional escapes of gas from a distributing network maintained constantly under pressure beneath the surface of roads and street pavements in use for all sorts of other purposes; and it is for the owners of electrical culverts to see to it that these do not increase the ordinary hazards of the streets. Jour. of Gas Lighting

## Electrified Paper

Mr. F. L. Stevens, North Hoosick, N. Y., states that in the paper mills in that place they are sometimes troubled with static electricity. In some cases sparks six to eight inches in length are produced as the paper eaves the calender. A steam damper is used to pre vent this, or a copper wire, well grounded, is made to rest on the web as it passes from the calenders to the

## A CONVENIENT SQUARE AND BEVEL

In this tool two blades are rigidly connected with each other at an angle of forty-five degrees, one of the blades having a graduation of degrees, sides of polygons, bevels, etc., while the other has tables for calculating rafters, braces, etc. The improvement has been patented by Mr. John McLean, of Miller's Ferry, Ala. Its stock, A, supports in its lower end a pivot, $B$, on which is fulcrumed a blade, $C$, having a segmental slot, $\mathrm{C}^{\prime}$, engaged by a bolt, D , in the upper part of the stock. The blade, C , has an extension blade, E , adapted to form a try square with the stock, and on the blade, $\mathbf{C}$, is a graduation, $\mathbf{F}$, indicating degrees aud subdivisions and also the sides for polygons, plumb levels for common rafters, hip and jack rafters, with seat and side bevels, and other desirable matter. This graduation is read on a fixed pointer, $G$, on the upper end of the stock. The blade, E, has on one face tables for calculating the length of rafters, its reverse face containing a brace scale, and there being in its lower edge apertures $\mathrm{E}^{\prime}$, an inch apart, to be engaged by a point, $H$, having at its middle an enlargement permitting it to abut for a rest against one face of the blade. A tranverse aperture, $\mathrm{A}^{\prime}$, in the stock, is adapted to receive a pencil or any pointed instrument The inventor designs that instruc tions shall be sent with the square, explaining the various purposes for which it may be advantageously employed.

## OUTFIT FOR CASTING LIGHT METALS.

The improved apparatus illustrated herewith is more especially designed for casting aluminum, or other metals so light as not to run freely from the crucible when melted, and which, from the same cause, are liable not to form so perfect a casting as desirable. To obviate this difficulty, the apparatus provides for injecting compressed air to the crucible above the molten metal, and also for maintaining the air pressure in the flask until the metal has cooled. The improvement has been patented by Dr. Edmond H. Casgrain, dentist, No. 51 Rue St. Jean, Quebec, Can. The crucible is supported in a furnace of firebrick or other suitable material, with an open space beneath for the flask, mount ed on a block carried by a screw, whereby the flask may be raised to bring its mouth inclosecontact with the outlet nipple at the bottom of the crucible or low ered for removal. In melting aluminum, a plug is not usually needed, the metal not running from the vent on account of the exterior air pressure, and the slight ordinary incrustation ; but in casting heavier metal the ordinary frangible plug may be employed, or a plug may be used which has a perforated diaphragm, ex tending around the mouth of the orifice within the crucible, and which has a handle extending up through the cover, as shown in the small view. The diaphragm


CASGRAIN'S METAL CASTING APPARATUS.
is employed to remove oxides from the metal in fusion before the crucible is closed. For melting metal ordi narily, the cover shown in the small view will be placed over the crucible, the other cover being then swung up to one side. In the front wall of the furnace is an opening to receive the end of a blowpipe, and near the top of the crucible is an inlet connected by an air pipe with a hand pump, or other means of supplying air under pressure. The air supply is controlled by a valve, and is delivered by a branch pipe into a reservoir and not directly to the crucible. Between the reservoir and the crucible is a valve, from the stem of which extends a lever, connected with which, by a link, is a cover adapted to be held down snugly upon the crucible to resist the air pressure within. The turning down of the lever carrying the cover to the position shown
in the illustration also opens the valve to permit compressed air to flow from the reservoir into the crucible. The air from the reservoir, rushing into the crucible on top of the melted metal, forces the latter through the outlet nipple and into the mould, the continuing pressure causing the metal to pack snugly and make a firm, smooth casting. The improvement is especially designed to facilitate the casting of aluminum and other dentures, as well as for a wide range of other work. It has been practically tested by the inventor during a period of three years.

The breeding of buffaloes.
A famous Montana character is Charlie Allard, of Ravalli. Mr. Allard is famous mainly because he

One of the oldest and most unique war vessels in the world is the ironclad canal boat belonging to Hol land's navy. The canal boat is a completely equipped war ship in miniature, and is intended for service on Holland's extensive canal systems. The boat is about forty feet in length and fifteen feet in width, and her upper deck is between three and four feet above the water line. Her sides are armored and her deck is water line. Her sides are armored and her deck is
provided with two little turrets, one fore and one aft. provided with two little turrets, one fore and one aft.
There are two masts, about twelve feet in height, and There are two masts, about twelve feet in height, and
the bulwarks are not much over a foot in height. The the bulwarks are not much over a foot in height. The
turrets are supplied with the heaviest guns which turrets are supplied with the heaviest guns which
may be used to advantage in such close quarters, and may be used to advantage in such close quarters, an
her tops are provided with efficient machine guns.

The canal war boat is a valuable part of the defensive armament of Holland. The canals of Holland are in many sections several feet above the level of the surrounding country, and they afford an im portant vantage point for the war ship's guns. The canals, besides, penetrate every part of the coun try, in most cases passing through the cities and towns, and it is, therefore, of the greatest import ance that a war ship of just this pattern should be at hand. Holland's navy includes, besides this unique feature, about one hundred and fifty men-of-war; of this num country, and country, and no man living has given to these now rar animals more patient study and attention than he.
"The coldest storms of winter do not trouble them," he says, "for their thick, shaggy coats are windproof During the heavy snows and blizzards they climb the hills and, turning their breasts to the wind, defy the storm. They feed where the snow is thinnest. Cattle are driven before a storm and will of ten go with a wind 60 or 100 miles from the accustomed range, unless they reach a sheltered spot. Horses turn their backs to storm, but the buffaloes face it every time. They seem to keep in about the same condition of flesh the year round, and are as good eating in the spring as they are in the fall, and a buffalo steak is as fine a morsel as ever a man made a meal of. About two years ago I purchased the Jones herd of buffaloes, which was at Omaha. There were thirty one of them in the herd and we paid (for I have a partner now) $\$ 18,000$ for the lot. Marchiel Pablo, a well known cattle man, has joined me in the business, and for the past year has had entire charge of them, so that I do not know just ex actly how many we have-about 140 I should judge now, and by next fall there will be fully 200 of them.
"We experimented in crossing buffaloes with al breeds of cattle and the results are most satisfactory. The polled Angus stock, when crossed with the buffalo, produces a magnificent animal. The fur is finer and closer than that of the buffalo and the meat is sweet and wholesome. We are procuring as many of these animals as possible, but will not put any on the market for several years yet. We are not selling any buffaloes either, for the reason that we need them all at present We receive letters every day from museums, parks, and shows, wanting them in all quantities, and though w might dispose of one or two singly, we have no pairs to sell.
"A good buffalo hide is worth $\$ 100$ now in the mar ket, and heads bring from $\$ 200$ to $\$ 500$ when mounted, and the value of these is steadily increasing, so that buffalo breeding is as good an investment as real es tate. Our herd is the only one I know about of any size. There is a smallone in the Texas Panhandle, and these, with the few that roam in the National Park, are the sole remnants of the thousands which roamed the prairies but a few years ago."-Anaconda, Mon., Standard.

## The Brazilian Pottery Tree.

Among the numerous vegetable products of Brazil the Moquilea utilis, or pottery tree, is not the leas noteworthy. This tree attains a height of 100 feet, and has a very slender trunk, which seldom much exceeds one foot in diameter at the base. The wood is exceed ingly hard and contains a very large amount of silica but not so much as does the bark, which is largely em ployed as a source of silica for the manufacture of pottery. In preparing the bark for the potter's use it is first burned and the residue is then pulverized and mixed with clay in the proper proportion. With an equal quantity of the two ingredients, a superio quality of earthenware is produced. This is very dura ble, and is capable of withstanding any amount of heat. The natives employ it for all kinds of culinary purposes. When fresh, the bark cuts like soft sand stone, and the presence of the silex may be readily ascertained by grinding a piece of the bark betwee the teeth. When dry, it is generally brittle, though sometimes difficult to break. After being burned it cannot, if of good quality, be broken up between the fingers, a mortar and pestle being required to crush it.

## AN IMPROVED VENEER PRESS.

For pressing together several layers of previously glued veneer, and holding them firmly until the glue has set, the press shown in the illustration has been patented by Mr. William Clayton, No. 125 Eighth Avenue, New York City. The lower fixed jaw is slightly convex on its upper side, the upper movable jaw, sliding vertically in guide frames, being also lightly convex on its lower face. Both jaws are preferably of wood, and first come to a bearing in the middle, afterward graduolly springing sufficiently under rressure to bring the adjacent faces to a level the layers of veneer being thus first squeezed together n the middle, but every part coming under pressure as the jaws are straightened out. At the upper end of each of the guide frames is a block through which extends a screw socketed at its lower end in one end of the upper jaw, while at its upper end is a hand wheel, here being on each screw a sprocket wheel, and these wheels being connected by a chain, that both wheels may be turned simultaneously to move both ends of the jaw at a uniform rate of speed. To make a tight or loose connection of the sprocket chain, so that on screw may be turned alone when desired, each sprocke wheel has in its hub a pivoted spring-pressed latch the bolt of which may slide in a smooth groove in the shank of the screw, or in another groove in which is a


## CLAYTON'S VENEER PRESS

hole to receive the bolt, as shown in the small view, either adjustment being made by pressing on the latch and moving the wheel a slight distance up or down. Projecting from the ends of the upper jaw and sliding on vertical rods are guide lugs, normally pressed upward by spiral springs encircling the rods, the springs operating to lift the upper jaw when the downward pressure of the screws is withdrawn.

Prof. Ruge states that the purchasing power of money was much greater in 1492 than at present. He says the first expedition of Columbus cost only $\$ 7,300$, including the equipment of the three caravels. The salary of Columbus as admiral was $\$ 320$ a year. His captains received $\$ 16$ a month, and the seamen $\$ 2$ to $\$ 2.50$ per month.

## DR. P. H. VANDER WEYDE

P. H. Vander Weyde, the well known scientist, and a former frequent contributor to the pages of the Scientific American, died at his residence in this city on the morning of March 18, after an illness of a few days.
Dr. Vander Weyde was born in Nymegen, Holland, in 1813, a country to which his family, originally German, emigrated at the time of the Reformation. He studied at Durpldorf and was graduated from the Royal Academy at Delft. He was early known as a scientific teacher, write and lecturer, his first appearance in the latter capacity having been made at Bois-leDuc in 1833, when he delivered a lecture on acoustics before the philosophical society of that place. Subsequently he was appointed to the chair of mathematics and natural philosophy at the Government School of Design. In 1842 he established a journal devoted to mathematics and physics, and three years later was awarded a gold medal by the Society for the Promotion of Scientific Knowledge for a text book on natural philosophy. At the same period, he was editor of a political journal which vigorously waged war against government abuses.

In 1849 he came to New York, bringing with him a valuable historical collection of philosophical apparatus which he had been forming for some time. He then turned his attention to medicine, and after studying at the College of Physicians and Surgeons and the New York University Medical College, was graduated from the latter institution in 1857. Directly after his graduation, he was appointed professor of chemistry in the New York Medical College; was also ap pointed physician to the Northwestern Dispensary, and practiced medicine in several parts of the city until 1859, when he relinquished his profession to occupy the chair of physics, chemistry, and the higher mathematics at the Cooper Institute.
In 1864, the chair of industrial chemistry was expressly created for him at Girard College. Resigning this professorship two years later, he returned to this city, and devoted himself to scientific writing and ex perimentation. In or about 1869, he con structed, after wood cuts published in a German periodical, a telephone transmitter that had been invented by the German schoolmaster Philip Reis. This apparatus, the first seen in this country, is illustrated and described in the Scientific American for May 29,1886 . The original instrument of Reis had no adjusting screws, so that its operation was uncertain. Having provided these and made certain other improvements, the instrument worked very satisfactorily. Not so with the receiver, with which he first had considerable trouble, but of which he succeeded in remedying the defects by abandoning the principle of Reis and substituting the intermittent magnetization of an iron bar for the intermittent elongation of iron needles. This resulted in the production of a receiver which worked perfectly.
Dr. Vander Weyde was not content to rest with the instruments of these types only, but a year or so later, in 1870 , made a form in which there was a horseshoe magnet mounted back of and facing the plate armature. It wassimply a powerful electromagnet receiver, something like, but immeasurably superior to, the instruments shown in the Bell patent of six years later.

In 1869, Dr. Vander Weyde accepted the editorship of the Manufacturer and Builder, a scientific journal of this city. During his long connection therewith his pen was very active, and his contributions to the scientific press and especially to this journal were numerous. He was one of the editors of Appleton's New American Cyclopedia and contributed many scientific articles to that work. As an inventor he had a wide reputation, the number of patents taken by him on inventions of his own, mostly pertaining to electricity, being more than two hundred.
Dr. Vander Weyde, who claimed descent from Walther von der Vogelweide, the celebrated minnesinger of the


## DR. P. H. VANDER WEYDE.

completed an article upon modern electricity for a scientific journal of this city.

At the Royal Institution recently Lord Raylergh, F.R.S., delivered the first of a course of six lectures on "Waves and Vibrations." After giving a brief account of the nature of the wave forms, he said that he pro posed that day to deal more especially with waves of water. In such waves the velocity was not independent of the wave length (or distance between crest and crest), as it was in the case of sound waves, which in air moved with the same speed whether they were long or short. With waves of water the long ones traveled more quickly than the short. Waves at sea were mostly <br> \section*{waves.} <br> \section*{waves.}

Waves.
thirteenth century, was also an accomplished musi cian and well known as a composer, the number of his comp
He was corresponding member of numerous scientific societies in Europe and America.
Notwithstanding his advanced age, he enjoyed vigorous bodily and mental health up to the time of his death, within a week of which event he wrote and


MR. GIRAULT'S PROJECT FOR THE PARIS EXPOSITION OF 1900.
generated by wind, though other causes, such as earth quakes, occasionally operated. By blowing the surface of a long trough of water with a powerful fan the lec turer showed that the waves produced close to the source of the wind were shorter than those set up fur ther away. The effect of oil upon waves was also illus trated and explained. Oil had no effect upon big roll ers, but the broken water upon which it acted was just dangerous to boats in a tempest. A storm in mid-ocean generated waves of all lengths but at a distance a kind of regularity was found, since the long waves arrived first the shorter ones following afterward. In the island of Madeira the lecturer said he had observed waves with the long periodic time of ten seconds. The height of waves in the sea had often been exaggerated, owing to the difficulty of measuring them, but the highest authentic observation was about forty feet. The lecturer next discussed stationary waves as opposed to the progressive waves of which he had been speaking. They were described as the result of the meeting of two perfectly equal sets of pro gressive waves, and the production of two systems of them was shown in a round tank Lord Rayleigh then spoke of the effects of waves on ships. He showed a small model boat so weighted as to have the same rolling period as the waves in the tank in which it floated. The result was that its rolling was exceedingly violent, but became com paratively slight when the weights were altered so as to change the rolling period. War ships, in which stability was very essential, were designed to have a longer pe riod of roll than any waves they were likely to encounter. The lecture was concluded with some remarks on standing waves, which it was explained would be formed in a river flowing four miles an hour by a wave traveling up it at the same speed. The waves produced would be standing as re gards an observer on the bank, but progressing as regarded the water.

## THE FRENCH EXPOSITION OF 1900.

The preparatory period of the Universal Exposition of 1900 has been devoted by Mr. Alfred Picard, its distinguished commis-sioner-general, to a public exposition of the projects, which, as Mr. Guadet has well expressed it, in a report relating to the opera tions of the jury, which terminated its labors on December 28, 1894, has been espe cially a "competition of ideas." The result of it has been entirely satisfactory. The French archi tects have been able to respond to the appeal that was made to them with their habitual qualities of activity, fertile improvisation and artistic training.
Finally, eighteen laureates have been rewarded, taking three first prizes, four second prizes, five third prizes and six mentions. According to the terms of the programme, their projects remain the property of the administration, which can use them as material from which to borrow the general elements of the final project that it has to establish. This labor is en trusted to Mr. Bouvard, an architect of merit whom a participation in the work of our preceding universal expositions makes especially competent.
This competition is itself alone a first indication of utility and interest. Afte examining what it has fur nished, it cannot be doubted that the Exposition of 1900 , although it has to surpass the fine one of 1889 , will be attended with a success that will be as great as it will be brilliant. For the artistic and industrial honor of France, it will worthily mark the debu of the twentieth century
Let us recall here that the laureates of the competition of projects for the Exposition of 1900 were the following :
First prizemen: Messrs Girault, Henard and Paulin. Second prizemen: Messrs Cassien Bernard, Gautier Larche \& Nachon and Raulin. Third prizemen: Messrs Blavette, Esquie, Rey \& Tron chet, Sortais \& Toudoire and Pradelle. Fourth prizemen Messrs. Bonnier, Hermant Louvet \& Varcollier, MassonDetourbet, Mewes, Thomas and De Tavernier
All these projects proceeded from the following great principles: To establish a con
nection between the banks of the Seine; to modify or rearrange the buildings remaining from the preceding expositions ; to preserve, as far as possible, the beautiful planted grounds of the city of Paris upon the site set apart for the Exposition of 1900 ; and to assure, also, as far as possible, an exact, methodical and rational classification.
To our regret, we cannot enter here into a detailed description of the prize projects, and still less, publish a host of original details, new conceptions and ingenious and grand ideas found in a large number of those that came afterward and do their authors honor.
We shall be content, following in this the magistral selection of the jury of awards, briefly to describe the three projects that were awarded the first prize and that appear to have responded to the main idea of the great enterprise that is preparing. Their "artistic mean," if it be permissible to express ourselves thus, well gives the image of the future exposition, and our readers, in looking at our engravings, will be able to obtain a preliminary idea of it. These projects are, as we have said, those of Messrs. Girault, Henard and Paulin. We shall take them in alphabetical order.

Mr. Girault's Project.-Mr. Girault, using the power accorded him by the general programme of the exposition, has suppressed all the structures remaining upon the Champ de Mars, with the exception of the Machinery Hall, of 1889, and the Eiffel Tower. These two grand structures will well symbolize, in 1900, the art with which the engineer and architect were able to appropriate metal in the age of iron and steel that will have just passed. Nothing will be easier, more over, if it be desired, than to rearrange the interior of the vast nave of the Machinery Hall and to "embellish" the Eiffel Tower in order to give it an architectural aspect. The 300 meter tower, which it would have been costly to demolish, is the joy and the admiration of visitors who come from every quar ter of the globe. From its summit, it will be possi ble not only to contemplate the completed Exposi tion of 1900 , but also to see it constructing and rising like an immense fairy scene. Were it to regard it only from this view point, it would be just and ra tional to preserve it. In the center of the Eiffel Tower, Mr. Girault has arranged a large and beautiful cupola and two great monumental greenhouses for horticulture on each side. This is the "embellishment" of the tower, and it is certainly well conceived.
Mr. Girault preserves also the Palace of Industry, of wnich he : modifies the approaches and gives it a monumental porch. This latter will serve as a secondary entrance to the exposition, the main entrance of which will be situated on Place de la Concorde.
In his project, this able architect has, with specia care, anticipated a general classification of the mem bers of a same group in the special palaces in whose center would be found the retrospective centennial exposition. He would thus furnish its visitors with elements of instruction such as have not as yet been seen grouped in any exposition, and this certainly is a very happy idea.
Mr. Eugene Henard's Project.-In his project Mr Henard has preserved the Machinery Hall of the Exposition of 1839 and the Palaces of Fine and Liberal Arts erected upon the Champ de Mars. What charac terizes his very beautiful and very imposing project is that the Machinery Hall would become the Hall of Fetes of the Exposition. The "hit," to use the common expression, would be a colossal dome 100 meters in diameter and 200 in height. The Champs Elysees would be connected with the Esplanade des Invalides by a three-arched bridge 100 meters in width
Mr. Paulin's Project.-In Mr. Paulin's project, which is very sensible and very moderate in its conceptions, it is the Seine that serves as the principal motif. Its banks, converted into gardens, would offer the visitors varied recreations, specimens of structures of all countries, and suspended gardens. As the river would serve not only as an axis, but also, in a manner, as an entrance to the exposition, a monumental bridge would be constructed at the height of the Palace of Industry and its approaches would be provided with great triumphal arches.

Mr. Paulin proposes the preservation of the Eiffel Tower, the Machinery Hall, and the Palace of Industry, but he would annex to the latter a gallery parallel with the Seine, and a vast central rotunda having an access near Place de la Concorde, with grand vestibule and monumental stairways.
Such are the broad lines of the three projects that obtained the highest awards from the jury. Wha will the exposition of 1900 be ? Every one is already asking this question with curiosity.
It would be necessary in truth to be more advanced than Mr. Bouvard himself and than Mr. Picard in order to answer this question, for it is certain that the general and definite plan, in course of elaboration, will borrow from the various prize projects all that they possess of the seductive, and that these different elements will be fused together in order to form a majestic and homogeneous whole.

As to the general impression, we will doubtless find a certain resemblance bet ween the new exposition and and the Machinery Hall materializes the souvenirs of 1889 in a grand and indelible manner.
But the extension of the exposition upon the two banks of the Seine will give it a character of evident innovation. The wide perspective opened, too, within the limits of the exposition, from the Palace of Indus try to the Esplanade des Invalides, will present to the visitors an unexpected spectacle. Itserves as a motive for the construction over the Seine of a bridge that will remain after the exposition and take a place among the beautiful things that may be admired at Paris.
Finally, the relatively wide area accorded to the exposition will permit its organizers to establish the classification of the products with a clearness and a method that have been wanting in our universal expositions since the remarkable one of 1867 , which, thank to the work of the learned Le Play, was a model of its kind. The visitor will therefore be able not only to be more easily amused and entertained, but also in structed, and this is a quality that ought to be essen tially possessed by such a great enterprise, the mission of which, in a manner, is to summarize the industrial artistic and scientific progress of an entire century. La Nature.

A SIMPLE CAMERA SHUTTER.
During last summer's vacation, the writer, while in he mountains enjoying the scenery and trying to survive an acute attack of photographia, received a superb lens ordered some time previously, but the shutter was not yet completed. The lens was used with great satisfaction with the cap as a shutter, the


A SIMPLE CAMERA SHUTTER.
only difficulty being that of overexposure aind the of casional loss of a subject requiring an instantaneous exposure. When, however, a desirable snap shot subject presented itself, an instantaneous shutter became necessity, and hence the invention of an exceedngly simple shutter for the emergency
This shutter, which is here illustrated, has been used since its first application to the camera, notwithstand ing the adaptation of the fine shutter belonging to the lens.
Twó oblong pieces of pasteboard box, four hair pins, our common pins, a long thin rubber band, a piece of black velvet, and a piece of thread constitute the materials, and the time required for making the ap paratus was twenty minutes.
In the center of one of the pieces of pasteboard wa formed an aperture to fit over the threaded end of the ens tube, and in the center of the other oblong piece of pasteboard was formed a wide transverse slit, and a piece of black velvet was attached to one side of the pasteboard and carried over the edges around the slit In the absence of other forms of wire four hair pins, a, were straightened, the ends of each one bent at right angles in the same direction and inserted in opposite edges of the pasteboard above and below the lens tube. Two of the common pins were inserted in the front of the lower part of the movable portion of the shutter, from opposite directions, forming a cleat fo the reception of the piece of thread, and in a simila way two pins were inserted in the stationary paste board. A slender rubber band, b, was stretched around diagonally opposite ends of the pieces of paste board within the wire arms, a, and was prevented rom slipping by
This shutter was set by raising the front part so o bring the lower imperforate portion against the front of the lens tube, thereby shutting off the light, then bringing the thread, c, already attached to the cleat on the stationary part, around the cleat on the movable part. The exposure was made by cutting the
thread by means of a pair of scissors as shown in Fig. 1. The focusing was done while the shutter was held open by another thread, d, having a loop in it, which was slipped on the front cleat as shown in Fig. 3.
To make a slightly prolonged exposure the thread, c , which held the shutter closed, was cut first as shown in Fig. 2. The looped thread, d, which held the shutter open was cut immediately after it, the time elapsing between cutting the first and second threads being the time of exposure. The rapidity of the shutter is increased by adding another rubber band.

Considerable attention has been directed of late to the purification of water in large quantities by means of artificial filter beds. A number of these filters are being tested in various parts of the United States and their use promises to become general. The use of un filtered water, it is generally recognized, tends to spread dangerous germs, and the importance of some conve ient and economical means of supplying pure water can hardly be overestimated.
The filter beds situated at Ilion, New York, will serve to illustrate the general form of the artificia filters now in use. The water to be filtered in thi case is supplied by a small stream which is dammed up and conducted to a storage reservoir. Before filter ing, this water passes through a fountain which serves to aerate it. It is thought that this oxygenates the water, so that it will permit of sufficient nitrification in the filter beds without necessitating from time to ime the aeration of the pores of the filter. The filter is arranged with an underdraining consisting of two courses of bricks laid dry. The lower course is placed end to end and forms lines which run at right angles to the main collecting drains. The space between thes lines is equal to the width of one brick. These space are covered with the second course of bricks, and ove this is spread six inches of pea gravel, and over this in turn a layer of sand thirty inches thick, of a uniform grade throughout. The water passes through this fil ter into the collecting channels formed by the firs course of bricks, and is then collected in a clean water basin for distribution.
A filter of a slightly different form was opened in 1893 in Lawrence, Mass. In this case the filter mea sures two and one-half acres, and filters $5,000,000$ gal lons of water a day. It is arranged in a number of beds, each of which has a depression in the cente which makes it possible for the water to rise gradually over the sand. The depth of the sand in these beds is five feet, and in the depressions a fine rgrade of sand is used to equalize the filtration for all parts of the bed Artificial filter beds of the same general form have also been introduced at Poughkeepsie, Hudson, and Mount Vernon, N. Y.; at Nantucket, Mass., and elsewhere
Some very satisfactory resulis are also obtained, it is claimed, by rapid or mechanical filtration with the use of coagulants. In this method, a rapid stream of water is furnished for several hours, and the filtering sand is washed by the disturbance created by revers ing the current until the water which comes from the sand is perfectly clear. Several processes of carry ing on mechanical filtration have been patented, and companies have been formed to fill contracts for contructing such filters. The filtration of drinking wate is a necessity in many parts of the country, and it is to be hoped that filters of some form may in time come into very general use.

## Primitive Fire Engines.

The oldest known fire engine for pumping water is probably the one mentioned in the Spiritalia of Hero hout 150 B . C. This engine, it is said, was contrived with two single-acting pumps with a single beam pivoted between the two for working the plungers. The streams of water united in a single discharge pipe and passed up a trough having an air chamber, and out of a nozzle which might be turned in any direction as desired. Fire engines appearalso to have been used extensively by the early Romans, who furthermore or ganized regular fire brigades.
In the early part of the sixteenth century a fire en gine known as a "water syringe" was introduced which, in a measure, resembled the modern forms of fire engines. This was mounted on wheels and the water was pumped by levers. This form of engine was very generally used in Germany. In England about the same time large brass syringes were used. These held several quarts of water and were operated by three men, two of them holding the syringe at eac side with one hand and directing the nozzle with the other, while the third operated the plunger. It wa necessary, after having discharged the water from the syringe, to refill it from a well or cistern near the fire or from buckets. The syringes were later fitted to portable tanks of water. The first successful fire engine was probably the Newsham engine, and this was the pioneer of manually operated fire engines. The pumps in these engines were built on many different designs, but in most cases they were operated by levers. Fire engines similar in form to the Newsham engine were in use up to the year 1850.

## Indian Funeral Trees

A remarkable specimen of the red cedar was recently unearthed by the opening of the Metzgar Indian Mound, on Deer Creek, near Yellow Bud, in Ohio. A large bed of ashes, a quarter of an inch in thickness, covered a space of about ten feet by six. Near the edge of this ash bed a large log was found. It was about five and a quarter feet in circumference, and as sound as if buried but a few years ago. The side branches had been cut away from the log, and one of the scars was so perfect that the marks of the stone axes used in the work are plainly discernible. There are no cedar trees now growing nearer than ten miles from that immediate neighborhood, and none were there growing when the early settlers came, so that the trees must have disappeared from there long ago in the past, or the improbable alternative accepted that the log was brought from a long distance. Evidence was furnished that the log was originally about eighteen feet long. Right beneath the log was a skeleton of a huRight beneath the $\log$ was a skeleton of a hu-
man being. A small pen had been made of small ceman being. A small pen had been made of small cethe large log. The skeleton was about two feet below the large log. The skeleton was about two feet below
the original surface of the ground, and the earth formthe original surface of the ground, and the earth form-
ing the mound over the skeleton had a depth of about ing the mound over the skeleton had a depth of about
thirty-four feet from the summit. The earth to form thirty-four feet from the summit. The earth to form
the mound had evidently been brought in baskets by manual labor, as the "dumps" in some cases, formed by different tinted materials, could be distinctly seen. The circumstances favorable to the preservation of the cedar $\log$ had evidently aided in preserving the skeleton, and it is possible the size of the log had some relation to a distinguished personage. The body had been laid straight under the log, with legs extended and arms at the sides. Around each wrist were two bracelets, made of native copper, and several hundred shell beads were around the neck and on the chest. It is believed that the dry ashes with which the body had been covered, in addition to the great depth from the surface, had aided in preserving the log as well as the human remains. Even traces of hair were found around the skull, as well as dried and rude cloth and matting, as well as buckskin, put over the corpse before the ashes, were in a fair state of the corpse before the ashes, were in a fair state of
preservation. As the use of the cedar log would seem to have been a matter of choice, it opens a new field for speculation as to the possibility of the tree having had some special significance in the funeral ceremonies of the Mound Builders. A section of the log has been secured for the museum of the Academy of Natu ral Sciences, of Philadelphia-the exploration, indeed, having been made under the auspices of that body.

## Painting Carriage Bodies.

Here is what an experienced man writes in Varnish My subject is white lead. I have been experimenting with it for some time, and am fully convinced that it should be used very sparingly in the painting of a carriage body, and more especially as a putty. You naturally ask why?
What is white lead? It is a corroded metal, which is capable of being brought back to its original state, but with a loss of its weight, thus proving that it has not lost its metallic property of expansion and contraction.

How can we prove this? Let us make a white lead putty taper two inches long, one and a half inches at the large end and one inch at the small end. Let it get perfectly dry, then have it turned accurately and fit a brass ring to the large end when the putty is at a temperature of 30 degrees. Then raise it to 90 degrees and attempt to pass it through the ring. You will find that you cannot do it, thus proving that white lead pu
What are its adhesive qualities? Very little in itself. It is unlike glue or other resinous substance, which penetrates the fiber of the wood and in a manner clinches itself, but like the brick to the mortar, is held by absorption.

How can we prove this? Paint a thin board with three coats of white lead mixed with oil and turpentine (or brick is still better). When perfectly dry place it under an exhaust pump, and you will find that the white lead coats will part from the wood or brick
Now, I need not tell you how we usually paint a carriage body, but we do not first coat it with lead and then freely coat it with a matter which has no expansive quality, except when subject to intense cold, and which contracts by heat. We here find that the element which expands the under coats contracts the outer ones. Is it any wonder that our paint cracks and peels off, or that our putty protrudes and shows? Or can you tell me of a varnish that we can expect to be capable of resisting the laws of nature?

That delectable and piquant fruit variously known as the shaddock and the grape fruit was first made known to Western palates by a certain Captain Shaddock, who was in the East Indian trade. Why the Florida fruit growers should have named it the
fruit is a mystery we have never seen explained.

SHIPS OF THE NNW UNITED STATES NAVY.
In August, 1882, Congress approved an act to com plete the double turreted monitors and for the con struction of a 6,000 ton protected cruiser. This ac was so vague that it was not until March 2,1883 , that Congress appropriated $\$ 1,300,000$ to begin the construetion of four ships. With these ships the new navy was born, and each year since it has been added to until we have now a naval list of nearly a hundred ships in commission, ready to be commissioned or building.

Among this number are five double turreted and thirteen single turreted monitors, six battle ships, one coast defense ship, twenty-fiye cruisers, one dynamite cruiser, one harbor defense ram, one naval school ship, eight gunboits, six torpedo boats (including one ram and one submarine), one survey and one dispatch boat, besides many vessels of smaller build and efficiency, serving in different capacities where they are respectively stationed.
Of the enumerated vessels, the six battle ships, eighteen cruisers, six gunboats, five torpedo and one dispatch boat, the naval school ship Bancroft, the harbor defense rain Katahdin, the dynamite cruiser Vesuvius and the coast defense ship Monterey, are built of steel.
The eighteen armored monitors, one cruiser, two gunboats, the survey steamer Ranger and the ram Alarm are of iron, while the old wooden ships include six cruisers and the store ship Mohican.
The ships are divided into four classes: (1) Armored including the battle ships, monitors, cruisers and coast defense ships ; (2) una:mored protected vessels, includ defense ships; (2) una?mored protected vessels, includ-
ing cruisers, gunboats and dispatch boats ; (3) unaring cruisers, gunboats and dispatch boats; (3) unar-
mored ships of iron ; (4) wood, comprising vessels of the old navy.

The illustrations on other pages will give our readers a fair idea of the appearance and the proportionate sizes of forty of these new vessels, the earliest built vessels being shown on the page to the left, and those of later construction on the right hand page.
The first elass battle ships Massachusetts and Oregon. on page 20 ., are each of 10,231 ons displacement, 9,600 indicated horse power, developing a speed of 16 knots to
the former and 16.8 knots to the latter. In armament the former and 16.8 knots to the latter. In armament inch, eight 8 inch and four 6 inch breech loading rifles, sixteen 6 pounder and four 1 pounder quick fire, and four
Maxim guns. The second class battle ship Texas has a speed of 17 knots with 8,600 indicated horse power and a displacement of 6,350 tons. She mounts two 12 inch and six 6 inch breech-loading rifles, twelve 6 pounder, four 1 pounder quick firing and four Maxin guns.
Of the protected cruisers, the Chicago has a displacement of 4,500 tons, a speed of 15 knots and 5,000 indicated horse power. Her battery contains four 8 inch, eight 6 inch, and two 5 inch breech-loading rifles, four quick fire and eight Maxim guns. The Baltimore has a displacement of 4,413 tons and indicated speed of $19 \cdot 2$ knots furnished by engines of 10,750 indicated horse power. Her battery has two 8 inch and six 6 inch quick fire and seven Maxim guns. The Philadelphia with the same displacement as the Baltimore of 4,413 tous, has made 19 knots with 10.500 indicated horse power. She mounts twelve 6 inch breech-loading rifles, four 6 pounder, four 1 pounder quick fire and 7
Maxim guns. The San Francisco has displacement of 4,083 tons, a speed of 19.5 knots and engines of 10500 indicated horse power. She carries twelve 6 inch breech-loading rifles, four 6 pounder quick fire and reven Maxim guns.
The Atlanta and Boston have each a displacement of 3,189 tons. The Atlanta has a speed of 15.4 knots, attained by 3,511 indicated horse power; the Boston requiring 3,780 indicated horse power to attain a speed the same, consisting of two 8 inch, six 6 inch breechloading rifles, six quick fire, and six Maxim guns.
Of the unprotected cruisers, the Minneapolis has de veloped a speed of 23.073 knots , with engines of 21,000 indicated horse power. Her displacement is 7,475 tons, she carries one 8 inch and two 6 inch breech-loading rifles, eight 4 inch rapid fire, twelve 6 pounders, eight 1 pounder quick fire, and four Maxim guns.
The Cincinnati and Raleigh are government productions, having been built, the former at the Brooklyn navy yard, and the latter at the Norfolk yard. They are of 3,183 tons displacement, 10,000 indicated orse power, and a speed of 19 knots each. The Cin cinnati carries one 6 inch and ten 4 inch breech-loading
rifles, two 6 pounders, two 3 pounder quick fire, and four Maxim guns. Mounted on the Raleigh are one 6 inch breech-loading rifle, ten 5 inch rapid fire. eight 6 pounder, four 1 pounder quick fire, and two Maxim guns.
The gunboat Yorktown, one of the first four ships authorized, has a displacement of 1.700 tons, an indicated horse power of 3,400 , develops a speed of 16 knots, mounts a battery of six 6 inch breech-loading ifles, four 6 pounder quick fire and five Maxim guns.
After building and commissioning the next two gun-
boats Machias and Castine, they were found to be too topheavy in a seaway. To rectify this defect it was de cided to lengthen them. Accordingly the two vessel were cut in two amidships and rebuilt, thus righting the blunder originally made. In these two versels there is but one point of difference, the Machias hav ing a speed of 145 knots from 1,600 indicated horse power engines with a displacement of 1,050 tons, where the Castine makes but 14 knots with the same horse power and displacement. In armament the two vessels each carry eight 4 iuch rapid fire, four 6 pounder, two 1 pounder quick fire and two Maxim guns. The Petrel is of 890 tons displacement, has a speed of 13 knots, en gines of 1,300 indicated horse power, a battery of four 6 inch breech-loading rifles, three 3 pounder quick fire and four Maxim guns.
The coast defense double turreted ship Monterey has a displacement of 4,048 tons, a sp
engines of 5,400 indicated horse power:
Mounted in her two turrets are two 12 inch and two 10 inch breech-loading rifles, with a lighter battery of six 6 pounder, four 1 pounder quick fire and four Maxim guns, mounted on the superstructure and in the fighting top
The harbor defense ram Katahdin carries but a light secondary battery of four 6 pounder quick fire guns. She has a displacement of 2,050 tons, a speed of 17 knots, and engines of 4.800 indicated horse power. The dynamite cruiser Vesuvius has a displacement of 725 tons, a speed of 21 knots, and engines of 3.200 indicated horse power. She was designed to throw 600 pound charges of dynamite from her 15 inch pneumatic guns, which are supplemented by three 3 pounder rapid fire guns. The torpedo boat Cushing is of 116 tons displacement, has engines of 2,500 indicated horse power, and a speed of 22.5 knots per hour. Among the vessels shown on page 201, the Iowa stands first with a displacement of 10,286 tons, in dicated horse power of 11,000 and a contract speed of 16.5 knots. When ready for active service the Iowa will carry a battery of four 12 inch and eight 8 inch breech-loading rifles, six 4 inch rapid fire guns, twenty 6 pounder, six 1 pounder quick fire and two Maxim guns. The Indiana, now nearing completion, is one of the three heaviest vessels which at present are on the naval list. She has engines of 9,000 indi ated horse power, a speed of 16 knots and a displace ment of 10,231 tons. In armament and construction she is the counterpart in every particular of her siste ship Massachusetts. Her battery will have four 13 nch, eight 8 inch, and four 6 inch breech-loading rifles sixteen 6 pounder, six 1 pounder quick fire and four Maxim guns. The second class battle ship Maine has a displacement of 6,648 tons, a speed of over 17.7 knots, and engines of more than 9,000 indicated horse power. She has four 10 inch and six 6 inch breech-loading rifles with a secondary battery of twelve 6 pounder, four 1 pounder quick fire and four Maxim guns. The cruise Brooklyn, now on the stocks, is an improved model of he New York. She is to have a speed, according to contract, of 21 knots, to be of 16,900 indicated horse power and have a displacement of 9,250 tons. He batteries will be eight 8 inch breech-Joading rifles, twelve 5 inch rapid fire, twelve 6 pounder and four 1 pounder quick fire, four Maxim guns and two light or field pieces.
The New York has a speed of 21 knots, triple expan sion engines of 16.000 collective indicated horse power and a displacement of 8,150 tons. Her armament con ists of six 8 inch breech-loading rifles, twelve 4 inch apid fire, eight 6 pounder, four 1 pounder quick fire and four Maxim guns. The Newark has a displace ment of 4,083 tons, an indicated horse power of 8,500 ,
driving her at the called for speed of 19 knots. In driving her at the called for speed of 19 knots. In armament she is inferior to the Chicano, carrying quick fire, and nine Maxim guns. The Charleston has a displacement of 3,730 tons, engines of 7,500 indicated horse power at a contract speed of 17 knots. Mount ing batteries of two 8 inch and eight 6 inch breech loading rifles, four 6 pounder, two 3 pounder quick fire, and eight Maxim guns.
In the Marblehead and Montgomery the governmen contract calls for two ships of the samedimensions and armament, with displacements of 2,000 tons, engines of 5,400 indicated horse power, driving the ships at a speed of 18.3 knots. The batteries of these two ships comprise two 6 inch breech-loading rifles, four 4 inch rapid fire, four 6 pounder, three 3 pounder quick fire, and two Maxim guns.
The Concord and Bennington are similar ships in all but their displacement, the latter being 1,750 to the former's 1,700 tons displacement, with indicated horse powers of 3,400 and called for speed of 17 knots In armament these two ships are identical, mounting
six 6 inch breech-loading rifles, four 6 pounder quick six 6 inch breech-loading
fire, and five Maxim guns.
The Columbia has a displacement of 7,475 tons, en gines of 21,000 indicated horse power and a speed of over 22 knots. She is probably the fastest cruiser in the world. In armament the Columbia and Minneapolis are identical, carrying oue 8 inch, two 6 inch breech-loading rifles, eight 4 inch rapid fire, twelve 6


THE NEW UNITED STATES NAVY-COMPARATIVE DIMENSIONS OF THE VESSELS.

the new united states navy-comfarative dimensions of the vessels
pounder, eight 1 pounder quick fire and two Maxim suns. The Olympia, with a displacement of 5,500 tons and engines of 13,500 indicated horse power, has a peed of $20 \cdot 2$ knots. In her batteries she carries four inch breech-loading rifles, sixteen 5 inch rapid fire, fourteen 6 pounder, six 3 pounder quick fire and four Maximguns. Among the first of the new ships, the Detroit was built on a contract calling for a displacement of 2,000 tons, driven by engines of 5,400 indicated horse power at a speed of 18 knots. She mounts two 6 inch breech-loading rifles, four $31 / 2$ inch rapid fire, our 6 pounders, two 1 pounder quick fire and two Maxim guns.
Among the vessels commissioned in 1894 was the naval training ship Bancroft of 838 tons displacement, with engines of 1,300 indicated horse power, developing a speed of 13.5 knots. For practice and drill her batteries comprise four 4 inch rapid fire, two 6 pounder, two 3 pounder, one 1 pounder quick fire and two Maxim guns.
The Dolphin, which was one of the first four ships contracted for of the new navy, is of 1,485 tons displacement, with engines of 2,300 indicated horse power and a speed of 15.5 knots. She is now the dispatch boat of the U. S. navy, carrying but a light armament comprising two 4 inch rapid fire, two 6 pounder quick fire and six Maxim guns.
Of the monitors, the Puritan, with two turrets mounting four $101 / 2$ inch breech-loading rifles, four quick fire and eight Maxim guns, with a displacement of 6,060 tons and indicated horse power of 3,700 , attaining a low speed of 13 knots, is the largest and heaviest of her type.
The Amphitrite, another of the monitor class, carries four $101 / 2$ inch breech-loading rifles in two turrets, with a secondary battery comprising six quick fire and our Maxim guns; she has a displacement of 3,990 tons, and engines of 1,600 indicated horse power, developing 12 knot speed, and is one of three ships of this class that stand next to the Puritan.
The torpedo boats Ericsson and the one now known as No. 2 are greatly different in size, the former having 750 tons displacement against No. 2's 120. These little fliers have a speed of 23 knots in the Ericsson and 24 in No. 2.

An Expediticn to the Antarctic Regions. Dr. Frederick A. Cook, the well known explorer, has recently declared his intention of leading a small but well equipped body of scientific men on an ex plon ing expedition to the Antarctic regions. The time for leaving New York has been fixed for September 1, 1895, and it is expected that the voyage will last for probably three years. There can be little doubt but that there will be much of srientific interest learned by such an expedition. The floor of the Antarctic Ocean is covered with an abundant fauna which will well repay a careful study. And it is thought probable that some isolated tribe of men may be discovered on the Antarctic shores. There is also much to be learned of the magnetic propertres of this little known region, of its ethnology, and much of more technical scientific interest
The details of the manner in which the expedition is to be equipped are interesting.

The party intend to sail in two small sailing vessels, each of about one hundred feet in length and of from 100 to 200 tons burden. Each vessel will be of the type known as "sealers" and will be manned by five men. The hulls of the boats will be thick!y sheathed in timber and heavily braced in order to resist the pressure of ice jams. Provisions will be supplied to last for three years. The garments to ke worn will be of the Esquimau pattern and there will be a plentiful supply of fur sleeping bags, robes, ata
A fine pack of Esquimau sledge dogs will also be provided. The scientific corps will consist of five men, who will carry with them such equipments as will assist them in carrying out their various lines of in vestigation. It is expected that it will take about three months to reach the Gulf of Erebus and Terror, where the expedition will probably disembark. A substantial wooden house will then be erected to be used as the headquarters.
Later on the sledging parties will be sent out from this point to penetrate as far south as possible. The party will, as far as possible, be made up of men experienced in Arctic exploration. Dr. Cook, it will be remembered, was surgeon and ethnologist in Lieuten ant Peary's first expedition to the North, and he has been to the Arctic regions twice since.

## Oil Production in Pennsylvania.

The oil fields of Pennsylvania have produced during the year 1894 about $30,000,000$ barrels of oil. During the year 1893, the total product was $31.000,000$ barrels. The oil was sold during 1893 for 64 cents, and last year for 84 cents a barrel. In all about 3,900 new wells were drilled in 1894, while in the previous year only 2,000 new wells were prepared. The demand for Pennsyl vania oil showed no diminution during the year.

## ACETYLENE APPARATUS

## o'conor sloane, ph.d.

Few chemical discoveries have attracted more inerest than the recent one of the method of manufacuring acetylene on a large scale. The production of the calcium carbide from which the acetylene gas is made by simple treatment with water bids fair to become a commercial process, and we have every reason to hope that the material will soon be produced by the ton. There is something fascinating in the idea of being able to evolve a gas of about 300 candle power by so simple a process. While the crudest possible apparatus, such as a tumbler of water, is sufficient to illustrate the production of the gas, the object of the present article is to show how a better demonstration can be produced with very simple appliances.
To show the gas with a tumbler of water, it is sufficient to drop into it a piece of the calcium carbide as large as a pea; the gas is at once evolved in large quantity, and a match can be applied repeatedly to the accumulation of bubbles on the surface of the water, giving a number of successive lightings. The apparatus illustrated in the cut, which gives more satisfactory results, is constructed from a battery jar and lamp chimney as the principal elements, and is made n the lines of the old hydrogen evolution apparatus. To the top of the lamp chimney, which should be of arge size, a cork should be tightly fitted. Unless the cork is better than the majority, it should be waxed or paraffined, which is very easily done by placing some fragments of wax or paraffine on it and melting the material with a hot soldering iron or poker. Through a central perforation a tube is inserted fitted

acetylene apparatus.
with a stop cock and a gas burner; the latter must be of the smallest size made, the Bray fishtail burner answering about the best of any yet tried. Merely to exhibit the gas, a simple jet may be made by drawing a glass tube almost to a point or by drilling a very small hole in a cap fitted to the pipe leading from the stop cock. Through a hole a little to one side of the evolu tion pipe a wire passes which moves up and down with some friction through the hole. Its lower end is form ed into a hook, to which is suspended a little baske made by bending up a little bit of coarse wire gauze A piece with one-quarter inch meshes will be about right. The suspending wire is bent at the top to give it a better handle.
To operate it, the lamp chimney is placed in the jar, the water is poured in until within an inch or two of the top, and a piece of calcium carbide half the size of a walnut is placed in the basket, which is drawn up until'pretty close to the cork. The cork is now placed in the lamp chimney and pressed down so as to make it fit tightly, and the wire slowly worked down until The basket becomes partially immersed in the water is evolved, and if the cock is open the air and gas within the chimney begin to escape. As soon as the odor of the escaping gas is strong, it can be lighted andwill burn for five or ten minutes with great steadiness. If the pressure decreases and the water rises. it comes in contact with the calcium carbide, more gas is evolved, and it falls again.
The apparatus may be further simplified by omit ting the stop cock, which is unnecessary, and a bucket necessary to secure the chimney against floating up
ward, although in the apparatus shown this is quite unnecessary.
It is well before lighting the gas to hold a test tube over the outlet for a few seconds until filled with the gas, and to light it with a match or at a gas burner. If the contents do not explode, it is safe to light the jet on the chimney; if it does explode, the light should be deferred until purer gas is evolved. Two or three minutes are sufficient to get it in working order. It must also be remembered that it is essential to have a very small burner, as otherwise the gas will smoke and the supply will be insufficient to obtain a satisfac. tory flame. The suspending wire must fit tightly, as if it slips down the apparatus will blow out or overflow. A very slight immersion of the carbide starts it.

## Oil of Lemon

Althongh the lemon industry in the United States has not reached any very large proportions, yet Florida lemons, says the International Confectioner, are occasionally to be found in the market, and Southern California will no doubt soon contribute. The oil is contained in the minute cells in the yellow rind of the fruit, and is removed by hand pressure, hence the term "hand pressed oil of lemon." The operator holds in the left hand a sponge and in the rimht a sec tion of the lemon peel, and, by dexterous pressure against the sponge, ruptures the oil cells; the sponge absorbs the oil, and a dish held in the lap prevent any being lost. When the sponge has taken up enough of the oil to be squeezed out, this is done, and the process repeated over and over again.
The tediousness of the method will be apparent when it is estimated that about one thousand lemons are required for the production of a single pound of oil. Oil of an inferior quality is made by machine pressure, by distillation, etc., but the principal bulk is produced as described. The manufacture of the oi is carried on very largely by the peasants throughout Sicily. Every proprietor of a lemon grove, large or small, makes oil from the small and irregular shaped fruit, and sends the better class to market to be shipped to the various parts of the world.
Experiments within the last few years have proved however, as in the case of oil of peppermint, that large establishments, where great care is taken to su pervise the manufacture of the oil, turn out a mucb superior product to that of the small producer.
Of the adulteration of oil of lemon nothing will be said in this article, except that while enormous quantities of oil containing more or less adulteration are be ing sold, yet an absclutely pure oil can be had at a reasonable price, if the confectioner is willing to pay that, but if he wants the cheapest he can get, he must not expect the best. What has been said about oil of lemon will apply to oil of sweet orange.

## orererments.

More than fifty years ago a student from Greece came to the academy, Monson, Mass., bringing with him from his rative country a species of overcoat with attached hood made of asbestos. It long remained in the mineral cabinet of the above institution as an ex ample of fireproof clothing made from this flexible mineral substance. Improvements have been made in the methods of spinning and weaving asbestos fiber, so that now it is practicable to weave a cloth of asbesto almost as fine as cotton cloth. This, of course, is not very strong, but by spinning thicker threads and doubling them a cloth can be made that is strong enough for most purposes and is still flexible. It is now recommended that this material be used as a pro tective dress for firemen, and at a meeting of the Na tional Association of Fire Engineers at Montreal last summer a representative of the company that is ex ploiting this idea demonstrated how it could be carried out. Clad in a suit of asbestos cloth he entered a burn ing frame building especially prepared for this test and remained there for several minutes, during which time he gave an exhibition of the utility of the fireproof asbestos rope for life saving, etc.
The asbestos suit which was worn consisted of a pair of boots, protected by iron soles, gaiters, pantaloons, jacket, apron, gloves and helmet, the last being pro ided with eye pieces of mica. Inside of the jacket is carried a respirator which cools and purifies the hot smoky air and allows the air breathed to be expelled properly. The efficiency of such a suit depends not only upon the non-combustibility of the material, but also upon the fact that it is a non-conductor of heat becoming hot so slowly that the wearer has ample warning of the proper time to flee. It is in no way hurt by water. It is not proposed that every member of a fire department shall wear such clothing, but it is urged that one or two members of every company be rovided with them
Other uses for these fabrics, such as the cloths made by H. W. Johns Mfg. Co., of this city, are for pro tecting merchandise against cinders; to extinguish mall fires by smothering; for drawing between build ngs ; and as a protection covering for the fire hose. It is already used extensively for drop curtains and flies in theaters.

## THE LOEB PATENT RESPIRATOR

In modern life the occasions when places charged with irrespirable and irritating gases have to be entered are constantly on the increase. In a case of conflagration the fireman or member of a life saving corps may have to enter a room full of dense smoke for the purpose of removing therefrom some one whose life is in danger from suffocation. In chemical works an accident may fill a building with noxious irrespirable gas or fumes of chemicals, making it well nigh impossible for any one to enter. In breweries or other establishments using ammonia ice machines, a break in any of the joints may set free enough ammonia to make it utterly impossible for any one to approach the scene of the accident to shut the valve or adopt other means of preventing the escape. For such cases as these the Loeb respirator is manufactured by the Loeb Respirator Company of this city and Berlin. Our cuts show its internal construction and give a view of the apparatus in use by firemen.
The purifying apparatus is carried upon the back and consists of three approximately cylindrical vessels. The air enters at the bottom of the two outside vessels, drawn in by the lungs of the person using it. These cylinders contain layers of cotton wadding, some diry and some moistoned with glycerine and intercalated between which sections of cotton are layers of bone black or animal charcoal. The central cylinder, whose top connects with the top of the side cylinders, contains glycerine arranged with a dip pipe so as to form a seal. For special cases an acid or alkaline liquid may be substituted for the glycerine. The air drawn through the wadding and the bone black is aspirated through the glycerine so as to give it a final washing and is then fit for respiration. From the purifying aprespiration. From the purifying ap-
paratus a hose is carried over the paratus a hose is carried over the
shoulder to the mouth. To its end a rubber mouthpiece is attached, which is held between the teeth. A pair of clamps are placed on the nose so as to close the nostrils, so that all the air is taken through the purifying apparatus and reaches the lungs bythe mouth.

The mouthpiece is of $\mathbf{T}$ shape. The portion connecting with the purifying apparatus is closed by three little check valves opening upward, while the arm of the T projecting away from the mouth has also a check valve opening outward. When the wearer inspires, the air is drawn through the purifying apparatus; the three valves open upward and the air readily enters the lungs. When he expires, these valves close and the other valves open, letting the air from the lungs escape.
The central or glycerine department of the purifying apparatus is so constructed that by turning the apparatus over, or by otherwise roughly handling it while in transit, the liquid cannot enter the chambers filled with coal and wadding, or into the valve box attached to the hose. The flanges within the glycerine chamber are so arranged as to catch all the liquids in any contingency.
For very bad cases a smoke helmet is provided to be worn with the apparatus. This helmet is made of buckskin and is easily connected with the mouthpiece. For the eyes glass spectacles are used, each glass of which is provided with a slide, which when pulled out and pushed back draws a piece of felt across the glass so as to clean it, something which is quite necessary in some cases. For signaling a whistle is provided, which can be attached to the outlet tube of the mouthpiece, or the workman carries a balloon or pneumatic whistle which sounds by the compression of an India rubber bulb. The same company sup ply various other auxiliary apparatus.
The tests of efficiency of the respirator have been most exhaustive and complete. A recent test made in New York before the chief of the fire department and other officials consisted in filling a wooden house, of about fifty cubic yards capacity, with smoke produced from a fire fed with shavings, tar, sulphur, and Cayenne pepper.
The room was filled with black smoke and was $a b-$ solutely untenable. The inventor himself and his assistant successfuily entered it, staying in fourteen and fifteen minutes respectively. Either of them could have stayed in much longer if desired. The respirator
was then taken apart and the cotton was found black-
ened by the impurities which had been extracted from the air.
Finally, Mr. Loeb entered again, when, after he had remained some eight minutes, the building, by some means or other, caught fire, and it burnt for a minute or more before the inventor left it, coming out entirely unharmed by his experiences. Similar tests have been tried, all of which have been successful. The apparatus has had extensiye introduction in fire departments, chemical factories, breweries where ammo nia ice plants are used, and in similar places. As a life-saving agent at fires, its use is obvious, but in chemical works, breweries and the like, it may aid in the prevention of great damage to property as well as o life and person.
Should the apparatus be used in ditches, wells, etc., filled with sewer and other gases, a hose is to be
gratis by property owners along the right of way. The company believes that in a few years the fruit vegetable and passenger business over the route will pay for regular steel rails, when the others will be used for ties. A small steam dummy will furnish power for the A von Park and Haines City road.

Belated Discoveries of Gold Mines
The Leadville, Col., mining district has an extremely instructive history. It first became famous as a gold camp, the washings in California Gulch having been very rich. Some gold veins were also discovered, the Printer Boy mine being long pointed to as a demon stration that Leadville had gold mines, and the whole district was, of course, thoroughly prospected for gold. The subsequent discovery of silver-lead carbonates in large quantities turned all attention to silver and lead, ndead, and the camp soon became noted as a very large producer of these metals and was the Mecca of all good prospect ors. The hills and valleys in all the country surrounding Leadville were again prospected as probably no other district on the continent has been, and many mines, and some outlying mineral districts, were discovered a nd opened. As Leadville mines attained depth, the rich silver-bearing lead carbonates gave out and the ores became low-orade in silver and lead and com menced carrying much eopper which menced was to carry zinc blende, which was the
opposite. Leadville became a copper camp

Then came the tumble in silver which led to the closing of many of the mines. No one wanted low-grade sii ver mines, and the miners overran the country searching for gold. They found it in many districts, and on the thoroughly prospected hills surrounding Lead ville, where thousands of pro spectors in early days had searched in vain, they opened the Little Jonnie, the richest gold mine in Colorado. Discovery has since followed discovery in rapid order, and on another page of this issue a telegram from our special correspondent announces the last new discovery, $\$ 80$ ( 4 ounces) a ton gold ore, at a considerable depth from the sur face. This, it is supposed, will lead to a new and rich gold mine.
The Cripple Creek district, which for twenty years was well known to contain some gold, and which was prospected again and again, and condemned, has in the past few years been demonstrated to be an extremely rich gold camp, probably the richest and most inviting district in the West.
The question now suggests itself, Where is this thing going to end? If the two richest gold camps in the country have been opened quite recently in ground which for twenty years has been the most thoroughly pros pected area on the continent, and these enormous riches escaped detection, how many other rich silver, and especially gold, mines may yet be found in ground that has been prospected and is now condemned ? Is not our method of prospecting very crude and inefficient when such belated discoveries are possible?
It must not be ignored, however that with the progress which has been made in recent years in the metallurgy of gold and silver, many ores which were formerly worthless are now "bonanzas," nor should it be forgotten either that low grade mines may be quite profitable enterprises and yet contribute but little to the aggregate of the world's gold production. A great many tons of ore must be treated to get a single kilogramme of gold.-Eng. and Min. Jour.

The French Geographical Society has received from General Venukoff a communication describing a submarine volcano which is under survey by the officers of the Russian dispatch vessel Lotzman. The volcano declared itself last summer, and, although under sea water level in the Caspian, projected a large quantity of mud and debris into the air. As a result of the sur vey, the position of the volcano has been determined as $38^{\circ} 13^{\prime} 30^{\prime \prime}$ north latitude and $52^{\circ} 37^{\prime}$ east longitude from Greenwich meridian, and above 24 miles from shore. The diameter of its crater is less than 20 feet, and at 200 fathoms from its center the depth of water is about 8 fathoms, while at a distance of one mile the sea hes its normal depth.

## The Demand for Electrical Engineers.

by frederick h. ford.
In a recent issue of a technical paper, devoted to the interests of electricity, there appeared an article, copied from the New York Sun, in regard to the demand for educated engineers. The writer made the statement that, in his opinion, the field of electrical engineering offered more promise of wealth and fame than "la the grocery business, writing, or knife grinding."
Although no editorial comment was made upon the article, its appearance in a technical paper would give added weight to the opinions of its writer in the mind of a young man making a choice of occupations.
A great mistake is being made in continually holding up the profession of the electrical engineer as one offering almost unlimited possibilities in the matter of salaries and demand for men. This mistake is most frequently made by persons who probably really know nothing whatever of the subject, and who are of the class who are continually making the statement that "electricity is in its infancy; and the laws which control its working are but little understood."
The aim of the present article is not to question the value of a technical education for the electrical engineer, but to give some facts in regard to the demand for young men with such an education.
At the present, time there are probably not more than half a dozen entirely distinct companies in the country that would be able to furnish the entire electrical equipment for a plant for light or power of more than 500 horse power capacity. In these large works the design and planning of both plants and machinery is under the immediate charge of two or three
electricians who have a thorough understanding of the practical requirements of their work, as well as the theories which govern it. The ideas which they furnish are carried out by the draughtsman in an almost purely automatic manner by the use of tables and slide rule. In the shop the work is carried on from tricity is required. When the machines are tested for efficiency or other qualities, the work is done according to some scheme worked out by the chief electrician, and the results are worked out by means of formulæ selected by him to fit the case in hand. In many cases the persons making the test know nothing of the reasons for what they do. In the smaller factories the apparatus is often designed by some outside engineer. It is turned out from working drawings, and no attempt is made to test the machines in any way. Often lay claim to the title of electrician

In the central station for power and light we find the same conditions. The aim of the supply companies has been to turn out machines of the utmost simplicity of design and construction. To such a degree of perfection has this been carried that all parts of a machine liable to injury or wear are made inter changeable, and it only requires a fairly good mechanic to make what repairs are needed. The work o keeping the machinery running is a matter of suc simplicity that almost any mechanic is thought equal to the task after a few months' experience.
The capital invested in the electrical industries of the country is largely in the form of stock companies. The larger companies have been gradually absorbing the smaller ones, and have urited among themselves. This has lessened the demand for educated electricians, the executive departments of the companies, uniting hav ing been combined into one department. The closing of many large works owing to financial trouble or pat ent litigation has also thrown a large number of men having both experience and ability on the market,
thus causing the supply of engineers to be in excess of thus causing the supply of engineers to be in excess of
the demand. The struggle for place caused by this state of affairs has forced down the wages to such an extent that the average engineer will not receive a
better salary than the head bookkeeper of a large better salary than
wholesale concern.
The statement that for the average young man the field of electrical engineering offers more promise o success than "law, authorship, the grocery business, or knife grinding," may be questioned.
He will be obliged to spend at least six years in pre paration before he will be able to earn enough to barely pay his expenses, and during the greater part of this time he will be paying out money instead of earning it. The same time spent in preparation for either law or medicine would qualify him for beginning practice, while the time spent in business or jour nalism should find him in a good position. In the law or medicine he is working for himself, and he reaps the benefit of whatever success he may have. The young engineer will in most cases not have the capital needed to start in business for himself, and is forced to accept to start in business for himself, and is forced
Here he will get but a part of the profit coming from any success on his part, the greater share going to $h$ is employer, while he will suffer for his failures as much as if he were working for himself.
The young man choosing electrical engineering as a profession must do so with the understanding that he will have to work hard and long, and for wages which are not large in relation' to the work done. For th
young man who loves engineering enough to work for engineering, and not for wealth, there is as good a field in electrical work as in any branch of engineering. The idea that there are positions with large salaries at tached waiting to be filled by him is a mistake. There are but few large salaried positions at best, and they are filled by men having large experience and influence with the capitalists back of the company.
The demand in electricity at the present time is not for educated electricians, but for educated capitalists for men who will see that it is better to hire men who know why things should be done, and who will look after economy in the output, rather than to hire cheap men and waste the salary of a good man in inefficient methods of working.
When capital has been so educated, then and not until then will the relation between work done and pay received by the engineer compare favorably with hat of the lawyer, the doctor, the writer and the mer hant.-The Electrical World.

## A Magnetized Governor.

The Electrical Engineer states that an engine and ynamo, direct coupled, were started and worked in satisfactory manner. After a time, however, complaints were received of unsatisfactory regulation From the character of these complaints it was concluded that there might be some defect in the gov ernor, and the maker incurred the expense of sending a complete new governor, requesting that the old one should be returned. The new governor was placed adjusted, and the plant started, and the report cam back that the regulation was perfect. In the cosmse of a week or ten days complaints were again made ht us satisfactory regulation. It then occured to the mis builders that possibly the governor was affected by magnetism. They conferred with the makers of the dynamo, and were told that in their judgment such could not possibly be the case. The governor wheel, it hould be stated, was on the far side of the engine. It has since been ascertained that a monkey wrench is held fast to the rim of the governor wheel when the engine is under full speed; the speed of the periphery of the wheel being about 5,400 feet per minute. When the engine is in service the magnetic attraction is suf ficiently strong to pull a man standing at the front or crank end with a wrench held out within two feet into the engine. Any magnetic substance, such as iron or steel, if placed on the throttle valve wheel, is held firmly. The distance between the center of the dynamo and the eccentric is about 48 inches.

## RECENTLY PATENTED INVENTIONS.

## Engineering.

Locomotive.-Melbern B. Bulla, Yuma, Arizona. In this engine the connecting side bars for the main and rear drive wheels, and the counter-
weights of the latter, are dispensed with, so that it is not liable to roll at a high speed or move on a hard pull, and will run smoothly at any speed. It is a compound engine, and has friction wheels between adjacent drivers below their centers, the arrangement being such that when live
steam is admitted to the steam chest of the high pressure steam is admitted to the steam chest of the high pressure
cylinder the friction wheels are moved into firm frictional contact with the faces of the front and rear drive wheels, and move out of such contact whe
from the high pressure cylinders.
Locomotive Water Elevator.George P. Glenn, Jackson ville, Fla. This invention fur nishes an apparatus for utilizing steam and compressed air, together or separately, to actuate pneumatic water elevators, providing also a coupling device to connect the pneumatic pipes, the apparatus consisting of a suitable valved
steam or air pipe carried by the locomotive and tender, steam or air pipe carried by the locomotive and tender,
and an air pipe carried by the movable joint of the water supply pipe, and furnished with a coupling device for automatically forming a connection with the pipe carried by the tender. Where locomotives are not provided with pneumatic air pumps, steam alone may be used for
raising the water.

Rotary Valve.-Brainerd W. Smith Delphos, Ohio. This valve mechanism comprises two segmental valve seats in the steam chest, with ports leading to the cylinder ports, the cylindrical valves turning
in the seats, each having a cavity to connect the interior in the seats, each having a cavity to connect the interior
of the steam chest with the corresponding cylinder port of the steam chest with the corresponding cylinder port
and the latter with the exharist chamber. Lugs connected by a link project from the valves, a valve stem pivotally connecting with one of the valves, and the stem having a head adapted to engage with its top surface the under face of the steam chest cover, the head also having rearward extensions traveling on a rib forming part of the bridge for the valve body. The valve is quick acting,
requires but little power to operate it, and without strain requires but little
on the valve gear.
Flue Cleaner.--Joseph Bott, Lead ville, Col. This device comprises a scraper forming a piston, and adapted to be propelled forward by steam or
other fluid under pressure, a revoluble drum driven by such pressure being connected with the scraper to return
it in the flue. The casing has an open end adapted for engagement with the flue, and an exhaust opening, and the piston is preferably made of two disks between which is clamped a rubber or leather disk fitting snugly in
flue and adapted to yield on rough places in the flue.

## Electrical.

Electric Cableway.-Richard Lamb, New York City. This inventor has devised a mechanism
heavy bodies or propel canal boats, etc. The invention consists in supporting a motor-carrying car on a cable, effecting tractional friction between the car and hauling cable, and combining with the propelling trolley a log-
carrying trolley on the supporting cable and connected with the propelling trolley. The latter is provided with a counterweight or balance to maintain it in a practically vertical position, and also has a seat for the motorman.

## Rallway Appliances.

Car Coupling.-Frank R. Bischoff, New Castle, and John C. Baird, Cheyenne, Wyoming. This is a knuckle coupler so made that by the movement of a single lever the locking device will be removed from
the path of the knuckle and the latter will be swung to the path of the knuckle and the latter will be swung to
one side. The pivoted knuckle has a rear portion extending transversely beyond one side of the drawhead, and carries a latch or lock bar, with a device for elevating the o move it sidewise. The coupling has but feer parts all of which may be made very strong. By beveling an outer portion of the vertical wail of the drawhead recess
the knuckle may be rocked to either side, and thus prothe knuckle may be rocked to either side, and thus pro-
vide for coupling upon curves or for ample room between cars when rounding curve.
Switch and Switch Shifter.-Robert E. Brackelsberg and Lewis Graff, Mankato, Minn. In switches for street railways this inventor has devised an improvement of simple and durable construction
whereby the switch may be automatically shifted from whereby the switch may be automatically shifted from
an approaching car. The invention consists of a frame dapted to be lowered on the car, and a shifting block slidng transversely on the frame to engage and shift the switch mechanism.
Leveling Tracks.-Hiram H. Spoenburg, Wadsworth, Ill. This is an improvement upon the surfacing board set crosswise upon the rails and supported by loose blocks, to determine the proper adjustvention provides for the employment of a target or measuring board supported by a slotted post or stand ard, a rail clamp to which the post is secured, and two one of them clamped to it.

## Iechanical

Cutting Machine.-Frank J. Richrds, Needles, Cal. This is a machine more especially designed for use on boilers, to conveniently cut off stay bolts at any desired distance from the plate, and the ma-
chine has a revoluble spindle with a head in which cutters slide radially, while a longitudinally sliding sleeve engages the inclined backs of the cutters to fit the latter to the work. The sliding motion of the sleeve and the to the work. The sliding motion of the sleeve and the
feeding of the cutters are readily regulated according
to the work, and the cutting tools may be easily removed
and replaced.

Nail Driving Implement. - Leonhardt Kornder, Uffenheim, Germany. This tool comprises an essentially cylindrical tube having at one end
opposing longitudinal slots into which project pivoted spring-controlled gripers, there being an exterior handle
end to each griper, while a plunger slides in the tube end to each gripper, while a plunger slides in the tube
The implemert tacilitates he driving of nails in difficult of access, and it may be elongated by additional screwed parts for driving nails at a little distance away.
Gyratory Rock Crusher.-Samuel C. McLanahan, Hollidaysburg, Pa. According to this he top, and tas below it a conical crushing hub operating in a crusher chamber, while at its lower end it is held in an eccentric bearing rotated by a beveled gear to give a gyratory motion to the lower end of the shaft and
a corresponding motion of less degree to the conical hub in the crusher chamber. The invention provides improved means of suspending the haft, bracing and
strengthening the crushing chamber at its upper strengthening the crushing chamber at its upper
edge, and closing the joints between the shaft and the教
Machine for Forming Stovepipe Joints. Josiah E. Smiley, smiley, Ohio. This machine comprises a frame with a fixed mandrel having a female die on its upper face, a vertically movable mandrel with male dies on its upper and lower faces, a bed plate
having a female die on its upper face, plungers vertically movable over the mandrels having female die members, and lever mechanism for operating the plungers. The machine is especially designed to quickly and accurately form joint sections of a special character for which a patent has been applied for by the same inventor
Soldering Machine.- Charles L. Olmstead, Big Timber, Montana. This is a slmple machine by which solder may be economically applied to
the seams of roofing tin or seams of tin employed to
 a portion of the machine, which is guided upon the seam, acid being applied to the seam in advance of the application of the solder, and a smoothing iron following the
solder receptacle, insuring the solder being conveniently applied to and set upon the seam, the work being done very quickly and inespensive
Machine to Head and Crimp Cans. $-J o h n W$. Green, Portland, Oregon. This machine has a support to hold and clamp the can body temporarily in place. a revoluble carrier so holding the cover that its
center will coincide with the center of rotation to turn the cover upon the open end of the can body, while a revoluble crimping disk is adapted to exteriorly press the cover
flange on the can body and rotate both the body and the cover carrier to firmly crimp the cover in place and seal the can body and its contents. The operation is continuously carried on as long as the main driving shaft is rotated, the operator placing a filled can body on the
body support and a cover in the cover feed, and the body support and a cover in the cover feed, and the
sealed can being delivered in a chute at the side of the
machine, the various mechanisms being timed to auto.
maticelly cery matically carry out the entire work.

Vulcanizer.-Edmond H. Casgrain, Quebec, Canada. This is an improvement in hand vulcanizers for vulcanizing small articles, the pot having an outer cover and a cover plate within the pot top carrying a mould-carrying yoke. A vertical stem on the cover plate is encircled by $\varepsilon$ sleeve threaded to fit in the cover.
there being a guide plug at the upper end of the stem there being a guide plug at the upper end of the stem
through which a screw spindle extends downward through which a screw spindle extends downward
through the stem and cover plate. The vulcanizer is through the stem and cover plate. The vulcanizer is
strongly made, the cover and mould may be very quickly adjusted and hermetically sealed, and the mould compressed to any desired extent after it has been sufficiently heated.
Door Check. - Patrick McMahon, signed as a substitute for a door guard and bolt degreater degree of safte for a chain bolt and to afford a the bolt may be readily disengaged from the guard when the door is closed, although it cannot possibly be disconnected from the guard when the two have been attached and ine door is opened. The device is simple, strong ployed a dead latch which cannot be forced open beyond a limited distance by any one outside the door.
Invalid Bed or Couch.-Richard V. W. Wicks, Brooklyn, N. Y. According to this improve-
ment, one lying on the bed or couch may with but slight exertion, elevate or depress the head section, holding it fixed at any desired point between the horizontal and vertical. The mattress automatically adjusts itself to the position of the central portion of the body, and a support is automatically provided for the legs at the
thighs and knees. A cool and simple head rest or pillow thighs and knees. A cool and simple head rest or pillow
is also provided which is capable of adjustment laterally and vertically.
Lawn Sprinkler.-Alexander Burt, Dunedin, New Zealand. This sprinkler will give a jet of a cyclonic character, or a single fine jet, as may be de-
sired, and it plain nozzle of a hose, or be employed for spraying trees or shrubs with a chemical fluid or insecticide. It may be used either single or double and the water or other fluid Propelling Garden Implements, eтc.--Hampden Wilson, Crockett, Texas. This inventor provides an improved harness to be comfortably worn by a male or female to facilitate the propelling of garden implements or machines, whereby all the power employed
will be most advantageously appled without unduly fatiguing, but will rather be beneficial to the ounduly fawill be impelled to continuously keep an upright position, favorable to lung expansion. The harness is so made as to suit people of different stature, leaving the
hands of the operator free to guide the machine, which

## may be a lawn mo

Wooden Stopples.-Randolph F Radebaugh, Tacoma, Washington. This invention pro vides a simple, practical and inexpensive process of and apparatus for treating bottle stopples and bungs in large way, to remove their resinous and gummy matters hy means of a strong alkaline solution, they being then subjected to steam or hot water to remove the alkali, and and flexible condition, being finally filled with paraffine or wax to render them impervious to liquids.
Burial Casket Handle.-Lyman E. Noodard, Owosso, Mich. Novel hinge joints are procaskets and wooden escutcheons that are ornamenta bases for the arms of drop handles. The joints are dapted to receive the weight strain and transfer it to the clamped connections of the hinges with the walls of the casket, thus avoiding undue pressure on the escutcheon and affording strong and direct connections for th andles wit
Note.-Copies of any of the above patents will be furnished by Munn \& Co., for 25 cents each. Pleas send name of
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## NEW BGOKS AND PUBLICATIONS.

## The 1895 edition of the annual director

 volume published by the Shoe and Leather Reporte then issued. Great pains are taken to make this on he most complete of any of the trade directories pub acturers of and dealers in boots and shoes, leather manings, harness, hides, wool, furs, machinery, and about It the commodities pertaining to the shoe and leathe industry in the United States and Canada, besides namesf leating houses in the trade in other parts of the world The volume has over 700 paces, and the first fifty page re allotted to facts and statistics of special importance rom a trade point of view.

## SCIENTIFIC AMERICAN

BUILDINGEDITION
MARCH, 1895.-(No. 113.)
TABLE OF CONTENTS.
Elegant plate in colors showing a cottage at Mount Vernon, N. Y., three perspective elevations an Vernon, N. Y. An attractive design.
2. "The Gables," a half timbered cottage recently com-
pleted at Glen Ridge, N. J. Perspective elevation nd floor plan. Mr. Charles E. Miller, architect New York City
3. A cottage at Great Diamond Island, Me., recently erected for H. M. Bailey, Esq., two perspective elevations and fioor plans. A unique design for an Portland, Me.
. A dwelling at Armour Villa Park, N. Y., recently erected for J. E. Kent, Esq., at a cost of $\$ 5,200$ complete, two perspective eleva
plans. A very picturesque design.
colonial cottage at New Rochelle, N. Y., recently
erected for C. W. Howland, Esq., two perspective elevations and floor plans. Mr. G. K. Thompson rchitect, New York City A unique example of modern dwelling.
6. The residence of Charles N. Marvin, Esq., at Mont.
clair, N. J. A design successfully treated in the clair, N. J. A design successfully treated in the
Flemish style. Two perspective elevations and floor Flamish style. Mro A. V. Porter, architect, Brooklyn, N. Y. Colial h. fine Colonial house at Elizabeth, N. J., recently
completed for Henry A. Haines, Esq. Perspective empletion and floor plans, Architects, Messrs Child \& De Goll, New York City
8. A residence at Flatbush, L. I., recently erected for $\begin{array}{ll}\text { C. H } & \text { Wheeler, Esq., at a cost of } \$ 11,000 \text { com- } \\ \text { plete. } & \text { Two perspective elevations and floor plans. }\end{array}$ plete. Two perspective elevations and floor plans.
Architect, Mr. J. G. Richardson, Flatbusb, L. I. An attractive design.
. A cottage at Plainfield, N. J., erected for Chas. H. Lyman, Esq., at a cost of $\$ 5,000$ complete. Two persective elevations and floor plans. Architect,
Mr. W. H. Clum, Plaintield, N. J. A picturesque deeign.
10. An elegant house at Scranton, Pa., erected at a cost and floor plans. Architect, Mr. E. G.W. Dietrich, New York City.

1. Engraving showing the new building of "The Bank for Savings," recently erected on 22 d Street, New York City. Mr. C. L. W. Eidlitz, architect, New York City.
2. Foundation piers of the American Surety Company's building, New York City. Four illustrations, showing the most advanced methods of caisson
construction for city buildings.
3. Miscellaneous contents -An automatic gas saving governor, illustrated.-Heating a residence with open grates, illustrated.-Arranging effective in-
terior, illustrated. The Scientific American Building Edition is issued monthly. $\$ 2.50$ a year. Single copies, 25 cents. Forty
large quarto pages,equal to about two hundred ordinary book pages; forming, practically, a large and splendid Magazine of Architectitre, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern ArchitecConstruction and allied subjects.
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marked sent for er labeled.
mamination should be distinctly
(6453) D. R. asks: 1. Can the field magnets of the motor described in "Experimental
science" be made of cast iron and wound with No sience" be made of cast iron and wound with No. 16
wire, the same as if made of Russian iron? A. Yes. have the armature of the motor completed, but find that it will not rest in any position; how may I fix it? A.
Possibly you can balance it by lead. It may not be sufficiently out of balance to do any harm. 3. If the moto were used as a dynamo, how many volts and amperes would it develop, and if run as a motor how many volts are required to run it, battery power? A. It is not
adapted for use as a dynamo. It runs with volts and 5 to 10 ampere 4 . What acid or acids used in a copper plating bath to give the bright effect, using blue vitriol? A. Various baths are used; the practice is often adopted of removing the partly plated articles and scratch-brushing, and then replacing in the bath. o bright copper bat
(6454) R. L. H. asks : 1. Will you please tell me which of the following conditions determine the number of volts and which the number of amperes genreted in dynamo: a. The weight of iron in the field nagnet. b. The number of turns of wire on field mag. net. c. The number of wire use. The speed at which the dynamo is run. A. A definite division cannot be made. In general a and d are ampereage dimensions, and the others are voltage dimensions; but all are interconnected. -2.
Will old iron that is slightly rusty do as well for the field Will old iron that is slightly rusty do as well for the field
magnet of a small dynamo as new ? A. Yes, except that the rust unless shellacked or removed invites and produces further corrosion of parts. 3. How can I convert
the dynamo in Supplem ent, No. 161, into a machine the dynamo in Supplement, No. 161, into a machine
generating a large quantity but of low E. M. F.? What is the quantity and E. M. F. thus obtained? A. Wind with wire of larger diameter. We advise you not to at-
tempt it. We have no data on the su bject. 4. What kind of cotton thread is suitable for insulating magnet wire ? A. Any kind will answer. 5. Why is shellac used on the coils of electrical apparatus? A. To protect foot long and wrapped with the same number of turns of wire, the first being 1 inch thick and the second 2 inches, which would be the stronger magnet? A. Other things being equal, the thick one will be far the stronger.
(6455) C. R. S. writes : I have six Le lanche cells of battery for ringing door bells and light found what don't work any more. I broke one open, What is the material, and can I wash it and use it over again, or will soaking a few days in hot water and then drying them again do any good? A. You cannot. By
pouring a strong solution of potassium permanganate into the porous cup without emptying it you may effect an improvement. The best plan is to get new cups. They are charged with manganese binoxide and carbon or graphite.
(6456) J. N. M. asks: 1. If soft annealed teel wire will work as the core of the armature of the
notor described in No. 641. A. It is almost impossible to get iron wire here, as steel has taken its place in the
manufacture of tube, plate, and wire work. 2. Will a
laminated core of No. 16 sheet of the dimension of the laminated core of No. 16 sheet of the dimensions of the
wire core answer as well as the wire $\boldsymbol{q}$ A. We answer wire core answer as well as the wire ? A. We answer
both questions affirmatively-use the steel wire or the
(6457) W. W. writes: I wish to put an ight or ten 16 candle power dynamo in a room 40 feet the same room, but at the opposite end, some 20 fee from dynamo? What size wire would it require for 100 light dynamo, 16 candle power each, to make a circuit of about five or six hundred yards? Also what horse power ngine would it require to run the 100 light incandescen dynamo in the same room with your watch movemt For one hundred 10 candle power 110 volt lamps use $N$ 5 wire for original leads, reducing in size as lamps a
(6458) B. F. asks: 1. In winding the ould the sections be? A. The thinner the better thick an inch is very good practice. 2. How thick should the rubber washers be to insulate the sections. The coil is to be 8 inches long, with $7 / 8$ inch core. A. $\frac{1}{1}$ to $1 / 8$ inch.
3. Have you any publication of the Scientific Ameri3. Have you any publication of the Scientific Ame de-
CAN or Supplement in which induction coils are de See our ? I have Supplench, 16 , 166 , Scis. A. AmErican, Nos. 10 and 14, vol.66. We have no special information as to the battery named.
(6459) F. A. R. asks: By what prepara copper by a thin coating of some kind, like a varnish oxide, so as to resist the passage of a current of about 15 amperes, and that will stand a heat of about $1000^{\circ} \mathrm{C}$.
without melting or heing dissociated, or lessening its inwithout melting or being dissociated, or lessening its in sulating qualitymaterially? ?. You must have the cop
per enameled. This will effect the object if the ename of high enough melting point. There will be trouble
(6460) A. L. H. asks the reason for hav ing and the action of the permanent magnet in alterna were not polarized, both ends would be equally attracted whatever the direction of the current might be. By pol rizing the armature so that both ends are of one polarit nd the center is of opposite polarity each end is attracted by a pole respectively or is repelled thereby according to ion with an alternating current, which causes the ring (6461) Bristletail or Silver Fish.-Mr H. M. Webster, of Providence, R. I., inquires about bout 3 inch in fids them in different parts of his house, especially in the bath tub. He also inquires whether they originated from some hickory or white oak which has been stored in the cellar for some three years. He mentions also that his house is always warm and dry. The animal is ndoubtedly one of the bristletails or silver fish, and, all probability, Lepisma saccharina, which is very comit also sometimes injures silks and other fabrics This particular species is almost uniformly silvery gray in color. Lepisma domestica is a white, hairy species, spotted with black,and is more often found in dry places, and this may be the species your correspondent alludes to. Both these agile rreatures have long setiform an-
tennæ, six legs near the anterior portion of the body, tennæ, six legs near the anterior portion of the body, aad three long anal stylets. The use of pyrethrum pow ing these inseets. The mave no particular connection with the wood stored in the cellar, and do no harm beyond that already mentioned.-Answered by Professo C. V. Riley
(6462) C. S. asks: 1. Is rain water fil tered through 4 inch brick wall (as in ordinary cistern construction) quite fit for drinking purposes? Is it as good as "hard" driven well water? Also, d scribe
simple tests for hardness of water. A. Such rain water simple tests for hardness of water. A. Such rain water should be perfectly good, and probably safer tban we
water. Test for hardness with soap, seeing how much of water. Test for hardness win soap, seeng how much of to the sample to produce a lather. 2. Does typhoid fever always result from germs in drinking water, and can Nerms be filtered out or destroyed make the water safe. 3. Does electricity cure rheumatism, and if so, is it by dissolving crystallized uric acid, which accumulates at the Will it not appear again elsewhere, and perhaps cause other more serious trouble? A. Any cure effected we would attribute to action on the nervous system. You take too much for granted in your statement of cause. 4. Is ordinary arc lamp carbon at all good for telephone purposes? A. Yes. 5. Could I carbonize hard coal (anthracite) by bringing it to a white heath closed vessel, and must it be packed in charcoal during
process? A. It would have little effect on it. It should be protected from the air during the process. The charcoal is not necessary if this is done. 6. What determines the ampere hour capacity of storage batteries? A. Trial and experiment. 7. Have you SuPPlements on "Zinc Plating by the Dipping Process, on a Commercial Scale"? If not, can you furnish book on the subject, and what price? Also have you Supplements or book on
ple Yet Eficient Alternating Motor Construction For articles on galvanizing see Supplement, No $833,851,911,912$, and 994 . Articles on alternating cur rent, motors, 601, 692, 717, 763 and 944.
(6463) T. F. C. asks : 1. Why does not gravity battery polarize? A. Because the negative
plate has no hydrogen set free on its surface. Copper is deposited there, and this is its own material. 2. What is the chemistry of bread making? A. The sugar of the mixture undergoes vinous fermentation, and the carbon dioxide set free makes the bread light. 3. What reactions take place in the explosion of gunpowder ? A. They are
very complicated. In general the carbon is oxidized to very complicated. In general the carbon is oxidized to
carbon dioxide and the sulphur to sulphur oxides at the expense of the oxygen of the potassium nitrate. 4. How is the weight of a lever eliminated? A. By making
both sides of equal moment.

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## INDEX OF INVENTIONS

## Which Letters Patent of the

March 19, 1895
AND EACH BEARING THAT DATE.


|  <br>  <br> Extractor. See Spoke extractor. Fastening device, covered, C. E. V an Norman. reedwater heater, internal, D. A. Quiggin...... <br> Felly expander, A. B. Arnold Fence :itav, wire, L. Bilhimer Fence, wire, E. J. Griffin <br> ence wire, t wisting machine, w. S. Barker.. ences, metallic stay for wire, M. H. Baer... ile case and desk. combined, W. H. Roberts. <br> File cas File, le Filter, <br> Beemial initioz <br>  <br> Fireproof partition or wail, N. Pouison Flood gate, E. Moon. <br> Floor construction. P. Mi. Bruner.... Flushing tank, F. C. K.lier Fodder mackine. A. F. Davis....... Folder and puncher. F. <br> Form, drapery Fuel, W . J. H. Knaph. Fumitham. <br> Fumigator, o. P. McDonaid. Furnaces, means f. D. Wright. <br>  <br>  <br> Gear, compensating, G. A. Anderson......536,066, Generator with instantaneous vaporization, $L$. <br> Governor, steam engine. J. V. Ebel............. Governor, stop motion, R.H.Rice..................... <br>  <br> Grinding machine, H. A. Havward............................ Grinding machine, apple or other fruit, <br>  <br>  <br> Hat, crush, O. K. Langham mer... Hhuing apparatus, J. H. Bellamy. Hester. See Feedwater heater. <br> Heel nailing jack, H. Houle Heel nailing machine, J. F Heel trimming machine- <br> Ejuinio <br>  <br>  <br>  <br> Horse power, G. W. Rıckerd.... Hose coupling, G. A. Anderson Hose coupling, H. Goodspeed. Hyd rant, fire, J. C. Kupferle <br> Index, A. H. Detwiler <br> Ink well, J. Black......................................... Insuiated trolley section and crossover, wood \& King................ <br> Iron info malieabie iron or steel, converting cast, <br> wroll... steel. converting cast, Hufty \& Cald- <br> Jack. See Heel nailing jack. Lifting jack. Journal and bearing, shaft, W. Scbofild... <br> Keyed wind instrument, W. Anthony.. <br> Labaling bottles, apparatus for automatically, G. Rehfuss et al............................... <br>  <br>  <br> Leather buffing machine, C. S. Johnson............. Lens for optical purposes, Goerz \& Von Hoegh.. Lever opening Lifter. Sate, W. Smith............. <br> Lifter. See Pan lifter. Lifting jack. M. P. Holmes Lock. See Door lock. <br> Loom shuttie box motion, W. W. Wattie.... ........... Lubricator. See Axle lubricator. <br>  <br> Meat or vegetabie chopper, J. C. Bullock Milk purlfylng apparatus, A. Clark. Mill. Pee Pulverizing mill. Windmill. <br>  <br>  <br>  <br>  <br>  $\square$ <br>  <br>  <br>  <br>  <br> Piatographic curtain shutter, W. Nehmiee Picture mats wing, C. S. Weber..... <br> apparatus for providing, or rectanuular holes, Pill or tablet. P. No Noyes......................... <br>  <br> Pneumatuminum. W. H. Legate. Power. See Horse wower. Eliott. Press. See Bors. <br> puvers.ing mill, C. R. Western .... Puvip, forceand lift, E. Brock way. Pump, measuring. Gee \& Wilkinson <br> Punching machin Puzzle, E. E. De Rail Rat <br>  <br> Rail way conductors, coilapsible conduit for elec tric, H. C Grant $\qquad$ <br> Railway, signal, J. R. Jones Ranilway sitht, j. Mater Railwav tie plate. J. It. Stewa <br> ectric, Bergl \& Tarbox <br> Reaping or mowing machine, Recining chair, Recorder. See saies recor ent. Rer. $\qquad$ <br> Rexister. See Cash rezister. Rem hoolder, harness, E. Yates <br> T. V. Allis <br> Rotary engine, C . H. B Be eier, J r . |
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