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NEW YORK, APRIL 8, 1899.
$\left[\begin{array}{c}\$ 3.00 \\ \text { WERLLY } \\ \text { A }\end{array}\right]$

## FRENCH SUBMARINE TORPEDO BOATS.

The widespread interest which has been aroused by the performances of the submarine torpedo boat "Gustave Zede" (so named after the late inventor) is out of all proportion to the actual fighting value of this type of vessel : for, although she is probably the most successful and practical vessel of the type that has yet appeared, she has done nothing to warrant the unbounded enthusiasm with which the French people have greeted her appearance-a fact which has been pointed out by some of the most noted experts of the French navy.

However, there is evidently something which takes the popular fancy in the idea of a fighting ship that can move unseen in the depths of the ocean, and strike a fatal blow unnoticed and unsuspected by the enemy. The "Gustave Zéde" has proved her ability to travel at a moderate speed at the surface of the water ; she has also shown that she can dive and proceed at a preatly re proceed at a greatly reduced speed below the surface; but it has yet
to be shown that she to be shown that she
can overtake a modern warship, sink below the water, keeping still in touch with her foe, and then deliver the fatal blow unerringly. In this, as in all other vessels of the class, the sels of the class, the weak point is the impossibility of keeping in sight a ship that is on the alert and in full command of her ma-
neuvering powers. At neuvering powers. At the same time, as is pointed out by the naval officer quoted at the close of this article, there will probably be a sphere of usefulness for the subinarine vessel


The "Gymnote" Rising After Submersion.
in assisting in the defense of a blockaded harbor. For this class of work it will rank with the torpedo and the submarine mine.
The first of the submarine boats built by Engineer Zédé was commenced at Toulon in 1886. She was named the "Gymnote," and was considered as a mere experimental vessel on which to test the principal problems connected with this type of warship; such, for instance, as those of submersion, steering, visibility, and habitability. The "Gymnote" was to all intents and purposes nothing more than a large Whitehead and purp. 50.7 fet in length and 5.9 feet in diamead torpedo. 567 feet in length and 59 feet in diameter, and with a displacement of about 30 tons It was provided with horizontal rudders to enable it to dive, maintain its desired depth below water, and rise again to the surface. It was built of steel and was driven by an electric motor of 55 horse power, the current being supplied from storage batteries. Its speed was about 7 knots sub)merged, and about 9 knots when traveling at he surface of the wahe surface of the water. The storage bateries were sufficient to un the vessel for four or five hours. Buoyancy was secured by means of watertight compartments placed fore and aft ; sufficient air was stored in convenient positions within the boat to give the the boat to give the necessary air for the espiration of a crew of our or five men when the boat was submerged. Attached below the hull was a certain amount of ballast. which, if desired, could be released from the inside of the vessel, thercby allowing the latte (Continued on p. 217.)


The Submarine Torpedo Boat "Gustave Zédé" in the Roadstead of Toulon.


Longitudinal Section Through the "Gustave Zédé."

FRENCH SUBMARINE TORPEDO BOATS,

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NEW YORK, SATURDAY, APRIL 8, 1899.
THE RECENT EXPLOSION OF A TEN-INCH ARMY

## GUN.

After the brilliant record of the Ordnance Department in the construction and testing of built-up guns, extending over many years, the recent bursting of an army 10 -inch breech-loading rifle will come as a painful surprise to the general public. It has always been the boast of our ordnance officers that the great care exercised in the design and manufacture of our guns has resulted in the production of weapons that were not surpassed in respect of their accuracy and endurance.

As a matter of fact, however, there are other elements besides those to be found in the gun itself which may conduce to its destruction. It may be burst through faulty loading, as in the case of the 12 inch muzzle-loading gun of the "Thunderer," where two charges were put in by mistake, or in these days of nitro-glycerine and guncotton (smokeless) powders, the gun may be burst by the irregular action of the powder itself.
There is strong evidence that it was the too sudden combustion of the smokeless powder, resulting in ab normal pressures, that caused the disastrous wreck at Sandy Hook, for one of the pressure gages has been recovered which shows that the powder developed a pressure of 36 tons, or nearly two and a half times as great as the allowable limit of 15 tons to the square inch, while it is likely that even this pressure was greatly exceeded

Mr. Hudson Maxim, who conjointly with Dr. Sch upphaus is the inventor of the perforated smokeless powde used by the army and navy, contributes an artscle, which will be found on another page, in which he explains the probable cause of the explosion. The discussion is of great interest as coming from the inventor of the powder, and in the absence of any evidence of other causes will probably be accepted as the true ex planation. That the army powder, which was sup posed to be particularly safe because of its low percentage of nitroglycerine, should be liable to semi-detonation, because of the form of the grains and the direc tion of the perforations, proves that the smokeless powder question is still in its trial stages, and that we have yet to produce the ideal compound.
It is a curious and pertinent fact that a powder with a higher percentage of nitroglycerine would, by virtue of its elasticity and toughness, be free from the danger of shattering and sudden generation of gas, to which causes, it will be noticed, Mr. Maxim attributes the explosion of the gun.

## PROPOSAL TO BUILD THE NEW YORK RAPID TRANSIT TUNNEL.

The proposal of the Metropolitan Street Railway Company to build and operate the proposed New York Rapid Transit Tunnel is the most important development in connection with this great scheme since it first received legislative sanction. The public is familiar with the history of the hitherto abortive attempts, extending over a period of many years, to secure the tending over a period of many years, to secure the
necessary funds (about $\$ 30,000.000$ ) and start the work necessary funds (about $\$ 30,000.000$ ) and start the work
of active construction. After surmounting a host of of active construction. After surmounting a host of
legal difficulties, the Board of Rapid Transit Commislegal difficulties, the Board of Rapid Transit Commis-
sioners found themselves face to face with the fact that New York was prevented by its charter from incurring the additional debt which would be necessary if the road was to be constructed at the city's expense. For some time it has been evident that if the work is to be undertaken at all, it must be done by private capital, and while, for obvious reasons, it is desirable that the road should be built and owned by the city, it that the road should be built and owned by the city, it
is realized that if city ownership and control is is realized that if city ownership and control is
made a sine qua non, this greatly needed improvement made a sine qua non, this greatly neede
will have to be indeinitely postponed.
At this juncture the Metropolitan Street Railway Company has come forward with a proposition which, while not altogether free from objectionable features, is yet on the whole a fair proposal and contains many features to recommend it to the favorable consideration of the people and the people's representatives, the Rapid Transit Commission.
Briefly stated, the proposal is as follows: A combination of capitalists who are largely interested in
the Metropolitan Street Railway Company propose to construct an underground railway according to the plans of the commission and lease it in perpetuity to the Metropolitan Street Railway Company. It is proposed that a company be organized to build the tunnel, work to begin on the first section, from City Hall to Fort George, within three months after the right is acquired and to be completed within three years' time. As soon as the first section has proved that it can earn 5 per cent on the cost of construction and equipment, the second section, extending from One equipment, the second section, extending frow One On its completion the road is to be leased by the ConOn its completion the road is to be leased by the Con-
struction Company in perpetuity to the Metropolitan Street Railway Company for a yearly rental of 5 per cent of its actual cost. The Metropolitan Company is to pay to the city 5 per cent of the gross receipts of the road after the taxes and the rental to the Construction Company have been paid.
As regards the operation of the road, the Metropoli$\tan$ Company will pledge itself to run express trains, charging a fare of 10 cents, these trains to run at a rate of 20 miles an hour below Ninety-sixth Street, and for at least 2 miles below Forty-second Street at the rate of 30 miles an hour. The fare on all trains, except the express, to be 5 cents

A most important provision-one which above all others commends this proposal to favorable considera-tion-is the proposal of the Metropolitan Company to operate the new tunnel road as part of their great system of electric roads throughout the city. All passengers carried on the way trains for 5 cents are to be entitled to be carried over the surface lines of the Metropolitan Street Railway Company for an additional fare of 3 cents. Conversely, all passengers over the surface lines of the Metropolitan Street Railway are to be entitled to be carried over the tunnel road on trains other than express for an additional fare of 3 cents. Passengers paying the express fare of 10 cents are to be entitled to transfers to any connecting lines of the Metropolitan Street Surface Railways.
Such are the main outlines of the scheme as presented to the Rapid Transit Commissioners, and it must be confessed that as matters now stand it would be wise policy on the part of the city to accept the be wise policy on the part of the city to accept the
proposition, subject to one or two important modifipropositi

The objectionable features, it seems to us, are the proposals that the city shall grant a perpetual fran chise and the fact that the proposed line of the tun nel is incomplete to the extent that it wiil terminate at the City Hall instead of running, as it should do, down to the Battery. We are aware that the extension to the Battery was cut out of the original plan because of the difficulties of construction, but nothing has been brought forward to prove that those difficulties are insuperable; and in view of the fact that the most important business interests of the city are centered nearly a mile south of City Hall Park, we think that the necessities of the case would fully justify the expense of construction.
The request for a perpetual franchise should be em phatically opposed. Fifty years is long enough to en able the various capitalists interested in the scheme to realize every reasonable profit from the undertaking. The spirit of the times is altogether against the pledg. ing away forever of such enormously valuable franchises as those of transportation over growing cities, and we think that the Metropolitan Company may well be content with a term of years that will cover the lifetime of the parties concerned.
With regard to the important question of increasing the fare on express trains to 10 cents, we think that, on the whole, the circuinstances of the case will justify it. It is generally admitted that the long distance travel on a 5 cents basis is run at a loss which has to be borne by the local traffic. Transportation companies naturally look with more favor upon local than they do upon long distance travel, and, therefore, in granting the franchise, particular care should be taken to specify that a certain number of express trains must be run daily in each direction. It is possible that at the first opening of the road the working classes and those who have to look carefully at the smaller items of their daily expense will avoid the 10 cent train. If this should prove to be the case, a reduction of fare would inevitably follow, and the matter would thus prove to be self-regulating.

## UNITED STATES NAVY AND ARMSTRONG GUNS TT THE PROVING GROUNDS.

A curiously perverted account of some tests recently carried out at the naval proving grounds has been going the round of the daily press. The story relates that, in consequence of some boastful remarks made by the British naval attaché at Washington to the effect that the Armstrong guns on the "New Orleans" are greatly superior to the United States weapons, the government determined to subject each type to a com parative trial under similar conditions, and accordingly two guns on the "New Orleans" were sent to Indian Head, where they failed under test to come anywhere near the record of the home-made weapons.

As a matter of fact, the United States naval experts are too seriously preoccupied in the work of turning out the very best possible weapons according to their own theories and methods of construction to waste time in any pyrotechnic displays for the benefit of the general press. The bureau finds sufficient satisfaction in the excellent record which it has made in working along its own independent lines, a satisfaction which is not measured by the ability of its guns to "beat" this or that particular make of some foreign power. The naval attache, woreover, never made any such invidious comparison-the gentlemen who hold such positions being too well grounded in the precepts of good breeding to be guilty of such an obvious breach of professional etiquette.
The facts of the case regarding these tests are as follows: It being desired to determine what charges of our own smokeless powder for the " New Orleans" guns would give the same muzzle velocity, and, therefore, the same energy, as the English cordite, two of her guns, a 6 -inch and a $4 \cdot 7$-inch, with some of their own English service ammunition, were sent to Indian Head, not for the purpose of making comparative tests with our own guns (though incidentally, of course, with our own guns (though incidentaly, of course,
the results obtained with the two types were compared), but in order to determine what weight of our own but in order to determine what weight of our own
powder must be put into the cartridges, which will powder must be put into the cartridges, which will
henceforth be supplied from our factories, instead of from England.
The "New Orleans" guns are fifty calibers long, and are supplied with cordite charges. For the 6 -inch gun the weight of charge is 18.65 pounds, the projectile weighing. like our own, 100 pounds. The average muzzle velocity obtained with three rounds of the muzzle velocity obtained with three rounds of the
above ammunition was 2,528 feet per second, the highest being 2,554 and the lowest 2,504 feet per second. This was about 100 feet per second less than was expected. The mean chamber pressure, however, was a trifle under 14 tons per square inch; therefore, if the weight of charge were increased somewhat, the velocity of 2,650 feet per second claimed by Armstrong could, no doubt, be realized without exceeding the usual limit of 15 tons. The falling off was probably due to deterioration of the cordite, resulting from climatic or temperature changes. The same gun was then loaded with a heavier charge of our own smokeless powder, a charge of 26 pounds giving a velocity of 2,576 feet per second, with a chamber pressure of 14.8 tons per square inch.
The above test took place in December of last year, and was compared with the firing of a 40 -caliber 6 -inch gun of our make, which took place in June of the same year. This gun with 31 pounds of smokeless powder gave a muzzle velocity of 2,601 feet per second for a chamber pressure of 15 tons to the square inch; the projectile weighing 100 pounds, or the same as that of the Armstrong gun. In the article to which we have referred, and which was so universally disseminated through the daily press, it was stated that a muzzle velocity of 3,000 feer, per second had been obtained at the December trial, but, as a matter of fact, the velocity of 2,601 feet per second is the highest that has yet been obtained in our 40-caliber guns within the limits of the chamber pressure of 15 tons. This high velocity of 3,000 feet per second is something which we are aiming at, and which we hope to obtain with the 50 -caliber guns which are now in process of manufacture for the vessels of the "Maine" class.
The 4.7 -inch 50 -caliber gun of the "New Orleans" with a cordite charge of $81 / 2$ pounds gave an average muzzle velocity of 2,549 feet per second, with a chamber pressure of 14.4 tons; the weight of the projectile being 45 pounds. A charge was fixed for this gun of $13 \cdot 5$ pounds of our own smokeless powder, which on firing gave 2,606 feet per second, the chamber pressure of $14 \cdot 6$ tons. As we have no $4 \cdot 7$-inch guns of our own build, no direct comparison could be made, but our present type of 5 -inch gun of 40 calibers has a muzzle yelocity of 2,725 feet per second, using a 50 -pound projectile. This projectile, however, is relatively light for the caliber and would tend, therefore, to increase the velocity. In the new guns which we are now manufacturing, the projectile will weigh 55 pounds and the gun will be 50 instead of 40 calibers in length. No at tempt was made to determine the maximum muzzle velocity that could be obtained within the allowed chamber pressure from the "New Orleans" when using our own smokeless powder, the object of the test being merely, as we have stated above, to determine what increased weight of our own powder would be necessary to give the same velocity as the stronger cordite powder which was supplied with the gun.

It will be noticed that it required about fifty per cent more of our navy powder by weight to give approxi mately the same velocity as was secured by the cord ite. This is explained by the fact that the cordite has greater strength weight for weight due to the large percentage of nitroglycerine employed in its manufacture. Our navy powder is composed almost entirely of guncotton, which is preferred by the orlnance authority, since it has been considered more reliable and safer than the high nitroglycerine compounds.

## ELECTRICITY AT HIGH PRESSURES.

Prof. Elihu Thomson, of Lynn, Mass., gave an enertaining lecture on the above subject on March 29, before the New York Electrical Society, at the house of the American Society of Civil Engineers, in this city, and exhibited a new form of apparatus which was very effective in producing electricity of a high potential. He described how, years ago, he became interested in frictional electric machines; how, as a boy, the frictional electrical phenomena attracted his attention; and explained how the apparently inert electricity bound on the surface of a sheet of hard rub ber is made to manifest itself by rubbing the surface with fur or silk. This peculiarity was still more marked by coating a smooth dielectric plate with varnish, letting the varnish dry, then stripping it from the plate. This film, in the act of being stripped, becomes elec trified, disturbing the electricity bound on the surface of the plate.

The principle of the influence electrical machine was the same, only on a larger scale, the breaking of the cleav age being continuous. He described the hydro-stear method of accumulating electricity of high potentials and showed that it was due to the friction of an ag gregation of globules acting on one another. This led up to an explanation of the production of electricity in thunderstorms, wherein the circular forms of clouds, known as thunderheads, collect, and intensify their electrical tension much in the same way. They being of one electrical polarity discharge with high pressure to the earth or other clouds of horizontal formation of the opposite polarity.

The estimated voltage of a lightning discharge was from twenty to fifty million volts. Influence machine have come into much request since the $X$-ray discovery. A Prof. Williams, of Boston, had constructed one, the glass disks of which were 6 feet in diameter, and produced a spark $\%$ feet long. Using this machine in connection with an $X$ ray tube, physicians were able, in an examination of the lungs, to detect the presence of the pneumonia microbes before any symptoms of that disease were felt or were indicated by the patient, and X-ray photographs could be taken in a fraction of the time ordinarily required.
The utility of high pressure currents was in the saving of copper in transmission lines; and as the price of copper was advancing, means for controlling and se curing the most economical results in the use and dis posal of such currents demanded the attention and consideration of electricians. Up to the present time it was practical to transmit high pressure currents distance of 83 miles, using a pressure of 50,000 volts. If a voltage higher than that was used, the electricity would escape from the wires into the air in the form of small, luminous blue flames. If a conductor is put within two inches of such highly charged wires, a discharge will take place. These peculiarities of high pressure currents make it difficult to control and measure them. He described a special form of meter for measuring such currents.
He exhibited and explained a new form of induction coil for producing currents of high tension. It con sisted of an inner copper cylinder having parallel glass tubes about a quarter of an inch in diameter longitudi nally on the surface. Over this is wound the fine wir of a secondary coil in one layer, the ends being duly insulated at one end. The wire is thus insulated from the metal cylinder. The secondary coil and cylinder are then set on end into a glass jar containing oil. A primary coil of coarse copper wire, having a diameter of about one inch larger than the interior secondary coil, is next set into the jar surrounding the secondary coil. The oil insulates the two coils, and this Prof Thomson found was very effective in using heavy cur rents
One of the most interesting experiments of the evening was the exhibition of the new "Wehnelt Electrolytic Interrupter," invented by Dr. A. Wehnelt, of Charlottenburg, Germany, and how it may be util ized. The interrupter is inserted in the primary cir cuit of an induction coil, no condenser being needed in the latter. Briefly, it is made by suspending in an elec trolyte solution a platinum wire, all except a half inch of which is insulated from contact with the solution, and a lead plate about a half inch or more below the platinum anode ; one wire is carried to the platinum wire and the other to the lead plate.
When the current from a strong battery or one of 110 oolts is sent through the primary circuit, immediately a peculiar high-pitched hissing sound is noticed coming from the glass jar holding the interrupter, and soon a peculiar-looking electric flame flows between the ball terminals of the secondary coil. It is evidently an interrupter of high frequency and remarkably simple The theory of its action was explained as follows: On closing the primary circuit, a film of gas is ormed at the platinum terminal, en veloping it like a wall, which breaks its contact with the electrolyt luid; the gas then escapes, contact again occurs and vibrations of wonderful frequency continue.
By another arrangement, he was able to vary the strength of the current and produce different sound notes, enough to indicate a tune. Still another appli-
cation was the placing of a coreless electro-magnet in the center of a wood resonator in the form of a box The closing of the primary circuit caused this magnet, ocated in the secondary circuit, to vibrate rapidly the back of the resonator, and produce a sound almost as intense as a whistle. Prof. Thomson suggested that with a contrivance of this character the usual compressed air whistle of the present electric cars could be dispensed with. The audience was very enthusiastic over these experiments. His last experiment illustrated a combination of electrical machines or features by which a low voltage of 60 volts was intensified to several thousand volts. A motor dynamo wasoperated by the usual 110 volt current; this produced an alternating current of 60 volts, which went into a step-up transformer, and from that the higher induced current was led to a series of vertical Plante condensers. Under these was a revolving frame rotating with the speed of the motor which alternately put the condenser plates in series or parallel.
This frame came within a quarter of an inch of the ower ends of the condenser plates. The induced current was highly intensified as a consequence, and sparks two feet long were readily obtained. He remarked that it was a sort of "multum in parvo" arrangement for the lecture room, and by it he was able to secure the same results as if 1,000 storage battery cells had been used. It was the very latest device of the kind he had built. Altogether the lecture was highly instructive and interesting.

## DEATH OF GENERAL FLAGLER

Brigadier-General Daniel W. Flagler, Chief of Ordnance, United States Army, died at Old Point Comfort on March 29. He was born in New York in 1835 and graduated from West Point in 1861. He entered the army as a second lieutenant and served during the Civil War, first in drilling volunteers at Washington and then with the Ordnance Department. He became Assistant Ordnance Officer at the Alleghany Arsenal; later he became Inspector of Ordnance in fitting out the Mississippi River flotilla and Chief of Ordnance to General Burnside's expedition to North Carolina. He had charge of the transportation of siege guns and occupied other positions, such as inspector at the West Point foundry and as assistant to the Chief of Ordnance. His services were not altogether in the foundry and office, for he took part in the battles at Bull Run, Roanoke Island, New Berne, Fort Macon, Summit Mountain, Antietam, Fredericks burg, Chancellorsville, and Gettysburg. At the close of the war he was breveted Lieutenant-Colonel for distinguished services in the fleld. After the war was finished he made a tour of inspection of the Western arsenals with the Chief of Ordnance. He held import ant positions in various arsenals and armories until he was appointed Brigadier-General and Chief of Ord nance on January 23, 1891. He was regarded as one of the greatest ordnance experts in the country, and the reports of the Chief of Ordnance which were issued by his bureau are most valuable reference books. The army has suffered a distinct loss in the death of General Flagler.

## THE AUDUBON SOCIETY

The annual meeting of the Audubon Society of New York State was held in the lecture room of the Ameri can Museum of Natural History on March 23. An illustrated lecture on birds was given by Prof. A. S. Bick more, and in the absence of President Morris K. Jesup, Mr. Frank M. Chapman, chairman of the executive com mittee, presided. An interesting letter was read from Governor Roosevelt, in which he stated that he sympathized with the purpose of the society, saying that he did not understand how any man or woman can fail to try to exert all influence in support of such objects as those of the Audubon Society. He said in conclusion, "When I hear of the destruction of a species I feel just as if all the works of some great writer had perished, as if we had lost all instead of only a part of Polybius or Livy." Rev. Dr. Henry Van Dyke sent a letter, in which he said the sight of an aigrette filled him with a feeling of indignation, and pity at the skin of a dead song bird stuck on the head of tuneless women made him hate the barbarism which lingers in our so-called civilization. The great singer Madam Lili Lehmann was introduced as a distinguished and loyal friend of birds, and she made an excellent address which was very much to the point. She said that in Europe there were wany societies for the protection of birds, and they all worked in harmony, and any person could become a member of those societies upon the payment of a nominal sum, equivalent to two or three cents, the main purpose being to enlist all kinds of people in the movement for the protection of birds. She said that she was sorry to learn that there were no places in Central Park expressly for the purpose of feeding birds. She had eight such places in her garden where the birds may come and be fed. She said there were $25,000.000$ useful birds slaughtered annually for use on women's bonnets, and that farmers were already suf fering from it and that "women enjoy wearing feathers like savages." Flowers and ribbons were a thousand
imes more beautiful and more becoming. It is the duty of every woman to battle against this grewsowe folly. For years Madain Lehwann's hats have not had feathers. Mr. Chapman stated that the wide pread use of the quills of the brown pelican for hat triwmings was fast bringing about the extinction of that species.

## SOME NEW KITE EXPERIMENTS AT BAYONNE

Mr. W. A. Eddy, of Bayonne, N. J., has recently tried some interesting kite experiments, and on March 25 , at 4 P . M., he made partly ready a hot air balloon for an ascension, but the wind and snow increased so rapidly that the air pressure on the side of the partly inflated balloon broke the pole which was being held in position, so that the balloon experiments with an electric wire and Leyden jar had to be deferred. The cost of the balloon is defrayed by the Hodgson fund of the Smithsonian Institution, and its purchase was authorized by Prof. S. P. Langley, secretary of the Institution. A kite-sustained thermometer was sent up at 5:10 P. M., however, notwithstanding the mingled snow and rain. It was finally hauled down at 7:45 P. M., a test of temperature being made at heights of 200,400 and 600 feet. The air at the 600 foot level was found to be $28^{\circ}$ above zero as compared with $31^{\circ}$ above zero at the earth. At 200 feet the air was found to be $1^{\circ}$ warmer than at the earth. The experiments demonstrated that during mingled rain and now there is an intermediate layer of warm air a short distance aloft, but higher up it is colder. The coolness was greater than the normal, indicating cooler weather.

## TESTS OF WIRELESS TELEGRAPHY.

Signor G. Marconi, the inventor who recently obtained permission from the French government to establish a station on the French coast for the purpose of experimenting with wireless telegraphy between England and France, announces that he has conducted successful experiments between South Foreland, in Kent, and Wimereux, near Boulogne, France, the distance being thirty-two miles. Thus far the experiments have been highly successful and the messages have passed with ease. Signor Marconi personally superintended the test. The London Times received the flrst wireless press message across the Channel. The Morse code was used. The French government officials, who have been watching the experiments, have been very favorably impressed. The messages received were read at the South Foreland Lighthouse with no more difficulty than those transmitted by cable. In the Scientific American Sopplement, No. 1213, there is an important paper by Signor Marconi which gives some of the latest results of his experiments.

## FOREIGN EXHIBITIONS OF 1899.

Usually the year before and after a great international exposition there are a number of smaller expositions. This is the case in the present year, and will also be the case in 1901. There will be an exposition in Western Australia, at Coolgardie, beginning in March, and intercolonial in character. On June 14, the Provincial Exposition of East Flanders will be held at Ghent. There will also be a department for foreign exhibits. The International Electrical Exposition and Congress of Electricians will be held at Como next summer, in honor of the birth of Alessandro Volta, the discoverer of the electric battery. The exposition will commence on May 15 and will continue until October 15.

## CONGRESS OF LIFE INSURANCE DOCTORS IN BELGIUM

The first international congress of doctors connected with life insurance will be held at Brussels from September 25 to 30, 1899. There will be representatives from all over Europe and the United States. It is proposed to establish universal formulas for the examination of persons desiring to be insured. As a result of the congress, it is hoped that permanent offices will be created in every country, composed of five medical members, who will see that the decisions of the congress are strictly observed.

## AN UNDER-TROLLEY CAR BURNS UP

A Sixth Avenue electric trolley car caught fire on March 28, in the Fiftieth Street car house of the Metropolitan Street Railway. The current had been shut off when the car was run into the car house, but the plow was still connected with the current, and this is supposed to have caused the fire. An alarm was turned in and Battalion Chief Binns, who was the first man to get aboard the car, received so severe a shock that he was unable to continue directing the work of putting out the fire.

## SPAIN'S NEW CRUISER.

The cruiser "Rio de la Plata," the money for whose construction was subscribed by the Spaniards of South American countries, has been completed at Havre and will shortly be delivered to the Spanish government.

## ダinntific Ampricau.

AN IMPROVED LENS-GRINDING MACHINE.
A novel grinding-machine has been invented and patented by Davilla S. Thomson, of Livermore Falls, Me., which is especially designed for the use of manufacturing opticians, and which is characterized by simplicity of construction and automaticity of operation. The machine comprises, essentially, lens-holding de vices, a centrifugal pump for the supply of abrading material, and a grinding mechanism, all these parts being driven from a common source of power. The lens-holding devices consist of a vertical shaft carrying at its upper extremity an abrading disk upon which the lens to be ground is placed. The disk is rotated

by means of a belt and pulley driven by a power-shaf at one end of the machine. On the shaft which carries the disk the centrifugal pump is arranged, the pro-peller-wheel of which revolves in a casing formed on the lower end of a pan in which the grinding materia is contained. This material, by means of the centrifugal pump, is forced from the pan to the lens through a coiled pipe, as the shaft carrying the disk rotates. The grinding-mechanism consists of a vertical spindle carrying a pivoted yoke at its upper end. Each arm of the yoke is provided at its outer end with a carrier containing a shanked ball, which is held in engage ment with the lens by means of a spring. Hach arm can be raised, if desired, as shown by dotted lines in the figure, and can be held in this inactive position. In order to grind the lens, the vertical spindle carrying the yoke is rocked by means of a rock-arm actuated by a worm-wheel engaging a worm on the power-shaft previously mentioned. The worm-wheel has an ec-centrically-placed hole in which a disk carrying a crank-pin is adjustable. By regulating the position of the disk, the throw of the spindle, and therefor that of the arms and carrier balls, can be increased or decreased. When the power-shaft is in operation, the lens-holding disk will be rotated, the pump will force

## POWERFUL FREIGHT LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD.

The Pennsylvania Railroad has for many years en joyed the distinction of being considered by European engineers, and by not a few in America, the mode railroad of the United States. It is supposed by Englishmen to hold, in respect of its roadbed and equipment, the same representative position accorded to the London and Northwestern in Great Britain.
While it is undoubtedly true that the reputation of these two roads has been well earned, and that twenty or thirty years ago they were easily first in their re spective countries, it is probable that there are now other roads which equal them in most, if not all, points of comparison. This fact, however, does not detract from the great credit which is due to them, and particularly to the Pennsylvania Railroad, for having inaugurated many improvements, which other roads, following their lead, subsequently adopted.

To the Pennsylvania system is largely due the vast improvement which has taken place in the past fifteen or twenty years in roadbed and track, and their heavy or twenty years in roadbed and track, and their heavy
rail sections and rock-ballasted and thoroughly drained roadbed were for some years the standard for other roads to follow. They were early in the field in the introduction of an adequate system of signals, and they were, we believe, the first company to introduce the old country practice of beautifying the station grounds and sodding and keeping in trim order the slopes of excavations and embankments.

In the matter of motive power and rolling stock the road has always been fully abreast of the best American practice, and in some respects has led the way; the "Chicago Limited" being at the first, perhaps, the most sumptuously appointed train in the world, al though to-day its counterpart can be found on more than one of the great systems of the United States.
The motive power of the Pennsylvania Railroad has always been marked by strong individual character istics, and while the practice has been to adhere to a few fixed types and patterns'of engines, a large amount of experimental work has been accomplished. It wil be remembered that this company was first in the field in serious and protracted experiments with the compound system, one of Mr. Webb's three-cylinder express engines being imported from the London and Northwestern Railway for this purpose, The compound system, however, does not appear to have favorably impressed the master mechanics of the road, if we may judge from the small number of the type that are to be found in service.
We present an illustration of the most recent and most powerful of the freight locomotives which have been built by the company. Although it is surpassed somewhat in weight or power by two or three of the other big freight engines of recent construction, it is perhaps the most shapely and pleasing to the eye of any of them. It is of the simple, high pressure type, with two cylinders $23 \cdot 5$ inches in diameter by 28 inches stroke, and a stean pressure of 185 pounds to the square inch. The weight on the drivers is 186,000 pounds, which is only exceeded by the great Pittsburg consolidation, illustrated in the SCIENTIFIC American

## April 8, 1899.

feet; the cars weighed 1,520 tons and the lading 3,692 tons; the total load being 5,212 gross tons
On another occasion it hauled from Columbia to Morrisville, a distance of 100 miles, against a maximum grade of 29 feet, a train of 60 cars. The weight of the cars was 743 tons; of the lading, 1,819 tons; and the total load 2,562 gross tons.

## A NEW POWER-HAMMER.

In an invention patented by Andrew Dinkel, of Auburn, N. Y., an improved power-haımer or presser is


## DINKEL'S POWER-HAMMER.

provided, by means of which a strong yet yielding blow may be given to the billet operated upon.
The accompanying engraving represents this new hammer in perspective and in section
The hammer-head slides in vertical guides, and is provided with a die which coacts with another die on the anvil. Within the hammer-head are a main liquidcontaining chamber and an auxiliary liquid-containing chamber, the two being connected by valved ports. Within the main chamber a piston moves, having a stem projecting from the chamber and connected at its upper end by means of a link with a rock-shaft operated from a driving-pulley through the medium of a rocker-arm and pitman. From the upper end of the auxiliary chamber a pipe projects, which passes in and out of a cylinder partially filled with some liquid, such as oil, a space being left to form an air-cushion. The pressure of this air-cushion may be regulated to the work in hand
When the hammer-head is in its uppermost position, the work to be operated upon is placed upon the anvil. When the belt upon the driving-pulley has been tightened, the hammer will be forced down, thus cansing a strong, yet yielding blow to be struck. After having descended, the hammer will remain stationary ;

pOWERFUL FREIGHT LOCOMOTIVE, PENNSYLVANIA RAILROAD.
Cylinders, $231 / 2 \times 28$ inches; steam pressure, 185 pounds; weight on drivers, 186,000 pounds; total weight. 208,000 pounds.
the abrading material upon the lens, and the carrier-
balls will be rocked so as to grind the lens as it rotates.

## $A$ Word of Advice.

O'Hoolahan (disgustedly).-The boss's goin' to give me a dom automobile truck to drive instead of the team, Norah.
Norah.-Well, what of it ?
O'Hoolahan.-"What of it?" Will, Oi'll have to subscribe to the Scientific American, so's to know how to swear at the dom thing!-From Puck.
of December 3,1898 , which has 208,000 pounds on the drivers. The total estimated weight of the locomotive in working order is 208,000 pounds, as against 230,000 pounds for the Pittsburg engine. The weight of the pouder loaded, is 104,600 pounds. The driving whe tender, loaded, is 104,600 pounds. The driving wheels are 5 inches in diameter
These engines, which are known as Class $\mathbf{H}-5$, are giving great satisfaction. On one occasion one of them hauled, from Altoona to Columbia, a distance of 161 miles, against a maximum grade of 12 feet, a coal train of 130 cars. The total length of the train was 3,877
but the piston in the main chamber of the hammer head will continue to move down against the resist ance of the air cushion in the cylinder connected with the auxiliary chamber. By this means a strong pres sure is brought to bear upon the work in addition to the blow.

It will be observed from our engraving that the driving pulley and connected rotary parts are mounted in the base of the machine, whereby the sway and vibration which would be caused by placing tnese parts higher, is reduced to a minimum.

CARRARA AND ITS QUARRIES.
Carrara marble is known throughout the world, yet few of the many tourists who are whirled along the Mediterranean Railway from Rome to Genoa ever stop to visit the spot from which this famous stone is obtained. Carrara lies on the railway bet ween Pisa and Florence, and an excursion to the Carrara Mountains is not difficult. Carrara itself is hardly worth visiting, being simply an aggregation of homely houses on the banks of a muddy torrent ai the base of the mountains. The mountains themselves can be seen even from the lins of the Mediterranean Railway, the marble cropping out in numerons places. All the inhabitants of the little town are directly or indirectly interested in the quarrying, working, and shaping of the marble, and the glare of marble dust and marble meets ble dust and marble meets
one on every side. The marble quarries are entirely differble quarries are entirely differ-
ent from what might be exent from what wight be ex-
pected, and in place of craning the neck to gaze down into the bowels of the earth, one only has to admire the long, irregular rift in the flank of the mountain, for the quarrying is all done on the surface and does not require the construction of pits or galleries. The quarries have been likened by onc writer to a cascade of water suddenly hardened into stone.
The percentage of men who meet horrible deaths in the quarries is very large, notwithstanding the fact that powder and not dynamito is used. Of course many of these accidents are caused by carelessness on the part of the workmen, but these could, in nearly every case, be safeguarded against by proper appliances. When the great blocks are once detached, they either roll down the mountain or are lowered to the desired place by means of ropes and tackle. No machinery is employed, and all the work is done with the crudest appliances. A blast is announced by three long notes on a horn, but little attention seems to be paid to this signal by the workmen, and many terrible accidents result in consequence.
A few years back, when accidents occurred, the cathedral bells were tolled to give warning to the people; but owing to the anxiety and anguish of thousands of poor families on hearing this grewsome sound; the custom has now been abolished, and the workmen all leave the quarries as soon as an accident occurs, in order to assure their families of their safety, and they are allowed their are allowed their full day's pay. The pay of the workmen is
wretched, varying from sixty to eighty cents a day. A blast is very exciting to a stranger, who is usually accompanied by a guide, who contrives to get him in a place get him in a place
of absolute safety of absolute safety
during the explosion. The marble is blasted high up on the peak, and the pieces bound or leap downward until they strike some obstruction some obstruction
or the valley or the valley
below. Formerly all of the im mense chunks of marble had to be transported by primitive carts hauled by oxen, but now the rail. way affords an easy means of transporting to the market, and one of our engravings shows


THE CARRARA MOUNTANNS, SHOWING RAILWAY TO QUARRIES.
rara marble has been a favorite with sculptors for nearly two thousand years, and to-day it is nearly al nearly two thousand years, and to-day it is nearly al-
ways used by the sculptor in preference to marble ways used by the sculptor in preference to marble
from any other locality. It is also largely used in decorating churches, such as altars, etc. We have al ready illustrated in the Scientific American Sup plement for February 12, 1898, the interesting quarries at Serravezza which Michelangelo exploited by thi" order of Leo $\mathbf{X}$. The methods of sawing and workil:the stone at Carrara are vei! much the same as those de scribed in that article.
School of Public Health. The council of New York University has set apart buildings near First Avenue, between 25th and 26 th Streets, for the use of a school of public health. There is a bill in the Legislature to provide in the Legislature to provide for the maintenance of the
school for the year which school for the year which
will begin October 1, 1899, by appropriating the sum of $\$ 25,000$. The object of the new school is the promotion of public sanitation in all its branches and specially in the prevention and cure of dis eases, by scientific investigations and the giving of free instruction in all methods and appliances for the prevention of disease. Free in struction is to be given to properly accredited sanitary officers, both lay and medical. of all the districts, towns, and cities throughout the State in matters pertaining to thei official work. The school also calculates to give experimental training in sanitation to engineers of all kinds, civil,

An interesting excursion is to one of the quarries which were worked by the Romans, and the quarries show how primitive were the means employed by men of antiquity. They first marked out the block upon the solid mass, and they actually cut it out by hand labor. In many places one can still see blocks which lie embedded in the rubbish caused in quarrying and shipping them. The Romans split their blocks into slabs by inserting wooden wedges and keeping them continually wet until the swelling of the wood burst asunder the stone. A Roman altar was unearthed some years ago near the quarries, and a few rusty implements have also been discovered

The views from the mountain are superb. To the east lies Tuscany, and to the south, on a clear day, can be seen the blue coasts of Corsica and Sardinia. Car mechanical, mining, etc., to public school teachers, to sanitary inspectors of schools and factories, to in spectors of foods, sanitary inspectors of charitable institutions, and to all others who hold officia positions which involve any responsibility for public health. It is to be also promoted by laboratory re searches and scientific investigations. The public is to be instructed in all sanitary matters by university extension work. It is also calculated to render exper chemical and bacteriological assistance to the Board of Health and to public health officers. A hygienic museum will also be established.

## of Sir Douglas Galton

Sir Douglas Galton died recently in London, at the age of seventy-seven. He was chiefly known in con


LOADING THE MABBLE; QUARRIES OF CABRARA. nection with his work in railway engineering and sanitary science. in both of which fields he was a great authority He also rendered important servic in the cause of subuarine tele graphy. In 1858 when the Atlantic cable had broken down and the Red down and the Red Sea and Indian telegraphs $h$ ad proved a failure, the British government appointed a com mittee to investigate the subject of subinarine telegraphs, a n d Sir graphs, and Douglas was ap pointed chairman
of the commitof the commit-
tee. In 1861 he tee. In 1861 he
published a re port which is most valuable collection of fact concerning sub marine cables. He acted as Gene acted as General Secretary of th British Associa-
tion for twentytion for twenty-
five years, and he has also been President of it.

Archæological News and Notes.
Some beautiful frescoes have recently been discovered in the church of the Frari, in Venice. They had been covered with whitewash in the seventeenth century.
Chæroneia's famous lion is to be restored and set up on the battlefield by the Archæological Society of Greece.
Money is being collected in England to help restore the belfry tower of the cathedral of Ravello, on the hilltop above Amalfi. It is necessary to strengthen and preserve the tower, as it is in a dangerous condition.
"Themis ocles Phrearios" is scratched on an antique potsherd just dug up in the Areopagus at Athens. This is believed to have been one of the votes cast some twenty-four hundred years ago to ostracize the victor of Salamis.
The men-of-war of the ancient Romans had a crew of about two hundred and twenty-five men, of which one hundred and seventy-four were oarsmen working on three decks. The speed of these vessels was about six knots an hour in fair weather.

A massive silver goblet weighing over two pounds has recently been found at Windisch, the old Vendonissa, in the Canton Aargau of Switzerland. The goblet had been hidden with great care, probably by some Roman soldier. The work shows a warrior in armor with a Mercury and an ox.

It was rumored some time ago that France proposes to sell at auction the picturesque ruins of the walls of Aigues Mortes, the now silted-up port from which St. Louis, King of France, set out on his last crusade. It is said that the government also intends to sell a part of Mont Saint Michel to a company that wishes to build a casino.

An interesting discovery has recently been made in the Palace of the Senators at Rome, usually known as the Capitol. For several days workmen had been employed to remove a wall which sbowed signs of weakness, and in the course of the demolition a number of mediæval frescoes were discovered, the colors being extremely well preserved.
Naples' Castel Nuovo, the stronghold of the Angevine kings, lying between the royal palace and the harbor, is at last to become visible by the removal of the inclosing walls and shops built up against them. Under the Bourbons the castle was used for a dungeon for political prisoners and many of them were sho in the castle ditch without the formality of a trial.
The first ruins brought to light in the island of Milo are those of an ancient acropolis; there were also discovered the structure of three towns, each built over the other, and two of them, as indicated by the style of the fragments and vases, belong to the Mycenean era. The third lies next to the rock. The acropolis belongs to the island epoch before the introduction and development of Mycenean art. The excavations are regarded as very important.
When the English captured the city of Benin, they found and sent to the British Museum some three hundred remarkable bronze castirgs. These present animals and human figures with various ornaments in relief. The lines are strong and the workmanship of great beauty. The origin of these castings ${ }^{-}$greatly puzzles ethnologists. It is now thought by some archæologists, notably Mr. Read, of the British Museum, that they were the work of some European bronze founders who settled there in the sixteenth century.
A few months ago the Italian archæologist Signor Franceshini discovered in the church of Santa Croce, Florence, Italy, the tomb of Lorenzo Ghiberti, the designer of the famous Baptistry gates. He also found at a later time in the convent church of Sant Ambrose six famous graves containing the remains of the Florentine sculptor Mino, of Fiesole; Andrea del Verrocchio, the Florentine sculptor, goldsmith, and painter, who was the master of Leonardo da Vinci ; Simone Pellaiuolo, Andrea Sansovino, the sculptor; Granacci and Leonardo Tasso.
In the cathedral of Genoa, Italy, is preserved, and has been for 600 years, a vase of immense value. It is said to be cut from a single emerald. It is $121 / 2$ inches in diameter and its height is $53 / 4$ inches. It is kept under several locks, the keys of which are in different hands, and it is rarely exhibited in public, only by an order of the Senate. A decree passed in 1476 forbids anyone going too near the precious relic. A Genoese antiquary has written a book to demonstrate that this vase was one of the gifts made to Solomon by the Queen of Sheba. It would be interesting to know if this vase has ever been carefully examined by a gem expert of reputation. It seems almost impossible that a single crystal of emerald of anything like the size could be obtained, and that it could be cut. Unfortunately, many of the precious jewels preserved in Italy shrink wonderfully in value when examined by the expert. Thus many of the jewels on the Bambino, in the church of Aracoli, in Rome, are practically worthless.

A NOVEL INSULATOR.
To provide a device which will serve both as an insulator and as a bracket for sustaining a wire, and which is adapted both to exterior and interior wiring, is the purpose of the invention illustrated in our engraving. The insulator, it will be observed, has a body portion eccentrically pivoted so that it can swing. The lower and heavier portion of the body is provided with three studs separated by grooves. Of these three studs, the central one is triangular in shape and is undercut to form an overhanging end. The two remaining studs are also provided with overhanging ends. In placing a heavy wire on the insulator, the body-portion may be rocked, and the wire laid in one of the grooves. By rocking the body-portion to the opposite


## BLOES' AND HARLOE'S INSULATOR.

side, the wire may be laid in the other groove and on the triangular central stud. In this manner the heaviest wire may be bent upon the insulator with ease. If it be so desired, the wire may be further secured in place by a fastening, as shown in the illustration; but the use of such a fastening is not always necessary. By mounting the body portion so that it can rock, the insulator is enabled to yield to the sag of the wire and is not readily jarred or broken. The insulator has been patented by the inventors, Wilton S. Bloes and Morton Harloe, of Peckville, Penn.

A SIMPLE VENTILATOR FOR RAILWAY-CARS.
The invention which forms the subject of the accompanying engraving is a ventilator which is designed to produce a thorough circulation of air in a railway car or other vehicle, without admitting dust or cinders. The invention has been patented by Lawrence White, of Dallas, Tex.

The ventilator comprises essentially two shafts, which carry the ventilating devices and which are connected by driving-mechanism.

Of these two shafts, one is vertically journaled in a bearing in the top of the car, and at its lower end is provided with a fan surrounded by a wire cage. Secured to an idler on the shaft above the fan is a cord, by means of which the shaft can be raised if desired.


At its upper end the shaft loosely receives the two arms of a vane.
In a bearing in this vane, the other shaft is horizontally journaled. This horizontal shaft is provided at its inner end with a bevel-gear meshing with a bevel-gear on the vertical shaft, and is provided at its outer end with a windwheel.
In the operation of the ventilator, the vane will automatically shift according to the direction in which the train is traveling, so that the current of air induced will revolve the wind wheel. This motion will be communicated to the vertical shaft by means of the bevel-gears in order to drive the fan within the car. When it is desired to stop the fan, the cord secured to the idler is pulled, thus raising the vertical shaft and throwing the bevel-gears out of mesh.

Sclence Notes.
$F$ During the recent religious fêtes in Turkey the government sent police officers to all of the druggists' shops to seal up packages of potassium chlorate in order to prevent its use in the manufacture of explosives.
M. Georges Claude has recently made experiments on the explosive power of acetylene at low temperaon the explosive power of acetylene at low tempera-
tures. He finds that the solubility of acetylene in acetone increases very rapidly as the temperature diminishes, acetone at $-80^{\circ} \mathrm{C}$. dissoiving more than 2,000 volumes of gas. Platinum wire may be kept at a red heat in this solution without any explosion taking place. Liquid acetylene at $-80^{\circ} \mathrm{C}$. behaves admirably.
Norway has passed a law prohibiting the sale of tobacco to any boy under sixteen years of age without a signed order from an adult relative or an employer. Foreign travelers are also forbidden to offer cigarettes to boys, and make themselves liable to prosecution if they do so. The police are required to confiscate all the pipes, cigars, and cigarettes of boys who smoke in the public streets. A sliding scale of fines is provided. They vary from 50 cents to $\$ 25$.
Word has reached Shanghai from Yachow, in the interior of China, of the safe arrival there of the French explorer and adventurer M. Benin, after many narrow escapes from death on the trip through Thibet. After Mr. Landor's remarkable adventures in Thibet, we do not understand why any other traveler would wish to run the chances of going through the same ordeal. The people of this strange land are certainly within their rights if they do not desire the visits of foreigners, and resent their trespass.
Bonn on the Rhine has been investigating the liquor drinking habits of its small children. Out of two hundred and forty-seven children of the age of seven and eight years in the primary schools, there was not one who had not tasted beer or wine and about one-quarter of them had tasted brandy. Beer or wine was drunk regularly every day by one-quarter of them. Eight per cent received a daily glass of cognac from their parents to make them strong, and sixteen per cent would not drink milk because they said "it had no taste."
The Judge Advocate-General of the Navy has rendered an opinion which has been indorsed by the department, relative to the question of the staff officers of the navy having a title of rear-admiral while serving as chiefs of the Navy Bureau. He has decided that officers of the line, serving as chiefs of bureaus, must be addressed by their actual titles in the line, notwithstanding the fact that they have the rank of rearadmiral while holding an office as head of the bureau. Should a rear-admiral receive such an appointment, he would, of course, receive the full title of his position.
We have often spoken of the danger of contamination of wells by sewage, and a striking confirmation of it was offered when the water works machinery of a Maryland town of three hundred inhabitants broke down. For one day, water from an old well was used. Ten days later there was an outbreak of inflammatory intestinal disorders, and three cases of typhoid fever resulted. The water was tested and found to contain not less than 4,100 bacilli in one cubic centimeter, which is, of course, equivalent to about fifteen drops. The regular water supply contained 80 bacilli to a centimeter, which cannot be considered very satisfactory.

Recently a street car on Lenox Avenue, New York city, was set on fire by electricity and burned, and a car of the Sixth Avenue underground electric line was also burned a few days later. This seems to threaten a new danger to citizens who depend upon street cars operated by electricity as their usual means of conveyance. Fortunately no one was injured in either case, but had the cars been very crowded, it is very possible that serious physical injuries might have been inflicted. Such fires have occurred on electric cars ever since the beginning of electric railroading. Fortunately, they start outside the car, so that chances are given to the passengers to make their escape. It would not be at all a bad idea for all electric cars to carry a small fire extinguisher. This is done on many steam railroads and on the Brooklyn Bridge.

According to the correspondent of The Daily Chronicle, the irrepressible Szczepanik, the young inventor, has presented the Emperor Francis Josef with the first web produced by means of his photographic process. It is about two meters square and gives an allegorical representation of homage to the Emperor. It is said the work contains $200,000,000$ crossings, 120 silk threads filling one centimeter. Two hundred square meters of pasteboard cards would have been necessary to produce this web according to the methods now in vogue, and designers would have required many years to carry out the work. It is said the work was done in five hours. Unfortunately, all of Herr Szezepanik's inventions are shrouded in mystery. However, at the coming World's Fair he promises to unbosom himself, and we shall probably have to wait until that time for explicit details of his inventions.

## FRENCH SUBMARINE TORPEDO BOATS

(Continued from first page.)
to rise quickly to the surface in case of emergency. As the boat was built merely for experimental purposes it did not carry any torpedo or torpedo tubes. The illustrations which accompany this aricle show th "Gymnote" at the surface of the water just afte making one of her trial plunges, and the other shows her traveling at the surface with the crew standing upon the bridge or navigating platform which extends amidships on the upper part of the hull. This plat form was added subsequently to the first construction of the vessel and does not appear in the sectional view. The tall tube which stands vertically just in front of the pilot house is the " Prismoscope," which is designed to be used when the vessel is submerged, for the purpos of keeping the enemy in sight and determining the bearings of the vessel itself. The upper part of the tube is capable of being bent at right angles and directed to any part of the horizon, so as to give the navigator below an all-round view.
The trials of this little craft were so satisfactory that Zede determined in 1890 to build a boat of the same type, but of much larger dimensions. The vessel which was at first known as the "Sirene," was in later years known as the "Gustave Zede." After construc tion had been commenced, a few modifications wer uade in the original plan, such as the substitution of bronze for steel in the construction of the hull and the addition of a platform for use at the surface of the water. Particulars of the vessel areas follows: Length 147 feet ; diameter, 10.75 feet; displacement, 260 tons The hull is of the general cigar shape, with long and harply pointed ends, and its model conforms more nearly to the earlier patterns of the Whitehead torped han to the later pattern, which has a short, blunt head The maximum speed on the surface is 14 knots, and bout $81 / 2$ knots when submerged.
The vessel carries a torpedo discharge tube, which is located in the nose and lies in the longitudinal axis of the boat, and a supply of Whitehead torpedoes con taining a charge of 220 pounds of guncotton. It carries complement of ten men
The "Zede" has been the subject of long and tedi ous experiments, and for two years, during which the ship lay idle, nothing whatever was done upon her. During the ast year, however, the experiments have been carried on with very promising results, and her successful experimental attacks upon the French battlehip "Magenta" which were made both while the latter was at anchor and in motion, have won for this vessel a world-wide reputation. These experiments were carried out in the vicinity of the Hyeres Islands, and the series was terminated by a trip of about 40 miles from Toulon to Marseilles, during which the "Zéde" behaved exceedingly well, in spite of a somewhat rough sea. After reaching Marseilles the accunulators were still sufficiently charged to enable the boat to make the return trip to Toulon, thereby provng that their capacity is equal to a continuous run of from 75 to 80 miles. It is thus seen that the boat, if used in defense of a blockaded harbor, would have a radius of action extending 35 miles in any direction.
It has been decided to construct another vessel, to be known as the "Narval," which shall be an improved "Zede," with a greatly enlarged radius of action. The "Narval" was put upon the stocks last year and will be pushed energetically to completion
lt is needless to say that these successful experiments with the "Zéde" have provoked widespread comment, both favorable and adverse. In the first rush of enthusiasm the average Frenchman sees himself in the possession of a weapon which neutralizes at a stroke the invincible powers of the battleship; but as a rule the professional men of the army, and particularly of the navy, have estimated the new vessel at its true worth. Vice-Admiral Dupont, an old and experienced naval officer, has recently warned his countrymen in the columns of the Gaulois against jumping to hasty conclusions regarding the possibilities of the submarine class of war vessels. He says :
"The recent trials of the 'Gustave Zede,' the presence of the Minister of Marine at these trials, and especially the note, in a certain sense official, which gave forth to the world the success obtained, seem to me to have somewhat excited public opinion, which, always ready to overshoot the mark, will conclude, if care is not taken, by attributing to the submarine boat qualities which it cannot possess and a condition of perfection which has not yet been reached. From this point to attributing to them a part which they can never play in warfare, and forcing our naval constructions on a wrong road, is but a single step. It is necessary that on the question of submarine vessels, the public should clearly understand that, in a naval war, they have no other than the extremely limited mission of rendering difficult and sometimes dangerous the blockade of a friendly port. It is certainly something, but. that is certainly all. It is a question of a weapon offensive in
its employ, but purely defensive in its action, especially and almost exclusively necessary for those navies which cannot acquire the supremacy of the seas. The British have never been mistaken. Owing to the undoubted power of their fleet making it improbable, almost impossible, for one of their ports to be blockaded, they have concerned themselves very little with tor-pedo-boats, preferring to build destroyers with which to annihilate these vessels, and they only seem to have slightly concerned themselves with the submarine navigation question."

The admiral deprecates such hasty action as would be involved in the immediate construction of a fleet o submarine ships, and urges that the French govern ment should conduct further and more exhaustive ex periments with the "Zedé" in order to determine her exact powers of attack and defense.
Our accompanying illustrations show the external appearance of the submarine boat when she is traveling at the surface. The photograph from which the engrav ing was made wastaken on the homeward trip when the "Zede" was returning from its experiments in diving The crew is grouped about the conning tower on the narrow deck or platform; the officer and two of themen are standing upon a kind of poop which is reached by means of a ladder. The hatches are on a level with the platform, which latter, as we have said, was added subsequently to the completion of the vessel for the purpose of facilitating the boarding and debarkation of the crew. The longitudinal section shows in detail the interior arrangements of the vessel $L$ is the tor pedo discharge tube, shown with a torpedo lying within it ready for firing. To the rear of the tube is a rack, $J$ carrying a torpedo, $X, A, A, A$, represent the storage batteries, and $D$ the motor; $P$ is the conning tower and below and forward of it is the steering wheel, $H$ $G, G$, are the vertical rudders for steering the vessel in a horizontal plane, and horizontal rudders which con trol the diving and submersion are arranged on each side of the boat.

## Discovery of a Mammoth.

On February 8, a Swede and his partner, while mark ing their claim on Dominion Creek, discovered, accord ing to a Dawson newspaper, a body of a mammoth 40


SECTION THROUGH THE SUBMARINE BOAT "GYMNOTE."
eet below the surface. The story was that the body was in a perfect state of preservation. Unfortunately here were no scientists in Dawson to examine th body, but, according to press statements, it measured $441 / 2$ feet long. Its right tusk was broken, but its lef tusk was perfect, so that it was probable that the righ usk may have been snapped off in the fall that cause ts death. The tusk which remains measures 14 feet 3 nches in length and 48 inches in circumference. Th lesh was covered with woolly hair 15 inches long, o a grayish-black color. The neck was short and the limbs long and stout, the feet short and broad, and had five toes. The flesh was cut and tasted sweet. Mam noth flosh has been tasted on other occasions. It is ery unfortunate that an expert geologist was not upon the ground at the time of the find, as it is of consider able importance.

## Acetylene Gas Congress.

An international exhibition of acetylene gas methods and appliances will be held in May at Budapest, Hungary, in connection with the second International Acetylene Congress. The industrial palace will be utilized for the exhibition, and silver and gold medals will be awarded. The deliberations of the con gress will bear upon the theoretical and practical questions relating to carbide and the acetylene gas industry. It will discuss the standard methods for the control of carbide and acetylene gas and the best means for removing the obstacles which prevent the general use of acetylene gas. Anyone who is interested in the industry may become a member of the congress upon the payment of five florins, and he will then receive the publications of the congress. The secretary is Bela Szasz, Budapest, Hungary.

A Scheme to Fortify Hart's Island.
There is reason to believe that the United States government intends taking Hart's Island in Long Island Sound for the purpose of fortification, and that a number of disappearing guns of large caliber will be mounted on the highest point of the island, which commands the Sound. The government has already made surveys. There are a number of buildings on Hart's Island, which were formerly used by the city and State for charitable purposes. The plateau on Hart's Island is 500 feet long and 250 feet wide and stands exactly at the entrance to Long Island Sound.

## Sorrespondence.

## Correction

To the Editor of the Scientific American
On page 178 of the Scientific American for March 25 , I regret to see an announcement that Prof. Thomas J. See "has been designated as Chief of the Nautical Almanac, to succeed Prof. Newcomb." This statement is without a shadow of foundation in fact, and I trust you will correct it, in order to avoid misleading the very large number of persons interested in science who rely implicitly upon your valuable paper. Prof. See has been assigned to a subordinate position in the Naval Observatory, and has nothing whatever to do with the Nautical Almanac Office

William Harkness.
$\begin{array}{cr}\text { March 27, 1899. } & \text { Professor of Mathematics, U. S. N. } \\ \text { Director, Nautical Almanac. }\end{array}$

## The 1898 Stamp Issue

To the Editor of the Scien'tific American
During the year 1898 the United States Bureau of Engraving and Printing issued $2,500000,000$ of the common red two cent stamps-enough to go almost twice around the earth. Stacked one upon another, they would pile up 150 miles beyond our atmosphere, equal in weight to two of our big locomotives, and would make a blanket to keep the frost off the city of Wash ington. If these stamps worked in relays, each taking the letter as far as allowed by the postal regula tions, the letter would be carried beyond the most re mote star ; and, at the fastest speed at the disposal of the postal authorities, would occupy millions of times the age of the earth in transit.
Washington, D. C.
C. Francis Jenkins.

## The Strangest Insect in the world.

To the Editor of the Scientific American :
With reference to Mr. Fitton's letter, page 103 of the Scientific American of February 18, 1899, the " night butterfly" mentioned by him evidently refers to the large moths Hepialus virescens and rubriviridans, from $41 / 2$ to $51 / 4$ inches in expanse of wing, viredans, from $41 / 2$ to $51 / 4$ inches in expanse of wing, vire-
scens being the smaller of the two ; the former is a beautiful green insect with satiny white upper wings marked with irregular darker green lines, and with whitish green under wings, the latter having green upper wings with dark reddish brown markings, and under wings of a pale rust color. Both are tree borers, not root feeders, as stated by some writers, so far as my experience goes. Virescens bores principally in the wood of the New Zealand currant, Aristotelia racemosa or wineberry tree, as the settlers call it, and rubriviri dans in that of the Manuka leptospermum and Rata melrosideros robusta. They are believed to be at tacked by Robertsii, and are distinct species from the large brown moths of the genus Pielus, whose cater pillars are also attacked by the same fungus. With re gard to the mode of attack, the root feeders might be come impregnated by burrowing in the ground in search of food by the spores lodging in the folds of the skin of the neck or other parts of the body, as simi larly suggested by Mr. Gray in his " Notices of Insects," pages 6,7 , or the larvæ might swallow the seed with their food; but whether the spores would survive the destroying influence of the gastric juices of the cater pillar's stomach, I could not say, unless the animals were in such an enfeebled condition by the excessive moisture of the ground as to be unable to resist the germination of the fungus, in which case both Mr . Taylor and Mr. Colenso are of opinion that it would gain the upper hand. The soil would no doubt be well supplied with spores washed into the burrows by the heavy spring rains, and as the fibrous roots spread far and wide and many lie near the surface, it may not after all be so difficult to conceive how the fungus gain a permanent hoid of the bodies of the caterpillars.
Mr. Fitton states that he has observed the fungus in many stages of growth, undeveloped imagos, and rem nants of moths scattered in the vicinity, the latter pro bably the work of the New Zealand morepork ow thene. Novae Zealundiae or as the Maoris term it Kainanga. A collection of such objects is very desir able, as it would, no doubt, tend to verify much that has been said on the subject or correct erroneous impressions. These remarks by no means settle the question, but I think it may be safely conceded that the mystery in which the vegetable caterpillar has been so long shrouded is now in a great measure solved

George J. Grapes
5 Terrace Road, St John's, Newport, Isle of Wight England.

More Workmen for the Panama Canal.
The officials of the Panama Canal Company have decided to send agents on March 24 to Jamaica for the purpose of securing 500 to 1,000 additional laborers to work on the canal.

CAUSE OF THE RECENT EXPLOSION OF THE TENINCH GON AT SANDY HOOK EXPLAINED by hudson matim.
At the Sandy Hook proving grounds, on Wednesday March 29, a ten-inch gun burst, killing one man and wounding several others, the gun being literally blown to fragments.

According to newspaper accounts of the disaster a full charge of 141 pounds of smokeless powder had already been fired, registering a pressure of only 33,000 pounds to the square inch. A suall addition to the charge was made for the next round, about enough, it was intended, to bring the pressure up to 35,000 pounds

The pressure gage found after the explosion indicated a pressure up to its full capacity of 79,000 pounds to the square inch. How much the pressure was which burst the gun there is of course no means of knowing but it is probable that it exceeded 100,000 pounds.
This is not- the first time that smokeless powder has shown itself to be very erratic. The reason for such tremendous mounting of pressure on the addition of but a small quantity to a charge which had previously given only 33,000 pounds to the square inch is a prob lem which requires careful consideration. The writer believes he can explain the curious phenornenon and the cause of the erratic action. He also believes that the remedy here suggested, if and when adopted, wil avert further disaster.
The writer understands that the smokeless powder grains which were used in the above test were in the form of cylinders about three diameters long, and longitudinally perforated with seven holes (see Fig. 1). In loading the gun these grains are filled into bags, which are placed in the powder chamber, the bags approximating in diameter the size of the powder chamber. On firing, the powder charge is ignited by a small flash charge of black rifle pow der. When all goes well, the combus tion of the grains progresses regularly from all the exposed areas, both out side and inside of the grains, as explained and illustrated on page 31 o the Army and Coast Defense number of the Scientific American Supplement, July $9,1898$.
As smokeless powder burns with a rapidity in creasing with the pressure, the combustion within the perforations is somewhat more rapid than upon the exterior surfaces of the grains, owing to the work re quired to displace the products of the combustion as formed. Fig. 1 shows the grain before being fired, having equal burning thicknesses between the per forations and between the outer circle of perforation ond the corer shows the same grain partially consumed by firing in a gun too small and under too low a pressure to effect complete consumption. This grain was recovered in front of the gin after firing, having been ejected from the gun end on with great ve locity, so that the rush of cold air through the perforations extinguished the flame. It will be observed that the remaining unconsumed walls between the perforations are wuch thinner than the outer and circumferential wall of the grain. This evidences considerably more rapid combustion within the perforations than upon the outer urfaces.
If we were to take a longitudinally perforate cylinder of smokeless powder, say eighteen inche n length, and ignite one end of it, and allow it to be burned in the open under atmospheric pres sure, the flame would run along through the per orations and jets of flame would be thrown out at both ends with great violence, until the pressure mounted sufficiently high to explode the grain, blowing it into fragments at its central portion. If we take a similar rod or grain about 8 inches long and ignite it in a similar nanner, we shall find that it will not explode as in the other instance. If, however, instead of burning this shorter grain in the open, we should place it in a gun and fire it under considerable pressure, it would burst, owing to the increased rapidity of interior combustion, with proportionate increase of internal pressure in excess of external presure. Fig. 3 illustrates a grain which has been shattered by internal pressure
As the external pressure upon the grains is increased, the internal pressure rises in due proportion, so that a length of grain and size of perforation which will not burst under atmospheric pressure will burst in a gun when the conditions of confinement become such that the internal pressure becomes so much in excess of external pressure as to exceed the bursting strength of the grain. Similarly, a length of grain and size of perforation which will stand without bursting when fired in a gun under a given pressure may not stand if the pressure be increased.


## 6.-SKETCH SHOWING POWDER JAMMED IN THE COMPRESSION SLOPE OR NECK

 OF POWDER CHAMBERsay, of 50,000 pounds to the square inch, or even somewhat more, would yet be disrupted under a sufficiently high pressure, say of 75,000 pounds. Consequently, it is not likely that the bursting of the grain in the above test was due simply to the sudden mounting of the pressure occasioned by the slight addition to the charge. It is probable that another cause operated to mount the pressure abnormally high and beyond the bursting limit of the grains, and which, coacting with their disruption, raised the pressure to a tremen dous height and destroyed the weapon.

abutment of the alexander iil. bridge.


THE 1900 PARIS EXPOSITION-FOOT BRIDGE FOR USE IN CONSTRUC
TION OF THE ALEXANDER III. BRIDGE.

Let us consider what probably took place. The flash charge set the whole charge forward against the projectile, and rammed it into the contracted neck of the powder chamber, where it narrows down to the rifled portion. The products of combustion set free at the rear of the charge, finding vent only by passing through the charge to follow the projectile along down the bore, produced a considerable excess of pressure at the rear of the charge, which tended to jam the forward portion still harder into the narrow neck (see illustration, Fig. 6). As a result of the excess of pressure at the rear of the charge and the impeded escape of the gases through the jam, the grains constituting the jam were more or less crushed, presenting a greatly increased burning area, with corresponding increase of pressure, which was sufficient to blow up all of the uncrushed grains, increasing still more, and to an enormous degree, the burning areas, and resulting in a pressure sufficient to burst the gun.
The substance of the powder grains under consideration is a very hard and vitreous colloid, and although it possesses considerable tensile strength, being by no means fragile, yet it is capable of being readily crushed or blown into fragments.
Explosive compounds are burned in two ways, one from surfaces, the other by what is called detonation, where the explosive is consumed nearly simultaneously throughout its mass by a wave action.
If a grain of smokeless powder be cut up into a fine sawdust and confined, and fired with a strong exploder, it will detonate like dynamite. Fibrous guncotton consists, in reality, of fine tubes, whose walls consist of a vitreous colloid, and the difference between guncotton in a fibrous state and that of the hard colloid used for smokeless powder is one of difference in the amount of surface presented-a difference in physical condition.

If a piece of smokeless powder be dissolved in acetone, and poured in a fine stream into water, the water will absorb the acetone and precipitate the smokeless powder compound in a fine state of division, with a fibrous texture resembling very state of division, with a fibrous texture resembling very
closely the original guncotton. This substance will detonate with the same ease and violence as fibrous guncotton ; and, if the smokeless powder contains a percentage of nitroglycerine, the artificial fiber thus produced will detonate with even greater violence than guncotton.
The foregoing considerations make it easy to understand how the disruption or crushing into fine fragments of powder grains in a gun can cause the pres sure to mount to a degree approaching that which would be produced by detonation.
The writer believes that the higher and higher ballistics which are constantly being sought, and the higher and higher pressures that are being employed to attain the highest possible velocities, will require a modification in the present form of powder granulation now adopted by this government. Although the writer is himself one of the inventors of this grain, he does not believe that the longitudinally perforated grain is the ideal form for the attainment of the highest ballistics. If the grains be shortened so that higher pressures may be had without danger of disruption, we still have the-same danger of jamıing into the forward end of the powder chamber. Furthermore, as the grains are cut shorter, the amount of initial burning area is increased, with consequent lowering of the ballistic qualities of the powder.
The writer believes that the grain shown in Figs. 4 and 5, made in lengths of, say, eighteen inches, and having a thickness of from three-quarters of an inch to one inch, and a width of from one inch to one inch and one-half, and mul tiperforated in the manner shown, is a much preferable form. The burning thicknesses between the perforations should be adapted to the caliber of the gun in which the grains are to be employed. Such a grain packed into the powder chamber in a longitudinal direction to the bore would be inca pable of jamming, while the initial area per unit of weight of material would be even less than that now presented to the flame of ignition by longitudinally perforated grains The perforations could also be made smaller without danger of disruption from interna pressure, and a greater increase of burning area secured.
While finely granulated smokeless powder, or a smokeless powder sawdust above de scribed, may be made to detonate like dyna mite, yet it must be borne in mind that the pressure necessary to produce the detonative wave in such material is very high indeed and much higher than ever could be attained in guns under normal service conditions. It is probable that the hard colloid of which
the grains were composed which blew up the 10 -inch gun would not detonate under 100,000 pounds to the square inch, although the rapidity of combustion under that pressure would be very great. To detonate the compound, it must be subjected to a sudden pressure sufficient to force upon the constituent molecules a rearrangement. It is probable that the powder did not detonate in the 10 -inch gun in the true sense of the word.
It is probable that had there been placed in the gun, with the charge which exploded it, a piece of powder material of the same size and character as the grains fired, but without any perforations, it would not have been all consumed.

A GLIMPSE OF THE PARIS EXPOSITION OF 1900.
by cearles riceards dodge.
The grounds of the Paris Exposition of 1900, lying within the city, comprise four plots or tracts, two of which, the Champ de Mars and the Esplanade des Invalides, are situated south of the Seine, with two lesser tracts, the Trocadero grounds and the site of the Art Palaces, situated on the north side situathe Seine The side tract, the Champ de Mars, tract, the Champ de Mars, and the Trocadero grounds just across the Seine, are connected by the Pont d'Iena, and thus form one section. A second section is formed by uniting the Esplanade with the plot taken from the city park system, the two being united by the beautiful Alexander III. bridge. in process of construction. These two sections are connected along the Seine by


THE 1900 PARIS EXPOSITION-INTERIOR OF THE SMALLER ART PALACE.

Seine has been encroached upon, and the embankments extended further out into the stream on either side at large outlay, the surface of the new embankments being at a lower level than those at present existing.
When in Paris recently it was my good fortune to be permitted to go through the ateliers of the Exposition. for the present located in that portion of the old Palais l'Industrie still standing, where are to be seen the plaster models, in exquisite detail, of two palaces of art, models of portions of the bridge structure and its approaches, besides many beautiful models and designs of art work to be used upon the bridge and to enrich façades of Exposition buildings now in process of construction.
The Grand Palace of Fine Arts, which will house the treasures of sculpture and painting of all nations at the Exposition, is on the west side of the Avenue Nicholas II. and quite near the famous Avenue des Champs Elysees. Prizes to the value of 45,000 francs were offered for designs for this building. The design of M. Louvet was selected from sixty competitors, and the first prize of 15 ,000 francs was awarded to this architect. The accompanying illustration shows the fine massive proportions of the Grand Palace, which is constructed of cut stone, the same that is used so largely for building purposes in the city of Paris. The palace is provided with two grand staircases, and will have an imposing entrance hall. The first floor will be devoted to a series of superl

the 1900 paris exposition-EXterior of the grand art palace.

the seine embankment coffer dam.

enlarged and completed seine embankment.
considerable spaces on either side of the river, formed by the Seine embankments, and, on the south side, by taking in Quai d'Orsay, one of the city streets. While the several sections are almost in the heart of Paris, with blocks of buildings and systems of streets between, it will be possible to fence the grounds into one inclosure, with gates at different points, so that one ticket will admit to all parts of the grounds. It should be mentioned that another section of the Exposition will be located in Parc Vintion of the Exposition will be located in Parc Vin-
cennes, eight miles distant, though directly connected with the Exposition grounds by rail, with rapid trains running at short intervals.

The main entrance to the dxposition proper will be
process of construction, which are to be permanent. To make room for these immense structures it was necessary to sacrifice the old Palais l'Industrie, and, to make the buildings themselves more imposing, a new thoroughfare is to be established, the A venue Nicholas II. Starting from the Avenue des Champs Elysees, this thoroughfare will pass between the two Art Palaces, upon which they will front vis-a-vis, and, crossing the Seine by means of the new Alexander III. bridge, will extend the entire length of the Esplanade des Invalides in a straight line, ending at the Exposition building that forms the boundary of the grounds in this direction.

In the effort to secure all available space, even the
exhibition rooms for paintings, and an enormous salon is provided for sculpture. There will also be suites of smaller exhibition rooms, besides a cafe and other rooms for entertainment or comfort of the Exposition visitors. Ample arrangements have been made for lighting all of these exhibition rooms, the upper ones, of course, being lighted from the roof.
The lesser Palace of Art, an interior view of which is shown, known as the Girault Palace, from the name of the architect whose design was accepted, occupies a position on the east side of the Avenue Nicholas II. It will be a permanent structure, similar to the Grand Palace in materials and general style, and I understand will be devoted to historical treasures, a part of the
grand retrospective exhibit which is the raison d'etre of the Exhibition of 1900 ; that is, to show to the world the progress of the past hundred years.
It is the intention of the Exposition authorities to beautify the grounds surrounding the Palaces of Ar in such manner that the landscape will connect natu rally with existing shrubbery and trees, giving a park like aspect, which will harmonize with the famous promenade, the Avenue des Champs Elysées, immedi ately to the north.
Passing from this grand promenade and drive through the new Avenue Nicholas II., to a point south of the Art Palaces, the visitor comes to the Seine, and to the extensive works now in progress on the new Alexander III. bridge, which will doubtless be one of the architectural features of the Exposition. The corner stone of this structure was laid in October 896, by the Czar of Russia. The architects of the bridge are Messieurs Cousin and Cassien-Bernard while the construction is under the immediate super vision of Messieurs Resal and Alby. It is to be a single pan bridge, 110 meters in length over all, with a width of 40 meters. While the main arch, naturally, will be of steel, the foundations will be of granite, though other stone will be used in the structure, even marble in connection with bronze, with which some ver beautiful ornamental effects will be produced. The eneral style is Louis Quatorze, with many statue and decorations; some of the ruodels for which it wa my pleasure to see in the workshops of the Exposition. Among the artists represented are Fremiet, Dalou, Gardet, Cordonnier, and others. During the construc tion period an iron foot bridge will span the Seine, just beneath which the work will go on. This foo bridge was built in sections and "thrown" or "launched "into position from the north side of the river. One of our illustrations shows its appearanc when it had only extended as far as mid-stream. The ther small illustration gives an idea of the solidity of the arch springing from the abutment. Beyond are arches to support the esplanade above, and in the dis tance are the walls of the great Art Palace. One peculiarity of the Alexander III. bridge is that the span is to have a rise of only one foot from ends to center.
The series of palaces on the Esplanade des Invalide will be devoted largely to exhibits in manufactures and the various industries. The United States has se cured ground space in this portion of the Exposition near the Alexander III. bridge, upon which to erect a building which will give about 15,000 square feet of space for various groups of exhibits.
On the Seine embankment, west of the Alexander III. bridge, will be placed some of the most interesting and beautiful struccures of the Exposition. On the south embankment, between Pont des Invalides and Pont de l'Alma, will be constructed the Palaces of Nations, in the midst of which our own beautiful na tional building will have a prominent position. While the plans of this building show a structure worthy of this great nation, it is believed that one or two buildings, to be erected by other nations, will cost more money, as they will be veritable palaces. The United States building, which will house a few exhibits of national interest, will be the headquarters and home of all good Americans at the Exposition. A little furthe along, likewise on the south side of the river, between Pont de l'Alma and Pont d'Iena, will be placed the Ex position building, to be devoted to army and navy exhibits, and beyond this the Palace for Commerce and Navigation. The United States will erect an annex near to this building on Quai d'Orsay, in which will be housed exhibits relating to our merchant marine and the United States Weather Bureau. The building has been specia.lly planned with regard to the uses of the United States Weather Bureau, and a novelty in this exhibit will be a working Weather Bureau observatory on the roof, accessible to the general public by an easy flight of stairs leading to a tower, with exit, on the roof level. The instruments on the roof are to be connected with those displayed in the exhibit hall below, in order that the public may be able to study every phase of weather observation and forecasting, including pre parations for publication and the printing of daily eports.
Another prominent building, just beyond the Merchant Marine, is the Forestry and Fisheries building, almost under the shadow of the Eiffel Tower. On the north bank of the Seine, opposite to the palaces of the foreign powers, will be located the Palace of Horticul ture and the Palaces of Social Economy and the city of Paris. The United States will have a very desirable ocation in the Horticultural building, and extensive arrangements are being made for the exhibits in this special department.
The work upon the new Seine embankments, upon which the buildings bordering the Seine will be con structed, has been in progress for many months. The manner in which the Seine is being encroached upon in order to give available space for these new building is shown in two of the small illustrations from photo graphs taken in the autumn of 1898 by the writer. Just beyond the proposed limits of the new embankment in the river double lines of piles are driven a few fee
apart and parallel with the shore. The space between is then filled in and a bulkhead is thus formed. Othe bulkheads are raised at intervals, running from the main line of piles to the shore, and, after pumping out the water which fills a particular section, the masonry work is begun. The other small illustration shows the appearance of the completed embankment, the incline on the right being the line of the river prior to the improvement. Additional temporary foot bridges are to be built over the Seine to provide ample facilities for crossing the river from one part of the exhibition grounds to the other

We have now reached the main portion of the Exposition, which may be designated as the Eastern Sec tion, and which includes the Champ de Mars and the Trocadero grounds. The latter plot, lying north of the Seine, will be devoted to the groups of buildings forming the Colonies Exhibits, some Ithirty in number, not including the Palace of the Trocadero, which was erected for the Exposition of 1878.
By far the larger portion of the Champ de Mars is covered by a series of palaces, practically under one immense roof system, which will house the following groups of exhibits: Agriculture and food products, machinery and electricity, textiles and clothing, mines and metallurgy, chemical industries, civil engineering, education, science and arts, etc. Just north of this series of connected palaces stands the Eiffel Tower, to the left of which is the palace devoted to the monster telescope, illustrated in a recent number of the Scientific American. Mention should also be made of the Annex to Agriculture, which is to be erected by the American Commission, and which fully doubles the space originally allotted to the agricultural groups

The old Palace of Machines which was used in 1889 is to be devoted to agriculture and food products, and will be known as the Palace of Agriculture. Nearly one-third of the central portion of the floor space of this structure, on Champ de Mars, is to be given up to the magnificent festival hall of the Exposition.
As previously remarked, the principal entrance, which is located very near the Place de la Concorde, and close to the Seine, will be in the form of a triand close to the Seine, will be in the form of a tri-
umphal arch, upon the face of which will be emumphal arch, upon the face of which will be em-
blazoned the arms of the city of Paris, while it will be blazoned the arms of the city of Paris, while it will be
surmounted by a colossal statue of Liberty. It is surmounted by a colossal statue of Liberty. It is
claimed that it will be possible to admit 60,000 persons per hour without difficulty.
Mr. F. E. Drake, Director of Machinery and Elec tricity for this country, states that the part which machinery and electricity will play in the coming Exposition is a more important one than ever assumed by these two great industries in former expositions. In a general way it may be said that but few important changes or improvements will be shown in the service of the Paris Exposition over the Columbian Exposition of 1893.

The great service power plant of the Exposition will occupy a favorable position in the main group of buildings. It will be installed immediately adjoining the space allotted for the exhibits of electrical and other machinery, and any benefits which might naturally accrue to the builder of machinery installed in the service plant will be accentuated by reason of its being located in close proximity to the exhibits not offered for regular service. The capacity of the boiler plants for the service of the Exposition will be approximately 20,000 horse power.

It is the Palace of Electricity to which all eyes will naturally turn at night, and as its main façade reaches across the entire width of the open plaza in the center of the Champ de Mars, splendid opportunity will be afforded for the attractive treatment of the archi tectural features of the exterior of this palace.

While the city of Paris will doubtless supply the "Midway" attractions, ad lib., there will be many novelties at the Exposition of 1900. Just across Avenue de Sutfren from the Palace of Agriculture, there wil be a mammoth wheel, some 25 feet higher than the famous Ferris wheel of Chicago, but built on a some what different principle. To the writer it appeared like a pair of mammoth suspension bicycle wheels, with swinging cars hung at intervals around the rims. It will beilluminated at night by electricity.
The Luminous Palace will be another novel feature, as it is said that it will be the greatest piece of glass and stained glass work ever produced. It will be over 100 feet in height. Its staircases are of crystal, and a electricity will be used for the lighting, the effect of a palace in fairyland will be produced.

Another novelty is the panorama of a tour of the world, which will require about 27,500 square feet of canvas. It will include a theater, cafes. etc.; and men and women of the countries represented will give performances in the foreground of the panorama. A history of costume has also been suggested, and "A Street of Paris" will doubtless be a little "Midway" all to itself.
There is no question but what the 1900 Exposition will be superior in its artistic decorations to any pre vious exposition, and stand as a monument of the remarkable skill and genius of the French nation in that direction.

THE HORNET AND ITS HOME
In the study of nature we are bewildered by so many wonderful things that the real goes far beyond imagination; and the little insect we are about to look at through the eyes of original investigation presents such notable features of architectural construction in its home building that we can but wonder whence all this knowledge comes; for the hornet's nest is commenced in the early spring time by one lonely female hornet, who has succeeded in passing the winter buried in some old tree stump or rotten trunk, whither she repaired the fall previous, after impregnation, to hibernate until spring shall come.
When the warm rays of the sun succeed in making their presence felt in the hornet's hiding place, she becomes awakencd to a sense of her duty, and repairs to a convenient place, be it bush or tree, and selects a site for her and her family's future home.
When a suitable place has been found, she goes to some old weatherbeaten loy or rail, and gathers the wood flber that has been set free by the elements, takes a mouthful, chews it, and mixes it with a peculiar caustic secretion of her mouth, whereby it becomes pasty, applies it to the limb, and thereby forms a nucleus for her home. This she continues to do until she has succeeded in forming twenty-four little cells or cups, which are intended for the depository of her eggs.
When this has been accomplished, she will put a covering over the nest for protection from weather. Then she will place an egg in each cell, and go on improving the home by putting another cover over the one already made, with sufficient space between the two to allow her to move about with freedom.
While these eggs are incubating she proceeds to tear down the first covering and make more cells from that material.
Meanwhile, the former eggs have materialized into tiny worms, which she feeds with small insects until they arrive at the period when the transformation from the worm or larva to the pupa or semi-insect takes place. Then she carefully places in the cell food enough to last the pupa until it matures into an insect, seals it over with a parchment-like substance, beautifully white, evidently understanding the law of the need of light for the development of the mature insect.
When the hornet comes from its cell, it does so as a full-fledged worker, and, without any previous experience, he goes to work straightway, and work of a royal kind he does. When these new-born workers come to the assistance of the lonely worker, she welcomes them by showing them every courtesy that a mother can. She leads them to the places where water and building material for the home construction are to be found.
The nest is of intricate workmanship, made from paper manufactured from wood fiber. It may be stated, in passing, that the hornets were the original discoverers of the fact that paper could be made from such materials, and the study by man of the hornet may have led him to adopt the same material, which discovery has since developed one of the greatest industries of the world, viz., the manufacture of paper from wood fiber.
Mr. T. W. Harris, in his interesting work, "Insects Injurious to Vegetation," published in 1852, says what Injurious to Vegetation," published in 1852, says what
sounds to our ears curious and interesting, viz.: "The sounds to our ears curious and interesting, viz.: "The
hornets are natural paper makers, who are not obliged hornets are natural paper makers, who are not obliged
to use rags and ropes in the formation of their durable paper combs, but have applied to this purpose fibers of wood-a material that the art of man has not yet been able to manufacture into paper."
The insect has a scissors-like arrangement that protrudes out of the mouth, and the fine fibers that stand up from the surface of the weathered rail or log, like so many fine hairs, are clipped off, and, as before stated, are mixed with a caustic secretion of the mouth, and thereby become a paste.
The hornet, when leaving his home for more material, does so very deliberately, never seeming to be in a hurry. He will take a stroll over the nest and apparently chat with the other workmen, and, when he has loafed long enough, he will take his departure for more flber. When he returns he reports to the master workman on the inside of the nest, then returns to where he left off and begins to force the pulp from his mouth by placing the edge of the work, already done, between his lips. His mouth opens vertically. He walks backward always in one direction, building up the leaf from the edge, and where he joined the fresh to the other material there is a distinct line, and from this mark you can tell precisely how many trips it took to make a complete nest, and the change in color of the material shows exactly when he changed his base of supplies.
No two insects work at the same portion of the nest, each one reserving a certain portion for himself, and no one dare encroach on his territory.
Different styles of architecture exist among the hornets, and there is a vast difference in the workmanship. Some do the work in a magniñcent, workmanlike manner, building compactly and gracefully, while others
are careless both in form and manner of using material. Some nests will be full of nice little nooks and corners of exquisite design, while others will be built on regular lines with no effort at ornamentation.
The site selected for the nest influences the style of architecture. Nests built on limbs of trees and bushes frequently in clude various branches with their leaves, the cells being always ar ranged in such a manner as not to be interfered with by the included parts of the tree.
If the nest is placed under the cornice of a house (which frequent ly occurs), the outside upper con tour of the nest follows the line of the cornice, but the cells on the inside are horizontal

The hornet, like the bee and other insects of like nature, makes the cell of the most economical geo metric figure, that of the hexagon

They have three broods a year which is ascertained by three fine linings that fill the cells; these ar made of white material, one inside the other, in the following order : When the first young makes its exi from the cell, all the debris that remains from the shell of the pre vious larva is not removed, but a new bottom is placed over it, and a cup modeled up entirely independent of the original cell. This pre vents any contamination from the filth left behind, and thus three sometimes four linings, which can be removed from within each other without injury to either, are suc cessively constructed. And the wonderful skill of waking these linings perfectly free from each other, yet in perfect juxtaposition, must be seen to be appreciated. The heavy clublike antennæ are used in shaping these interior delicate cups.

The floor of each successive tier of cells is held to the previous one by tiny hollow columns which do not in-


CELLS SHOWING WHITE CAPPING AND IMMATURE PUPA.
terfere in the least with the system of cells out of which they rise ; for these little fellows never waste either space or material. The material used in these columns is much tougher (evidently intentionally) than that used merely for cell walls.

The hornets are quite rapid at the work. A nest measuring about twenty inches in length was set on fire by some mischievous boys who wanted to see some fun, and they saw it! Somehow the nest was not wholly consumed, only the outside covering burning away. The boys, nevertheless, concluded they had enough, and did not disturb the hornets further. The unroofed house was completely mended ky the clever workers within four days. Cases are known where nests were almost completely destroyed by stones thrown at them, yet in a short space of time they were remodeled, showing clearly where the new parts were joined to what remained of the old structure.

Two nests are never found in close proximity to each other, as hornets do not swarm, but continue in one community for the whole season.

In these nests there is no place provided for the comfort of the mature insects, they having to rest themselves on the roof of the cell tiers, and the only intention of the nest seems to be for the purpose of raising the young. The nest is never used more than one season ; in the fall it is abandoned. One very remarkable thing is that hornets seem to have the faculty of marking the direction of a missile that is thrown at their nest.
There is always at the entrance a sentinel who will note and give warning of the approach of an enemy, and when a stone is delivered at the nest, the nand that threw it has been marked as sure as the sun shines, and before the attacking party can possibly turn the head he will feel a stunning blow in the forehead, and possibly drop to the earth with pain, for
the hornet flies with such velocity at his enemy that the human body is not swift enough in its movement to get out of the way. Then the hornet flies with head and tail together, and the stinger is inserted deeply : but if the enemy gets behind a tree or bush,
than themselves in mid-air. A locust, for instance, will be conquered in a few seconds by one of these rascals, and when they have overcome their prey, they will tear the wings and legs off, and quickly repair to the nest. Sometimes the fun that the boys intend to have at the expense of the hornets is reversed, as the following instance will show :
A number of farmers came across a nest in the field in which they had been working one hot summer day, and one of them suggested the fun of taking it home and burning it to see the struggles of the insects under the fire. The nest was duly plugged, the limb was cut and the branch thrown over the shoulder of one of the boys. The procession started. On the way one of the more venturesome ones slipped up under the nest, pulled the plug of grass out, but not quick enough for the carrier. Immediately the latter raised the nest high in the air hit the meddler over the head with the nest, and there was a mighty scramble for the tall grass in the immediate vicinity by the smart one, who had to do some tall wallowing before he got the hornets dislodged from himself, and when he came to dinner his mother knew him not.
The way to capture a nest so that there will be no danger from being stung is to locate the nest in the davtime. Do not disturb it until after dark. The hornets wil: then all be at home, and as the nest has but one exit, carefully plug
and throws from there at the nest and keeps his hiding place, the hornet will not likely be able to locate him, as they seem to have no power of location butby sight The stings of the female or neuters of hymenopterous insects, such as the honey bee, the wasp, and the hornet, are much alike, but perhaps the sting of the hornet is more to be dreaded than that of the other insects similarly armed. The sting, to the naked eye, appears to be a single needle-like organ, but when ex amined under the microscope it is seen to consist of three pieces, as shown in the larger engraving, a short stout cylindrico-conical outer sheath cleft through its length on the under side and obtuse at the end, within which are partly contained two long curved lances thickened at the end and furnished on one margin with teeth directed backward. The other margin is exceedingly sharp. These lances play within the sheath, and both the sheath and the lances can be protruded and retracted. A poison duct leads from a poison sac to the ducts opening between the teeth of the lances, as shown in the enlarged view of one of the lance points.
The effect of the poison introduced through the sting needs no description. Besides serving a defensive purpose, it is used also to paralyze its prey, so that it may be kept in store for future use.
Should you be taking a meal with a farmer and see a hornet come in at the window, do not hit at him or display any nervousness. It is not you he is after, it is smaller game. Watch him catch a fly and quickly tear off its legs and wings, then immediately make his escape through the window, with a morsel of food for the babies. They will attack insects very much larger


STING SHOWING LANCES DETACHED FROM THE SHEATH. $\times 35$ DIAMETERS.

POINT OF ONE OF THE LANCES. $\times 150$ DIAMETERS. (gTUDI froi life.)

up this hole, carry the nest carefully to a box in which you have placed a few small pieces of cyanide of potassium. This box should be airtight. Place the nest in it, having the lid ready. Deftly remove the plug from the nest, close the box, and allow it to remain so for three or four days. When opened, you will find all will be dead except the pupæ, which will be found

sealed up in the cells, so that the fumes of the cyanir. cannot get at them. Then you can watch the devel oping insects cut their way through the cover and come out. Then catch them and make investigations for yourself.

Hervy Laney.

## The Current Supplement.

The current Supplement, No. 1214, contains a number of very valuable articles. "The Periar Dam" describes an important engineering work which is carried on by the government of India for irrigation purposes. "Dirigible Air Vessels" is an article by Carl E poses. "Dirigible Air Vessels" is an article by Carl E.
Myers, the aeronautical expert. There is published in this number a very large collection of formulas for varnishes, sixty formulas in all, many of them being for varnishes which our correspondents are constantly needing. "The Preparation of Some Properties of Pure Argon " is an important paper by Prof. Ramsay and Mr. Travers. "Bacteria and Their Uses" is a popular lecture by Dr. Seneca Eghert.

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| lusects, |  |

## RECENTLY PATENTED INVENTIONS

## Agricultural Implements.

 TOOTH-HOLDING DEVICE FOR HARROWS.object of this invention to provide a device for clampin the teeth to the harrow-beam, so that they may be con veniently set at any elevation and at any place on the eam. With this end in view the invention provides clamp or holder formed with bifurcated arms, each hav ing an opening therethrough to receive the harrow-tooth and binds the holder at any place on the harrow-beam. PLANTER- Theodore Crow, Cameron, W. Va means for operating shoes and in the means for re ulating the seed-drop. The means for operating the shoes consist essentially of arms attached to the shoe and of levers secured to the arms. The shoes may be aised or lowered independently as required; and, af te having beeu fixed with relation to the ground over which hey are to travel, they may be simultaneously raseed orlowered. The seed-drop regulating means comprise $e$ a drop-piate provided with removable pins and operated by the movement of the machine. By changing the number and distance of the
any desired distance apart.

Engineering-Improvements.
deep-mine or relay pump.-George S. Herolsheimer. Denver, Colo. This inventor has devise to pump water out of a mine shaft at one or more levele路 connection of the individual pumps. The pumps are ar
ranged in pairs and are connected with a common water main. Each pair of pumps comprises two crlinders having suction and discharge connection with the water main. The pistons of the cylinders have rods extending thirough stuffing. boxes in the upper ends of the cylin ders. Two reciprocating power-transmitting rods ex and connect with the piston-rods to operate the pumps.

## Electrical Apparatus.

ElyECTRIC RAILWAY SYSTEM. - Georae Camprell, Dushore, Penn. The system employs
closed conduit having a continuous main conductor an sectional service conductor, a trolley being caused $t$
travel with the car by the influence of an electromag. net. The trolley comprises a wheeled frame, below ied by the frame. When the pivoted wheels are held contact with the rail or other conductor, a eh:rt, per fect path for the current from the rail to the sectiona onductor
automatic telephone-switch. - Charle S. Karoly, Aurora, Ill. 'This invention seeks to pro vide a simple and trustworthy switch-mechanism only one halp the copper line usually required, and with which a call and return or answer call can be quick made withont the intervention of the central office. Th switch includes a movable plate, forming part of a circuit. A pash-finger having connection with the tele
phone-wire is adapted for engagement with the plate close a circuit. In the circnit a receiver-supporting leve mounted, to which a shoe is pivotally connected engage and

## Mechanical Devices

MATTRESS-STITCHING MACHINE.-Elijar T ng ma tresses consists of a frame and of a car stirc prting the sewing-machine, provided with a shaft having an eccentric upon which a pawl fits. A spring resses the pawl into engagement with a feed-bar on the
framing, and a lever and connecting-rod lift the pawl framing, and a lever
PRINTING-PRESS. - William G. Johnsto Woodbury, N.J. To provide a simple means for stoping or limiting the movement of the type-bed, should to provide a novel and improved means for operating the type-bed and for inking the type, are the purposes of
this invention. The type-bed is vertically-movabie and this invention. The type-bed is vertically-movabie and
is connected by links with an eccentric on a rock-shaft. As connected by links with an eccentric on a rock-shaft. A spring-pressed lever has connection with a crank-arm
on the rock-shaft, and is held in its normal position by another rock-shaft. A tripping-roller normally engages he rock-shaft to disengage it from the lever, should the paper break.
line-casting machine.-Henry J. Derbysirre, Columbus. Ohio. In casting-machines as at present constructed it is necessary to make the line or slug
tapering in order that it may be readily ejected from the mold. Moreover, smaller projections are cast on the side of the line, which projections are trimmed off by a knife, so as to make the line of equal thickness :hrough-
out. By reason of this operation the type tuckles in the form and constantly topples over. The linotype-casting machine devised by the inventor is provided with a revolving and reciprocating casting-wheel carrying a mold
having a movable wedge-shaped member for releasing cast slug or line. A fixed pusher is adapted to engage he movable member to dislodge it and release the cast lag or line
Flour paicker.-James m. Mattingly, Hartford. Ky. It is the purpose of this invention to con-
struct a machine in which the grinding action upon tho struct a machine in which the grinding action upon the minimum, and in which the flour is delivered white and granular. In order to overcome the grinding action com mon to most flour-packers, the in ventor employs a recip
rocating plunger consisting of cup-shaped packing rocating plunger consisting of cup-shaped packing
plates, which, when forced down, compress the flour plates, which, w
withont grinding.
vending-machine.-William h. Murphy, Fox Lake, Wis. The machine is particularly designed to distribute pencils or articles of like character. The
pencils are arranyed one above another in a receptacle, pencils are arranyed one above another in a receptacle,
the lowermost pencil being located in front of a plunger,
the inward movement of which is normally prevente
by a barrier. By dropping a coin within the apparatus a barrier. By droppirg a coin wieles the apparatus,
mechanism is operated which releases the barrier and nables the plunger to be pushed in,
DRILL CHUCK. SLMUEL
DRILL-CHUCK.-SAsurl Thompson, Schaghticok imple drill-chuck which is capable of receiving drill, he shanks of which are of different size and cross ection. He has worked out this 1dea by providing pivoted cylinder having vertical peripheral grooves of
various size and shape, and by clamping the drill-shan arious size and shape, and by clamping the drill-shank
tween this cylinder and a rectangular centering-block The centering-block has a grooves of different cross ction in its four faces, and is backed by a locking g -plate is in the shape of an inverted L . It project ver the top of the centering-block, and by withdrawin the block is also removed.

## Rallway-Appliances.

ENGINEER'S BRAKE-VALVE.-Join.V. Wrlls, Wimer:ing Pa. This invention is an improvement
pon a similar device patented by the same inventor The valve is provided with a number of feed-valves se ond interposed betwes and connected with one anoth we con to the pith prese pe connection, to supply the train-pipe with pressure
rom the main reservoir, according to the pressure to which one of the feed-valves is set, and to maintain an ncrease of pressure in the train-pipe according to the pressure to which the pther valve is set.

Miscellaneous Tnventions.
TOY.-George B. Hvares, Washington, D. C. The
oy represents, by means of models, the destruction of he "Maine," and the victory of the United States ov pain. The figures of the "Maine," of a Spaniard, and of a pig are mounted on an inclined plane and held in place by fins. Upon operating a rod, a percussion cap
is disclarged; the "Maine" fadle in two; and the pis rolls down the inclined plane, colfides with and overturn the Spaniard before him
GAME-APPARATUS,-Grorge Halder, Mitwaukee, is. This invention provides a game-apparatus in wich a fortress is represented capable of being demol-
ished. In connection with the fortress targets are em loyed which, when struck by bullets, will overthro he figures of soldiers attached thereto, or will destroy ortion or lag. When this flag is struck, it falls over and in it tead an American flag rises, thus symbolically repre senting the capture of this Spanish fortress by Ameri belt-shifter.-Williay D. Gratie, St. Angga lowa. The invention belongs to that class in which means are provided for throwing the belt on and off th riving-paley, and is charactrized by a loose pulley the driving-pulley, and is provided with devices by which
MAIL-STAMP.-Thomas H. Stokre, Lincoln, In This mail-stamp is designed to be used for canceling anps on letters, and comprises a base and a stamp
olding block, the two being joined by an eccentricall ocated pivot, the axis of which intersects the conta plane of the base and block at right angles. The conlace type in the block.
Firearm.-Alpredo Rosa y Pascual, Manhattan barrel of larger caliber than ordinary, or a barrel of any predetermined caliber, may be connected in a detachab nanner to the stock and firing mechanism of the gun,
he application being especially adapted to rifles fired rom the shoulder. The inventor also provides a rest fo the firearm capable of being readily and quickly inserted may not only be given any desired inclination, but ma be turned as upon a pivot and secured in adjusted posi
.
device for injecting fumes.-Abram Miler, Harvey, N. D. It is the object of this inve tion to provide a device so constructed that poisonous
umes can be generated and forced into holes, burrow or nests infeeted by animals or insects. The device An injector is connected with the receptacle and inated ided with a nozzle at one end and with a piston at the opposite end. The nozzle and piston ends are separated by valve-controlled partitions through which a conduct-ng-tube is passed from the nozzle to the piston end. SUPPORT FOR FOLDING CARRIAGE-TOPS John S. McConnell, Argo, Iowa. This support for carriage-tops comprises a telescopic rod, one member
being pivoted to the eeat and the other to the upper end of a bow. A fixed rest is adapted to engage the rod when the top is down in order to support the top. The the side curtains and also in redusing the liability of the ows ${ }^{\prime}$ breaking.
harness-buckle. - Jacob polka, Smith Centre, Kan. The buckle is formed with parallel side-bars, the ront and rear edges of which are connected by crosebars. The etrap is received by an attaching cross-bar
At its middle on a pivot cross-bar a lever is fulcrumed provided at its inner end with a pin for engagement with one of the apertures in the strap, the opposite end being formed with a cross-bar operating in conjunction with he rear cros-bar at the front of the buckle to form
passage for the strap. A buikle thus made is of cial value when used on traces, hip-straps, and crupper straps, ther
Game-boX.-Harry F. Wmliams, Hartford, Conn cards having questions printed thereon, and is furthe designed to give answers to these questions by means of raps produced within the box. The cards are dropped turning of a crank, simultaneously with which by the the raps will be heard. By menns of a circular which
accompanies the apparatus, the raps can be translated
into answers to the questions upon the cards. into answers to the questions upon the cards. A nu ACETYLENE GAS GENERATOR. - Robert AREs, Pleasant Mounds, Minn. This apparatus co ing a carbid-receptacle. The acetylene zas is generated by allowing water to drip upon the carbid. Should the pressure or quantity of gas become excessive, generatio sautomatically stopped, and the surplus gas is allowe eecape through a vent-pipe to the outer atmosphe TEMPORARY Binder.-Charles T. Rosente navesvile, Ark. This binder is constructed of meta angle plates so placed together as to form several. sec
tions in which memoranda relating to different subjects can be flled. The construction is such that one or more leaves from any section, or a whole section even, can be fering in the slightest degree with the other leaves sections.
bridle.-Samubl Van Bubkire, London, England his invention consists of two bits which cross in the horse's mouth, each having one end fastened to a rein nimal's head. When one rein is pulled, the bit to which it is fastened presses against the jaw, not only o sile ond head; while, when the opposite side of the wo bita assume such a crosswise position relatively ach other, that the horse is prevented from taking the bit between his teeth and thus rendering it useless.

GARMENT-SUPPORTER.-EmMA BENTON, Buttu Montana. This supporter coneists of a flat piece on may be strung and having the other end curve round in a emall roll, out of the center part of the to urving flat spring is pivoted to this body plate near the upper end and preses aganst the curved portion whe the rectangular piece has been removed, thas clampin the stocking or other garment firmly. By pressing the spring, it may be slip
acetylene gas generator.-Jean Reibe Angoulême, France. The distinctive feature of this a paraus io a carbid-chute. This belt is rigged on rollers whicu moves forward and dumps more carbid into a chute This chute has two elbows and an opening near one he elbows so placed that any bubbles of cas generated in the chute will pass out into the gasogene. The wate in the chute is covered with petroleum to keep all
moistu:e away from the carbid. There is an overflowpipe which carries off surplus water and allows of continuous stream being run through the
Notr.-Copies of any of these patents will be furn the name of the patentee, title of the invention, and da of this paper.

## NEW BOOKS, ETC.

AMERICAN NEWSPAPER ANNUAL FOR 1899. Containing a Catalogue of American Newspapers. Philadelphia
N. W. Ayer \& Son. 1899. 8vo. Pp. 1517. Price $\$ 5$

The annual of Messrs. Ayer is a most valuable pubin cation, and is useful not only to advertising agents, but oo many other lines of business as well. It contains a complete list of every paper publiehed in the United States which inserts advertisements, including not onls It gives particulare regarding circulation, issue, price date of establishment, political creed, names of edilors and publishers, and street addresses, together with the population of the countries and the places in which the papers are published, and the present volume contains list of newspapers and periodicals pubished in Havana, In addition to this, there are separate lists of religious and agricultural periodicals and class publications of all kinds, which are particularly valuable features of the book. Maps are provided which were made spectally for the annual. The amount of work necessary in compiling a book of this kind and keeping it up to date must be incalculable. The book is clearly printed, on goos
paper, and it is attractively bound. The present volume even superior to its predecesson
Annual Report of the Board of ReGENTION OF THE SME year ending June 30 1896. Including Report of the United States National Museum.
ton, 1898. 8vo. Pp. 1107. ton, 1898.
The report of the Smithsonian Institution occupies
less than 300 pages of the volume, and the remainder is taken up with one of the most interesting and important series of monographs which we ever remember seeing. Prehistoric Art; or, the Origin of Art as Manifester the Work of Prehistoric Man," by Thomas Wilson, is ravings and 74 plates. The whole subject of the at the paleolithic and neolithic periods are described. It includes flint chipping, engraving, sculpture, painting (such as it is), ceremonial objects, lapidary work, etc. Next in order we come to Scewart Culin's "Chess and
Playing Cards." This is a catalogue of games and imPlaying Cards." This is a catalogue of games and im-
plements for divination exhibit $d$ by the United States National Museum in connection with the Deoartment of Archæology and Palmontology of the Universits position at Atlanta. It is accompanied by 228 illustrations and 50 plates. This monograph is almost as inter esting as the preceding one, and the Smithsonian Insti tution merits our warmest thanks for profucing work of this kind. "Biblical Antiquities." exhibited also a the same exposition by Cyrus Adler and I. M. Casano
wicz, is the third interesting monograph, and it is ac companied by 45 plates "The Lamp of the Ezqui
graph, and appeals to the archæologist rather more tha o the general reader. This delightful and portly volum produced by the Smithsorian Institution has ther been ing of the black cloth binding to a handsome gree should be specially. noted
History of Physics in its Elemen'r ary Branches. Including the Evo Macmillan Company. 1899. 12mo Pp. 322. Price $\$ 1.60$.

This history is intended mainly dents and teachers of physics. The writer is convince that some attention to the history of science helps make it attractive, and that the general vew of the d velopment of the human intellect obtaned by readin zing Strange to as there is litle literature in lish upon the history of physics, although there is abund ant biographical material of such men as Faraday. T volume before us is a most valuable contribution to the subject and is a serious work, the pages simply bristing
with foot notes of authorities. This is, however, a ver with foot no
Rouse's Dictionary of Synonyms for the Use of Chemists, Their As-
Sistants and Apprentices. LonSISTANTS AND APPRENTICES. Lon-
don: Rouse Brothers, 61 Charlotte Street, Totten

This collection of our and five thousand references. It covers a larg area and is more complete than any heretofore published. The chemists' trade, or, as we say in this cou most of the articles in demand rejoice in several names, nd to a certain extent, the greater the dema trives to cal chemicals as "antipyrine " boasts of four names. From what has been said, it will be seen that there is an ample field for a little book of this kind. It is an excelially adapted to American need.
MANUAL OF Receipts. Being a Collec iled from the Files of Aure. Con piled from the Files of American ArSidney P. Johnson. Chicago: Ame rican Artis

The rolume will doubleas prove of particular value sbeet metal workers. It is accompanied by an excellent General View of Commerce and In DUSTRY IN THE EMPIRE OF JAPAN.
Published by the Bureau of Commerce and Commerce of Japan. Tokyo. ture
1897.
This ittle volumegives in brief outline the commer cial and industrial state of Japan, and is intended by excellent maps of the country and of the principal cities, and will doubless prove of value to those who are in any way interested in that country by reason of

Electro- Horticulture. George S.
Hull, M.D., Pasadena, Cal. 12 no . Hull,
Pp.
.
The interest of the author was first directed to the Bican some five or pix mentation he carried the subject into the lecture field, and the interest manifested by farmers and students anally led him to put the matter which he was able to gather into shape, and the result is the volume before us. The subject of electro-horticulture is a most attractive
one, and Dr. Hulls contribution to its literature will one, and Dr. Hulls contribution to its literature will turists.
Text-Book of Theoretical Naval ARCHITECTURE. By E. L. Attwood. $\begin{array}{lll}\text { Green } \& \text { Company. } & \text { 1899. } 121 \\ \text { 292. } & 114 \text { diagrams. } & \text { Price } \$ 3 .\end{array}$

A new work on theoretical naval architecture has been needed for a long time, and the present volume is admirably adapted to the use of all who are in any way en-
gaged in building or repairing veesels. The literature upon this subject in English is altogether too meager and we are sure that naval architects all over the world
will warmly welcome this volume, which gives admirable will warmly welcome this volume, which gives admirable
rules in concise form. The author is an Assistant Constructor in the Royal Navy and is a member of the Institution of Naval Architects.
Notes on Water Supply. J. T. Rodda, Eastbourue, E
140 . Price $\$ 2$.
This book has no pretensions to being a treatise but its value consists rather in pointing out a specialist from whom valuable information may be obtained, and to in dicate the best water works appliances now on the
market and their usefulness in the modern distribution market and their usefulness in the modern distribution
of water supply. The book will doubtless prove of value

Monumental Records made its first ap pearance a year ago in large quarto form, but, owing to for preservation in libraries, the editor has decided to adopt a large octavo form, which seems to meet all the requirements of such a publication. The text and pho enable the use of the color prints when necessary and also to reach a higher standard in art printing. The former numbers appeared only at irregular intervals, but now the magazir.e will be issued regularly and th subscription price will be $\$ 2$ per annum. A popu-
lar illustrated journal on archeology has long been lar illustrated journal on archæology has long been
needed, and the Rev. Henry Mason Baum. D.C.L., It is published at 64 Fifth Avenue, New York, N. Y.

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（7633）J．N．D．asks：1．About what would be the required dimensions of the glass plate in a
simple electric machine，to charge a small Leyden jar？ A．Holtz machines are made with plates as small as
inches in diameter．These will charge Leyden jars and perform many experiments．We should advise you to 279,283 ，price 10 cents each，in which many experiments are described．2．At what speed should it be revolved ？ A．The speed of the plates of a Holtz machine is only
limited by the strength of the glass．3．Where should a body be placed，to be affected most by the earth＇s at－
traction？A．A body is affected most by the earth＇s at－ traction at the surface of the earth，that is，bodies weigh most at the surface；lees，both above and below the sur－ face of the earth．4．State three proofs that the earth is
an oblate spheroid．A．One method of determining the an oblate spheroid．A．One method of determining the
form of the earth is by measuring arcs of meridians in different latitudes．A second is by taking the times of and from these are calculated the intensity of gravity at those points．See Young＇s＂General Astronomy，＂pages 99 to 107 ，price $\$ 2.50$ by mail．We do not know any third mode of finding the form of the earth．
（7634）F．V．writes ：While experiment－ ally testing the efficiency of a ground wire of a telephone
line from Winsted to the railroad station at Leeter Prairie，six miles sonth of here，the ground wire of the telephone at that point was connected with the telegraph
wire．A areat improvement was found in the transmitter and also in the receiver at Lester Prairie；and while still commenting on this，the operator at New Germany，a
station on the Great Northern four miles east of Lester Prairie，called and told the operator at Lester Prairie，hy telegraph，that he had heard the whole conversation，and which was later actually verified，more than once．Th remarkable feature of this，however，is that there is no telephone of any kind at or near the station or even in the town of New Germany．Tesla and Marconi may
send their messages without wire，but they must bave their instruments．But here we have an instance of re ceiving messages without any apparent instruments over a wire a distance of ten miles．［A．We regret to say that this matter is neither new nor strange，though doubtless your observation of it was entirely original with yourself． The Scientific American as long ago as 1881 contained an account of using a telegraph key as a transmitter and a sonnder as a receiver of articulate speech．So far from your telephone wire to the telegraph line．All tha rest was plain．The telephone message then went over the telegraph line，and the operator heard it at his sounder， whicb chanced to be well situated and adjusted for the purpose．－ED．］
（7635）P．N．writes：I am interested in a scientific problem on which I desire the evidence of
or decision of a second party，and would ask you to answer the following：Suppose a man weighing 150 pounds will require to expend a force of 501 foot pounds （or a certain amount of force）to walk a ccrtain distance， road on a modern bicycle of 20 pounds weight with lese force expended？The man is supposed to lift himself 2 inches at every step，the road is supposed to be per－ fectly level and smooth．time not being taken in consid－ eration．By the above you may judge the simple ques－
tion to answer．Is the human body a mechanism that，
in its natural way of locomotion－walking－is superior in
economy of force to one seated on a bicycle and impart－ ing the force to the wheel？A．The bicycle is a great can only exert one－eighth of a horse power for a few hours is more than a match for a horse in the long run．
He can outdo his own walking power on a good road at least four times．If the weigbt of the bicycle is taken into account，the prop
be somewhat grearer
（7636）J．K．asks the difference between marine，field，and night glass．A．Marine glasses are also termed night glasses when they have a large diame－ reduced area by day，by placing a diaphragm cap over the object glass，A field glass may be a terrestrial tele scope of the same combination of lenses with a very short focus，or a pair mounted for each eye．For the lower powers for field glasses，the opera glass form is used，only made longer than an opera glass，the object glass and eye lens being achromatic．
（7637）E．S．asks for the formula for a compost to imitate marble，which will be very hard and will take a high finish，and how to polish the same．It
 limestone to a very fine powder by grinding and sifting， （zinc white）and $1 / 8$ its weight of Portland cement，and mix thoroughly into a thick paste with a sufficien quantity of a hot aqueous solution of waterglass，con taining about 40 per cent of the glass．Mould the paste
under pressure while warm，and expose the mouided under pressure while warm，and expose the moided
form for a week or ten days to warm dry air，before fin ishing．


INDEX OF INVENTIONS
For which Letters Patent of the United States were Issued or the Week Ending MARCH 28， 1899. AND EACH BEARING THAT DATE．
 Air brake，Ansley \＆Topham，．．．．．．．．．．．．．．．．．．．．．．．．．．．．
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