
a WEEKLY JOURNAL 0F PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

|  | NEW YORK, AUGUST 1, 1896. |  |
| :---: | :---: | :---: |

HYDRAULIC LIFT DRY DOCK AT THE UNION IRON WORES, SAN FRANCISCO. We present a series of views of a hydraulic lift dry dock, which has many features of novelty. It was designed, novelty. It was designed,
built, and erected by the Union Iron Works, for their own use, and forms a conspicuous feature at their fine yard in South San Francisco The dock was designed with a view to securing: minimum cost of construction ; expendi ture of power and time in pro portion to the vessel to be raised; rapid creaning and paisting of a ship's bottom convenience in handling heavy weights, such as pro pellers or propeller blades, which, when the platform is raised level with the wharf can be run onto the platform on low trucks
The construction of the platform is simple and unique consisting of a series of steel irders; one center longitudi nal girder having a depth of 6 feet 4 inches, forming th keel, with two girders on each side of the keel, running parallel to it.; the two outer girders having a depth of 5 feet. The five longitudinals re tied together by thirty-six are tied toge ind has ran full depth of the keel at the center, and a depth of 2 feet 10 inches at the ends, the whole being securely riveted


THE ZARAGOZA, FLAGSHIP OF THE MEXICAN NAVY, ON THE UNION LRON WORKS DRY DOCK, SAN FRANCISCO.
together, having heavy angle irons at the corners. Over the whole platform is built a flooring for the men to work upon. Immediately over the center girder or keel are built the keel blocks, with a length of 3 feet. On each of the transverse girders are built the bilge blocks, supported in position against the side of the ship by a pawl engaging a rack. The bilge blocks are placed in their respective positions by ropes in the usual way. The length of the platform on the keel is 436 feet 6 inches and the width is 65 feet 7 inches.
This platform is carried by thirty-six cast iron rams $30 \cdot 7$ inches diameter, having a lift of 14 feet 6 inches, eighteen on each side of the dock.

On the upper end of the ram is carried a sheave 6 feet in diameter, grooved for eight 2 inch diameter steel wire ropes. One end of the ropes is *attached to the platform, then passed over the sheave, and the other end is secured to the base castings of the ram, which are stationary. This arrangement gives 2 feet lift of platform to 1 foot lift of ram. There are two piers of piles to support each ram, constructed as follows :

A steel casing 50 inches internal diameter was constructed long enough to have its lower end several feet in (Continued on page 120.)


# 居rientific Ammerian. 

## ESTABLISHED 1845

MUNN \& CO.. Editors and Prpprietors. published weekly at
No. BG1 BROADVAY, NEW YORK.
terms for the scientific american.

 The scientific American Supplement (Established 1876.)

tion of scientific American (Established 188.5.)


Export Edition of the Scientific American (Established 1898)


 div. Readers are specially requested to notify the
any failure. delay. or irregularity in receipt of papers.

NEW YORK, SATURDAY, AUGUST 1, 1896.


## TABLE OF CONTENTS OF

## SCIENIIFIC AMERICAN SUPPLEMENT

NO. 1074.
For the week Ending August 1, 1896.


 III. BOTANYAYD HORTICULTURE.-Rbododendron Smirnnwi
 V. FTHNOLOH Y - Buabmen's Arro fri. An interesting paper fron
 VII LOCOMOTIVE ENGINPERING.-Australian Consoldidation VIII. SPCH ANICAL ENGINEERRING, Conipound Blower-





 an interest which extends beyond the limits of the cit itself. The peculiar nature of the site upon which the city is built-a narrow and long-drawn-out peninsula with its great business center located at its extreme end -renders the transportation problem one of more than with great interest by the country at large, and par ticularly by all municipal engineers.
The beeting municipal engineers.
the 16th ult., was marked by two important events : the statement by Mr. Gould of the latest scheme of extension of the Manhattan elevated roads, and the presentation of an amended plan for an underground tunnel by the chief engineer of the commission. The proposals of the Manhattan Company may be dismissed with the announcement that the much talked of ex tension of the system into the annexed districts north of the Harlem River has dwindled down to a proposal to build certain surface trolley lines to connect with the present elevated system, and that this poverty stricken proposal is saddled with a demand that such roads, if built, shall be guaranteed against all claims for land damages. The lavish promises which were made to the mayor of the city, at the time that the appellate justices had the competitive rapid transit scheme under advisement, have certainly shrunk to a very small measure. From the construction of express elevated roads, running full sized trains, to the laying down of single car trolley lines, is a big drop, and probably no one was less surprised than the representa tives of the Manhattan Company themselves that the commission gave the proposition a cool reception, and went into secret session to hear the amended scheme o their chief engineer for an underground tunnel.
The new plans have been prepared so that they shall be in conformity with the requirements of the law and the late ruling of the appelrate justices, and, at the same time, avoid any conflicts with the interests, real or supposed, of the property owners. The main objections urged against the Broadway tunnel scheme were the cost, the invasion of the rights of property owners on Broadway, the interruption to traffic, and the fact that it involved subsurface travel. It will be seen from the extract from Mr. Parsons' report, given below, that the first three objections are removed by the adoption of the Elm Street route. There will be no interferenc with property owners, inasmuch as Elm Street is about to be opened through to Center Street and the City Hall Park, and the buildings on either side will be torn down, so that it can be widened. These improvements and the construction of the tunnel could be carried out simultaneously. The estimated cost- $\$ 26,500,000-\mathrm{i}$ only 50 per cent of the total expenditure allowed by the only and to those who object to underground travel it must be said that, judging from the events of the past few months, it begins to look as though the publi would have to choose between a tunnel and nothing. The report says: "I suggest a route commencing at the southwest corner of City Hall Park, with a station on Broadway. Thence with a two-track loop around the park, merging into one four-track road at Brooklyn Bridge. Thence northerly with four tracks under Elin Street and Fourth Avenue to Forty-second Street Thence diverging with one two-track road under Forty second Street to Broadway and under Broadway and the Boulevard to One Hundred and Thirty-fifth Street
"Also an east side route to have one two-track road cominencing at the junction at Forty-second Street and through and along Fourth Avenue and across th Harlem River, as proposed in the previous plans, or a route diverging from Fourth Avenue to the west a about One Hundred and Tenth Street, and running northerly across private property to the Harlem River "On the east side line, north of One Hundred and Tenth Street, and on the west side line north of Forty-second Street, I suggest the construction of a third track for distance of about one mile on each route. These third tracks would be used as express tracks for south-bound trains in the morning and north-bound trains in the afternoon. South of Forty-second Street two of the fou racks would, of course, be devoted to the express trains.

I estimate that such a system can be constructed fo $21,000,000$ exclusive of right of way. But to allow for unforeseen and not estimated contingencies, I prefer to add percentages varying from 20 to 40 per cent, accord ing to the several sections of the work, which percen ages aggregate the very liberal figure of $\$ 5,500,000$, making a total of $\$ 26,500,000$. A two-track elevated railroa north of the Harlem River, if built, will cost aboù $\$ 350,000$ per mile
"The physical capacity of such a system for carrying passengers would be as great as that of the system at first designed by the board.
In making this estimate, the prices of the Board of Experts, Messrs. Hewitt, Chanute, Clarke, Sooysmith and Burr, are used ; and Mr. Parsons says that the cost of the recent tunnel work in Boston shows that these prices are very liberal, and that it is probable the work can be done for much less.
Regarding the speed of express trains, it is expected to make forty miles an hour, including stops. This is not too high an estimate. It was conceded by the op position to the Broadway scheme that a speed of thirty five miles an hour could be realized, and in view of the subsequent and continual improvement which is going on in motors and in methods of transmission, it is likel that by the time the scheme is completed-estimated a two years from the commencement of work-this speed can be reached or even exceeded.

It is estimated that the Pan-American railway to the southern extremity of South America would extend about 4,500 miles and cost $\$ 180,000,000$.

SOME PHENOMENA OF THE ST, LOUIS HURRICANE, A very spirited description of the formation and course of the late St. Louis storm was recently contributed by Mr. H. A. Kirchner, F.A.I.A., to the American Architect and Building News. The barometric readings for the day show a steady fall from $29 \cdot 30$ at 7 in the morning to 28.75 at $5: 15$ in the evening, when the storm was at its height. They were as fol lows:

| $7 \mathrm{~A} . \mathrm{M}$. | 29:30 | 3 | P. M. | . $29 \cdot 10$ |
| :---: | :---: | :---: | :---: | :---: |
| 8 " | 29.28 | 4 | " | 29.05 |
| 9 " | .29\%\% | 5 | " | 29.00 |
| 10 | . 2928 | 5:15 | " | 2875 |
| 11 " | . 29.25 | 6 | " | $29 \cdot 10$ |
| 12 M . | . $29 \% 25$ | 7 | " | .2914 |
| 1 P. M., | .29223 | 9 | " | . $29 \cdot 16$ |
| 2 " . | $29 \cdot 16$ | 10 |  | 2 |

The first evidence af the coming trouble occurred at noon, when there were signs of a storm gathering in the west. At 3 P. M. the northwestern sky was overcast at 4:30 there was "a flying scud underlying light gray cumulus clouds," the wind was increasing and was from the east.
" At 4:35 the flying scud was traveling very rapidly from southeast to northwest, the sky in the south and southeast still remaining clear. The wind increased, still from the east, attaining a velocity of thirty-seven miles per hour. Every indication pointed to a catastrophe in the elements. The western sky became black, the scud piling up in high banks. Suddenly, at 5 P . M. a line formed on the northern sky, showing an attack by the elements from that direction. The line was moving rapidly to the south, forming a straight line from east to west, and mounting high into the sky, all underneath the rapidly advancing line of the storm being of a transparent green color. At the same time the moisture in the air over the city condensed into an inky blackness, from which issued magnificent bolts of lightning in bands of heroic size, setting fire to several buildings and destroying telephone boxes, power houses and light plants. The wind, blowing from east northeast, suddenly increased to 120 miles per hour, tearing, ripping, demolishing everything in its path. Joists, scaffolding, tin roofs, trees, cornices, signs, glass, brick, every material, large and small, found in the country or city, seemed in grand conglomeration to move westward with a speed indescribable, amid the roaring, crashing, booming artillery of the onslaught of wind and water, the lightning lighting up the scene to only a few feet from the observer, as the elements were so thick as to obscure light. The effect was the same as sunshine when seen from under the water. This
turmoil ceased after ten minutes' duration, when it set turmoil ceased after ten minutes' duration, when it set
in again, more terrific than before, from the west northwest, with an interval of but a few seconds. The second onslaught lasted about ten minutes. Twenty minutes after, a third storm, but with wind of moderate velocity (about 25 miles), set in, accompanied by severe lightning, hail and flood. Altogether over three inches of rain fell in one hour."
The effect of these storms was distinct, the one from the east wrecking the northeast part of the city and the river front, the second wrecking the southern and southwestern part of the city. The storm, how ever, was general, for severe damage was done thro
out the city, and ovar an area of 150 square miles.

Mr. Kirchner is of the opinion that the storm wa more of the nature of a hurricans than a tornado, although " undoubtedly derived from the same source as a tornado," both resulting from the unbalanced magnetic condition of the atmosphere. The damage, as assessed, amounts to some $\$ 20,000,000$, and in th opinion of the writer was caused :

First. By the direct pressure resulting from the ve locity- 120 miles an hour-of the wind. This is esti mated at 79 pounds per square foot of surface, normal
to the direction of the storm. Secondly. The pressure of the wind was assisted by the impact of flying debris These two causes would operate to bend the columns of a building of steel skeleton construction, throwing the wall out of plumb and causing the shell of brick or stonework to fall out of the framed work, as the combined result of shock and gravity. It is estimated that the total pressure upon a skeleton building of 50,000 square feet front, which the writer was constructing amounted to $4,000,000$ pounds. Thirdly. Telegraph poles would snap in two, and the cross trees and wreckage attached to telephone, telegraph, and electric wires
swayed from side to side, knocking down buildings on swayed from side to side, knocking down buildings on
each side of the street. Fourthly. Tin roofing was torn loose, and swept through the air, assisting in the general destruction.
It is suggested that these periodical storms should be made the object of special scientific study. It is certainly humiliating that with all our wonderful advance in science, and our ever increasing knowledge of natural phenomena, we should be so ignorant of the real cause, and so helpless in the presence of, such storms as this In view of the appalling loss of life and property which attends these Mississippi valley storms, it would be both humane and prudent to make a special appropriation for their investigation. All possible data should be gathered regarding previous storms, and an effort made to find out the laws which govern, or at lea
very earliest signs which foretell their approach.

THE THREE NEW BATTLESHIPS, NOS. 7, 8, 9. The Naval Department has lost no time, since the appropriation of the necessary funds by Congress, in the preliminary arrangement for the construction of the authorized battleships, and the circular of the Secretary calling for bids is in the hands of the various builders. The contracts are to be made on or before Octo ber 8 of this year. Proposals will be received by the department either under its own plans and specications or under plans and specifications submitcations or under plans and specifications submit-
ted by the bidder and approved by the Secretary of ted by the bidder and approved by the Secretary of
the Navy. The dimensions of the new ships are to be the Navy. The dimensions of the new ships are to be
as follows : Length on water line, 368 feet ; breadth, 72 as follows : Length on water line, 368 feet; breadth, 72
feet; mean draught, $231 / 2$ feet; normal displacement 11,500 tons; and they each carry a total of 1,200 tons of coal.
The armament will consist of four 13 inch guns, mounted in two 17 inch turrets, the barbettes being 15
inches thick. There will be a broadside battery of four teen 6 inch. Ther wall of $51 / 2$ inch armor, extending in the wake of these guns from turret to turret. Between each 6 inch gun a $11 / 2$ inch splinter bulkhead will extend from deck to deck, serving to confine the flying fragments to one particular gun station. Disposed throughout the ship in com manding positions will be some twenty-five smaller rapid fire guns, consisting of sixteen 6 pounders, four 1 pounders, four machine guns and one field gun.
The hull is protected at the water line by a belt of teel $161 / 2$ inches in its thickest part and 7 feet 6 inches wide, 4 feet being below and 3 feet 6 inches above the water line. The $161 / 2$ inches thickness will be continu ous from the aft to the forward barbette, and from the forward barbette to the bow it will gradually diminish to 4 inches. Athwartships, at the barbettes, there will be bulkheads of 12 inches of steel, to resist a raking fire by the enemy. This wall of armor will be roofed in by a protective deck of $23 / 4$ inch steel which will be carried out to the bow and stern, and curved down to below the waterline at the sides, the thickness being increased to 3 inches at the bow and 5 inches at the stern. Be low the bottom edge of the side armor the hull will be double, the space between the two shells being sub divided into watertight compartments.
There will be two military masts, each carrying two fighting tops, and the conning tower of 10 inch steel, which will be placed beneath the pilot house, will be supplemented by another armored position aft, from which the ship can be fought in case the first should be destroyed. The stability of these ships will be as sisted by a complete belt of corn-pith cellulose-a substance which swells rapidly when wet and will auto matically plug up shot holes-which will be worked in rom stem to stern in the wake of the 6 inch armor To reduce the fire risk, as little wood as possible will be used in the construction of the internal fittings of these ships. The speed is to be 16 knots and the cost is not o exceed $\$ 3,750,000$.
It will be seen that the completion of Nos. 7, 8 and will add a very formidable trio to our new navy. The designs are full of interest, and show that the naval board have made a compromise between the Iowa and Kearsarge type. They have departed from the Indiana in the matter of armament, by throwing out the 8 inch guns altogether, and substituting an extremely powerful battery of 6 inch rapid fire guns. The new type has the high freeboard of the Iowa; the forward heavy guns being located on the upper deck, which only extends back to the aft barbette, and the after pair being on the main deck. There are the same number of heavy rapid fire guns in the secondary battery as ther are in the Kearsarge, but the caliber has been raised from 5 inches to 6 inches, and they are better disposed, ten being on the main deck and four on the upper deck Though the number of guns in the heavy rapid fire battery is the same as in the Kearsarge, the increase of power to such an extent of that guns increase total energy of on rapid fire broadside of the new ships will be about double one discharge of the corresponding battery on the Kearsarge. No doubt many admirers of the noble rio represented by the Indiana will regret the absence of the 8 inch guns, which were their characteristic eature; but the substitution of rapid fire is in the line of modern ideas on battleship building, and the actua weight of metal thrown by the new ships in a given time will be equal to, if not greater than, that of any ship afloat.

## Sir John Pender

Sir John Pender, to whom we are largely indebted for the first Atlantic cable, died on July 7, at the age of eighty-one. Had it not been for his generosity and faith in the cable scheme, we should undoubtedly have been deprived of the cable for many years. In 1857 he was one of the original stockholders. When the cable parted in 1865 the case seemed desperate; neither the public nor the government would help. Then Sir John came forward and pledged an enormous sum as a guar antee. It was largely due to him also that Australia and the East were put into telegraphic communication with Europe. His public services were unquestionable and many honors were bestowed on him.

There are fishes that build nests just as birds do. Not long ago some of them were brought to this country from Japan, and the San Francisco Examiner says one can buy a pair of them for a small price at any fan er's now.
The habits of these creatures are remarkably interesting, and, unlike gold fish, they will breed in an aquarium or even in a glass globe. They produce three or four broods of young annually, so that the owner is likely to be able to make money by disposing of the increase. In the land of the Mikado, to which they are native, they are called paradise fishes.
The nests they make are very odd, indeed, being composed entirely of air bubbles. When the time for mat ing arrives the male fish undergoes a striking change in its appearance. Ordinarily he is of a dull, silvery color but now he exhibits stripes of red, blue and green, with streaks of brightest orange on the ventral fins. Such is the costume in which he goes a-wooing
Later on the female proceeds to construct the family nest at the surface of the water. Swallowing air, she nest at the surface of the water. Swallowing air, she made permanent by glutinous capsules from a secretion in her mouth. Having got together in this way a sufficient mass of bubbles, she proceeds to lay.
At this stage the female paradise fish seems always to be seized with a strange desire to gobble her own eggs. This she would inevitably do but for the watchfulnes of the male, who prevents her, taking the eggs in his mouth and ejecting them beneath the mass of bubbles, to which they rise and find a resting place among them. Sometimes he will conduct his mate under the nest, so that the eggs as they are laid may ascend to it. When laying is finished he keeps guard over the nest, attacking the female if she comes near. Meanwhile he busies himself in the making of fresh bubbles to take the place of those which chance to burst.
This performance is kept up for five days, at the end of which the young are hatched out. They cannot swim but cling like little tadpoles to the bubbles. If one falls to the bottom, as happens now and then, the papa fish takes it in his mouth and disgorges it among the bub bles again. His watchfulness is continued until the little fishes are able to take care of themselves.
They grow fast in a glass globe or aquarium, attain ing a length of three or four inches. They thrive best on chopped angle worms, but raw beef cut fine will erve as a substitute. Apparently they are exclusively carnivorous. Care must be taken not to expose them to cold, which quickly kills them.

## Plans for the Sandy Hook Station

Plans have been prepared at the War Department for important improvements at the Sandy Hook military station, officially known as Fort Hancock, says the New York Tribune. These have been approved by Secretary Lamont, and the probabilities are that in the hear future the work of building quarters and barracks at the station sufficient for the purposes of a fair sized army post will be begun. The plans drawn up con template the erection of a number of houses for officers and a barracks to accommodate about 100 men , and the making of suitable parade grounds, walks, roads, etc. These plans were prepared under the direction of the Quartermaster-General. It is proposed to make the buildings of brick, and to place in them all modern conveniences for the health and comfort of officers and men. In his last annual report General Miles said that Sandy Hook was an important military point, which, in time of war, would be a valuable outpost in the defense of New York. He recommended that steps be taken to make the place more formidable. Congress took up the subject, and in the army appropriation bill provision was made for quarters and barracks in connec-
tion with a permanent artillery garrison at Fort Hancock.
For this purpose Congress authorized the application of $\$ 100,000$ of the total appropriation for the fortification and equipment of the new fort. It is expected that this money will suffice to provide what is known as a two battery post, and that will mean a garrison large enough to man the defensive works already constructed, although not sufficient for all future needs. Therefore the plans have been so projected as to permit of a ready extension of the quarters at any time. They have already been prepared, and the quartermaster's department will at once take steps to procure all further necessary information for beginning construction work. The projected work will not interfere in any manner with the completion of the defensive works of the fort itself, which is to be pressed as rapidly as the resources of the engineer's department and the capacity of the army ordnance works will permit.
Much has already been accomplished at Sandy Hook that is unknown to the public in the matter of placing mortar batteries, and there are also several heavy caliber modern rifles there mounted on disappearing carriages. The ordnance shops are making rapid progress with other heavy guns, and it is expected that considerable additions will be made to the Fort Hancock defenses as soon as the engineers can prepare the emplacements, possibly this summer or fall.

HYDRAULIC LIFT DRY DOCK AT THE UNION IRON WORKS, SAN FRANCISCO.
(Continued from first page.)
the mud, as shown in end view, with its upper end about water level at mean high tide. This casing was filled with piles 100 feet long, seven to each pier, all leveled off even with top of casing, and the whole capped with a cast iron cap. Each pier is capable of sustaining a weight of eighty-two tons, giving a capa city of 164 tons to each ram.
Running longitudinally and supported on the cast iron caps are two steel girders, with a depth of 18 inches, which directly support the ram cylinders, as will be plainly seen by reference to the end view. To balance the twisting tendency of the transverse girders on the piers, cantilevers were extended out 28 feet from each side of the dock and the ends anchored to two piles for each lever, two levers being used for each ram or a total of 72 levers.
The equalizing device for the rams is an ingenious affair and exceedingly simple in its operation; each ram being its own governor. The supply pipe, $D$, for the rams extends along two sides and across one end of the dock, connecting with the accumulator in the pump house. The relief pipe, $E$, extends over the same course, and discharges back into the supply tank on the roof of the pump house. At the top end of each plunger there is placed a double hydraulic valve, $A$, with a pipe, B, connected to each one, and telescoping into pipe, $C$, that extends under water alongside the piers and draws its supply from the main line, $D$


UNION IRON WORKS HYDRAULIC DRY DOCK-SIDE VIEW OF LIFTING RAMS AND PIERS

At the valve, $A$, a lever, $F$, is carried, with its fulcrum equidistant from the center of each valve stem, one being the inlet and the other being the outlet, while the end of the lever engages a nut, $G$, carried on a vertical screw connecting with a line of shafting survertical screw connecting with a line of shafting sur-
rounding three sides of the dock, and operated by a rounding three sides of the dock, and operated by a
pair of 6 inches by 6 inches vertical engines placed in pair of 6 inches by 6 inches vertical eng
the pump house for that purpose alone.
It will be plainly seen, as the nut travels upward on the screw, the lever opens the inner valve and allows the water to flow into the cylinder, thereby raising the plunger until it brings the lever on a level and shutting off its own supply, causing the plunger to follow the nut on the screw. By this means a ship is raised on one end of the platform, with perfect safety, while the ther end is unoccupied, all the while the dock being kept on an even keel.
In the pump house, for supplying power to raise the lock, are two 12 inches by 16 inches vertical steam engines, with 90 pounds steam pressure, connected by pinion and gear to four horizontal pressure pumps, $33 / \mathrm{A}$ inches diameter of plungers, 36 inches stroke, running at an average of 31 strokes per minute, and discharging into an accumulator, whose ram is 8 inches diameter by 48 inches stroke with a total weight of 62,000 pounds. From the accumulator the water passes into the rams, under control of the valve mechanism. The accumulator has
detachable weights that are added according to the weight of the ship to be balanced in raising, as the operation is simply a case of balance between the ship and accumulator.
The throttle valve of the pump engines is connected to the accumulator, so that whatever leakage takes place in the pipes is constantly kept supplied automatically without any attention.
When the dock is raised a series of locks on each side are run under the platform by hydraulic rams, and the platform is allowed to settle upon them and relieve the ropes and rams from the weight.
The dock has been in successful and constant operaion since 1887, and has a record for number of ships docked that is rarely equaled. Considering the novelty and boldness of the design, and the reliable service hat it has rendered, this is a piece of engineering which is entitled to the greatest credit.


Eight 2 inch diameter steel ropes per ram.

Platinotype Effects on Gelatino-chloride Paper. A correspondent of the Photographic News suggests he following :
A pure platinum black cannot be obtained by using gold toning solution.
A very near approach to it, however, can be secured by using the ordinary sulphocyanide bath.

| Sulphocyanide of ammonia | 30 grains. |
| :---: | :---: |
| Gold chloride | 2 " |
| Water. | 16 onn |

When toning, examine the prints from time to time by holding them up to the light and looking through them.
Toning is complete when the warm tones have disappeared, except from the darkest portions of the print, which should appear of a deep chocolate brown. At this point transfer the prints to a dish of clean water and wash for a few minutes.
On placing in the fixing solution the prints will turn slightly warmer in tone, but will become darker when finished and dried. When the prints have been fixed and thoroughly washed they are ready for finishing.
Take a piece of finely ground glass such as is used or focusing screens. Wash well with soap and water, wipe perfectly dry, and rub lightly with a soft cloth and powdered talc.
Dust off the superfluous talc; wipe the edges and


UNION IRON WORKS HYDRAULIC DRY DOGK-CROSS SECTION, SHOWING CONSTRUCTION OF RAMS AND GIRDERS OF PLATFORM.

Two 12 inch by 16 inch vertical steam engines for pumps.
Four pressure pumps, 36 inch stroke, diameter of piungers, $33 / 4$ inches.
One Worthington duplex pressure pump, 4/2 by
$13 /$ by 4 inches.
One accumulator
One accumulator, 8 inch diameter by 48 inch
stroke.
Weight on ram

Average speed of pressure pumps, 31 strokes per minute.
Pressure of lifting empty dock........... 275 lbs. per square inch Speed of platorm, loaded dock.........1,250 " ". " $3 \cdot 2$ inches per minute, 1,250 lbs. per square inch
Steam pressure............................. 90 lbs. per square inch VESSELS RAISED ON DRY DOCK OF UNION IRON Year.
1887
1808
1889
1890
1891
1892
1893
1894
1895
1896

| Year. | Number vessels. | Tonnage. |
| :---: | :---: | :---: |
| 1887. | 48 | 56,634 |
|  | 114. | 112.167 |
|  | 120. | 129,828 |
| $18: 10$ | 132 | 113,738 |
|  |  | 157,0¢2 |
|  | ... 131.. | 144,544 |
|  | 122 |  |
| 1894. | 107. | 141,587 |
|  |  | 154,414 |
| 1896 to |  | 48, 578 |
|  | 1,072 | 1,228,695 |

This is equal to about $10 \cdot 1$ vessels per month
back of glass clean. Place the glass in a dish and cover with water.
Take up a print and wash the surface with a small sponge, using plenty of water. This is to free the surface from any particles of grit or dirt which may be adhering to it.
Float the print on to the ground glass under water, taking care to avoid air bubbles.
Withdraw from the water, place a pad of blotting paper over the print, and squeegee it into contact with the glass.
A perfect matt surface can be obtained in this way. More detail is shown than if ready-made matt surface paper is used, and the result is very artistic.

Some one in Germany, according to a recent account, proposes to build a house of which the framework is to be made up of water tubing, through which warm water is to be circulated in winter and cold water in summer, warming or cooling the inclosed spaces as may be prompted by the requirements. All the floors and ceilings and walls are to be crossed and recrossed with water pipes, affording heating and cooling surface exactly where theory tells us it should be to give the nost desirable results. The building of that house would certainly afford an excellent, modern, practica demonstration of the value of these ideal principles.

## gasoline pumping engine.

We give an engraving of the Charter gasoline engine and pump combined. This combination was designed for any kind of service that piston pumps are capable of. It is compactly built, a feature which, in places where floor space is valuable, is especially desirable. It is easily operated. When through pumping, nothing remains to do but shut off the gasoline. As no special attendant is required, it is especially desirable for filling railroad tanks, as the station agent or his assistant can take care of the engine and see that the pumping is done without interfering with their regular duties, thus saving the expense of employing a man to go from station to station to fill the tanks. The workmanship and material are the best obtainable. The gears are all machine cut, the pump cylinder is brass lined, and everything about the engine and pump is built on the interchangeable plan. The cut illustrates an engine and pump capable of delivering 60 gallons of water per minute against 100 or 200 feet head, or equivalent pressure. It is self-contained and may be set in operation almost anywhere. This engine is made by the This engine is made by the
Charter Gas Engine Company, Charter Gas En
Sterling, Illinois.

## The Endurance of Rotating

 Shafts.Some of the results arrived at by recent tests made at the Watertown Arsenal are regarded as of special importance in relation to the endurance of ro lation to the endurance of ro tating shafts. While it has been found that great improvements in tensile strength and elastic limit have been obtained, it has
not been shown whether the not been shown whether the limit of endurance under repeated strains has been increased. In the rotating tests of cylindrical shafts, alternate tensile and compressive strains are successively applied, and under these conditions of loading no steel has yet been experimented with which will endure a continuous fiber stress of 40,000 pounds per square inch without rupturing, and this result has been reached after a total number of repetitions of from four to seven millions for number of repetitions of from four to seven mill

## APPARATUS FOR MEASURING THE INTENSITY OF THE PERFUME OF FLOWERS.

Mr. Eugene Mesnard, one of our most clever botanists, has for several years past been making profound researches upon the perfumes emitted by flowers, and which are interesting not only from the standpoint of plant biology, but also from that of the perfumer's art. In fact, the art that consists in extracting the aroma of odoriferous bodies, and in making mixtures thereof agreeable to the smell, is a matter of no ordinary empiricism. It is only through daily practice and multiple comparisons that perfumers have succeeded in establishing the rules that define the combinations of odors that are to enter into bouquets or different toilet articles. On another hand, as regards the production of perfume by flowers, one might seek in vain for the smallest work upon the question.
The idea of an attentive study of the phenomenon, from a biological and industrial standpoint, must necessarily have presented itself to the mind of a botanist. Let us congratulate Mr. MesLet us congratulate Mr. Mes-
nard for having taken it up, nard for having taken it up,
and especially for having purand especially for having pur-
sued it with success. Such a study, in fact, was not one of the easiest of matters. The perfume of flowers is something so subtile, so impalpable and so difficult of comparison that we ask ourselves how it is rendered manageable. The important point to be estab lished in the first place is its intensity, that is to say, the greater or less action that it exerts upon the olfactory organ. The measurement of this is a very delicate matter.

The indirect method that Mr. Mesnard employed for
measuring such intensity is very precise. As he remarks, although the sense of smell is not capable, as might be supposed, a priori, of estimating the intensity of an
odor in absolute measure, it may be a wonderful com parer. The perfumer who has five or six hundred vareties of odors in his store is perfectly able to distin cuish one from another while it is not in his powstindefine their intensity with certainty. So, too, it is posible, by the sense of smell, to recognize the existence of a great number of chemical substances, but'without of a great number of chemical substances, but'withou
it being possible in any way to prejudge of the quanti


## COMBINED GASOLINE ENGINE AND PUMP.

the air. Let us suppose, then, says Mr. Mesnard, that we cause air charged wlth a certain perfume and air that has passed over a special volatile oil (oil of turpenine, for example) to enter a given receptacle, In this way we may obtain a mixture in which the sense of mell will detect only a neutral odor, that is to say, an odor such that it will suffice to slightly vary the proportion of the volatile oils in one direction or the other in order to detect either the perfume or the oil of tur pentine. It may then be admitted that the odors are equivalent, and if we have at our disposal a method that permits of measuring the intensity of the turpen tine, we shall obtain by that very fact the intensity of the perfume.
In order to estimate the intensity of the turpentine, there is taken as a basis the property that the latter possesses of extinguishing the phosphorescence of phospossesses of extinguishing the phosphorescence of phos-
phorus. To this effect, there is used a little starch


APPARATUS FOR MEASURING THE INTENSITY OF PERFUMES.
ning the perfumes. Z. Tripod. C. Mercury reservoir. No. 2. Internal
supports the case, D. No. 3. Lever for closing the tube, E, by pressure.
soaked in some sulphide of carbon in which phospho rus has been dissolved. The sulphide evaporates, and the starch, which is a very homogeneous substance,
becomes impregnated with phosphorus, which becomes
luminous in the air. Mr. Mesnard has shown that in
order to prevent the phosphorus from glowing in
given space it is necessary to introduce therein a vol ume of air that is so much the greater in proportion as it is charged with a lesser weight of vapor of turpentine oil.
Oil of turpentine thus becomes a common standard for the various volatile oils, and the intensity of the perfume emitted by a given weight of volatile oil may be called the ratio between the weight of the oil of turpentine that neutralizes the perfume and the weight of this same oil which, employed alone under the sam conditions, acts upon phosphor escence with the same energy.
In all experiments it is neces sary to carry along the odors (which are generally heavy) mechanically by a strong current of air.
The following is the way in which Mr. Mesnard realizes all these conditions in an apparatu constructed at the laboratory o Mr. Gaston Bonnier.
The flowers, the intensity of the perfume of which is to be deter mined, are inclosed in a large glass case (No. 1 of the figure) placed upon a pedestal which is itself supported by a metallic tripod, Z, provided with level ing screws. This pedestal con sists of two parts: (1) a narrow one, C , hollow in the interior into which mercury is put, and (2) a wide one, $B$, which is sep arated from the glass case by a partition. These two parts form but one and the same receptacle. A rubber tube that may be closed by a lever (E, No. 3) establishes a communication between the case, $D$, and the mer cury reservoir (No. 2). In this same receptacle likewise de bouch different conduits, one of which is designed to lead the air charged with oil of turpentine coming rom the bottle, T. The odors are detected in the apparatus through the tube, 0 .
Through the manipulation of a rubber bulb pro vided in front and behind with ajutages and with a three-way cock, $R$, it is possible at will to agitate the air either in the case, $D$, and the mercury reservoi communicating with it, or in each of these two parts isolatedly.
The neutral odor having been obtained as previously stated, it is a question of measuring the charge of the il of turpentine that has produced this result. The phosphorescent substance is suspended in a blackened glass bulb, $F$, of about $100 \mathrm{c} . \mathrm{cm}$. capacity that com municates, at its base, with the reservoir through a horizontal tube full of mercury. A black cardboard tube, V, permits the phosphorescence to be observed even in the full light. For the transfer of the perfumed air from the mercury reservoi to the bulb, $F$, the following arrangement is employed. In the same axis of the connect ing tube is placed a smaller tube, one of the extremitie of which opens in the mercury just beneath the bulb. The other extremity of this tube is prolonged by a solid axi provided with a winch, M Toward the center of the re servoir, it receives a spirally curved branch, $S$. In a cer tain initial position, the spiral and the tube that prolongs it may be entirely filled with mercury; but, if the winch be revolved, the extremity of the spiral will enter the atmosphere, and, at every re volution, withdraw therefrom a certain quantity of per fumed air which it will carr along through the mercury the extromity of the tube where the air will escape, bub ble by bubble, and become diffused through the bulb.
The winch is revolved until an extinction of the phos phorescence is obtained. The number of revolutions or frac tions thereof is proportiona to the quantity of air that to the quantity of air tha has been carried along. Moreover, the spiral is gradu ated, and, by raising the level of the mercury in the reservoir more or less, it is possible to modify the volume. A rubber bulb, U, permits of blowing a little air upon the phosphorescent substance. Another
bulb, Q, distributes warm air throughout the apparatus. -La Nature.

Rulew of the Providence Horseless Carriage Race The following are the rules and conditions of the held on September 7,8 and $0,11,1896$ at Narraganse Park, under the auspices of the Rhode Island State Fair Association. The race will be twenty-five miles, for a $\$ 5,000$ dividend. The rules are very sensible, and the race will tend to awaken public interest in the horseless carriage. It will be noted that an entrance fee of $\$ 100$ is charged. This is a step in the right direction and will certainly prevent the pitiable defections rom the ranks of competing vehicles which have marked both of the former races.
official rules and conditions.
Entrance fee, $\$ 100$ per carriage, payable August 10. No conditional entries accepted.
The race to be five heats, of five miles each day of the fair, September 7, 8, 9, 10, 11, 1896.
Ten carriages to enter and five to start, or no race.
Vehicles must be able to show a rate of speed equ
to 15 miles an hour to compete in the race.
Vehicles must carry one person in addition to the driver. (Weight carried must be 165 pounds.)
Only vehicles propelled by other than animal power allowed to compete.
Vehicles not limited in number, but no one owner can enter more than one carriage and start in the race. If the starters number ten or more, for reasons of safety the carriages may be divided into classes and started in two or more divisions.
Division of the race purse will be in the following proportion to the winners of the race: $50,25,15$, and 10 per cent of $\$ 3,000$. First, $\$ 1,500$; second, $\$ 750$; third, $\$ 450$; fourth, $\$ 300$.
To the vehicle winning the greatest number out of five heats, first money, etc., but all vehicles must stay in throughout the five heats.
Distance waived, but those vehicles which do not cover the course with an average speed of fifteen miles an hour will be disqualified.
Each vehicle will be required to carry its number in large figures; other printed matter not permitted.
Contestants will be required to conform to such rules and regulations as may be made by the association, particularly in regard to their position on the track. All legal responsibility is thrown upon the contestants, the association declining to assume any whatsoever.
In case that less than five carriages shall respond to the call of the starting judge, the race shall be declared off, and to those answering the call and who are ready with their vehicles, their entrance fees paid in shall be refunded. With ten or more entries received, the association will open, in addition to the speed contest, prizes to be competed for as an exhibition, judging to be made on points of manageability, etc., for $\$ 2,000$, divided as follows :
First prize, $\$ 1,000$ and the association's gold medal and diploma.
Second prize, $\$ 500$ and the association's silver medal and diploma.
Third prize, $\$ 300$ and the association's bronze medal and diploma
Fourth prize, $\$ 200$ and the association's diploma.
In the exhibitive competition the following percentage scale of points shall be made the basis of awards :

| Speed............. 40 per cent. | Cost.......... .. 10 per cent. |
| :---: | :---: |
| Control......... . 20 " | Maintenance...... 5 |
|  |  |

Vehicles may compete, if desired, in both racing and exhibition.
Entries will close August 10, 1896. Entry blanks will be furnished on application to Rhode Island State Fair Association, Providence, R. I.

Novel Method of Rapid Photographic Printing.
Sometime ago we described and illustrated themethod of automatic photographic printing as carried on in this city by the Automatic Photographic Printing Company, who print from glass negatives. Now appears another kind of apparatus, recently patented in England by Mr. Friese Green, for accomplishing the same
object in a different way when using flexible negatives. object in a different way when using flexible n
He describes it in his specification as follows:
"I print successively by means of photography a number of impressions from the same photographic or other negative, or from the same series of negatives,
upon a continuous band of sensitized paper or other upon a continuous band of sensitized paper or other sensitized material, as this is caused to travel continuously in contact with a translucent cylinder which bears or carries the negative or negatives, the said cylinder being lighted internally, preferably by one or more incandescing electric lamps.
"In carrying out the invention, when the negative or negatives employed are photographic negatives, I use negatives which have been taken upon a flexible translucent material such as a thin sheet of celluloid, and I place this sheet upon a supporting cylinder of glass in such manner that the sheet bearing the negative or series of negatives surrounds the cylinder. Within this
cylinder I place one or more lamps. Over or under the cylinder, and in contact with the celluloid sheet there.
on, I carry a band of sensitized material from a roll or otherwise, this band being so guided that there is always a part, say several inches, of its length in contact with the celluloid sheet, and this part of the band being maintained taut. Rotary motion is given to the
cylinder and forward motion at the same surface speed cylinder and forward motion at the same surface speed to the band, with the result that every section of the band equal to the circumference of the cylinder has printed upon it by means of the light a positive impression from the negative or negatives on the cylinder, the same picture or pictures being produced upon every successive section of the band. On leaving the cylinder the band is carried to and through fixing and developing baths; or, if it be required to print upon both sides of the band, it goes from the first cylinder to a second and similar cylinder, where it is printed in like manner upon its second side; it then passes on to the fixing and developing baths.
"When the negatives employed are not photographic negatives, they may, for example, be transparencies or sheets having the parts that do not constitute the design in black, red, or other nonactinic color, and the other parts, that is to say, the design, transparent, or vice versa.
"It is not essential to employ the glass cylinder described if the sheet that bears the negative or negatives is strong enough to be self-supporting."

## HARTMANN'S SPOOL WIRE CLAMP.

To confine reeled wire upon its reel, whether it be unannealed or spring wire, holding the wire always in proper position without the necessity of fastening its free ends, the simple and inexpensive device represented in the accompanying illustration has been patented by Charles R. Hartmann, of No. 110 Cambridge Avenue, Jersey City, N. J. It consists of a U-shaped clamp whose side members are preferably connected with the reel by a central tube or pin, permitting the clamp to be readily moved along the outer surface of the reel to any point desired. The side members are provided with loops which serve as handles, and also as springs, holding down the portion of the clamp which extends over the outer surface of the reel, and this portion has downwardly extending flanges inclosing a pad of cork
 rubber, leather, or other elastic material. The improvement is especially adapted for holding in place wire designed for use in stringed instruments, preventing the wire from springing off, and, at the same time, permitting any length of string to be held in the order in which it was originally wound.

## A Rallway Accident Caused by Heat.

Lieut. Col. H. A. Yorke, R.E., has reported to the Board of Trade on the accident that occurred on May 6, near Banavie junction, on the West Highland (North British) Railway. As the 7:35 A. M. passenger train from Glasgow to Fort William was running round the curve between Spean bridge and Banavie junction on that day the whole train, with the exception of the engine, left the rails and ran along the ballast for 115 yards before it came to rest. The permanent way had three rails bent, and 120 sleepers and 112 chairs, more or less, were destroyed.
Lieut. Col. Yorke says he has no hesitation in attribut ing this accident, which by rare good fortune was un attended by any personal injuries, to the expansion and consequent distortion of the line produced by the great heat prevalent on the day of the occurrence. During the forenoon of May 6 the temperature registered at Fort William, by a thermometer placed in the sun 2 feet above the grass, was 128 degrees. The accident hap
pened at $12: 38 \mathrm{P} . \mathrm{M}$., when, the railway at the spot be ing entirely devoid of shade, the rails were exposed to the full glare of the sun. Driver Thornton says that when he was passing the $971 / 4$ mile post he saw that the line a short distance in front of him was distorted to the left to such an extent that he anticipated that the train
would leave the rails. He promptly applied the Westinghouse brake, and almost immediately after this the tender and vehicles composing the train left the rails toward the inside of the curve. Inspector Campbell had traveled over the line early that morning in the van of a ballast train, and noticed nothing wrong with it. The fact that the engine did not leave the rails, although the train did, may probably be attributed to the flexibility imparted to the engine by the leading bogie, which was able to adjust itself to the irregular curvature of the line produced by the expansion of the rails; whereas the tender, with its six wheels and rigid
wheelbase, was most probably the first vehicle to leave wheelbase, was most probably the first vehicle to leave
the metals, and dragged the rest of the train after it. The mishap must be regarded as purely accidental, and there is no evidence to prove that any blame attaches to any servant of the company in connection with it. There are, however, the report adds, some indication a thoroughly first class condition.-London Times.

Dr. J. Doerfler, of Vienna, has published his Botaniker Adressbuch, a guide to botanists throughout the world. It contains upward of 6,000 addresses of botanists, as well as those of botanical gardens, botanical institutes, societies, and journals.
Jenner's silver lancet case and lancets, the former engraved with the initials and the latter with the name of the discoverer of vaccination, have been presented to the Royal College of Surgeons by a doctor who obtained them from the grandson of Jenner's assistant.
Natural Science notes that Mr. G. A. Boulenger is one of the first to use $\mathbf{X}$ rays for purposes of systematic zoology, having used a skiagram to determine the more important points in the skeleton of the rare toad Pelodytes caucasicus, the second known species of the genus represented by a single specimen. The skiagram showed the junction of the astragalus and calcaneum, the form and extent of the frontoparietal fontanelle, the shape of the widely expanded sacral transverse processes and the direction of those of the lumbars.
Prof. H. L. Bolley, in a paper on cleanliness in handling milk, says bacteriological considerations tell us that gelatine plate $31 / 2$ inches exposed to air one minute contained the following number of germs. Ordinary living room five minutes after sweeping, 543 germs, eight species. (Fargo.) In open meadow, when quiet, 6 germs, two species. (Madison, Wis.) Open meadow October, quiet, 8 , three species. College cow stable between the cows after feeding time, October, 570, eleven species. (Madison, Wis.) University creamery and cheese factory, pasteurization room after scrubbing, August 21, 5 germs, three species. (Madison.) Refrigerator, storeroom temperature $40^{\circ} \mathrm{F}$., one species (Madison, Wis.) (Bull. 21, N. Dakota Agr. Exp. Sta.) The Lancet states that a surgeon in the United States navy reports that in Japan among 1,200 soldiers 1.58 per cent were red blind and 0.833 per cent green blind. Among 373 boys 1 per cent were red blind, and among 270 girls 0.4 per kent. Among 596 men in Kyoto $5 \cdot 45$ showed defective color sense. Dr. Fielde, of Swatow, China, examined 1,200 Chinese of both sexes, using Thompson's wool tests. Among the 600 men were 19 who were color blind, and among 600 women only 1 The percentage of color blindness among Chinamen is then about 3 per cent, and does not vary greatly from then about 3 per cent, and does not vary greatly from
that in Europeans. Dr. Fielde, however, found that fully half of those tested mixed up blue and green, and this investigator thinks that many of the race are quite blind to the violet colors.
Signor Palmieri, who for some years has been study ing the earth currents at the observatory on Mount Vesuvius, has discovered that the direction of the current changes when the volcano is unusually active. The earth line runs from a deep well in the village of Resina, at the foot of the mountain, to the observatory, near the top. From 1889, when the experiments be near the top. From
gan, till August, 1893, the currents were from the lower station to the higher, so that Prof. Palmieri had lower station to the higher, so that Prof. Palmieri had
concluded that the earth currents always ascend. In concluded that the earth currents always ascend. In
that month, however, the direction began to change and settled into the opposite of the direction since 1889, the volcano being abnormally agitated. In Jan uary and February, 1894, the mountain became quies cent, when the current again moved upward, and ater turned downward once more, on an increase in the activity of Vesuvius.
As the result of his prolonged study of those striking phenomena, the thunder storms of Madras, Prof. Smith informs the Scottish Meteorological Society that the first remarkable fact observed by him was that of certain seasons of the year, when sheet lightning appeared almost every night, always in a west or southwesterly direction, and invariably near the horizon; it may be therefore, he remarks, that these discharges occur in the region where the moist and dustless sea winds meet the dry and dusty land wind, one being, perhaps, positively electrified and the other negatively. In these lightning displays as many as 300 flashes per minute have been counted, this rate being kept up for an hour or an hour and a half. Another notable peculiarity marked of this region is that the heaviest rains are unaccompanied by thunder, while the displays of lighting are not accompanied by any rain.
W. N. Hartley has determined the composition of a coin by an ingenious adaptation, of the methods of spectrographic analysis. The spectrum of the coin wa photographed and the metals present first ascertained, after which their relative proportions were arrived at by comparing the photograph with a series of quantitative spectra, in which solutions of known strengths yielded spectra with a certain number of lines of definite length and strength. Alloys were then made to mitate the metal, and photographs of their spectra aken in the same way. The third trial produced an alloy, the spark spectrum of which yielded a photograph dentical with that of the coin, a "white" sou of th French revolution of 1798, the composition being found by the usual methods of analysis to be: Lead 13.93 per cent; copper, $72 \cdot 35$; iron, 0.85 ; zinc, $12 \cdot 70$ By this novel method of analysis the composition of antique jewelry and coins may easily be determined without injuring them in any degree.

## Sorrespondence.

## The Fluoroscope

o the Editor of the Scientific American
While experimenting with a half dozen lot of Geissler tubes recently, I found two of tiem to give the Roentgen effect sufficiently to light up my fluoroscope very well.
The length of the tube permits one to reach a definite conclusion regarding the terminal, which is impor tant in $\mathbf{X}$ ray work. While the question has been de finitely settled, yet it may interest some of your readers to apply this simple test. Turn the screen toward the anode so no light can reach it from the cathode, and nothing is observed, then turn screen toward the eathode, and at once light is seen to come from that source.
J. T. Coleman.

Charleston, S. C., July 16, 1896.

## Barisal Guns.

To the Editor of the Scientific American
In your issue of June 27 you speak of the Barisal uns, and ask if any one knows of a like occurrence On the evening of December 28, 1885, I was with a com panion in a sail boat on the Gulf of Mexico, about twenty miles southeast of Cedar Keys, Florida. We were becalmed. The next morning the sky was cloud less. There was a light fog and no breeze, the atmo shere was bracing, but not frosty. We were about ten miles out, but in shallow water. Shortly after sunrise were heard reports as of a gun or distant cannon They came at intervals of about five minutes. We wer not certain as to the direction. My companion, who lived several miles further down the coast, said he had often heard those reports on still mornings. New Castle, Ky.
W. S. Cooper.

## Effect of a Volcanic Eruption.

The bombardment in some places must have been terrible. I have seen tracts of land, once smooth and fertile plantations, now covered with the great rugged stones so that you have to pick your way among them as you pass. Many of them are four or five feet broad. Of course, these are only the larger stones; the little ones were buried under the soil long ago.
Stones seem to have fallen all through the eruption, sometimes in one place, sonetimes in another. Not long after the first expulsion of smoke, a negro boy was tending goats on a hillside. I have seen the place often. Suddenly a small stone fell near him, and then another He thought that some of his playmates were pelting him from the bushes, and so began to throw stones in return. But the contest was too unequal, for it was the mountain that was throwing stones at him; and ere long he fled in terror, leaving his goats to their fate.
I have no space to tell you the whole story of this great eruption; how many plantations were ruined by the shower of stones, and, far worse, how fifty or per haps a hundred people were killed by them, with great numbers of cattle and horses; how the lava dammed back a stream and formed a boiling lake, which broke through after a month and came hissing down the valley, overwhelming a whole negro settlement; how ashes were carried five or six hundred miles out to sea and Barbados, eighty miles off, was darkened by th and use candles in their houses; how the explosions were heard hundreds of miles away, and it was thought that they were the guns of a great fleet or army.
But one thing I must tell you. When the eruption was over and people could ascend the mountain again,
they found the crater-the one Dr. Bell had visitedthey found the crater-the one Dr. Bell had visitedall changed. Instead of the smoking cone, there was a lake of water nine hundred feet below, filling the whole area, and so deep that no one has ever been able to fathom it. And besides this, separated from it only by a thin wall, they found a new crater, even larger ; it was nearly a mile long, three-quarters of a mile wide and eight hundred feet deep, with sides like walls. That pit was blown out by the great explosion.
I have stood between the two craters, and looked
down into them. The new one is green and pretty down into them. The new one is green and pretty
now, with bushes and ferns, and no signs of fire; but the old one is a hideous depth of gray green water through which bubbles are always ascending and bursting into sulphur fumes at the top. Sometimes the wind carries these fumes over the neighboring plantations, for miles around, as if to warn people that the old fires are not yet extinct. I hope it may be long before they break out again!-Herbert H. Smith, in St. Nicholas.

A curious phenomenon, first discovered by M. Charles Margot, was shown in a modified form recently by Prof. Roberts-Austen. An electric current was sent through an aluminum wire, raising it to a temperature of $400^{\circ}$ above its melting point. Strange to say, it did not fall, the film of the oxide on its surface holding it
intact. In this condition it was attracted, owing to the current within it, by a magnet, and by careful manipu lation could be made to tie itself into a knot.

## Interesting Statistice of altitude.

In the Niagara rapids the water descends 52 feet in less than a mile; the falls are 164 feet high on the American side and 150 on the Canadian. Mount Lebanon, from whose sides were cut the cedars for Solomon's Temple, is believed to be the highest elevation in Syria, 11,000 feet. Lake Titicaca, in Bolivia and Peru, is 12,000 feet being 100 miles long by 35 in width. Mount Etna, the largest volcano in Europe, and one of the largest in the world, is 10,050 feet high and 90 miles in circumference at its base. In 1843 Mauna Loa poured out 17,000,000,000 cubic feet of lava; in $1855,38,000,000,000$ feet In 1859 the lava stream from this volcano ran 50 miles in eight days. The Peak of Teneriffe, 12,236 feet high, is the greatest altitude in the Canary Islands. It is said to be visible at sea, in clear weather, for nearly hundred miles.
The River Jordan makes the greatest descent in the shortest distance of any stream. During its course of 120 miles it has twenty-seven falls and descends 3,000
feet. It is said by some geographers that Mount Wranfeet. It is said by some geographers that Mount Wrangel, 140 miles west of Mount St. Elias, is over 20,000 feet in height, but no authentic measurements have been taken. Mont Blanc is 15,776 feet high. This famous mountain is exceeded in height by many, but its posiion in the line of tourists' travel has given it a name above many others. Chimborazo, in Ecuador, 21,444
feet, is said to be the highest in that State. Cotopaxi, 19,408 feet, and Antisana, 19,150 feet, are second and third in the order of their height. Mount Ararat, 12,700 feet, is the highest land in Armenia. The perpetual snows that lie upon its summits are believed by the dwellers in the valleys beneath to cover the remains of Noah's Ark. Kilauea, a part of a cluster of volcanic mountains denominated Mauna Loa, is only 3,970 feet high, but is the largest active volcano in the world. Its crater is a great pit 8 miles in circumference and 1,000 feet deep.
Pike's Peak, where gold was first discovered on this side of the Rocky Mountains, is 14,320 feet high. The "Roof of the World," the plateau in the Pamirs of Thibet, is from 10,000 to 15,000 feet above sea level Mauna Loa, in the Hawaiian Islands, is 13,760 feet high ; Mauna Kea, 13,963 feet; Mauna Hualalai, 7,822 feet. Mount Sinai, the mountain from which the law of Moses is said to have been delivered, is 8,000 feet high. California has forty mountains, each of which exceeds 10,000 feet, and quite a number are more than 12,000. The Simplon, under the shadow of which lay the once famous stage route from France to Italy, 11,542 feet high. There are 412 mountain peaks in the United States, or its Territories, each having a heigh the greatest elevation in Morocco. Although almost under the equator, its summit is never free from snow. The Illimian Mountain, a peak 21,780 feet, is the high est point of land in Bolivia. There are extensive dis tricts in Sahara which are below the level of the ocean White Top, 5,530 feet, is said to be the greatest recorded
altitude in Virginia. High peaks are numerous in Colorado; there are in that State of mountains 178 peaks, each of which towers above the sea to a height greater than 10,000 feet. The steeple of the famous Cathedral of Strasburg rises to a height of 474 feet.
There are ten mountain peaks in Arizona, each of which exceeds 10,000 feet in height. Clingman's Mountain, 6,707 feet high, takes precedence of all others in North Carolina. There is no mountain 10,000 feet high on the American continent east of the Rockies. There
are two or three lakes in Colorado more than 10,000 are two or three lakes in Colorado more than 10,000
feet above the level of the sea. Popocatapetl, 17,775 eet above the sea, is regarded as the highest elevation in Mexico. In New Mexico there are thirty mountain peaks rising above an altitude of 10,000 feet. The peak of St. Gothard, above the pass of the same name, in the Alps, is 9,080 feet high. Mount Olympus, whose summit Homer made the abode of the gods, is 9,754 feet high. The cross on the dome of St. Peter's, in Rome is 448 feet above the pavement of the portico. The chimney of a noted chemical factory in Glasgow, Scotland, is 454 feet in height. Most of the lower valley of
the Po, in Italy, is from 5 to 40 feet below the level of the Po, in Italy, is from 5 to 40 feet below the lev, but
the stream. The pyramid of Cheops is 543 feet, but about 30 feet of the former top was ages ago removed. Mount Marcy, in New York, 5,403 feet above sea level, is said to be the highest in that State. Mount Parnassus, the home of the Muses, is only 3,950 feet high. The tower of the Parliament house, in London, is 340 feet high. Stromboli, the island volcano, off the Italian coast, is 3,850 feet high. The most extreme altitude in Alaska is Mount St. Elias, 19,500 feet. Bentonville is the highest point in Arkansas, 1,790 feet above the sea. Long's Peak, the celebrated landmark in California, is 13,400 feet high. Wyoming has forty-four mountain peaks, each of more than 10,000 feet. Mount Shasta, celebrated volcano of California, is 14,450 feet high the foundation. Mount Pindus, the seat of Greek his tory and romance, is 7,677 feet high. The dome of the Capitol, in Washington, is 300 feet above the pavement. Mount Rosa, in the Sardinian Alps, is the highest in
that region, 15,550 feet. High Knob, 1,799 feet above
sea level, is the highest point in New Jersey. Mount Washington, 6,288 feet high, is the highest peak in New Hampshire. Lake Victoria Nyanza, in Africa, is over 4,000 feet above the level of the sea. Mount Carmel, where Elijah slew the prophets of Baal, is 2,000 feet high. The summit of Notre Dame Cathedral, at Amiens, in France, is 422 feet high. The highest falls are those of the Yosemite, some of which exceed 3,000 feet. The Eiffel Tower is 990 feet high. The Rock of Gibraltar is 1,470 feet. The famous tower of Utrecht is 464 feet. Mount Pilatus, in the Alps, is 9,050 feet high. Bunker Hill Monument is 220 feet in height. The Brooklyn Bridge is 278 feet above the river. The porcelain tower at Nankin was 248 feet high. The Sea of Galilee is 653 feet below the Mediterranean. The Washington Monument is 555 feet from base to tip. The Statue of Liberty, in New York harbor, is 305 feet high.-St. Louis Globe-Democrat.

Protecting Electric Apparatus Against Lightning.
The problem of protecting electric apparatus against lightning has not been altogether one of invention; it has been quite as much one of careful and patient observation. Four years ago it was customary to place a single lightning arrester at the point where protection was desired. To-day the same point is protected by distributing line arresters at frequent intervals over the system. This change has resulted partly throagh the invention of more simple and effective lightning arrest-ers-instruments which can be trusted at a distance from station attendants and which are free from the necessity of occasional inspection; but perhaps mo:e through a more complete understanding of the problem of the conditions which have to be met.
The most important characteristic of static discharges from electric circuits is that of selection. Discha'ges do not, as has been commonly supposed, follow the "shortest and easiest path to earth." Whe.e this the case, one arrester carefully installed would be all-zufficient. The discharge being selective, it is rery ccrtain that one arrester is not suff.cient, and f.athe:, if line arresters be connected at frequent intcrals, the path which will be selected will more and more likely be one of the arresters rather than the apraratus in proportion as the number of arresters is increased. This statement is sustained in practice by the rapiclly growing use of line arresters. Station arresters are peihaps advisable as an extra precaution, but in qe: e- al dischargers entering the station offer a fair indication that more lightning arresters are needed on the line.
The question naturally arises: "How many lightning arresters should be connected to a given length of circuit?" The writer recommends four to the mile of wire, but this is by no means to be taken as an invariable rule; much depends upon the local conditions, the character of the soil with reference to ground connections and liability of lightning to strike, the grade of insulation to be protected, the voltage of the circuit, which latter governs the safe spark gap length which may be employed, and the surroundings with reference to telegraph and telephone wires. In general, thickly settled districts tend to decrease the number of lightning arresters which may be required.-A. J. Wurts, in Cassier's.

Household Inspection of Plumbing.
The following questions are given by Mr. Reuben S . Bemis, inspector of plumbing of Providence, R. I., in his report for 1895 as likely to call the attention of householders to points in their plumbing which should be carefully regulated :
Have you a plan of the system of pipes in your house?
Is all the plumbing work exposed to view or easily accessible?
Are the fixtures on the different floors placed over each other so as to avoid horizontal soil and waste pipes?
Are all the pipes airtight as shown by a proper test?
Is the continuation of the house drain outside of the house to the sewer or cesspool properly laid?
Does each water closet have a sufficient supply of water discharged with sufficient force when emptied completely to scour the traps and branch waste pipes? Are all objects excluded from the water closet which are likely to obstruct the pipes?
When a fixture is not in use for some time, are arrangements made to prevent the water seals in the traps from being broken by substituting oil for water? Are the traps so arranged as to resist siphonage?
Mr . Bemis also calls the attention of householders to the fact that the water in the traps of the plumbing is apt to evaporate when people go away and shut up their houses for the summer, and that this leaves an open entrance from the sewer to the house. The Engineering Record suggests that the drying of the pipes makes it possible for disease cerms on their sides to float upward as dust and get into the houre and into the systems of the occupants when they retian in the fall, and Mr. Bemis suggest; that the ontb:cais of typhoid fever so often fullowing the ic'ula of pcople to their homes in the fall may be calazed $b_{j}$ this neglect of the plumbing.

## LORD MAYOR'S COACH.

The illustration which we give below shows the lord mayor's civic state coach, which was built by Messrs. Offord \& Sons, Limited, of 67 George Street, Portman Square, in 1887, and which is more generally known as the "Jubilee" state coach. As will be seen, it is a most handsome turn-out, and has been greatly admired by visitors to the Crystal Palace Exhibition. This carriage was constructed for use in the city ceremonies riage was constructed for use in the cit
during the office of Sir Polydore de Key during the office of Sir Polydore de Key
ser, and, as will be noticed from our ser, and, as will be noticed from our
"cut," it is of exceedingly expensive and "cut," it is of exceedingly expensive and
elaborate construction. It is hung on elaborate construction. It is hung on
$C$ and under springs, with swan-necked double steel perch, giving full lock under for turning in the narrow city streets. The brass and gilt work which is introduced is very massive in appearance, and the decorations embrace both national and civic emblems. Especially noticeable are the rose, shamrock and thistle of the solid roof cresting. The interior is adorned with the most costly golden and blue silk ; while the lamps, of solid chased brass, are also noteworthy and exhibit very fine workmanship. We are indebted to the Hub for our illustration. -The Road.

## A Curious Accident.

A peculiar accident occurred on July 16 at the new tower of the New York and Westchester Water Company, in Glen Park. A sheet iron worker was on the tower, eighty feet above the ground. He lost his balance and fell down the inside of the tower. As he felt himself going over he threw himself against the side of the tower. All the way down he bounded involuntarily from side to side. As he neared the ground he struck the sides of the tower less frequently and his velocity increased. The zig-zag course saved his life, as he wil probably recover.

## A STEAM MISSIONARY

We have received from Mr. James H. Stevens, of the Barney \& Smith Car Company, Dayton, O., a photograph of a novel and interesting logging machine, which we herewith reproduce. Mr. Stevens has forwarded the design with the request that it should be "brought before the mechanics of the country merely as a suggestion in the direction of cheaper logging in timber too sparsely distributed to justify the use of steel rails," and he trusts that "some one may be stimulated to get up something on the same order that will be a great deal higher, with the same or greater power,
gines are of 30 horse power, and steam is supplied by a boiler of the Scotch marine type. The weight of the whole engine is about 11 tons, and the cost about $\$ 3,000$. The train, when equipped for work, will consist of the engine, as shown, a water car, and four log ging cars. The engine is provided with sheet-iron wood boxes, one at the front and one on each side; and on the right hand side, as shown in the cut, is a wate the right hand side, as shown in the cut, is a water
not built for looks, and is open to that improvement which Mr. Stevens invites; but for work in virgin forest lands, and particularly in getting out those valuable hardwoods which abound in swampy jungles, it certainly should prove to be well adapted.

## A New Thames Tunnel

The Bridges Committee of ithe London County Coun cil have prepared a scheme which will shortly be submitted to the Council for approval, for the construction of a tunnel under the Thames to connect Millwall with Greenwich. It is intended that the tunnel shal be for foot passenger traffic only, having a footway of 8 feet, with a headway of 9 feet $41 / 2$ inches in the center, reduced to a minimum of 7 feet 6 inches at the outsides. The cast iron tubing would be lined inside with concrete faced with giazed tiles, and the tunnel would be glazed by electricity The shafts on lighted by the ive be 32 feet either side the rity would be 32 feet inches internal finished diameter, and a spiral staircase 6 feet wide would be constructed, 20 feet clear diameter being left in the middle, in which hydraulic lifts might be constructed at some future date, should necessity arise. The heigh of the stairway would be 43 feet 6 inches on the north and 51 feet on the south side of the river. The total estimated cost of the works amounts to $£ 65,000$. The land which would be required
chain gearing on the opposite side of the boiler. It is chain gearing on the opposite side of the boiler. It is
provided with a shaft and pulley through which it could furnish power for a sawmill or for other purposes. The engine is mounted on springs and the boiler is arranged so that it can be tilted on sharp grades in order to maintain the water level. To enable it to turn very sharp curves without breaking the driving chains it is provided with compensating gear. At each end of the engine a steam reel is provided, each of which can carry 2,000 feet of wire rope, by means of which the engine can haul in logs from a distance of 2,000 feet to right or left. By means of these ropes it can haul itself up a grade of 1,700 feet to the mile; and then use its whole force in hauling the load up after it. This system of wire haulage it is claimed is specially adapted to logging in swampy country, where the ground is too soft to permit the use of cattle. The first machine to be built has been shipped to Nicaragua, where it will be used in getting out mahogany logs in a locality where the ground is wet and spongy. In explanation of the novel name which it bears Mr. Stevens says: "I named
would cost $£ 5,500$, making a total for land and works of $£ 70,500$. In addition to that, as the law at present stands, £25,000 would have to be paid as compensation to persons interested in the existing ferry and ferry rights, but the committee hopes the Council will isucceed in obtaining a clause by which the improvement of interest will be considered, thereby re ducing this amount very considerably. The capital cost of the tunnel, including compensation for the ferry rights-viz., $£ 59,500$-has been reduced to an annual sum, and amounts to about $£ 4,190$ per annum for the first year, diminishing each year till the debt is paid off in fitty-three years. The committee asks the Council to seek the necessary parliamentary powers to carry out this scheme, which they state will meet a long desired requirement of the people living on both sides of the river.-London Times.

At a recent meeting of the Royal Society, Prof. Worthington and Mr. R. S. Cole showed instantaneous photographs of splashes taken each with an electric


A STEAM MISSIONARY.
and that can be utilized for pioneer work as well as lumbering."
The engine, as will be seen, is adapted to run on a pole road; but it is also arranged so that it can be quickly changed so as to run on a standard iron road; or, if desired, upon the ground as a traction engine. The en-
it this because the thought occurred to me that if it spark giving an exposure of less than three-millionths of were placed in the proper hands, a machine like this would become a great civilizer."
We place this invention, which is not patented, before our readers, as possessing features of real merit and utility, and well worth examination. The machine is $\left\lvert\, \begin{array}{ll}\text { minute detail. Especially interest } \\ \text { illustrate the formation of a bubble }\end{array}\right.$

THE REPAIR OF SINGLE TUBE BICYCLE TIRES. Single tube bicycle tires have become deservedly popular among American riders. Although it is sometimes more difficult to effect in them a positive and permanent repair than in the inner tube tire, a temporary repair, good for a thousand miles or more of riding, may often be made in a few minutes. We illustrate several methods of repairing such tires, which methods are
tools the plug is left in the aperture, and its head may be pulled up by moans of its projecting stem against the interior of the tire. Fig. 5 shows the plug, and in the section of the tube one plug is shown in position.
In the next cut, No. 4, a more complicated apparatus is shown, used for introducing the plug shown in Fig. 6 of such cut. A pair of pliers of peculiar construction of such cut. A pair of pliers of peculiar construction
n Fig. 5, where a plug with a hole in the stem is used. A piece of wire is heated, Fig. 1, in the flame of a match, and while hot is forced through the puncture, burning off the ends of the threads and leaving it ready for plugging, Fig. 2. The wire, still hot, or slightly reheated if necessary, is now inserted in one of the apertures of the plugs, 4 , to which it adheres. The plug, after lubrication, is forced into the puncture by

divisible into three classes, plug repairing, patch repairing and band repairing.
Our first cut illustrates typical forms of plugs, one with a cylindrical stem, two double-headers shaped somewhat like cuff buttons and another with a conical stem. They are made of various sizes and proportions.
One of the simplest and most popular means of inserting a plug is shown in the cut No. 2, where pliers specially made for the purpose are employed. The approved method of operating is to tie a string or strong thread tightly around the stem of the plug, which plug thread tightly around the stem of the plug, which plug
is then grasped by the pliers in the manner shown, is is then grasped by the pliers in the manner shown, is
well lubricated with solution and is forced into the well lubricated with solution and is forced into the
aperture with the head innermost ; the solution is then squeezed out of the flexible tube, which is supplied with a special nozzle for the purpose, through the puncture, so as to fall upon the head of the plug within the tire. The tube of solution is withdrawn, the plug is drawn into place by the thread and part of the protuberance is cut off. The double header plug, such as shown in Fig. 3 of cut No. 1, is inserted by this instrument with the small head innermost. The large head is cemented to the outside of the tire by covering its inner surface and part of the tire adjacent to the puncture with rub ber solution, allowing the surfaces to dry as perfectly as possible out of contact with each other, and by then pressing them together, when they instantly adhere.
Cut No. 3 shows a method of introducing a plug by a very simple apparatus. Fig. 1 is a metal tube with cross handle. The tube is cut off obliquely at its lower end. With it is provided a bent piece of metal, Fig. 2, by means of which a plug previously moistened with a solution as a lubricant only, Fig. 4, is forced into its oblique end, Figs. 1 and 2. The tubular tool is then driven into the puncture and the pricker is forced down through it after its introduction, Fig. 3, so as to expel
from it the head of the plug. On withdrawal of the two

Figs. 1 and 2, of varying size. For each cutter a conical bed piece is provided, also shown in Figs. 1 and 2. The bed piece is secured to the pliers below its cutter, and the bed piece, which, as held by the pliers when open, will be in advance of the cutting edge, is forced hrough the puncture. By closing the pliers, the bed

mall round disk is cut out of the rubber. The cutting peration, as shown in Figs. 3 and 5, shows the result. by reversing the pliers and opening them, the plug is保 in the other jaws, as shown in Fig. 4, and after a the aperture into place
A peculiar system of introducing the plugs is shown
the wire, which is then drawn back, pulling the head of the plug up against the interior of the tube.
We here encounter for the first time the burning out of the hole with hot wire, and for all phases of tire mending where a plug is to be used it is an excellent plan to burn out the hole rather than to cut it out by any means. The burning out removes the projecting ends of the threads and does away with the fertile source of so-called porousness.
Band plugging is shown in the next cut, No. 6. A needle about eight inches long, with an end not too sharply pointed and containing a large perforation, is used. The other end should be bent into a ringshaped handle. The needle is threaded with one or nore bands of India rubber. It is shown as used with a single band. If it be desired to introduce a single thickness into the puncture, on account of its smallness of size, the manipulation shown in Fig. 1 is adopted. The needle is threaded, a small portion of the band projecting from the eye; after lubrication with solution, the needle is introduced, and being directed very obliquely, is pushed far in, the band being held back on the outside until it snaps out of the eye of the needle. On withdrawing the needle, a single thickness of the band is left in the puncture. If two thicknesses are required, the needle is thrust well into the tire through the puncture and withdrawn, as shown in Fig. 2, carrying with it the end of the band. In executing the manipulation of Fig. 2, the condition shown in Fig. 3 is always reached; when, if the ends are long enough, the bands may be cut at the bend where it passes through the eye of the needle, leaving three thicknesses in the hole. In Fig. 4 the double band is forced well into the hole, and then the band is withdrawn to be cut off close to the eye of the needle, leaving four thicknesses in the hole. By carrying out this system almost any number of thicknesses of bands


No. 5.-WIRE PLUGGER FOR SINGLE TUBE TIRES.


No. 6.-PLUGGING TIRE WITH RUBBER BANDS.


No. 7.-TIRE PLUGGED WITH RUBBER BAND.


No. 9.-PUNCTURE BANDS.
may be introduced. The process seems exceedingly ell adapted for irregular punctures.
Our next cut, No. 7, shows a tool for introducing small rubber bands in quantities. Fig. 2 shows a needle with a small cross piece and notched end. A quantity of small endless bands are strung upon it, their center portions passing over the notched end and their ends being looped over the two extremities of the cross piece. The needle and cross piece are so proportioned as to stretch the bands considerably. After lubrication they are forced into the tire as shown and the looped ends are pushed off the crossed piece. The needle is then withdrawn, leaving the bands in the hole, to be trimmed off as desired. Fig. 1 of the same cut shows a needle cut out of a piece of hard wood to be used in an emergency in perfecting this kind of a repair
A patch repair executed with the well-known tire tape is shown in cut No. 8, designed for use especially for bad cases. A patch is built up of tire tape, by cutting short pieces and placing them transversely to each other, batten fashion. If a cut is large enough, such a patch is placed in the interior of the tube and pressed up firmly against the cut by forcing the sides of the tube together. Another such patch is placed outside and the whole is secured by winding the tire tape. Solution may be used to secure the tape in place if the tape is too dry to adhere without it.
Cut No. 9 shows a puncture band, which may be of heavy pure gum rubber or of leather, Figs. 1, 3 and 4. Fig. 1 is arranged to be secured by strings around the tire. Fig. 3 has a buckle and a strap, and Fig. 4 has the well-known eylet and stud catch used on gloves. To apply these, if made of leather, an India rubber patch is first cemented by solution over the puncture on the outside of the tire and over it the band is secured. The band shown in Fig. 4 is of somewhat thick and elastic India rubber, long enough to be wound twice around the tire before being secured, thus producing a very perfect tension. This or other bands can be directly cemented over the puncture, the rubber patch being dispensed with. This is not recommended. As a substitute for the bands a leather shoestring, which is wound tightly over the rubber patch, is excellent. In all these cases the tire should be incompletely inflated, so that when finally inflated the tension is increased.
There are two points relating to the subject to be considered. One is the alleged porousness of tires. Single tube tires in general consist of an inner lining of India rubber, surrounded by a fabric, the latter bedded in and coated with India rubber. The tightness of such a tire depends almost entirely on the maintenance of the integrity of its inner lining. If this is punctured or injured from the inside, air will get into the fabric and following the threads escape in a quantity of minute streamlets, so that when sponged with water, minute bubbles will be seen escaping from an indefinite number of places. The tire may be punctured by a nail and the puncture may be mended so as to be perfectly tight, yet the nail may have punctured the inner coating on the opposite side too without cutting through, and this puncture may be enough to start leaks, producing socalled porousness. There is no way of finding the location of such an inner lining puncture
Another point relates to the putting on of a patch by means of rubber solution. The adherence of these patches does not depend on cement-like action of the India rubber, but on cohesion. The best way of doing it is as follows: The surfaces to be fastened together are coated with the solution, which is allowed an hour or more to dry. If possible it is well to give ten to twelve hours. Or, after drying two or three hours, a second, and after a similar interval, a third coating of the rubber may be given to the surfaces, the final drying being as long as possible. When perfectly dry, the surfaces are placed in contact. The instant they touch they cohere and the operation is complete. In mending on the road, where time is an object, the surfaces coated with solution may be dried more rapidly by exposing to the sun and by blowing upon them.
A puncture in a single tube tire may be readily found by immersing the tire in water, and still more simply by wetting the surface with water, using a sponge or even the hand and watching for the escape of the bubbles from the wet surface. It is assumed, of course, that the tire is kept inflated all the time. For burning out a puncture in an emergency a hairpin may be employed, heated by a match.
As a desperate remedy a porous tire may have a longitudinal slit, about six inches long, cut through its inne periphery. At one end a hole half an inch in diameter is made. A weight, such as a nut from a bolt, is tied to a string and it is worked around the tire. An inner tube is drawn by it into the tire. The slit is then laced up, and the tire becomes an inner tube tire. This is to hold the lacing

## Railways.

In St. Louis the electric railway officials are ver much concerned over the ever-increasing loss of cur rent. The rail return has proved, under present practice, inadequate, with the result of loss of power to the company and the partial destruction of lead and water
pipes near the power houses. The ends of each rail are bonded with a smal! copper wire. and the running of supplementary wires between the rails, so that the current, after passing through the motors, can find an unbroken passage back to the generators at the power house. The bonds and wires used in the past were small, and many of them are now broken, so that the current, seeking the path of least resistance, leaves the wires and rails in hundreds of places, passes through the moist clay, and starts off along a water or gas pipe for some distance ; then again wends its way through the moist earth back to the wires and rails. This is the moist earth back to the wires and rails. This is
called by the electricians leakage of the current, and the action it produces on the pipes is termed electrolysis. Up to the present time but little has been done to remedy the evil. The trouble is becoming so marked that steps must soon be taken to suppress it
The rail has a large current-carrying capacity and would prove an excellent return conductor were it a continuous one. But no matter how close the ends are to each other or how tightly clasped with fish plates and bolts, the connection for the conveying of current is a poor one. To obviate this, holes are bored near the ends of each rail and a copper wire the thickness of a lead pencil soldered and riveted to the two rails. This is called bonding. Every few feet copper wires were, up to a year or so ago, soldered to these and crossing over to the opposite rail, and also connected to a wire running alongside the track. Later on these wires were found too thin, and on new work thicker copper wires were used. The latest is a copper rod, each end of which is riveted to a rail. Even the copper rod bond, riveted to the web of the rail, has not proved satisfactory. Electric welding was tried on the Baden and St. Louis line, and the rail made a continuous one The cost is prohibitive, however; the price per join being about $\$ 6$, and there are 352 joints in a mile. Cast welding costs $\$ 3$ to $\$ 3.50$ per joint.
Three of the St. Louis roads have an almost perfect rail return, namely, the Baden and St. Louis, the Southwestern and Citizens' line. On the first named the rails are electrically welded, and on the other two they are cast welded. The later process has been
found by experience to be as good as the electric weld found by experience to be as good as the electric weld, while its cost is only half as much. A short time ago workmen started cast welding the rails of the Forest Park, Laclede Avenue, and Fourth Street line. Mr. P. C. Maffitt, president of the Missouri Railroad Company had a great deal of trouble with leakage of current. It was a case of buying additional generators or attending to the return conductors. Mr. Maffitt decided to cas weld the joints, and this is being done without prevent ing traffic or even hindering it in the least. The joint are prepared during the day, and after midnight the perambulating foundries come along with molten iron, and 100 pounds or more of liquid iron is applied to each joint. This kind of a joint does away with fish plates, bolts, copper bonds, supplementary wires, and the like When the work is finished the consumption of energy it is estimated, will be from 15 to 20 per cent less than at present.-St. Louis Globe-Democrat.

Recent Archeological News.
Among the fragments of Egyptian papyri at Dublin, eighty lines or parts of lines of Homer's "Iliad" have
been identified out of a manuscript of the third cenbeen identified out of a manuscript of the third cen
tury before Christ. In the eighty lines are thirteen which do not exist in the "Iliad," but Prof. Mahaffy asserts that the Alexandrian critics took great liberties with the text.
Dr. Richardson, of the American School of Archeology, and his party, who have been making excava tions in Corinth, have discovered the ruins of a large theater and a key to the topography of the ancient ity of Corinth
Over four hundred diamonds are known to have been recovered from the ruins of Babylon. Many are un
but most of them are polished on one or two sides
A Druidical dolmen has been transported from Brittany and erected again in its original form over the grave of an archæologist named Piketty, at Meudon outside of Paris. It is called the dolmen of Kerhan comes from the neighborhood of Lochmariaquer, and consists of fourteen blocks of granite.
Santorini, the ancient Thera, the chief island of the Sporodes, in the Ægean Sea, has prehistoric remains which will be systematically explored by the German school of Athens.
Herr Dorpfeld, President of the German Archæologi cal Institute, Athens, has resumed the work of excavation at the southwest of the Acropolis, and has discov ered two statuettes of Hecate and Demeter, in brass. At Delphi, a beautiful bronze statue of Apollo, eigh inches high, has been discovered. It is thought that more
place.
Ruins of an important temple have been discovered at Conea, between Velletri and Porto d'Ansio. It is believed to be the famous shrine of the Mater Matuta spoken of by Livy, and to mark the site of the ancient
Satricum. The temple had been added to. The earliest building belongs to the sixth century before Christ. The pediment of the primitive temple was
the Greek archaic type, the most important yet found in Italy. Traces of two other temples, bits of the walls of the city, and the site of the necropolis have also been found, and further important discoveries are expected. At Chassenon, in the Department of the Charente, France, a statue of a Gallic god has been found in an old well believed to have been filled up in the time of the invasions of the barbarians. It is two feet high, squatting like a Hindoo Buddha, and has the collar of the Gauls around its neck.
The excavation of the so-called "Temple of Vesta," at Rome, has brought to light the foundations of surrounding walls. These are built in what is called opus reticulatum ; there have also been discovered old black glazed Etruscan vases and several lamps, which have names in the Etruscan language scratched on them.
Recent archæological discoveries along the valley of the Tennessee River, in northern Alabama, have led to the belief that the region was once inhabited by cliff dwellers, and an expedition from the University of Pennsylvania is soon to explore the caves in that region. Prof. Mercer will head the expedition, and it is believed that valuable discoveries will be made. Many specimens of ancient pottery believed to have belonged to the cliff dwellers have recently been found in the caves along the Tennessee
M. Maspero has found that the scarabs and other Egyptian ornaments discovered at Eleusis all belong to the time of the Ptolemies, and, consequently, their discovery does not help the theory that the Eleusinian mysteries originated in Egypt.
Excavations have been begun on the site of the ancient Roman city of Verulamium, near St. Albans, England. It is hoped that traces of the adjacent city of Cassive
From the discovery of the remaining fragments of the Hymn to Apollo at Delphi, imploring the protection of the Roman government for Delphi and Athens, the date is fixed as being not earlier than the taking of Corinth by Memmius, in the year 146 B . C.
Dr. Robert Fletcher, in his "Anatomy of Art," and Dr. Luigi Sambon having shown conclusively that Greeks and Romans must have had a good acquaintance with surgery, it seems strange that in the mediæval Euro pean period there was dense ignorance and no skill in amputation. Sword and lance wounds were necessarily of constant occurrence then, and the treatment was merciless. We have shown before how there was among primitive people a fair acquaintance with sur gery, and even a knowledge of the refinements of it, as in plastic operations. The discovery of a manuscrip of the eleventh century shows us conclusively that among the Arabs and in Syria at the time of the first crusades there was a fair knowledge of surgery, and that the Syrians held in poor estimation the Frank doctor. Osama tells how a knight was suffering from an abscess of the thigh and a woman from consumption The Frank physician had the knight's leg put in a block, and it was hacked off with a sword. The woman was treated by having her hair cut and a cross cut into he skull. The knight died at once and so did the woman Then the chronicler says the Syrian doctor who had been called in left disgusted, having learned "more abou Frankish medicine than he had ever known before."

## Instinct Not Always Faultess.

Many persons still believe that the instinct of animals preserves them from certain accidents, and that they never eat anything that is injurious to them. Well instructed persons have long known that in this regard animals are no better off than men. A chicken does not hesitate to drink paint; a cow partakes of water in which bags containing nitrate of soda have been washed; ducks strangle and choke in swallowing snails. M. Giraud, a veterinary at Barnewitz, now notes a fact that merits the attention of poultry farmers. He has observed numerous cases of poisoning in ducks following their feeding on caterpillars, especially those of the cabbage moth; these caterpillars have been given to the fowls in mass or are found on the cabbage leave furnished them for food. After from six to twenty hours, according to the number of caterpillars eaten, poisoning manifests itself by loss of appetite, great weakness, tottering steps, accompanied sometimes by symptomatic movements, finally by difficulty of breath ing and often death, after an agony of variable dura tion, during which the beak and claws grow pale. The lesions disclosed by an autopsy consist chiefly in an
inflammation of the digestive passages. The disease is inflammation of the digest
not always fatal. - -Cosmos.

## Astronomical

A dispatch from Geneva, New York, dated July 22, A
says :
" P
'Prof. William R. Brooks, director of Smith Observa tory, while observing the moon last night with the arge telescope, made a most interesting and unique discovery. A dark round object was seen to pass rathe slowly across the moon in a horizontal direction. Prof Brooks believes that it was the passage of a dark meteo between the earth and the moon, far beyond the earth's tmosphere, so that it remained non-luminous. The observation is new in astronomical records."

RECENTLY PATENTED INVENTIONS. Engineering.
Gas, Oil, or Vapor Engine.-Frank s. Mead, Montreal, Canada. The giving of an impulse to the piston at every revolution of the crank shaft is the
principal feature of a aimple and durable engine designed by this inventor. A heated vaporizing and exploding chamber receives the fuel from a pump unmixed with air, this chamber heating and holding the oil, vapor or gas as the piston rises and presses fresh hot air into it
and the mixture being ignited when the piston is on the and the mixture being ignited when the piston is on the other suitable manner, so that the explosive charge iston down. The pumping the liquid oil, or taking the vapor of previousl heated oil, or gas, and forcing it into the explodin

Vaporizer for Oil Engines.-Isaac Allman, Jersey City, N. J. This vaporizer hasa mix ing chamber connected by a pipe with the cylinder of the
engine, a suction being produced in the chamber on the outward stroke of the piston at the time the charge is to pass into the cylinder. The invention consiats principally of a valve box or casing having air inlets, a valve covering the orifice, but adapted to open upon suctio rom the cylinder to draw air in through the opening and ithrough the valve seat, the air on its oassage taking The engine exhaust plpe passes through the mixing chamber to vaporize the oil and mix its vapor with the cham
air.

## Rallway Appliances.

Car Fender.-Rudolph C. Hoyer, and beneath the car body, according to this invention, is a lower or receiving fender to receive any object that may
be encountered by a moving car, while held above and in dvance of this fender is a second fender, which is give rotary reciprocating movement, causing it to act in the apacity of a rake to convey any object in the path of constantly reciprocated from the car axle when the car is in motion, and has a yielding lower edge and elastic covering, so that it will not injure a body with which it

Car Fender and Brake. - John Matzingei, Mount Vernon, N. Y. This inventor has designed a fender which will always be in position for con-
tact with a person or object that may be on the track preventing any one from being run over by the car, while he brakes are applied to immediately stop the car when any one is struck by the fender. The fender consists
of a skeleton frame with bed of woven wire and rubber of a skeleton frame with bed of woven wire and rubber
cushon, and is light and strong and readily transferred mally held in outward position by springs, but when an object is struck in the path of the car the inward
movement of the fender causes a brake shaft to be carried downward, bringing a set of brake shoes be-

Brake.-Alexander H. Moyes, Ogden, Utah. This is an improvement in automatic fluid press-
ure brakes of the Westinghouse type, and provides a quick and positive action of applying and releasing the brakes, and for graduating the tension of the brakes is rigid .with and projects at one end into an auxilithe opposite end is a third cylinder communicating with the brake cylinder, there being in the side of the latter a pipe leading from the train pipe connected with the en-
Car Coupling.-Louis L. Moore, Cal-
houn, Ky. This coupling is adapted to automatically houn, Ky. This coupling is adapted to automatically couple meeting cars, and permit of their ready uncoup-
ling from either side of the car. Within the drawhead ocking arm, and a coupling block sliding in the draw rocking arm, and a coupling block sliding in the drawdropping throogh the link when the latter pusbes thedog
rearwardly. This coupling is simple, durable, and inexpensive, and there are no exposed working parts to be obstructed by sleet or snow in the winter season. The
improvement may also be used along with the ordinary link and pin car coupling.
Switch and Mate.-David F. Carver Brooklyn, N. Y. This invention is for an improvemen on a formerly patented invention of the same inventor,
in which a swing tongue has a certain novel arrangement of flanges of such length and breadth as give the tongue a contact along its whole length with either the guard provides for a modification by which provision is made
premin for the entrance of a switch iron or equivalent device, mainly to facilitate the removal of dirt from between the opposing side edges of the tong
Speed Indicator. - Talbot O. Bateman, Fort Worth, Texas. This device is specially designed for use on trolley cars or vehicles, indicating au-
tomatically to a foliowing car or to any observer whether a car is running at a proper rate of speed or is going too
fast. A governor mounted in a casing is connected with moving part of the vehicle, and in the casing is a lever
connected to the governor and an insulated plate having two contact points, past which moves a contact plate ac-
tuated by the lever, thus making signals and electrical tuated by the lever, thus making signals and electrical
connections. The governor is controlled by the running part of the car or vehicle, the device actuating a normal part of the car or vehicle, the device
signal and an alarm or dangersignal.
Screw Jack.-Alexander H. Moyes, Ogden, Utah. This is an improvement more especially
designed for use on railroads, for conveciently jacking designed for use on railroads, for converiently jacking
up cars, engines, journal boxes, etc. The invention comprises a casing in which screws a post having at its upprises a a head with a cap turning on ball bearings,while
pa sleeve on the casing has a handle and an extension a sleeve on the casing has a handle and an extension
through which elides a bolt adapted to engage the inside
of the wheel rim to hold the wheel down on the rail while jacking up the joarral boxes. A weighted pawl pivoted
on the eleeve is adapted to engage one of the exterior cir blocks and similar devices, as heretofore.

## Electrical.

amalgamator.- Francis B. Austin Temple, Arizona. According to this invention curren of electricity are applied to the amalgamating plates to at ract and hold fine particles of gold, the apparatus provid receiving pan. The sluice through which the pulp and water passes has a full width bottom opening adapted to receive a copper pan having inwardly extending and hor zontal flanges at its sides, a cover plate resting on the
flanges, and the plate being insulated from the pan. Spikes project from both the plate and the pan, there be-
ing in the pan a quantity of mercury, and means are ng in the pan a quantity of mercury, and means are
provided for electrically charging the cover plates and
pan.
Lightining Arrester and Fuse BLock. - Thomas L. Carleton, New Orleans, La. Accord ing to this improvement, the parts, after one operation, operation, thus maintaining the circuit complete except t the instant of rupture by lightning or other cause.
pair of curved bars, one of insulating and the other pair of curved bars, one of insulating and the other of
conducting material, are secured to a base, and shunt conducting material, are secured to a base, and shunta
connect the insulating with the conducting bar, while an actuating bar resting against one of the shunts is capable of automatically passing to the next shunt on the destruc tion of the first, the metalicic bar being connected with
the line and the spring-pressed bar with the ground or line. A contact also engages with the arm after it has
completed contacts with and destroyed all of the shunts.

## Miscellaneous.

Bottle Stopper. - Abraham L. A. Hommelwright, Middletown, Conn. The invention re-
lates to an improvement in bottle stoppers, and the object of the invention is to provide a bottle stopper which
will prevent the reflling of bottles by unscrupulous par will prevent the refilling of bottles by unscrupulous par ties, who might. replace the goods with inferior or coun-
terfeit fluid and sell the same as the original contents and terfeit flud and sell the same as the original contents and
under the original label. In brief, the invention comprises a bottle stopper consisting of two sections mounted locking arms connected to one section and controlled by the other section to engage the bottle upon movement of ne section in a predetermined direction, and means for

Bookbinding.-John B. O'Riva, New York City. The object of the invention is to provide a binding for books which will be strong and durable, without necessitating the destruction of the grain in the nereessary to so crimp and press the eat has been often of book covers that the grain will be destroyed and the beauty of the binding very much impaired. The invention consists in a peculiar manner of constructing the binding, by which the corners are made as strong and
durable as heretofore, and at the same time the grain of durable as heretofore, and at the same time the grain of
the leather is left in its original beauty. In brief, the imthe leather is left in its original beauty. In brief, the imfaps, one of which is folded inward and one edge of said inding crimped :against the main portion of and bove the crimped portion to hide the same
Sole and Heel Spring for Boots or Shozs.-George E. Swan, Beaver Dam, Wis. The inand heels of boots and shoes, being especially adapted for application to the heels of footwear, and the object of the invention is to provide a spring pad or cushion
which will serve to lift the heel of the boot or shoe as it leaves the pavement, road or other surface with which it is brought in contact, thereby preventing the shock or hard roads, and rendering the step easy, elastic and youthful. A farther object of the invention is to provide a mechanical applance to boots and shoes which will, in the cartilages of the knee and other joints incident to age. The invention consists of a spring tread for boots material bent upon itself to form a body or an attaching material bent upon itself to form a booy or an attaching
member, and a base member substantially parallel with the body member throughout a portion of its length, the ree end of the base member being outwardly curved and carried in a direction to meet and pass the free end of the ody or attaching member.
Adjustable Book Support.-David J. Wilson, Washington, D. C. The object of the invention is to provide an adjustable book support, designed
to be screwed upon a desk or table and more especially antended for use in or by commercial houses, banks, record offices and similar institutions, for conveniently whose position the bookkeeper is required to frequently change in making the various entries and rulings thereon, obviating the necessity of using very high chairs and tilting the ledger on the edge of the desk in order to reach the top lines, which movement is very injurious to heavy
books, and also obviating all moving and sliding of the books, and also obviating all moving and sidiang of the
ledger, as required in posting. In brief, the patent consists of a book support comprising a horizontal frame
having parallel guide grooves or runways in the sliding base moving in the same, a turntable mounted upon said base and a book holder mounted upon the

OPENER FOR ENVELOPES OR WRAP pers for Newspapers or the Like.-Frank E. Munn,
New York City. The invention relates to improvements in openers for envelopes, wrappers and the like,and has for its object to provide an opener of the character indicated, which is equally adapted for envelopes, newspaper wrapdescription and boxes themselves. A further object of the invention is to provide an opener which will virtually attached thereto that it can be readily graspea and drawn in direction of one or the other ends or sides of the en
velope or wrapper, so as to sever the same and disclose
the contents thereof without injury to the same. In the contents thereof without injury to the same. In
brief, the invention consists of the combination with an anvelope, wrapper or the like, of an opener, consisting o of the envelope or wrapper, each end of the wire being passed outside of the envelope or wrapper, then bent backward and passed inside of the same, and then again
bent so as to run parallel with the main portion of the wire, whereby closed loops, consisting of three substanaily parallel strands, are formed, the strands inclosing
Kneading and Rolling Machine. KNEADING AND ROLLING MACHINE. William Dann Sprague, Black Mountain, North Carolina machines which are adapted for use in working dough and the object of the invention is to produce a machine of the greatest simplicity, which is adapted to rapidly and efficiently knead and then roll dough, avoiding the neces
sity of working the dough with the hands, and, further, to sity of working the dough with the hands, and, further, to ikely to get out of order and so that it may easily b ept clean. Anowh o sect of the the the same manner as it is worked by the hand, and which has its rollers adjustable so that they may bear upon the ough with the requisite pressure
Printer's Roller.-Benjamin Day, West Hoboken, N.J. This invention is for a fiexible taken off the roller stock, the roller being of gelatinous side which protect the soluble flexible material in the body of the roller from the effects of moisture and air. he roller may be made of the ordinary roller composis and glycerin-one part of gelatin to two parts of gly-cerin-but the invention consists principally of the
means of forming the roller with the least water in its composition, and the forming of an insoluble skin on its Musical InSTRUMENT. - Bruno E. Wollenhaupt, New York City. This improvement relates being applicable to violins, violas, guitars, citheras, mandolins, etc., and betng designed to greatly increase the volume and duration of the sound without rendering it more difflicult to play the instrument. The shanks o graduated tuning forks are secured to a sounding suppor within the body of the instrument, the tuning forks be ing graduated according to a chromatce scale to form a ympathetic vibrating the, and sonding sympamet at the time by the performer.
Curtain Pole and Hanger.-John H. Hilliker, New York City. This invention provides a superior cartain pole and fixtures, the curtain being mounted so that it may slide along the pole while being adjusted. The pole has a longitndinal slot in its under
side, the slot being enlarged at the axial center of the side, the slot being enlarged at the axial center of the
pole, and an upwardly extending arm of a bracket secured pole, and an upwardly extending arm of a bracket secured
to the window frame enters the slot. The curtain securto the window frame enters the slot. The curtain secur-
ing pins have at their upper ends a head fitting in the in the slot. A cornice or ornament may be held in front of the pole by means of hooks on the pole and eyes on the rear of the cornice.
Hook and Exe. - John H. Akers, Washington, D. C. The hook, according to this invention, is made of a single piece of metal, bent in the mid. dle to form attachingloops, while its ends are extended and bent over to form hooks converging toward each ent outwardy to form locking receee The eas part bent outwardly to form locking recesses. The eye part
has two eyes to receive the hooks, two shanks to pass between their spring jaws, and a cross loop adapted to lock in the receses. This hook and eye will fasten the meeting edges of garments in an easy and secure manner, and
the two members will not accidentally disconnect themthe two members will not accidentally
CAP.-Joseph Kornfeld, N
Cap.-Joseph Kornfeld, New York City A cap which may be folded into small space without in-
jury, which may be made very light, and which affords thorough ventilation, has been designed by this inventor. The body of the cap is formed of a series of sections, be tween which extend strips of perforated material, such as flbrous netting, the strips extending from the center the lower edge, or extending entirely across the body crossing each other at the center. Th
Napkin Holder. - Nicholas F. Clark son, New York City. This is a device by means of
which the napkin may be conveniently held suspended from the neck, and which is adapted to hold the napkin plate having a hook, while a transversely arched clamping plate has a hinged connection with the back plate at each side of the hook, a tongue extending through an
opening in the shank of the hook to an engagement with spring attached to the body portion of the back plate. Shoe Holder. - Anthony B. Crocco, ew York City. To hold a shoe in position to facilitate blacking and polishing it, this holder is made with two hinged lastshaped parts, separated by a screw rod as in a through which the screw rod passes affords a bearing for erected on a stand. The stand has a drawer for holding polishing and blacking tocls, and the last parts can be opened or closed to fit any sized shoe, the shoe being
readily turned to give the operator access to it on all Shoe.-David D. Toal, New York City. This is a shoe especially adapted for bicychsts and
pedestrians, being designed to afford more than usual pedestrians, being designed to afford more than usual become wet. The vamp of the shoe, just back of the toe cap, is made with two large tab portions, one crossing the ends of form the coveriug for the top of the foot the ends of these $b$ sections being estended to engage
ment with buckles or other fastenings at the sides of the
ankle.
LAW joseph J. Burke, Wilber, Neb. This is an easelly manipn

Ted machine of simple and durable construction, which vermits a ready adjustment of the knife supporting de lation to the grinding wheel to sharpen the knives very ccurately. The invention consists principally of ad justable bearings or supports for the knives to be ground, a movable knife rett. and a revoluble grinding
wheel, both rest and wheel being mounted on a longi wheel, both rest and wheel
tudinally movable carriage.
Fence. - James N. Young, Parma Mich. This invention relates to wire fences having pickets atach the wres of the fence, and provides ence which is very strong. easy to erect, and adapted to
withstand and compensate for the contraction and pansion the fence wires The post is forme angular bent plate metal, strongly braced against long tudinal and lateral strains, and the pickets are readils placed on and secured to the fence wires by hook headed

Hammock. -Thomas J. Woodcock Philadelphia, Pa. This hammock has the end of the loop from which the tormed aourled on iself to ouble upon iteelf to form a hinged adjacent loop divided to form two pockets, one for a pillow and the other for
spreader. The pillow may be thrown back over the and partially over the suspension cords to lengthen the hammock when necessary, and the spreader pocket orms the connection between the pillow and the body of the hammock, all being formed of a single piece of
Bracket for Swinging Stages.Heury Witzgall, Pittsburg, Pa. For use in connection
with the swinging stages employed by painters, etc., this inventor provides brackets capable of ready attachment to the stirrups of the stages, the attachment being so brackets, permittin will be readily adjustable on it clear projections of the building, while the brackets have cushioned rollers adapted for constant engagement with the face of the structure. The brackets are also so constructed that they hold the stage firmly in the ad-
justed position, enabling one to walk on it as on a perjusted position,
Table. - Max Lesser, Boston, Mass. This is an article of furniture devised more especially for be readily secured to a bedstead or other suitable sup. port. Its construction is such thatit mas be readily ad justed and changed to make it serviceable for a dining table, a table upon which games may be played, or for a
reading and writing table. The top of the table has hinged sections and rotates on a standard which is vertically adjustable in a sleeve on which are opposite arms carrying clamping devices.
Oil Stove. - Enos F. Depuy, Port has slots in its bottom through which extend the wicks. and a grated platiorm eateals abover open top of the chamber to support the culinary vessels, the latter being
held suiently high to permit sufficient air to pass to the flame and effect complete combustion, preventing any smell of oil. The wick tube has au oil chamber con-
nected by a pipe with an oil reservoir at one side of the nected b
casing.
Safe Attachment.-Abrabam Oberndorf, Jr., Centralia, Kan. This is an improvement on a portable attachment, which whed in a safe vault, or strong room, will, in the event of an attempt to
blow open the same, cause the generation of a stifing blow open the same, cause the generation of a stining
and poisonous gas, in which the burglar cannot live. A ang up or detachably fastened in the safe vault forms a housing for a fanlike pneumatic trigger, trip is acted upon by the concussion of the blast to fracture a bottle containing the ingredients of poison vapors, allowing the poisonous gas to be generated and fill the safe or vault, so that to continue operat
the burglar would mean death or insensibility.
Mechanical Motor.-Archie D. Bryce, Lake City, Mina. an elastic cord in connection with pulleys or drums, the rums and made to exert its tension in such manner as to become unwound from the first and wound on others,
producing more power than may be ordinarily obtained in such manner. In a rectangular frame is a shaft carrying a cone with six concentric palleys, there being a drum adjacent to the smaller end of the cone, and in the op-
posite end of the frame is a shaft on which is a cone. Fixed to the drum and to thz largest pulley of the cone or the pulleys of the cone, after being carried around the cone shaft in the opposite end of the frame.
Bottle Stopper.-Wilber E. Cook, Indiletown, N. Y. To prevent the refilling of a bottle and its use as an orginal package, this inventor pro-
vides a bottle with a double head, an inner and perma nent head and a neck and outer head or hcood, the latter being firmly connected with the former and the two so
connected that the outer hood must be separated from connected that the outer hood must be separated from
the neck before the bottle can be opened, giving to the bottle an appearance very different from the original and head may be readily but the hood or head cannot be replaced after the bottle has once been opened.
Supporting and Moving Invalids. Sewell S. Hepbarn, Oliver, Va. To facilitate lifting and moving invalids to different points in a room this in-
ventor has devised an apparatus which may be adjusted for use and taken down in a comprises a sectional standard with clamping devices, a
windlass of novel construction windlass of novel construction, and a hammock frame
and hammock the adjustments of which may be varied to a great extent. The hammor way be varie hanger, may be conveniently raised or lowered at its huitable position.
Movable Index for Record Books. -Bruce B. McCreight, Dubois, Pa. This invention
comprises an index elip and a flexible guide having at
each end means for attaching it to the sections of a book,
the index slip having movement on the guide. The the index slip having movement on the guide. The
movable or duplicate index is adapted to be carried over the face of ore or more pages, to temporarily locate the names, letters or figures at a point distant from where
they are entered on the book, economizing time and lessening the chances of mistakes.
Potato Cutter.-Oscar A. Bulette, Seattle, Wash. This is a simple and easily operated de vice for cutting potatoes into longitudinal blocks. The blades of the cutter are so arranged that they will cut all
sides of the blocks, insuring a niform shape and avoiding feather edges, which have a tendency to crinkle or
become too crisply been perfectly cooked. The several parts of the device Inkstand.-Francis B. Pratt, Canton, feeder duct leading from the bottom of the ink well to he bottom of the supply well, while an air duct leads from the upper portion of the ink well to the supply well. A cup shaped plug, closed at the bottom and open
at the top, and suited to hold a sponge, has a screw at the top, and suited to hold a eponge, has a screw
thread engagement with a flange in the upper end of the ink well, and by screwing the plug downward the ink is cleaned and filled, and but a small quantity of ink need be exposed at any time.
Playing Cards.-Charles B. Rosenberger, Pittsburg, Pa. This invention provides a plu-
rality of suits of cards, each suit having an identifying character common to all the cards in the same suit, and each card having scoring numerals, one for an identifying character without color thereon, and the other for the same and its color. The game affords two grades of
chance, and a commensurate degree of remuneration for chance, and a comm
Temporary Binder.-Jos. W. Wood, Baraboo, Wis. This improvement comprises a back piece
from the ends of which metal clips extend forward, each clip being curved to form a channel providing seats for a lacing cord which is woven back and forth through the
clipg in the channels. A simple and inexpensive binder is thus formed for pamphlets and newspapers, in which he back edges and bottom ends of the matter bound will

Mole Trap.-Jacob W. Reger, Charles W. Denison and George D. Denison, Judson, Mo. In a U shaped frame whose pointed ends are adapted to be pressed into the earth at opposite sides of a runway is which is made to rest on the earth directly over the runway. The mole, in passing, raises the earth slightly, when the trip rod releases a spring pressed follower,
which carries prongs or teeth that pass into the runway which carries prongs or teeth that pass
Note.-Copies of any of the above patents will be urnished by Munn \& Co., for 10 cents each. Please of this paper.

## NEW BOOKS AND PUBLICATIONS.

The Prinart Factors of Organic Chicaqo: The Open Court Publish
Chich iny ${ }^{\text {Com }}$
Price $\$ 2$.
This work by Prof. Cope is entitled to a far more exended review than we can possibly give it here. We feeling that a mere statement of its title and the author's antly printed book to give it standing. It is a very ele gantly printed book, thoroughly indexed, elaborately tion of the doctrine of evolution. Darwinism itself is in such a state of evolution, has been so modified by Weis
mannism, that what is known as a "New Darwiniem" mannism, that what is known as a "New Darwinism"
has been created, so that it really requires almost as much has been created, so that it really requires almost as much
reading to keep pace with the modern science of evolution as with electricity or any other science. The author mannist. A to be, by any means, a prox inclines us to the belief that it is not very accurate in its paging.
an Examination of Weismannism. The Open Court Publishing Como pany. ${ }^{1896 .}$ Pp. ix, 221 . Price, paper 35 cents, cloth $\$ 1$.

Weismannism critically examined by one who figures as having produced more effect on modern Darwinism than all others, probably, put together, and to those who
desire to study modern evolution, perhaps the reading of desire to study modern evolution,
both these books will be of value.
On Germinal Selection as a Source OF DEFINITE VARIATION. By
August Weismann. Chicago: The Open Court Publishing Company. 1896. Pp. xii, 61. Price 25 cents.

This paper was read in the first general meeting of the
International Congress of Zoologists at Leyden on International Congress of Zoologists at Leyden on
September 16, 1895, as we are informed in the preface. September 16, 1895, as we are informed in the preface.
We have put it with the other two books to complete We have put it with the other two
the series which they seem to form.
The Century Science Series. James
Clerk Maxwell and Modern Physics. Clerk Maxwell and Modern Physics.
By R. T. Glazebrook. New York:
Macmillan \& Company. 1896. Pp. Mi, 224 . Price
\$1.25.
The students of the history of science have some favorite characters whose liver they are never tired of read-
ing, either because of their interesting characters or because of their interesting work. Fleeming Jenkin is, cause of their interesting work. .
perhaps, the most fortunate in his brapher, Robert
Louis Stevenson having written a most graphic life of the scientist. Faraday and Maxwell form two kindred spirits whose lives will ever be favorites with all who ad-
mire the simple and gentle in humanity. As a supplemire the simple and gentle in humanity. As a supple-
ment to the Campbell and Garnett more personal biography of Maxwell, the same publishers give us here, in
brief, an account of his life in science and what hedid in
the scientific world. We have just reviewed several
books on evolution, and it seems a little pecoliar to find in them, as well as in this, no apparent reference to Max-
wellis physical demonstration of the difficulties attendant Darwin's theory based on the probable size of the molecule. As a supplement to the
life of Maxwell, the present book will be quite indispenlife of Maxwell, the present book will be quite indispen
sable. The Sugar Factory Manager's HandBOOK OF NOTES, TABLES, RULES, and Data. For managers, engineers, chemists, overseers, panboilers, ure of cane sugar and the distillation of rum. By B. R. Body. Manchester : Office of the Sugar Cane.
1896. Pp. 78. Price $\$ 1.50$. This is one of those familiar little English books containing information relating to particular trades and businesses. It is written from the technical standpoint chemists as representing a most practical view of the sabVan Nostrand's Science Series. Sewerage and Sewage Purification. By
M. N. Baker. New York: D.
Nostrand \& Company.
Non.
Pp. iii, ii, 144.
This excellent little addition to Van Nostrand's Science Series is devoted particularly to the disposal of sewage from the American standpoint. It really relates as much
to the laying of sewers as to the disposal works, and the disposal works themselves are very fully treated, the disas of which is particalarly to be commended.
An AdVenture in Photography. By Octave Thanet. Illustrated from 1893. Pp. xi, 179. Price $\$ 1.50$.

There are few brighter writers than Octave Thanet, and to our mind the authorship of this book is an exceltures in the South with her camera, details her tronbles and her successes, and throughout is replete with hints as to photographic processes. The work throughout is coached in most lively language, and whether one under reading. There are numerous illustrations, many of wich serve as pegs on which to hang the story
Domestic Sanitary Drainage and PlUMBING. Lectures on practical
sanitation delivered to plumbers, encineers and others in the Central Technical Institution, South Kensingon,London, under the auspices of the or the Advancement of Technical
Education. By William R. Maguire. Second edition. New York: D. Van
Nostrand Company. 1896. Pp. 475. Nostrand
Sanitary engineering from the scientific aspect is here excellently treated, for the book presents the practical
application of scientific hydraulics to the plumbing of dwellings, and with much success. Instead of starting out with the practical presentation of its subject, the
book opens with a reasonably good treatise on the elementary science, touches on the subject of the education of plumbers, passes on to sewage and sewage disposal, the est of the work being devoted to sewerage and water supply. Throughout the plumber is kept in mind, and even many years' standing from the pages of this work. It has an index and a table of contents, is liberally illustrated, and is a tribute to the present desire of the public
to have the best sanitary appliances in thedwelling house. THE LOCOMOTIVE. Hartord Conn Published by the Hartford Steam Boiler Inspection and Insurance
Company. New series. Vol. XVI. Company. New
1895. Pp. iii, 191.
The Locomotive is a trade publication and an example to all of how such a work can be conducted. It is a journal in which details of boiler accidents and explosions are given ; in which the practical points about boilers are discussed, and into which a considerable amount of interesting scientific matter relating to the subject finds its way. To our mind the journal is most interesting,
and bound in book form, is a welcome addition to the ibrary.
GESCHICHTE DER EXPLOSIVSTOFFE. rauchschwachen Romocki. in. Dier in inrer Entwickelung bis zur Gegenwart. Mit Oppenheim (Gustav Schmidt). 1896. Pp. xi, 324 . Price \$4.
This second section of this work is devoted to smokeless powders, and really gives a most admirable treatment
of the subject. Those conversant with the languge need of the subject. Those conversant with the language need
not be troubled with the German type in reading it, the Roman type used in this book being one of its merits. Chemistry at a Glance. A study in
molecular architecture. Issued in series. No. I. Oxides. By Herbert
B. Tinttle. New York. 1896. Pp.
59. Price 60 cents.
This is the first of some ten successive publication designed to cover the fleld of chemistry. The author works almost entirely with graphic formulæ, and while far, yet the book, for a young chemist properly warned, will be, we believe, a most useful one, and will do a great deal to systematize his ideas. It will be easy enough for him to escape the danger of too great fixity by his work
in the laboratory and his study of other books. Indeed in the laboratory and his study of other books. Indeed,
we believe that for the young chemist to start in this way, with chemistry as a porely mathematical science and then to find from investigation in the laboratory and in
subsequent reading the numerons exceptions to the fixed theory which he will have formed, is perhaps the hest
and most useful way.

ヤBusiness and Personal.
The charof for Insertion under this head is One Dolar a ine
for ecci invertion : aboutd eioht woris to a line Aver

## tieements must be received at publication ofice as eariv as Thursday mornino to appearin the followino week's issue

Marine Iron Works. Chicazo. Catalogue free. C. 8." metal polish. Indianapolis. Samples free. Haseses \& Dles. Ferracate Mach. CO., Briageton. N. $J$. For bridge erecting engines. J. s. Mundy, Newark, N. Screw machines, milling macnines, and drill presses Wet Tool Grinder, Sensitive Drills, for all light work Wet Tool Grinder, Sensitive Drills, for all light work,
especially adapted for Bicycle work. C. N. CADY especially
cadastota,
N. $\mathbf{Y}$.
Emerson, Smith \& Co.. Ltd., Beaver Falls, Pa.. will
send Sawyer's Hand Book on Circulars and Band Saws end Sawyer's Hand
ree to any address.
Tree to any address. Engine is built by the De Le Fergne Refrigerating Ma-
chine Company. Foot of Fast lissth Street, The best book for eiectricians and beginners in elec
 Stay with your job, and witb your wakes pay install ments for a proftable olive orchard. Booklet free
Whiting's Oilve Colony, Byrne Building, Los Angeles Whitin
cal.
Concrete Contractors-Make more money by extend-
ing your business. Investigate Ransome's Concrete Construction. Liberal terms for exclusive rigbts.
some $\&$ Smith Co., 758 Monadnock Block, Chicano.
MANUFACTURING Invited.-Yarties with paying ar
tocation, write Secretary Board of Trade Thisiout loa No bonuses; no experiments; only practical busi-
Pess now paying, or which can be made to pay, a reaness now paying, or which can be made
sonable per cent. on investment desired.
CTVend for new and complete catalogue of Scientifc New York. Free on application.

## 

HINTS TO CORRESPONDENTS
Names and Address must accompany all letters
or no attention will be paid thereto. This is for our
 Se repeated; correspondents will bear in mind that
some answers require not a little research, and,
though evendeavor to reppy to all either by letter
or in this department.
B yerch must take his turn. Buyers wishing to parchnase any article enot advertised
in our columns wil be furliged with adreeses of
houses mannfacturing or cansing the
 Scientitic Ancrican Supplements referred
to may he had at the offce. Prce 10 cents each
Books referred to promptly supplied on receipt of Mrice.
wing sent for examination should be distinctly
marked or labeled.
(6908) S. E. E. says : I would like to know, frrst, what is the proper dressing or polish to nse
on kangaroo and goat or kid shoes to keep them from cracking. Also the proper dressing for patent leather to prevent cracking. A. Add some olive oil to some pure wax which has been melted in a water bath and then add lard. Mix thoroughly by stirring over a moderate fre.
Add oil of turpentine, then a little oil of lavender. This Add oil of turpentine, then a little oil of lavender. This
will form a paste which should be put in boxes. Apply will form a paste which should be put in boxes. Apply
with a linen rag. The paste keeps the leather soft and
(6909) R.
(6909) R. G. writes: I hare been ex perimenting with thin films. Thus far I have failed to ing fllm. Can you give me a formula for a good mixture A. C. V. Boys, in his interesting work on soap bubbles says, "Common yellow soap is better than fancy soap."
The mixture we like best is made as follcws :"Fill clean stoppered bottle three-quarters full of pure wate (distilled water preferred). Add one-fortieth part of it weigh of oleate of soda, which will probably float on
the water. Leave it for a day, when the oleate of will be dissolved. Nearly flll up the bottle with pode or abine and shake well. Leave the bottle stoppered for about a week in a dark place. Siphon off the clear
liquid, add one or two drops of strong ammonia to every
pint of the liquid. Use the mixture from a small work. pint of the liquid. Use the misture from a small work
ing bottle. Do not get out the stock bottle every time a bubble is to be blown, Do not warm or filter the mixture. This mixture will keep fora yearor so
(6910) E. McD. asks : Can you inform me how to prepare a slide of crystals of iodosulphate of
quinine for microscopical examination ? A. Mix
and drachms of pure acetic acid with one drachm of alcohol, water). Place one drop of this fluid on a glass slide and add a minute particle of quinine. After this has dis solved add a very small drop of tincture of iodine by means of a fine glass rod. After a time, chemical action ceases and the crystals begin to form slowly, without
heat. These crystals are beautiful in polarized light. (6911) J. D. asks (1) the meaning of ampere turns. A. The product of the amperes passing
through a wire multiplied by the number of complete circles made by such wire. 2. Name some good open circuit batteries. A. The Leclanche is standard. Dry plementy, Nos. 157, 158, 159, 792. 3. Where can I get catalogne of small electrical apparatus? A. Address any
of our advertisers of electrical goods. 4. Name Suprue MENT number with simple ammeter and voltmeters. A There are no really simple ones. For examples see our
SUPPLEMENT, Nos. 652, 563, $618,628,668,353,734,5$ SUPPLEMENT, Nos. 652, 563, $618,628,668,353,734.5$.
How many grains of copper does one ampere deposit ? college craduate? A ber with induction coils. A. Nos. 160, 569, 229.
(6912) A. J. E. writes: 1. Constracted directed, which of the two motors, 759 and 641, would give more power \& A. The motor of Supplement, No
759 , is the more powerful. 2. Could motor 641 be wound so as to furnish $1 / 8$ horse power, with two cells of EdisonLalande batteries : A. No. 3. For a drum armatur would disks of tin answer as well as carriage waskers or
punchings? A. Disks of sheet tin would answer, as this is simply tin-plated sheet iron. 4. Are thedisks insulated from the shaft in a dram armature? A. They need no be. 5. Which better for the fields of motor 641: (a) or.(c) fields made up of a piece of wrought iron 1/isinch or.(c) fielas made up of a piece of wrought iron $1 / 2$ inch
thick ? A. For even cross section the solid wrought iron field is slightly the better.
(6913) S. \& T. write : We wrote you bout length and size of wire for resistance for Plant know polls. You gave iron wire 10-12, but did no rent and is made to run 100-110 volt lamps. Is the num ber of lamps the machine is able to light the potential ?
A. There is no such thing as a 110 volt current. Potential A. There is no such thing as a 110 volt current. Potential is expressed iu volts, current in amperes. You requir volt lamps. A No. 5 current for 10016 candle power 110 this-a No. 0 or No. 00 iron wire. The amount a wire will carry varies with its surroundings. If exposed to the air, it will carry more without dangerous heating than if insulated and tightly wound. The smaller iron wire would be quite large enough, if wound in a loose spiral-
The potential of the machine gives the voltage of the lamps proper to go with it.
(6914) F. A. McL. asks how many vibra tions it takes to produce the lowest note on a piano, say
A, and if they increase regularly or not. That is, does ach note increase with the same number of vibrations of its neighbor? Do every two notes differ with the sam the number of vibrations to produce each of the notes of the piano keyboard $\% \mathrm{~A}$. The middle C is taken generally as corresponding to 256 double vibrations per second. C one octave below has one-half this number of vibra-
tions, C one octave above has double, two above four times and so on. Then for the musical scale, taking C a $\mathrm{C}=1, \mathrm{C}$ sharp $=\frac{20}{2}, \mathrm{D}$ flat $=\frac{2}{2}, \mathrm{D}=\frac{9}{6}, \mathrm{D}$ sharp $=\frac{75}{8}, \mathrm{E}$ flat $=$ $\boldsymbol{i}, \mathrm{E}=\boldsymbol{i}$, etc. Thus to get the number of vibrations in any of the above in the octave above middle $\mathbf{C}$, multiply 256 by the fraction. All this is subject to varlations in the
standard pitch. Thus the French standard middle $\mathbf{C}$ has standard pitch. Thus the French standard middle C has
261 , the English 256 double vibrations. The lowest audi261, the English 256 double vibrations. The lowest audi-
ble note is about 16 per second; under some conditions ite note is about 16 per second; under some conditions
it is claimed that 9 vibrations per second have been audible. On some grand pianos A with $2 \pi 1 / 2$ vibrations per second is included on the keyboard, and the range may go up to Aiv with 3520 or Cr with, 4224 vibrations per
second. The intervals between notes are expressed by fractions, thus: $\mathbf{C}$ to $\mathbf{D} \frac{8}{8}, \mathbf{D}$ to $\mathrm{E}_{3}$. . $\mathbf{E}$ to $\mathbf{F}$ f8. etc., each interval being the quotient of the ratio
divided by the ratio of the higher note.
(6915) W. asks : 1. Approximately what would be the dimensions of permanent magnets,
giving an output of three or four 16 candle power lamps -alternating current? A. This question cannot be an vered without krowing the quality of the magnets and
voltage of lamps. You would need 20 square inches of pole area and 2.500 turns of No. 18 wire on the arma ture, taking low excitation of the magnetic circuit. 2 Driven by the same power, how many more 16 candle
power lamps would an alternator furnish over a direct power lamps would an alternator furnish over a direct current machine? The fields being excited by a separate dynamo, the above power being figured on the basis of one-half horse. A. There should be little or no differ
ence. 3. Will the power or current required to excite the fields equal powditional lights in the to excit You cannot escape using power to excite fields, whether derived from an outside source or from the dynamo itself 4. Would it not be better in small plants to use the alter natormore extensively, of course double winding the ar-
mature, for current to excite the fields? Would there mature, for current to excite the fields? Would there
not be less fuctuation in the lights with the variations not be less fluctuation in the lights with the variations
of the power, and would not less trouble be experienced in general management of dynamo and lights? A and disadvantages. The direct current is more conven ient in some ways and is less liable to give bad shocks. (6916) H. V. S. asks how to prepare a mplex or a hektograph for producing copies of letter A. Our Supplement, No. 438, contains an illustrated
description with full details of the hektograph. We can (adiv) mail for 10 cents.
(6d17) E. A. B. says : There is a preparawhich, in solution, will preserve quite perfectly fruits and vegetables immersed in the solution and kept cov ened by it, sealing not being necessary. Can you tell me
what this preparation is, and how to make it, or wher what this preparation is, and how to make it, or where
to procure it in bulk ? A. Use only fruits and vegetable which are thoroughly sound. The fruit or vegetable may be washed if desired. The fruit may be packed in jars, crocks, or kegs as desired. Put it in as closely as possible without injuring the fruit, as the more compact is packed the smaller will be the quantity of liquid re quired to cover it. Take two ounces of salicylic acid an twenty-five pounds of sugar (coffee C); the acid and the
sugar are dissolved in $61 /$ to 7 gallons of hot water. See that both the sugar and acid are all perfectly dissolved let the solution get cold and then pour on enough of the liquid to cover the fruit. The top of the vessel should be covered, but need not be sealed. The quantity of sugar is usually sufficient to make the fruit sweet enoug for table use. The quantity of liquid named above is sufficient to cover about twenty five gallons of fruit. Fo
preserving pease, beans, tomatoes, sweet corn, pickles, etc., the quantity of acid remains the same, but twenty ounces of sodium chloride (common salt) are added and the quantity of hot water is reduced to five gallons; pro red with the. When cola, the vegetables can be cov fruit or vegetables are completely covered by the solution at all times. Any fruit found floating on the top should be promptly removed, as it would tend to contaminate the ccntents of the vessel. If it is found tha
the solution is evaporating, more of the liquid shonld b added. It is perhaps as well to have the crocks, etc., have

August 1, 1896.]
covers which fit tight enough to prevent evaporation of
the contents. All medical authorities do not consider the contents. All medical authorities do not consider
that this process of preserving fruit by salicylic acid is that this
healthy.
(6918) G. K. D. says : I write to ask if you can furnish me with the approximate formula (as
exact as possible) of the composition used for making the Swedish safety matches, both the composition in the head of the match and the composition of the coating o matches in general, not especialls to the Swedish make although that is a very good sample. A. 1. Dip the splints in a paste composed of chlorate of potash, 6 parts; alphide of antimony, 2 to 3 parts; glue, weighed dry, part. The paste for the rubbing surface is amorphous
phosphorue, 10 parts ; oxide of manganese or sulphide of antimony 8 parts; glue 3 to 6 parts, weighed dry The ingredients must be thoroughly mixed and care must be taken not to mix tne chlorate of potash in the dry state with the other materials; it should be mixed arst with the glue dissolved in warm water. The paste for the rubbing surface may be spread with a brush or patula on the slie of the box. 2. Glue, 16 parts manganese, 24 parts; hyposulphite of lead, 8 parts and chlorate of potash, 36 parts. Composition for the box.-Hyposulphite of lead, 260 parts ; chlorate of potash, 14 parts ; oxide of iron, 7 parts ; powdered glass, 8 parts;
finest glue, 4 parts ; and amorphousphosphorus, 24 parts. Glue is dissolved in water; other ingredients, being in of paint and applied with a brush to the surface of the x.
(6919) G. M. asks (1) whether in the anufacture of calcium, carbide for the production o in regions where wood is abundant and coal is acarce A. Charcoal probably could be substituted for coal, but he economy of so doing, and its practicability, would have to be the subject of experiment. 2. Can fuel gas be made directly from wood or charcoal, the same as fro oal in circumstances as described above ? If so, wher an I find a description of the process ? A. Yes; woon perhaps than charcoal, and certainly much more ecoomically, as it would avoid the loss of heating con tuens incidental to the manufacture of charcoal. here can I find a description of the process for the UPPLEMENT, Nos 7pa 733, 734, $848,872,937,951,959$ 960 , and 982 , for valuable data. 4. What numbers of the Sientific American Supplement contain an ac York? A. Nos. 19, 20, 21, and 22 , vol. 74 .

TO INVENTORS.






## INDEX OF INVENTIONS

 or which Letters Patent of th United States were Granted
## July 14, 1896,

## ND EACH BEARING THAT DATE



|  |  |
| :---: | :---: |
|  |  |
|  |  |
|  |  |
|  | Mail receiving a |
|  | Matronanauiajofoe |
|  |  |
| ment, F : |  |
| f. W. Silegel.e. |  |
| E. |  |
| Clamp. See Wire confining clamp. |  |
|  |  |
| duttin maccine, F. F.e. C |  |
| , rriction |  |
|  |  |
| methud of an app |  |
| wing |  |
| Collar hirs hre, | Naphtha frio |
|  |  |
| Concentrator'ran amalasamator | Ov |
| Coorer See Bot |  |
| Linquat |  |
|  |  |
|  |  |
|  |  |
|  |  |
| 硡 | para |
| al enflnes, olectric ken | Pbotoprapio prinitime |
| diotionoilee |  |
|  |  |
|  |  |
|  | w, |
|  |  |
|  |  |
|  |  |
|  | Po |
|  | nti |
| ric machine, dyn | Print |
| Tichiverab | ${ }^{\text {Prating }}$ |
|  |  |
|  |  |
|  |  |
| ne. See Rotary engir no. steam engine | ${ }^{\text {Pu}}$ |
| elop M. Donnelly. M .............. |  |
|  |  |
| der |  |
| fraction tin, A. Clarkeialile | Rallway switch, L Wieleand |
| rot for liquide under pressure |  |
| ceamaid |  |
| File bill J. M. Butcher, il. |  |
|  |  |
|  |  |
|  |  |
|  | Rolilin. |
|  | $\xrightarrow{\text { Rotar }}$ |
|  |  |
|  |  |
|  |  |
| pulyer | Scales count Indicator |
|  | Scraper andieveie |
|  |  |
|  |  |
|  |  |
| Renerators, ire co |  |
| Me. |  |
| e. J. Simpson. $\qquad$ | Sewing machin |
| erator. See Gas generator. |  |
| Yernor | Shade rollerliedeeni |
|  | sbelr |
|  | Sbingling gase, Fi. L. Pelleg. Bhoe polishing fabinet, |
|  |  |
|  |  |
| carrier atachment. W. Lioud | signal |
| nibitiolioumoive | Sole |
|  |  |
|  |  |
|  |  |
| ge, roll er bearing, Dic |  |
|  |  |
|  |  |
|  |  |
|  | Stande |
| rom | 边 |
|  | Steam bol |
| me | m |
|  |  |
| ng machine, ilrculur. H: E |  |
|  |  |
| central |  |
| central |  |
|  |  |
| aduater ior central |  |
| Lantern, madic, Hasiling $\mathbb{D}$. Kuseel |  |
|  |  |
|  |  |
|  |  |
|  |  |
| Sans for litita |  |
|  |  |



TRADE MARKS.
Bandages, suspensory. E. (at. Ramson............. 28,586
Bicy cles, bueber Watch Case Manufacturing. Com-





 Farm implements. T. caicad..........
FTour, J. . Camors Company
Flour, wheat. Cbristiansen \& Hener









Phovertisements.



 WOOD oy mitill workrs mithout steam powere can save
time and money by using our Footand Hard Power ${ }^{\text {Ilachinery }}$ - Wood-working MacheSRMECA F FILLS MFG. COMPAMT

AMERICAN PATENTS. - AN INTER



$\frac{\pi}{4}$
 THE CURTIS Water Pressure Regulator

 D'ESTE \& SEELEY CO.

Automatic Wire Forming Machinery


FEDERAL BENCH PUNCH


 CHANDLER \& FARQUHAR 38 Federal St., Boston, Mass. CROOKES TUBES AND ROENTGEN'S



 5 New Friction Disk Drill. FOR LIGHT WORK.
The spas
thanes oreat Alvantages



Combination Pliers


"My Well and what came out of it." A story by the novelist Frank R. Stockton.
"Your Well and what will come out of it."
By the Pohlé Air Lift Pump The Ingersoll-8ergeant Drill CO. "QUEEN" ARCHITECT LEVEL $\$ 50$






## 





The Edison Phonographic News A PHONOGRAPH or A KINETO8COPE the great money-earning wonders. Sample copy 100.
THE OHIO PHONOGRAPH CO. CINCINNATI, 0 .


TWELL DRILLING MACHINERU WILLIAMS BROTHERS. ITHACA, N.Y.
MOUNTED OR ON SILLS,FOR DEEP OR SHALLOW WELLS,' WITK STEAM OR HORSE POWER
SEMD TOR CATALOQU SEAM FOR CATALOAUE


THE W. F.F. \& M. CO. bank street, waterbury, CONn.


SINTZ GAS ENGINE CO. GRAND BAPRD, MIOR, Mantactures of the sintzin



"WOLVERINE" GAS an GasOLINE





DORMAN'S VULGANIZERS
 121 E. Favetie E ..,

## AARBORUNDUM E 

There is more proft on it to all concerned
There is more proft on it to all concerned than on
any other iron. any other iron.
To the maker, becanee thee make more of it.
To the sellers, beause they cell more of it.
 Apoilo Iron and Steel Company,
Pittsburgh,
Pa.


ACETYLENE APPARATUS-ACETY





BOOKS ON ELECTRICITY AND MAGNETISM


 HENRYCAREY BAIRD \& CO. \&io Walnut St., Philadelphia, Pa., U. S. A. The man who sets type noo


THE BLISS School of Electricity

Bliss Building, WASHINGTON, D.C. The only Intitution teaching practical Electrical En
ineering excluivively Laboratory
lent. Instruction the best. Catalog oquipment encelt
lentication.





HALE A CENTURYOF CYCLES-AN



FT Howard Ohainless Bicycle.


## Experimental Science

GEO. M. HOPKINS.
Seventeenth Edition. revised and enlarged.


840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, $\$ 4$. Half morocco, $\mathbf{8 5}$
This splendid work is up to the times. It gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that wil enable him to comprehend the great im provements of the day. It furnishes sug. gestions for hours of instructive recreation.

Send for illustrated circular and
MUNN \& CO., Publishers, office of the
SCIENTIFIC AMERICAN, 361 BROADWAY, - NEW YORK.
 The Light Running DENSMORE The World's
 correspondence and manifolaling, best system of soales. best for both From the U. s. Govgrnment-departient or the intrrior,





THE DURANT COUNTING MACHINES
 mie fpewilier EXCHANGE, $1 \nmid$ Barclay St., New York 156 Adams St., Chicago, 38 Court Sq., Boston. 818 Wyandotte Street, Kansas City, Mo





## wanted



## SCIIENCE MECHANICS. <br>     

 TOMN .......am


 Experimemalal Mided Woin

 DEAPNESS CUREDI THE



ROSE POLYTECHNIC IN8TITUTE Terre Hantion Ind A Bchool or Manineerlig
 Chain BeLTING of Various Styles, ELEVATOR8, GONVEYORS,

FGESFIS DEAD



 BUY TELEPHONES That Are Good--Not Cheap Things
 Hundreds of similar cases may be cited affecting the
apparatus of nearly all so-called competitors. WESTERN TELEPHONE CONSTRUCTION C The Largest Manufacturers of Telephones in the U.S.

## G MWM M MERCN

ETSTABLISHED 1S45.
The Most Popular Scientific Paper in the World Only $\$ 3.00$ a Yenr, Including Postage. Weekls--52 Numbers n Yent
This widels circnlated and splendidly illustrated
paper tis publistred weekly. Every number contains six. teen pages of useful information and a larke number of representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanice, Manufactures, Cbemistry, Flectricity.Telegraphy, Photography, Archi-
tecture, Agriculture, Horticulture, Natural History, etc. Complete list of Parents each week.
Terms of Subscription.-One copy of the SCIEN-
TIFIC AMERICAN will be sent for ne year - 52 numbergpostage prepaid. to any subscriber in the United States
pose Canada, or Mexico on receipt of Thiree Dodilars by
the publishers; six months, 81.50; three months, z1.00. Clubs. - Special rates for several names, and to Postmasters. Write for particulars,
The safest way to
remit is
The safest way to remit is by Postal Order, Draft, o
Express Money Order. Money carefuly of envelopes, securely sealed, and correctly addressed seldom goes astray, but is at the sender's risk. Address
all letters and make 'all orders, drafts, etc., payable to all letters and make all orders, drafts, etc., payable to

This is a separate and distinct publication from The
SOIENTIYIC AMERICA., but is ontform therewith in size, every number containing sixteen large paces full
of engravinge many of engravings, many of wnich are taken from roreser
papers and accompanied with translated descriptions. The Scientipic american SUpplement is published
weekly, and includes a very wide range of contents. It preserts the most recent papers by eminent writers in
all the principal departments of Science and the Useful Arts, embracing Biology, Geologe, Mineralogy, Natura
History, Geography Archæoloej, Astranomy try, Electricity, Light, Heat, Mechanical Engineering Steam and Railway Eneineeriog, Mining, Ship Building Marine Engineering, Photography, Technology, Manu-
facturing Industries, Sanitary Engineering, Agriculture Horticuiture, Domestic Econowy, Riography. Medicine etc. A vast amount of fresh and valuable information obtainable in no other publication,
The most important Envineering The most important Enoineering Works, Mechanisms and described in the SUPPLEMENT. Price for the SUPPlemintr. for the United States
anada, and Mexico, 85.00 a year; or one copy of (:anada, and Mexico. 85.00 a year; or one copy of the MENT, both mailed for one year to one address for 87.00 Single copies, 4 cents. Address and remit by postal order, express money order, or check,
MUNN \& CO., $\mathbf{3 6 1}$ lironalivay, Ne work
Thuilding Eilition.
The Scikntific American Building Edition in
issued monthly. 82.50 a year. Single copies 25 cent Thirty two large quarto pages. forming a large an splendid Maeazine of Architeoture. richly adorned with elegant plates and other fine engravings; illustrating th Construction and sillied subjects. A specia
if a variety of the latest and best plans for private resi dences, city and country, including those of very mod
erate cost as well as the more expensive. Drawing in rate cost as well as the more expensive. Drawings in
perspective and in color are given, together with Floo Plans. Descriptions, Locations, Estimated Cost, etc. The elegance and cheapness of this magnifcent wor
have won for it the Jargest Circulation of an Architectural publication in the world. Sold by all MUNN

Exproxt Edition
of the Scientipic American, with which is incor or Spanish edition of the Scientific A Andustrial, lisbed monthly, and is uniform in aize and typograph With the Scientific amerioan. Every number con sins about 50 papes, profusely illustrated. It is the fines lates throughout Cubs, the West Inolies, Mexico, Ce ral and South America, Spain and Spanish possession ENTIFIC AMERICAN EXPORT EDition has a larg out the wortd 83.00 a vear postpald, to pay part of the world. Single copies, 25 cents.
IT Manufacturers and others who desire to secure Ereign trade may have large and handsimely displaye announcements publisbed in this edition at a very MUNN \& CO., Publisher

361 Broadway, Now York.


## The

## American

Bell Telephone Company,

125 Milk Street,
Boston, Mass.

This Company owns LettersPatent No. 463,569 , granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephnne, covering all forms of Microphone Transmitters or contact Telephones.

NEWAYGO AUTOMATIC CIRCUIT BREAKERS



AFENTSW/ NNTED FORFINETOOLS INEVERYSHOP


- HAVE YOU GOT OUUR OLT

Gas and Gasoline Stationary Engines Gasoline Traction Engines

Combined Engines and Pumps
casoline portable Engines
USED ANY PLACE
CHARTER GAS ENGINE CO. ANY PURPOSE


## Of All Refractory Substances

## Is the " Griffin Mill, ${ }^{\text {" }}$ whose first cost, wear, and operating ex-

 pense is much less than stamp mills, and which yields a larger product at less cost than any other mill, with perfect success in every instance.It will work by either the wet or dry process, and deliver a uniformly sized finished product of from 30 to 350 Mesh, with equal facility. Its capacity is 3 to 4 tons per hour on Phosphate Rock, $11 / 2$ to 2 tons per hour on Portland Cement, Quartz Ores, etc.
Correspondence solicited, and illustrated déscriptive catalogue sent free by mail on application to

## Bradley Pulverizer Co., No. 92 State Street, Boston.

< JUSTI OUTI! 5oth) Fimiviersary number

OF THE

"Scientific American."
In this issue is published a resume of the progress of the Industrial Arts and Sciences during the past ffty ye
No expense or pains have been spared to make this a publication of rare merit and great value. The articles have all been prepared by specialists. Some of the principal subjects treated are


ENGINE LATHES, From 12 to 30 inch swing. UPRIGHT DRILLS, From 10 inch Sensitive to 36 Also KEYSEATING AND CUTTING-OFF MACHINES. ROCHESTER, N. Y., U. S. A. na for Circulars and Photographs. PREISTMAN SAFETY OIL ENGINE
 PREISIMAN \& CO.I. Incorp'd, 1 PHIIADELIPHIA, PA.
530 Bourse Blag.,



The Transatlantic Steamship. Naval and Coast Defense. Railroads and Bridges. The Sewing Machine. Physics and Chemistry. Electric Engineering. Progress of Printing. The Locomotive. Iron and Steel. Phonograph. Photography. Telegraph. Telephone. Telescopes. The Bicycle. History of the Scientific American.

Wany ntwer articles of great interest, by the best scientife writernst the dary are also partant of which is the prize emean, entitied among the mos "THE PROGRESS OF INVENTION DURING THE PAST FIFTY YEARS,"
 ME 72 PAGES PROFUSELV ILITUSTRATED.
 MUNN \& CO., Publishers of the "Scientifía American," 36I Broadway, New York
the sort for which sico The Colatogumia Art
 POPE MFG. GO., Hartford, Conn.


PRINTIING INKES


