SCIENTIFIC AMERICAN

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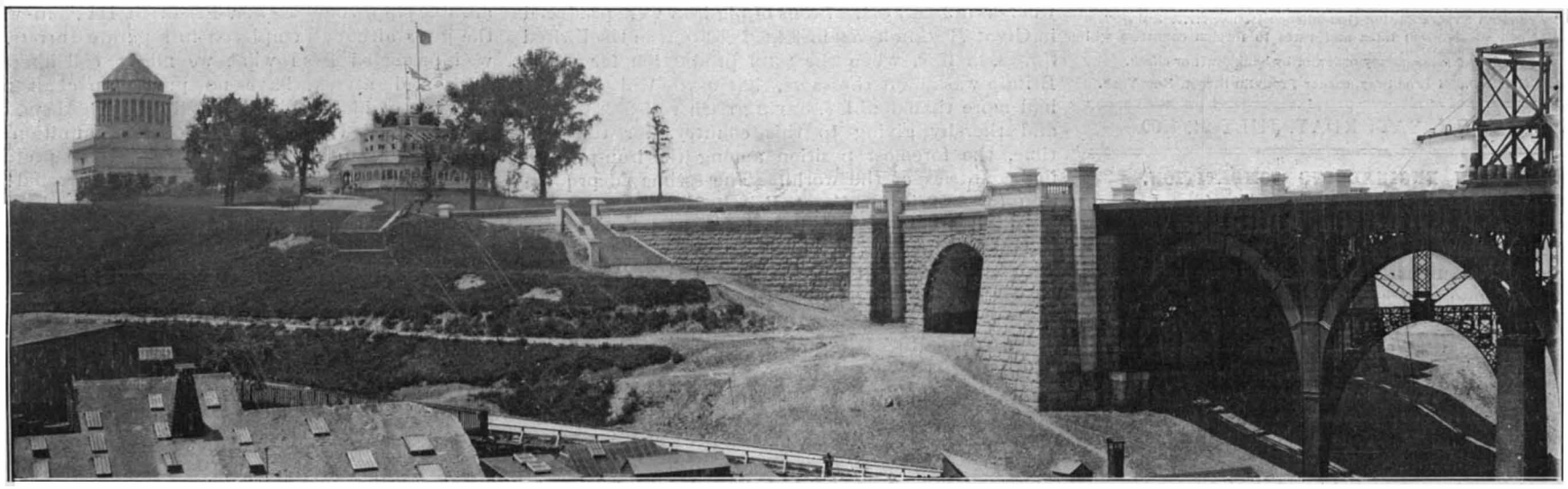
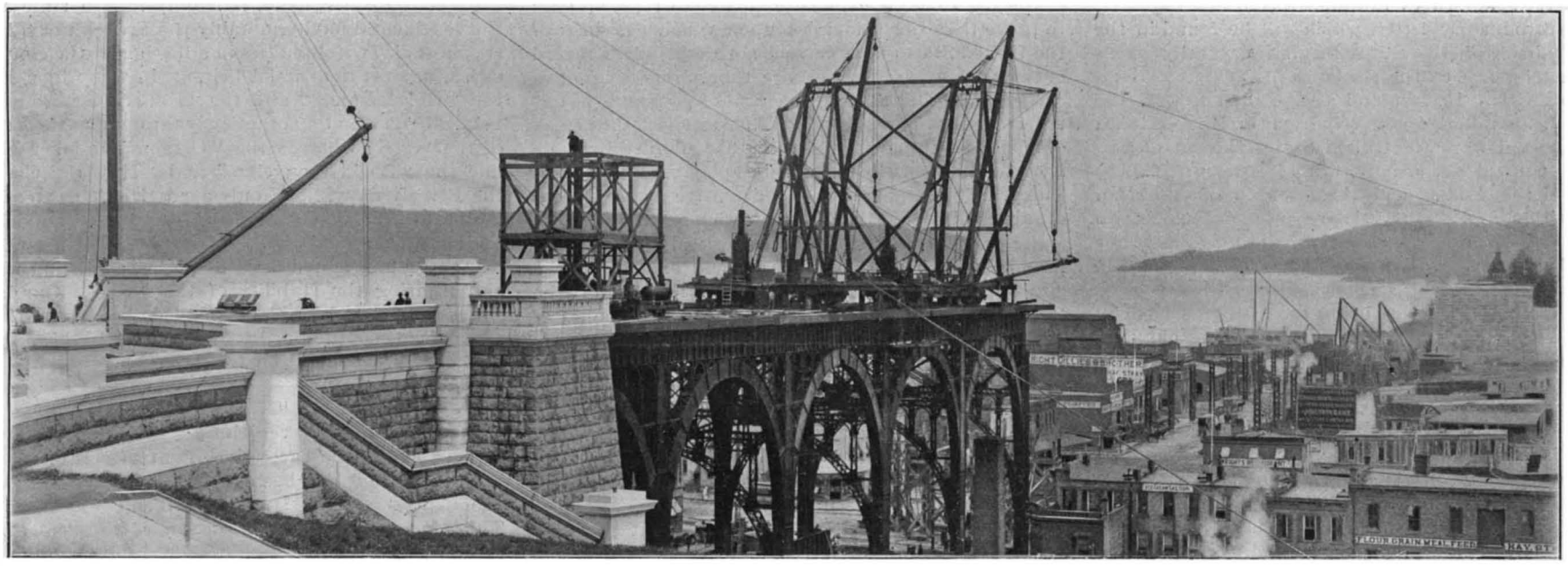
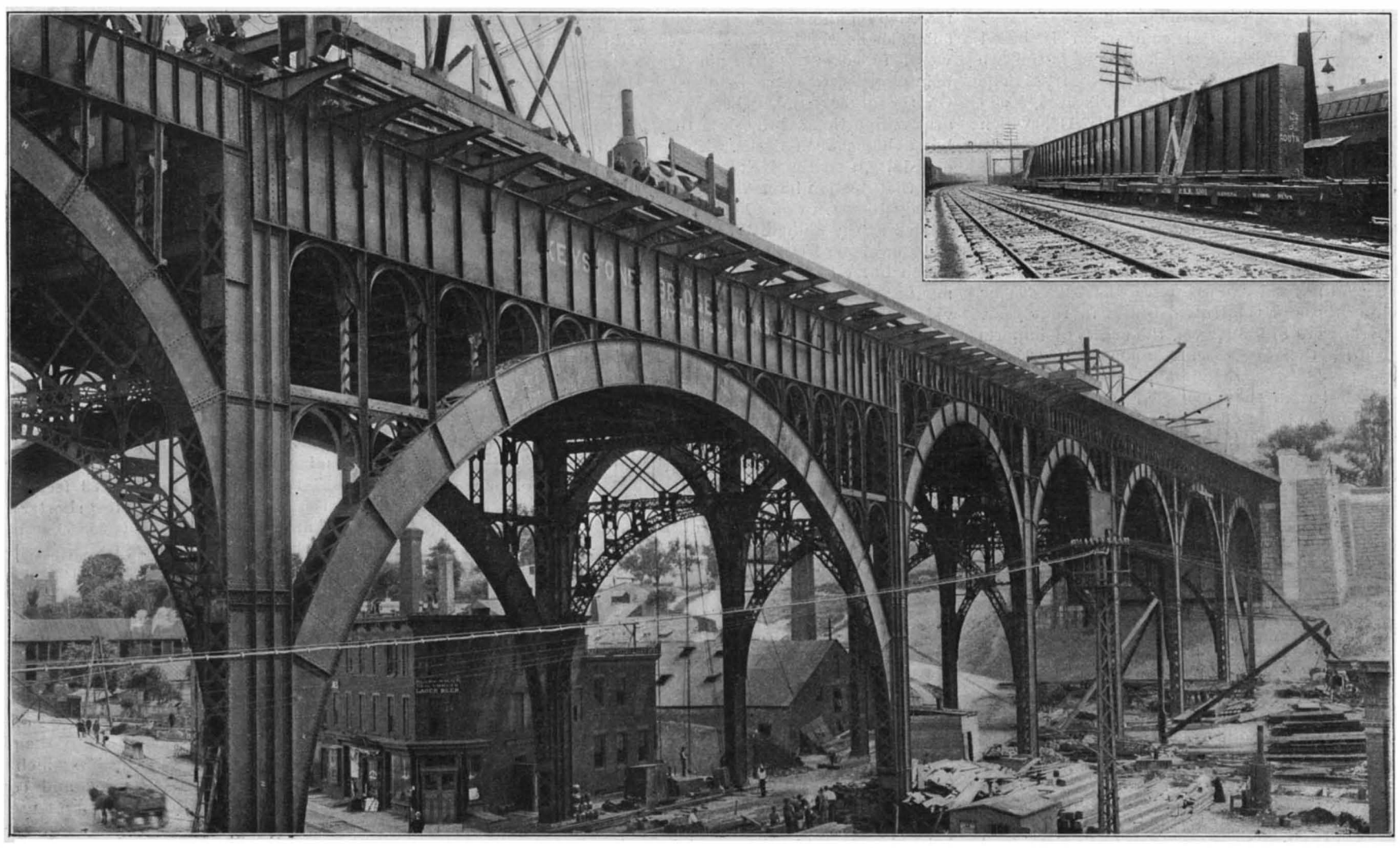


Southern Abutment; Grant Memorial in the Distance.



Looking North up the Hudson River.



The 130-Foot Arch Across Manhattan Street.

Transporting the big girders on four flat cars.

RIVERSIDE DRIVE VIADUCT, NEW YORK.—[See page 38.]

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NEW YORK, SATURDAY, JULY 21, 1900.

AMERICAN ENGINEERING COMPETITION.

British manufacturers are indebted to The London Times for a remarkable series of letters on the subject of American engineering competition, which have lately been communicated to that journal. Previously to writing these articles, the author made a tour through the chief manufacturing States of the Union, for the purpose of personally examining the plant, management, local conditions and transportation facilities, of the leading industries and gather all other information necessary for a comprehensive and intelligent discussion of the subject. It is evident that he is technically qualified for the task, and the series forms such a valuable compendium on the subject that we have concluded to publish it in consecutive issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

The introductory letter, which will be found in the current issue of the SUPPLEMENT, naturally opens with a reference to the statistics of imports and exports of Great Britain and the United States, the figures being taken respectively from the British Board of Trade and from the United States Bureau of Statistics. Statements of imports and exports afford the most reliable evidence of the strength of American competition and of the relative progress of the two countries in the world's trade; although, as the writer reminds his readers, Sir Robert Giffen, in a recent lecture before the Royal Statistical Society, has warned the British public against being too easily alarmed by an excess of imports over exports, pointing out that Great Britain has a fruitful source of income in the return upon the enormous British capital invested in railways, public works, etc., in different foreign countries. While the force of this suggestion is not disputed, it is pointed out by the correspondent to The Times that for a country to carry on an export trade is an indication that it can meet and beat other nations in competition, while the falling off in American imports, though it may be caused by a protective tariff, is an evidence of the nation's greater ability to manufacture for its own needs, and for the consumer to pay the price demanded by the producer.

The introductory statistical comparison is based upon the changes which have taken place in the two countries during the decade from 1888 to 1898. The total exports of the United States were, in 1888, $695,954,507, while the imports were $723,957,114, which gives an excess of over $28,000,000 of imports over exports. In 1898 American exports had risen to $1,231,482,330, while the imports had fallen to $616,049,654, which shows that instead of buying more than we were selling, as at the beginning of the decade, we were selling more than we were buying by an enormous margin. The statistics of English trade show that in 1888 the total exports were $1,492,887,705, or over double those of the United States in that year. The imports were $1,938,178,715, the excess of imports over exports, therefore, being about $445,000,000. Eleven years ago Great Britain and the United States imported more than they exported; by 1898 British exports had fallen to $1,470,069,940, while the imports had risen to $2,351,892,914, showing that the excess of imports over exports had risen to over $881,000,000, the excess being about double what it was at the beginning of the decade. Comparing these results we find that, whereas in 1898 Great Britain bought about $881,000,000 worth more than she sold, the United States sold about $640,000,000 worth more than they bought.

Speaking of the natural advantages enjoyed by the engineering trade in the United States due to the vast extent, richness and accessibility of the ore, and the fortunate geographical distribution of the raw material for the steel industries, The Times correspondent shows that whereas the Lake Superior ores contain from 59 per cent. to 65 per cent. of iron, as against 57·6 per cent. of iron in the so-called rich Cumberland and Lancashire ores, in the Cleveland ironstone the percentage is very much less. A further natural advantage is due to the fact that coal is being worked very much nearer the surface in the United States than in England, and that in cases where long distances have to be covered, to gather the raw materials at the blast furnace, the improved methods of transportation peculiarly characteristic of the United States have gone far to neutralize the disadvantage. Moreover, it seems that so far from the coal, ironstone and flux lying geographically close together in Great Britain, the ore used in the manufacture of Bessemer steel has to be brought a thousand of miles by sea from the Spanish mines. Thus, in 1898, when Great Britain produced 8,631,151 tons of pig iron, she imported nearly five and a half million tons of ore, chiefly from Spain.

Among all the statistics bearing upon the engineering trade of the two countries, none are more significant than those of the production of pig iron, for, whereas in 1884 7,811,727 tons of pig iron were produced in Great Britain as against 4,097,869 tons in the United States, in 1890, when the total production for Great Britain was about the same, that of the United States had more than doubled, having risen to 9,202,703 tons and thereby giving to this country, for the first time, the foremost position among the iron-producing countries of the world. The estimated production for 1899 is for Great Britain 9,500,000 tons and for the United States 14,000,000 tons, an excess over Great Britain of 4,500,000 tons. The letter concludes with the statement that during the tour through the United States, made in the interest of the series of articles referred to, the writer found everywhere the same state of booming prosperity; works of all kinds full of orders for a year and more ahead, old works being enlarged and new works started.

OUR BATTLESHIPS IN THE LIGHT OF THE "BELLEISLE" EXPERIMENT.

The very remarkable test of the "Belleisle" recently carried out by the British Admiralty is particularly gratifying to naval experts in this country, for it goes to prove that the principles upon which the ships of the United States navy have been designed in regard of their defensive qualities are thoroughly sound; in other words, that the emplacement of guns and the distribution of armor is better suited to resist the attack of modern high-power guns than that adopted by those navies which must be regarded as possible antagonists. The principle underlying the defensive arrangements of our vessels is that the best protection against shell-fire is the provision of a continuous, vertical wall of armor from below the water-line up to and embracing the gun-emplacement. Thus, in the battleships of the "Alabama" type, we have from 9½ to 16½ inches of armor extending from below the water-line to several feet above it; then the 15-inch wall of barbette armor, and above this the 14-inch protection of the turrets; while for the 6-inch guns of the intermediate battery we have 6 inches of armor from the belt to the deck upon which these guns are carried, and 5½ inches of protection in front of the guns themselves. Now 6 inches of armor will, in almost every case, burst a shell on its outer surface, or at least before it can effect an entrance within the vessel.

Turning now to the account of the damage done by the guns of the "Majestic" upon the "Belleisle," as recorded on another page, it will be noticed that the 6-inch shells which struck the armored portions of the vessel failed entirely to penetrate, the lyddite shell being in this respect as helpless as the common shell. On the other hand, whenever they struck the unarmored portions of the ship, they passed through and burst the between decks, with the result, in the case of lyddite, that the deck was lifted over a wide area, and that portion immediately over the explosion completely blown away. Now, it has always been contended by Sir William White, the very able Chief Constructor of the British Navy, that high explosive shells which burst between decks would act exactly in this manner, and that it was absolutely imperative to provide a complete wall of side armor, of sufficient thickness to keep out a high explosive shell, which should cover each gun-emplacement and extend without a break from the gun-platform down to and below the water-line. This principle has been faithfully followed in all the battleships and armored cruisers of the modern British navy, and, with the exception of the "Maine" and the "Texas," the same principle has governed the construction of the battleships of our own navy.

To appreciate the value of a continuous wall of vertical armor from water-line to gun-emplacement, we have but to look at some of the most notable of the German and French designs; such, for instance, as the three French battleships of the "Charlemagne" class, and the four German battleships of the "Kaiser Friedrich III." class. In every one of these seven first-class battleships, there is a wide gap, extending over a height of two decks, say about 15 or 16 feet, and reaching horizontally the whole length of the vessel, upon which there is not an inch of armor protection. In the case of the "Charlemagne," although the eight rapid-fire guns on the main deck are protected by 3 inches of armor in front, they have nothing but the thin shell of the vessel to prevent high-explosive shells from being burst within the vessel immediately below the deck on which they are mounted. This shell plating would serve simply to give the shock necessary to explode the shell at the point where it would do most damage. The way in which the decks of the "Belleisle" were blown to pieces suggests that in a duel at moderate range between the "Charlemagne" and, say, our own "Alabama," the seven 6-inch rapid-fire guns which the latter would be able to bring to bear, to say nothing of the 12-inch rifles, would, if firing high-explosive shells, very quickly put the whole of the rapid-fire battery of the "Charlemagne" out of action. This will be readily understood by referring to the armor diagram of the "Charlemagne," published in our article on the French Navy (SCIENTIFIC AMERICAN, January 28, 1899).

The same serious defect exists in that otherwise admirable ship, the "Kaiser Friedrich III.," in which, the guns although emplaced in separate turrets, and well protected from what we might call lateral or horizontal attack, have no protection against the bursting of high-explosive shell beneath them, other than is afforded by a small armored ammunition tube extending from the base of the gun to the protective deck some 15 or 16 feet below. Well-directed shell would pass through the unarmored sides above the water-line belt, and could be burst in great numbers beneath the floor of the turrets. In the "Kaiser Friedrich III." this is true, not only of the rapid-fire battery, but of the two turrets containing the main armament of four 9½-inch guns. A diagram of the "Kaiser Friedrich III." appears in the article upon the German Navy, SCIENTIFIC AMERICAN, April 22, 1899. If the diagrams of these German and French ships, be compared with those of such vessels as the "Oregon," "Kearsarge," "Alabama," and the "Maine," it will be seen at a glance how vastly better equipped for defense are the American ships than those of France and Germany.

Upon the other hand, it is only fair to state that the continental navies, notably the French navy, have shown their farsightedness in adhering to the continuous, as against the partial belt, at the water-line. Both the "Charlemagne" and the "Kaiser Friedrich III." have a belt extending practically throughout the length of the vessel; whereas the "Oregon" and her class, like the "Royal Sovereign" and "Majestic" class of the British navy, have only a partial belt extending for two-thirds of the length of the vessel amidship. Judging from the "Belleisle" results, shell fire would tear these unarmored ends to pieces, admitting water and injuring the stability of the vessels. Our later ships, however, of the classes named above, are to have a practically continuous belt, and will be in this respect a great improvement over the "Oregon."

THE "DEUTSCHLAND."

There is something very impressive in the ease with which each of the successive giant vessels of the Atlantic fleet that has been started on its westward voyage has attained the speed for which it was designed. The contract for the construction of the "Deutschland" called for a sea speed of 23 knots an hour. It usually requires three or four voyages to bring the engines down to their bearings, and no attempt is made to push the vessel to its highest capacity on the first few trips; certainly not on the maiden trip. Hence, the record of the "Deutschland," which ran from Plymouth to New York at an average speed of 22·42 knots an hour, is particularly meritorious, and makes it reasonable to expect that this fine vessel will ultimately make an average speed of 23¼ and possibly 23½ knots an hour for the whole distance. The "Deutschland's" speed is greater than that achieved by the "Kaiser Wilhelm" on the maiden voyage of this vessel from Southampton to New York, which was made at an average speed of 21·39 knots per hour; but it is not quite so fast as the highest average of the "Kaiser Wilhelm," on its fastest eastward trip to Plymouth, when it made the distance in five days sixteen hours and ten minutes, at an average speed of 22·63 knots an hour.

The "Deutschland," which, like her great rival, was built at the Stettin Yards, Germany, is larger than that vessel, though not so large as the "Oceanic" of the White Star Line. In external appearance there is a great likeness between the two German boats. The "Deutschland" is 686½ feet long, or 38 feet longer than the "Kaiser Wilhelm," and 7½ feet shorter than the "Oceanic," and her horse power is 35,000, or about 7,000 more than that of the other two boats. Her beam is 67½ feet, or half a foot less than that of the "Oceanic," and her displacement is about 23,000 tons, which is 5,500 tons less than the displacement of the "Oceanic," on a 32½-foot draught. She is driven by quadruple-expansion, six-cylinder engines, of 35,000 horse power, and steam is supplied from twelve double-ended and four single-ended boilers.

The brilliant success of the "Deutschland" on her maiden voyage naturally turns attention to the plans of the rival company for a new steamship which is to exceed the "Deutschland" in size, speed and equipment. Particulars of this vessel are not at present available; but it is understood that she will have a contract speed of at least a knot greater than that of the "Deutschland."

PRESSED STEEL CARS.

Most revolutionizing inventions are practically developments, and though one man may finally succeed in giving to it a useful existence, the germ of the idea dates back many years. This is the case with the new pressed steel car, which is producing remarkable changes in American railroading. Although it has only succeeded in attracting general attention in the last year or two, it is not exactly a new invention. It is an evolution of the old wooden freight car through the structural steel car to the modern product, which is made of large sheets pressed into shape by machinery.

It was some thirty years ago that the first steel car was built in France, and that first clumsy attempt of 1869 is in a good state of preservation to-day. It is cited often by authorities to show that the life of the steel car is much greater than that of the old wooden structure. The modern steel cars made in this country are all of such recent manufacture that they cannot be quoted as samples of longevity. The known life of a wooden freight car is fifteen years, and half a century of use in this country has demonstrated that sufficiently to make it a positive fact. Although the first French steel freight car is in good condition to-day, it may not necessarily follow that the modern pressed steel cars used on American roads will have an equally long average life; but there is good reason to suppose that they will far exceed the useful lifetime of wooden cars. Painting often and thoroughly to prevent rusting will be an important factor in determining the life of a steel car, and a great deal will depend upon the amount of attention given to its rolling stock by a railroad in settling the much mooted question.

The modern pressed steel car, more generally known as the Schoen car after the inventor, Charles T. Schoen, is now in general use and demand on most of the railroads. In 1897 there were not more than a few hundred in existence, but to-day the Baltimore and Ohio road has over 6,000 in use, the Pennsylvania some 4,500, the Pittsburg, Bessemer and Lake Erie 2,000, the Philadelphia and Reading, the Lehigh Valley and Chicago and Alton, Great Northern, Lake Shore, Erie, Union Pacific, Pittsburg and Western, and Chicago and Eastern Illinois about 1,000 each. Nearly all of the other prominent roads, East and West, have placed orders for the new type of cars, and it is only a question of time when most of the old wooden freight cars will be replaced by the pressed steel cars. Fifteen to twenty small coal roads and private ore companies operate from fifty to five hundred of the cars. Many of the coal and ore mining companies find them far more serviceable than the ordinary type.

The Fox Pressed Steel Equipment Company was the first pressed steel concern established in the country, and a fine plant was in operation at Joliet, Illinois, before the Schoen pressed steel car had been invented. In 1897 the Schoen Pressed Steel Company was organized for the manufacture of the pressed steel cars, and a plant established in Pittsburg. In 1899, January 12, these two companies operating in pressed steel products were consolidated as the Pressed Steel Car Company, with a capitalization of $25,000,000. The consolidated company owns one large plant at Pittsburg, where pressed steel cars are made exclusively, another where steel specialties, such as truck frames, bolsters, counter planes, and general miscellaneous car parts are manufactured, and the Joliet plant for similar car specialties. The capacity of the car plant when running to its utmost limit is 100 cars a day, and this daily number has frequently been turned out during the past year to meet the demand.

The new type of cars are constructed entirely of steel, all the parts except the sheets that make up the sides, ends and flooring being forced into shape directly from the uniform sheets of steel by hydraulic presses of great power. The structural steel cars by virtue of their shape and riveting weigh about 10 per cent more than the pressed steel cars. The former had already sounded the doom of the old wooden freight cars, and on all the roads handling heavy freights the steel cars were rapidly displacing the old wooden types. The saving in weight by pressing single sheets of steel into shape to make the cars is not the only advantage obtained in the modern article. The sheets of steel can be made heavier at certain points where the strain is the greatest without increasing the general thickness of the sides throughout. Thus at the corners and at various other points the thickness of the pressed steel cars is quite double that at other places. There is a direct economy of material in this work which proves an important item in the manufacture. Of course there is more or less riveting required, but there is about 60 per cent advantage in the number of rivets used and their consequent cost and weight over the structural steel cars.

In recent years the low transportation rates that have of necessity prevailed on most of our railroads have worked havoc with the profits of even some of the best-equipped roads, and many of the weaker ones have been forced into bankruptcy. The effort to economize in every possible way seemed a hopeless task. Some roads were making their profits on passenger traffic and conducting their freight department for the love of it until better times returned. But it is not likely that freight rates will ever advance to their former figures. Everything points to a gradual lowering of transportation rates both on land and water. There was consequently an imperative demand for some freight car that would have a carrying capacity sufficient to enable the roads to earn dividends in handling bulk freight. The modern steel cars were the outcome of this universal demand.

The standard wooden car of about 30 tons costs to-day about $725, which is in excess of a steel car of the latest pattern. The standard wooden car, with a carrying capacity of 30 tons, weighs 30,000 pounds, and when loaded the ratio of the load or paying freight to the total weight of car and cargo is 66·67 per cent. The pressed steel cars, with a carrying capacity of 50 tons, weigh only 34,000 pounds, and when loaded the ratio of the load to the total weight of car and cargo is 74·60 per cent. In the larger steel cars, those of 55 tons for instance, the ratio of the load or paying freight to the weight of car and cargo is a trifle over 75 per cent.

The whole question of profit or loss is often decided by this ratio of paying load to the total weight of loaded car, and the matter of figuring out a profit on lines where the freight charges must of necessity be the lowest is one of securing the right cars. Roads equipped with the latest freight cars have made higher mileage profits at as low rate charges as other roads equipped with the old-style cars. Freight profits differ widely on different roads. There is the question of competition, long and short hauls, and character of the freight to be considered; but there should be some average struck to show the relative superiority of one car over another. The Pittsburg, Bessemer and Lake Erie holds the record for the highest train-mile earnings in this country, and with 50-ton pressed steel cars, 30 cars to the train, it earned $5.38 to the mile in hauling iron from Lake Erie to Pittsburg and coal back to the lakes. This heavy earning capacity must not be attributed entirely to the use of the new style of freight cars; but other important roads, equipped with old wooden cars, were making at the same time earnings that varied only from $1.47 to $2.73 to the mile. These latter roads were widely distributed over the East and West and were engaged in hauling a great variety of freight. Thus the New York Central's train-mile earnings for the same year were $1.84, the Great Northern $2.73, the Northern Pacific $2.70, the Erie $1.47, and the Chesapeake and Ohio $1.38.

Figures of course speak on a railroad's balance sheets more plainly than words, and when the year's comparisons of the different road earnings are presented, there is always an investigation to discover the reason for one road's superior earning capacity over that of another. One road may thus lead in innovations for a time, but the others are sure soon to follow. With the clear demonstrations of the superior earning capacity of steel cars over the wooden structures, it is only a matter of a short time before the wooden cars will be relegated to the past. They are just as surely doomed as the old horse cars of our city. Meanwhile improvements in the steel cars may still further revolutionize the freight traffic of the country.

FRENCH CONGO REGION.

The bulletin of the French-African Committee gives an analysis of the report recently published by the government of the French Congo as to the situation of that region in 1898. A notable increase in the commercial movement is marked; during the year the total figure for the imports and exports reaches $2,108,000, which is an increase of $338,000 over the preceding year; the greater part of this commerce is with foreign countries, especially England. Of the products exported by the country, that of caoutchouc will be the most considerable, as soon as measures have been taken to stop the depredations made by the natives upon the rubber-producing plants, and the industry will be greatly increased when proper facilities for transportation have been provided. Experiments have been made on the cultivation of the cocoanut, coffee, tobacco, clove, vanilla, and other plants, which have proved quite successful. The report gives interesting details as to the postal service in the region and the meteorological conditions. The primary schools are conducted by the various missions; there are 52 schools, counting 2,654 pupils.

ANTI-ALCOHOL SERUM IN FRANCE.

Drs. Sapelier, Thebault and Broca have advised the French Academy of Medicine that they have discovered an anti-alcohol serum. They stated that their experiments proved that a horse fed for a certain time on doses of alcohol and food mixed with alcohol furnished a serum antiethyline which, injected into victims of the alcohol habit, gave them an absolute distaste for the liquor. Dr. Sapelier has sent a second communication to the Academy stating his methods and results obtained. He cited fifty-seven cases of drunkards treated by antiethyline; thirty-two cases were successful, or sixty per cent: fifteen per cent had their condition improved, and the failures amounted to twenty-five per cent which was caused by irregularity in following the treatment, or from physical defects considered as unfavorable. It has been stated that the success obtained by the injection of anti-alcohol serum is due to imagination or auto-suggestion, but this is refuted by Dr. Sapelier, who states that the hysterical and impressionable patients figure among the failures, or those who were merely improved in condition. The three doctors have deduced an ingenious theory from their system. They say that the action of anti-alcohol serum awakens reflex acts which, as a whole, constitute originally the instinctive distaste of man for alcohol, thus re-establishing a natural habit in place of the induced habit.

PARIS EXPOSITION NOTES.

Among the interesting exhibits in the American section at Vincennes is that of the McCormick Harvesting Machine Company, who have built a special pavilion near the Machinery Building; it is of tasteful construction, and contains a number of agricultural implements, many of which are shown in operation. A small model of the company's works at Chicago is to be seen; it is represented in motion, with the small boats moving along the Chicago River, railroad trains, etc. Another model is that of a farm, with different agricultural machines in operation. The pavilion was recently inaugurated by a ceremony at which Mr. McCormick, Mr. Peck, and a number of American representatives were present.

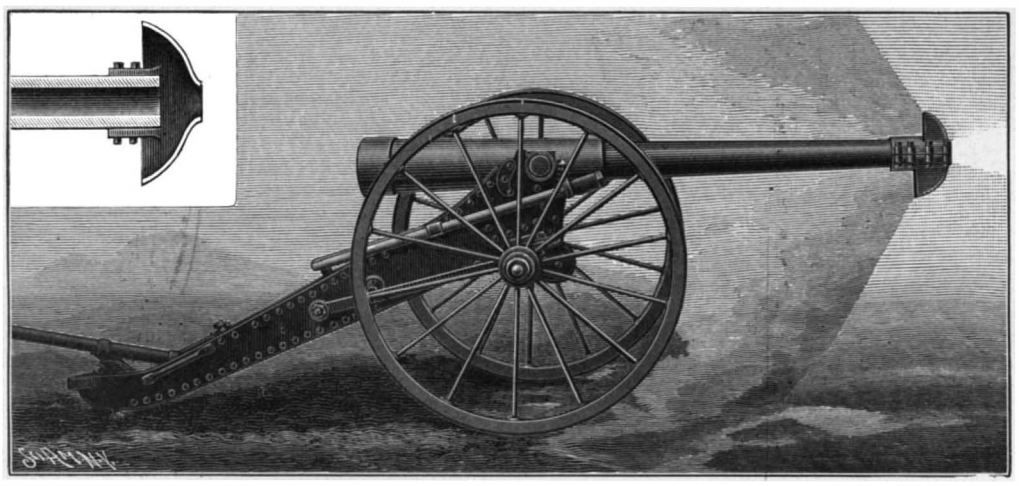
The United States section in the department of textile fabrics has recently been opened; the exhibits give a good idea of the American industry in the lines of textiles, furs, boots and shoes, hats, and like manufactures. A number of fine sets of furs are to be seen. An interesting feature is a series of shoe machines which are in actual operation, showing the American method of manufacture. The exhibit of silks and other fabrics is also of interest, as well as that of clothing, hats, etc. A moving staircase, or inclined way, of American make, conducts the visitors to the gallery above. It differs from the platforms of French make in that it is made up of a series of steps, the latter being constructed on the endless belt system; of these there are a number in different parts of the Exposition.

The first illumination of the Electric Palace and Fountain took place on the evening of May 27. An immense crowd had gathered to witness the sight, and at 9 o'clock the circulation became difficult in this part of the Exposition. The public were not disappointed, for not only was the front of the Electrical Palace lighted up with a succession of colors, but also the fountain of the Château d'Eau was illuminated for the first time. The appearance of the fountains when viewed during the day is pleasing; the jets of water in the various basins are projected to a considerable height, and a number of sprays are sent into the basins from different sculptural groups around the border. At night, when the light is sent up from below into the jets, a strikingly brilliant effect is obtained, and the cascades appear blue, green, purple, or golden, as the different colored lights are used in succession; the fountain is thus visible from all parts of the grounds. The rich carvings and reliefs of the great central arch reflect the light of different colors, and are thus seen under a new aspect.

A number of handsome pavilions have been erected on the upper floor of the Electrical Palace; some of these represent different governments, and others have been built by private firms. Among the latter the Allgemeine Electric Company, of Berlin, is the largest and most attractive; it comes next to the United States Pavilion. It is built of white staff, of square form, surmounted by a dome. The sides and dome are ornamented by a vine and leaf design in iron and repoussé metal of handsome construction; it contains incandescent lamps at intervals, and a number of lamps are placed around the pavilion; the reliefs in staff, of a somewhat grotesque character, are very pleasing. The interior is frescoed in different designs, some of which show the interiors of different electrical shops. A number of interesting electrical exhibits are to be seen, both in the interior and exterior. The pavilion is to be lighted in the interior by Nernst lamps, and small dynamos, motors, measuring instruments, Roentgen tubes, etc., are to be seen. The same company has erected another structure in the gallery at the end of the main dynamo room; it is built of repoussé copper in various designs, with stained glass, and is surmounted by a dome. The interior contains exhibits of various cables for telegraph and telephone; for high tension, etc., as well as a fine display of insulating material. The attention of the public is attracted by the noise of a large spark which is passed across a sheet of mica from a high-tension transformer. A system of wireless telegraphy is to be established, which will make communication between the two pavilions, and show the recent German types of this apparatus. It may be remarked that the exhibits of German dynamos and electrical apparatus are among the finest in the electrical section and have received many favorable comments.

CANET GUN WITH GAS-RECOIL-CHECK.

The device shown in our illustration of a Canet field-gun, is of that generic kind which at first sight suggests the criticism that "it is impossible to lift one's self by one's boot-straps." On closer inspection, however, it will be found that the principles of the gas-recoil-check are perfectly sound, and that part of the energy of the explosion which causes the gun to recoil may be utilized to check that recoil. The device consists of a funnel-shaped, steel casting, which is bolted to the muzzle of the gun, as shown in the small detail view, and is provided at its apex with a hole which is in line with the axis of the gun, and is made slightly larger than the bore of the gun so as to allow the shot to pass through freely. The instant the base of the projectile has passed clear of the muzzle of the gun, the gases spread out in mushroom shape and strike against the inside of the recoil-check-plate. Here they are deflected to the rear, as shown in the engraving. The impact of the gases upon the plate tends to move the gun forward in the direction of the fire line, thus serving to check, to a certain extent, the recoil. The trail of the gun ends in a fixed spade attached to the trail-plate, which is forced into the ground as the carriage is driven to the rear, and cooperates with the gas-recoil-check in preventing the recoil.



Powder gases strike the inside face of dished plate and assist in checking recoil.

CANET GUN WITH GAS-RECOIL-CHECK.

In the experiments carried out by the Schneider-Canet firm at the proving ground it was found that, while the device acted favorably, there was a certain disadvantage in the fact that the gunners had to stand outside the wheels in order to avoid the hot gases which were deflected to the rear by the recoil-check. We are of the opinion that while this invention provides a cheap substitute for the expensive recoil springs and hydraulic cylinders commonly in use, it is not likely to be adopted very largely in modern batteries.

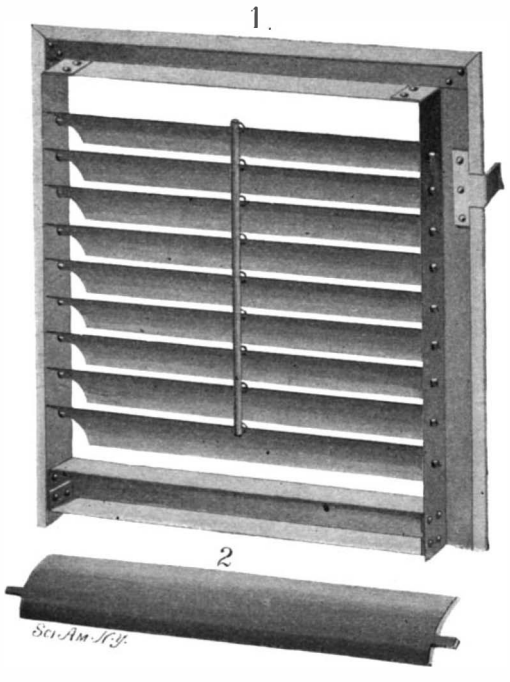
A FIREPROOF SHUTTER.

In order to prevent the passage of fire through windows, a new shutter has been invented by Hezekiah A. Hickock, of 157 South Carolina Avenue, Atlantic City, N. J.

The shutter is entirely constructed of sheet metal, with the side and end rails riveted together. Flanges are formed by turning the edges of the side and end rails inwardly, which flanges are joined by tongues.

The slats are made concave in form, but are otherwise similar to the slats usually employed in shutters, and are caused to move in unison by means of the ordinary longitudinal central bar.

This shutter, besides its fireproof qualities, possesses



HICKOCK'S FIREPROOF SHUTTER.

the merit of being lighter than a wooden shutter. By joining the several parts of the framing, as described, a rigid and serviceable construction is provided.

Foundry Coke.

That there is considerable difference between furnace and foundry fuel coke is quite well known, but as there are some things concerning the preparation and composition of these two fuels which are little known, a few words relative to foundry coke may be of interest here. In these days when the demand for all coke fuels is in excess of the production, and when important advances in the methods of coke-making are being urged and in many cases adopted, economy and excellence in fuel supplies is a most important question with foundrymen.

The cradle of the coke industry is in the Connellsville region of Southwestern Pennsylvania. This coal district is a detached portion of the Pittsburg coal seam, and extends along the western slope of the Chestnut Ridge range of the Alleghanies from Latrobe, on the main line of the Pennsylvania Railroad, forty miles east of Pittsburg, southward to the Maryland and West Virginia line. The average width of this coking coal field is only four or five miles, and while the original Connellsville region included some 100,000 acres, to-day its limits have been widened considerably, owing to the fact that the profits of the industry have caused capitalists to engage extensively in this departure in fuel-making. Much of the coal area, being controlled by the H. C. Frick Coke Company and other allied concerns, the later operators in the field were compelled to take up adjacent lands, where more or less difficulty is experienced in producing a first-class article.

In the Connellsville region the coal is a natural coking one. When coke was first made in the early days of the century, the coal was heaped in open ricks, built on the ground, and a good article of coke thus produced. Later the bee hive oven, the type now in general use, was introduced. This oven takes its name from its shape, and really makes no provision for the chemical enrichment of the product. But in a strictly coking coal, such as the Connellsville coal, there is little need for such provision.

In the bee-hive type of oven the difference in composition between a furnace and a foundry coke is obtained through a variation in charging the ovens and in the time consumed in the coking process. Thus, for producing a foundry coke, a heavier charge of coal is required, and, while forty-eight hours is considered the proper time for furnace coke, the time for foundry coke is fixed at seventy-two hours. The consequence of these provisions observed, when a good foundry coke is desired, is a harder and purer product, the time and manner of charging accomplishing the proper results as to the distribution of cell space through the proper combustion of the coal coked.

However, where the bee-hive type of oven is used it is not possible to get a perfect uniform product. But the general introduction of the various retort and by-product oven systems now being urged will accomplish this result. As ordinary foundry coke is superior to anthracite coal, so too will be the by-product oven coke be superior to the ordinary bee-hive oven product. Already this has been proven, for the by-product oven is no longer an experiment, being in successful operation in many localities.

For foundry purposes it has been conclusively proven that the by-product oven coke is at least 20 per cent superior to the bee-hive oven product. Tests of by-product oven coke produced from Connellsville coal, made in Pittsburg foundries, have shown even a higher percentage in favor of the new method coke. It requires less blast, gives a smaller amount of slag, does not clinker, will carry more scrap, and will melt more iron with the same quantity of coke.

As to the saving of ordinary bee-hive oven coke over anthracite coal, I have the figures of a large foundryman. In substance they state that, for a day's work in his foundry, under anthracite, 3,000 lb. of fuel were used at a cost of $10.50. The loss of time to molders amounted to $12, and the extra power to drive the blower cost $1. Using coke but 2,250 lb. were required, costing about $7.25, which left a balance in favor of the ordinary of $16.25 for the day's operation, with the further economy of 20 per cent. to 25 per cent. A considerable enconomy will follow the general introduction of by-product coke for foundry purposes. But as these figures were compiled some time ago, when all kinds of fuel were much lower than at present, the prices of to-day would raise them considerably.

Another phase of the by-product coke oven development is that it will have the effect of shifting the coke plants to the foundries. The profit to be reaped from the utilization of the gas, tar, ammonia and other products which are utilized by these ovens, will more than meet the cost of transporting the coal to the ovens thus located. Then, too, the gas can be utilized for foundry purposes. To-day millions of dollars are being wasted annually through the general use of the old bee-hive type of ovens. In this age of economy and fuel reforms, manufacturers are coming to a realization of these wasteful methods. Furnace and foundry operators are already operating by-product oven coking plants in Pittsburg and elsewhere, with flattering success. A number of such plants are in operation in New England. At Wheeling, W. Va., Syracuse, N. Y., Sharon, Johnstown, Dunbar, and Latrobe, Pa., plants of these systems are in successful operation.

The requisites for foundry, as well as for all other branches of iron and steel manufacturing, is a fuel which is absolutely uniform. While anthracite coal, in a large degree, met these requirements, yet the porosity of this form of fuel was not sufficient to make it a desideratum.

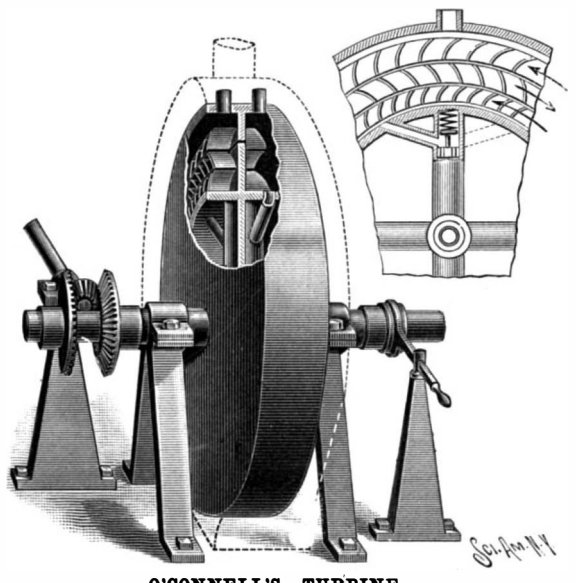
That the by-product coke fills this and other requirements has been proven beyond contention, although this departure in fuel-making is yet in its infancy.

A NEW STEAM TURBINE.

An improvement in reaction and radial flow turbines has been devised by Mr. Michael O'Connell, of Cappoquin, County Waterford, Ireland, which improvement embodies a reaction-wheel and an impact-wheel, provided with steam-deflecting vanes, whereby it is possible to drive the wheels together or independently.

Mounted on a hollow shaft communicating with a steam supply is a central reaction-wheel provided with two sets of radial channels leading in opposite directions to the periphery of the wheel. Upon the outside are double ring sets of vanes, divided by a partition, these vanes being disposed in opposite directions and constituting an impact-wheel. When the steam is passed through one set of channels and vanes, the central wheel rotates in one direction; and when the steam is passed through the other set of channels and vanes the central wheel rotates in the opposite direction. After issuing from the channels, the steam is conducted through stationary vanes, constituting a deflector, and thence acts on vanes attached to the central wheel. The stationary vanes (deflector), which are fixed to a casing, can be made to rotate in an opposite direction to the central wheel (see diagram), so that the steam, after passing through one wheel, acts directly on the second wheel.

To cut off the steam from the channels, a ring-valve in the form of a spoked wheel is mounted between the



O'CONNELL'S TURBINE.

channels and vanes, the ring-valve having ports corresponding with the forward and backward ports in the channels. To run the motor forward, the ring-valve is rotated until its ports register with one set of channels; to reverse the motor, the valve is moved until the opposite ports open; to stop the motor, the valve is moved to an intermediate position, so that all ports are closed. The valve is operated by a lever connected with a sliding sleeve on the shaft, the sleeve having a spiral groove engaging a pin on the hub of the ring-valve. To regulate the speed of the motor, a governor in the form of a spring-pressed valve is placed in each channel. When the speed becomes excessive the governors press against their springs and partially close the ports.

CHINA AND THE CHINESE.

The area of China is 4,218,401 English square miles. Of this territory only 1,336,841 miles belongs to China proper, the remainder being the dependencies of Manchuria, Mongolia, Thibet, Jungaria and East Turkestan. Nothwithstanding the relatively small size of China proper, it contains the bulk of the population, having 386,000,000 inhabitants out of a total population of the kingdom of 402,680,000. The present Emperor of China belongs to the Manchu dynasty, which overthrew the native dynasty of Ming in the year 1644. As the late Emperor died suddenly, he did not designate a successor, as is the custom in China, where there exists no law of hereditary succession. This is one of the causes of the trouble in China, owing to the fact that the Empress Dowager was able to obtain ascendancy over the young Emperor, so that on September 22, 1898, an imperial edict was issued announcing that the Emperor had resigned power to the Empress Dowager, who has since retained the direction of affairs and by her dislike of foreigners has done much to foment the troubles and has made it easy for the Boxer movement to gain headway, even if she is not directly responsible for the attack, as has been suggested by those who have an intimate knowledge of Chinese affairs. On January 24, 1900, it was declared by decree that the son of Prince Tuan should succeed the present Emperor. This is generally regarded as equivalent to Kwang Su's deposition. The lively interest which Prince Tuan is taking in the attacks on foreigners is easily accounted for by his son's right to the throne.

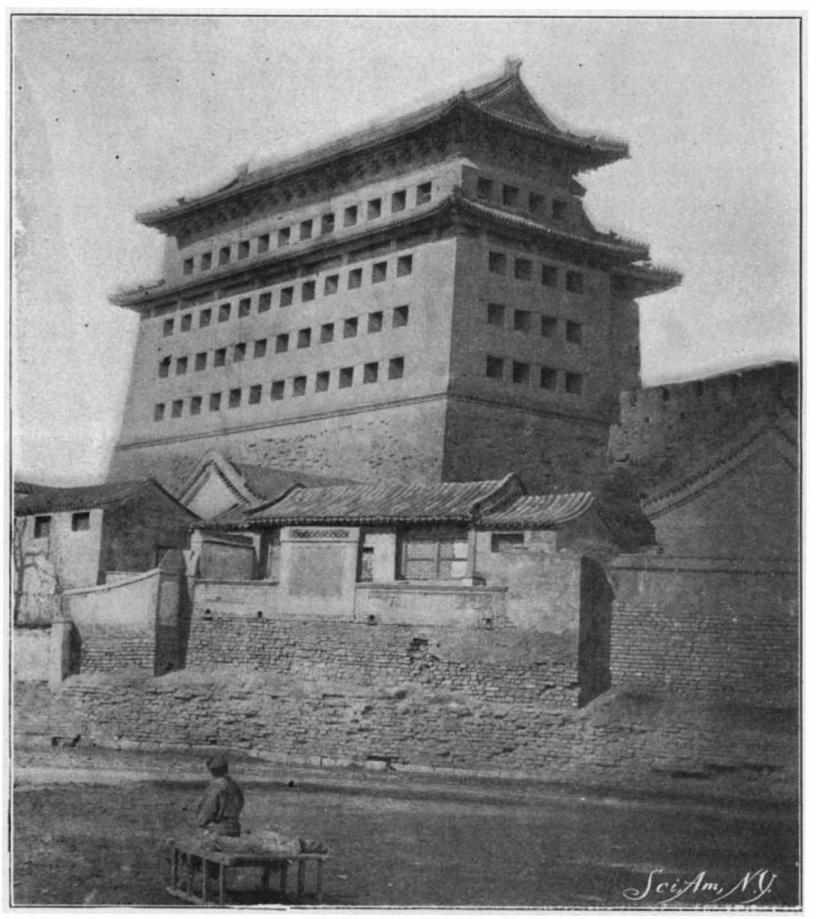
CHINESE CARPENTER PLANING A LOG.

A CHINESE SAWMILL.

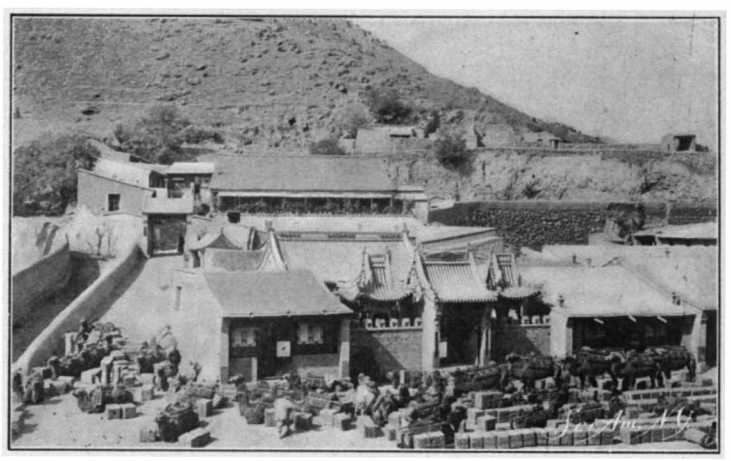
The government of the state is based upon the government of the family. The supreme direction of the Empire is vested in the privy council or grand council. The administration is under the direction of a cabinet comprising four members, two of Manchu and two of Chinese origin, besides two assistants from the great college, who have to see that nothing is done contrary to the civil and religious laws of the Empire. These members are called ministers of state. Under their orders are seven boards of government, each of which is presided over by a Manchu and a Chinese. The boards are: 1, for civil appointments; 2, for revenues; 3, for rites and ceremonies; 4, for military affairs; 5, for public works; 6, criminal jurisdiction; 7, admiralty board. Independent of the government, and theoretically above the central administration, is the Board of Public Censors, which consists of forty or fifty members under two presidents. They are privileged to present any remonstrance to the sovereign, and one of them must be present at the meetings of each of the Government boards. Each of the eighteen provinces is governed by a governor-general, who is responsible to the Emperor for the entire administration, political, judicial, military and physical. He is assisted by a council and other officials. Each province is subdivided into departments, ruled by prefects, and each department into districts, each under a separate ruler. Each town and village also has its governing body, and among the various rulers there is a regular gradation in rank, each being responsible to his immediate superior. Political office in the general administration of the Empire is less sought after than the position of viceroy or governor in the provinces, where there are opportunities of acquiring wealth. The number of foreigners resident in the open ports of China was 13,421 at the end of 1898, British subjects predominating. About a half of the total number of foreigners reside at Shanghai.

It is 200 feet high and it has 2,000 iron bells rung by the wind.

PA-LI-CH'UANG PAGODA, PEKING.

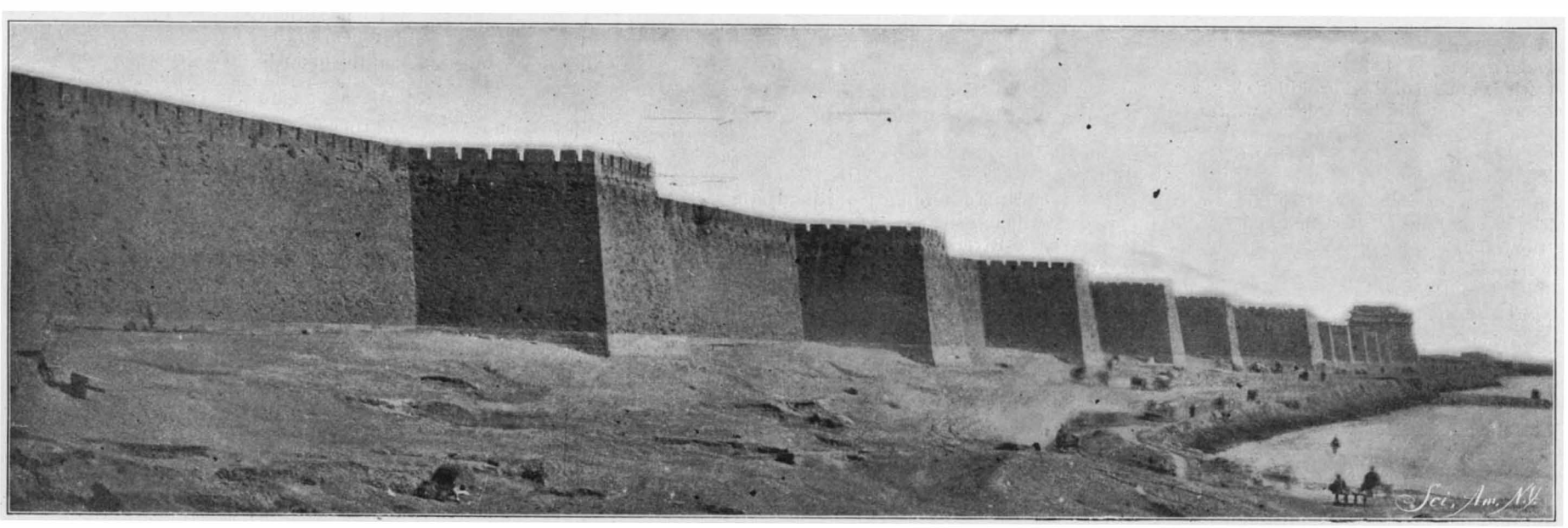


TOWER OF CITY GATE, PEKING.



DEPARTURE OF A TEA CARAVAN.

Three religions are acknowledged by the Chinese as indigenous and formally adopted: Confucianism, Buddhism and Taoism. The Emperor is considered the High Priest of the Empire and can alone, with his immediate representatives and ministers, perform the great religious ceremonies. Confucianism is the State religion. With the exception of the practice of ancestral worship, which is everywhere observed throughout



CITY WALL OF PEKING, SHOWING THE MOAT.

the Empire, and was fully commended by Confucius, Confucianism has little outward ceremonial. The study and contemplation and attempted performances of the moral precepts of the ancients constitute the duties of a Confucianist. Buddhism and Taoism present a gorgeous and elaborate ritual in China. The bulk of the people are Buddhists. There are about thirty million Mahommedans, one million Roman Catholics, and fifty thousand Protestants. Most of the aboriginal hill tribes are still nature worshippers.

The army of China comprises "the Eight Banners," nominally containing about 300,000 men. The national army whose nominal strength is about 550,000, has about 200,000 available for war. Besides these forces there are mercenary troops ready in emergencies and Mongolians and other irregular cavalry. The latter are nominally 200,000 strong, but like everything else in China they largely exist on paper. They number really but 20,000 and are of no military value. The total land army on a peace footing is put at 300,000 men, and on a war footing of about 1,000,000, but the army, as a whole, has no unity or cohesion. There is no proper discipline, the drill is merely physical exercise, and many of the weapons are long since obsolete; but since April, 1895, British firms have shipped to China 71 guns of position, 123 field-guns and 297 machine-guns and a German firm has supplied China with 460,000 Mauser rifles and 3,000,000 rounds of ammunition in the same period. From this it will be seen that the Chinese are not as backward, as regards war material, as has been supposed. Supplies of ammunition for the guns have been adequate. The Chinese navy during the war with Japan disappointed those who regarded it as an effective fighting force. Some modern vessels have since been added to the fleet.

Peking is at once interesting, despicable, superlatively beautiful, disgustingly filthy, and, in short, a city of contradictions. Originally a Tartar encampment, begun by the hordes that swarmed to the eastern part of China, Peking soon became a fortified city of much strength. Here the Tartar rulers lived, surrounded by their Manchu followers—fearing the white man's usurpation far less than the numerical preponderance of the Chinese. So, in order to protect themselves from unexpected assault, they constructed a huge wall around their city—for China is a land of walls—and for a time lived in tolerable security.

Gradually, however, the Chinese, realizing to some extent their power, began a rival city adjoining the Tartar fortress. They, too, built a wall, and, as the Tartars did, whenever a workman died, his body was entombed within the wall. In this manner, it is estimated, that one million human beings found their last resting places in the walls surrounding Peking.

While the Chinese city is of much interest, both from a sociological and architectural viewpoint, yet the Tartar city is the more important, for within its precincts is the "Forbidden," or Purple City, where lives Kwang Su, the unfortunately progressive monarch of the Chinese. The Forbidden City is a city of night, for there the denizens of the palace of the Son of Heaven awaken and begin their life.

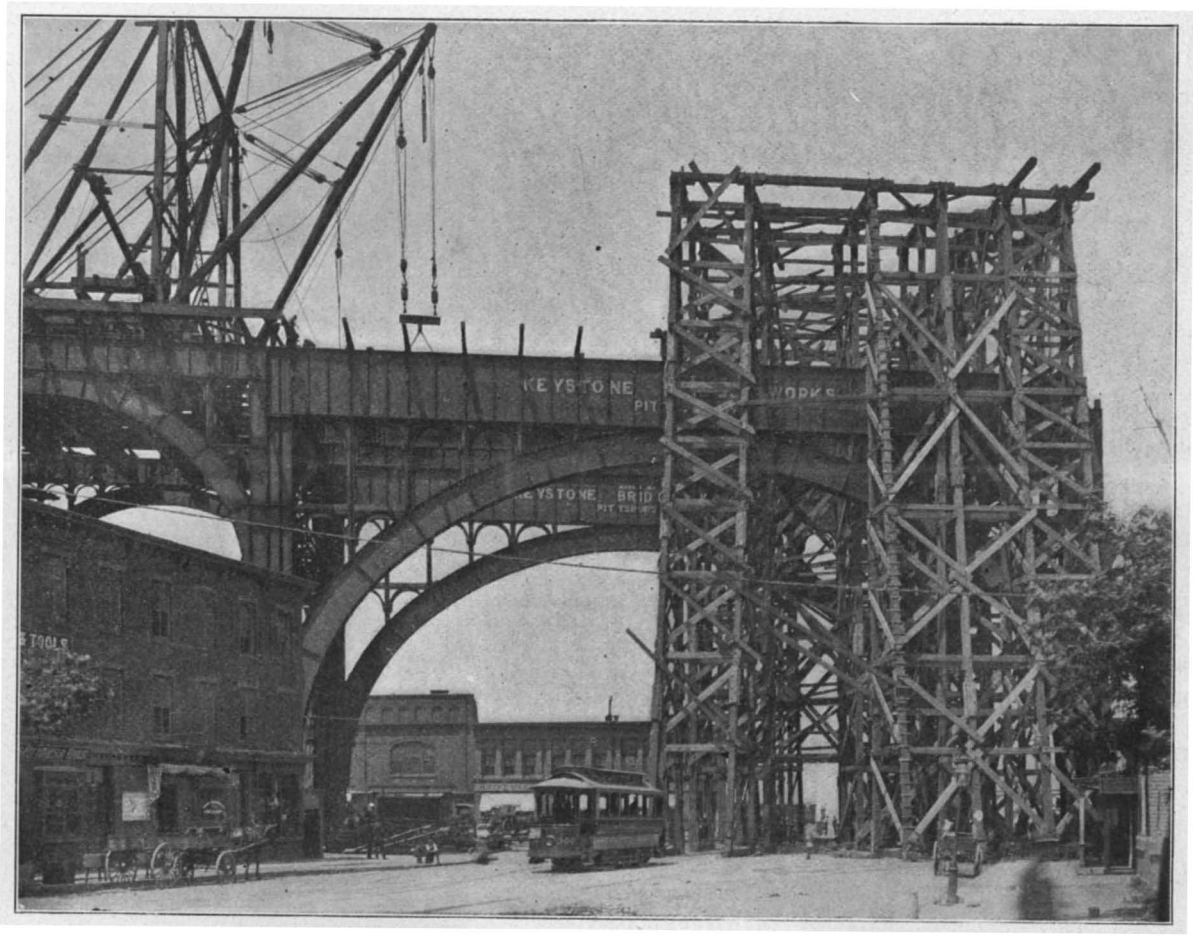
Little is known of the Forbidden City, for within the memory of man not half a dozen whites have entered it. All that is known is that it contains the palaces of the Emperor, and, what is perhaps more interesting, the famous coal hill. This immense heap of coal was accumulated for use in case the city was besieged. The hill is several hundred feet high and contains hundreds of thousands of tons of coal.

Whenever the Emperor was about to leave the Forbidden City, for some religious or State function, the legations of the foreign nations have been notified, so that no unholy eye might rest upon the puny form and sallow face of Kwang Su. The entire route to be traversed was curtained off and thousands of soldiers line the so-called streets, so that no Peeping-Tom could ply his trade. But despite all such precautions, the well-known Oriental propensity for money, exceptionally strong in the Chinese, enabled foreigners to see Kwang Su at close range. They beheld a shrinking, slight figure, dressed plainly and utterly eclipsed by the gorgeous apparel of his retinue.

The rest of Peking is very much like all Chinese cities—picturesquely confusing and terribly dirty. Streets run in the most bizarre fashion, totally oblivious of their beginning and end, aimlessly wandering from bad to worse, fringed on both sides by hovels and palaces, in confusion. Dogs and pigs meander about, jostle equally offensive beggars and unkempt children; stuffy litters, suspended on long bamboo poles and carried by coolies, make life a burden; odors, concentrated beyond the power of descriptive writing to portray, overwhelm the nostrils; the effluvia of ages of non-sanitation, drawn heavenward by the torrid sun, spreads disease; the chatter of a thousand gutteral Mongols and Chinese is intermingled with the yelping of the dogs, the squealing of the pigs, the screaming of the children, and the loud cries of the coolies—such is Peking.

Of course, there are parts in the outlying hills where the rich mandarins and merchants live, where true Oriental luxury can be found. There, magnificent palace-like dwellings dot the landscape, surrounded by idyllic gardens. The art and imagination of the Chinese architect have found full scope for his talent, and as a result these habitations are a credit, externally and internally—all save the sanitation, of which the Chinese are in blissful ignorance. Yet the wealthy Chinese has luxury, even though a coolie takes the place of an electric fan to cool his fevered brow.

Taken all in all, China and the Chinese make an interesting study from any viewpoint, but it is wrong to underestimate their brain power in such study, for they are far more advanced than is generally conceded.



One end was lifted from the traveling derricks and the other from the timber falsework.

LIFTING THE 130-FOOT GIRDERS INTO POSITION.

Let China be civilized, and the world will witness as great a metamorphosis as that which so astonished the world when Japan emerged from her chrysalis of Middle Age conservatism and provincialism.

RIVERSIDE DRIVE VIADUCT, NEW YORK.

The handsome viaduct which is now being constructed across Manhattan Valley is being built for the purpose of connecting Riverside Drive with the important system of driveways which encircles the northern end of Manhattan Island. When it is completed the citizens of New York will be provided with a continuous high-level boulevard, reaching from Seventy-second Street and the Hudson River to the western end of Dykeman Street, on the Harlem River, a distance of 7¼ miles. As the latter thoroughfare is practically the northern terminus of the Harlem River Speedway, which is some three miles in length, the completion of the Riverside Drive viaduct will afford a continuous drive of ten miles along the picturesque banks of the Hudson and Harlem Rivers.

Manhattan Valley has a width of about a third of a mile and is intersected by six different streets, one of which constitutes the main approach to the Fort Lee ferry and is traversed by horse and electric trolley lines, the latter fact alone rendering the valley unsuitable for the construction of a public driveway at the level of the streets. On the north the valley rises abruptly to Washington Heights, a ridge or tableland which extends northward between the Hudson and Harlem Rivers to the extreme limits of Manhattan Island. Around its western and northern bluffs winds a most picturesque driveway known as the Boulevard Lafayette. This boulevard and the Riverside Drive to the southward afford magnificent views of the Hudson River, which is here flanked by the lofty cliffs of the Palisades on the west and she richly wooded heights of Manhattan, Spuyten Duyvil and Yonkers to the east.

The viaduct, which has been designed with a view to its harmonizing with the features of the surrounding country, is a steel structure whose total length, including the masonry approaches at either end, is 2,074 feet. The southern approach is located just below Claremont, a villa rich in historic interest, which is situated in the loop which at present forms the northern terminus of Riverside Drive. Immediately to the south of Claremont rises the massive pile of the Grant Memorial Tomb. This entrance to the drive will be carried on a masonry approach 262 feet long. The steel structure, 1,564 feet in length, consists of a series of steel arches of 65 feet span carried on steel latticed piers. The roadway, 60 feet in width, is constructed at an elevation of about 75 feet above the ground level. Ten-foot sidewalks, supported on brackets, are provided on each side of the roadway, and at regular intervals balconies are built out from the sidewalks to afford places of rest and observation. The southern entrance is widened out and bounded with a semicircular wall, in the center of which stone staircases lead down to the lower level of the valley. The masonry of the approach is finished in coursed ashlar limestone, while the pedestals, copings, capstones, etc., are of granite, hammer-faced. The 65-foot arches of the viaduct, which are 3 feet in depth, are of latticed plate-girder construction and are rectangular in section. The steel columns are oblong in section, measure about 3 by 5 feet, and are also of latticed plate-girder construction. The floor is carried on floor beams 5 feet in depth, of which there are six to each span, and upon these are thirteen rows of 12 inch longitudinal I-beam floor joists. Above the joists is a solid floor of riveted ⅜-inch buckle-plates. The plating of the roadway and sidewalks will be covered with a paving composition of coal-tar residuum and broken stone, and upon this will be laid the asphalt surface.

From a structural point of view the most interesting feature is the large semicircular arch of 130 feet span by which the viaduct is carried over Manhattan Street. In its relative proportions this span is exactly similar to the smaller 65-foot spans of the viaduct. It will be noticed that the plating of the columns is carried up in every case between the spandrels of the arches to the level of the under side of the longitudinal plate girders which carry the floor system. These plate girders are designed to carry the whole of the dead load of the floor system, and they have been so nicely calculated that when the bridge is completed their under side will just touch the crown of the arches. Most of the live load that comes upon the bridge, consequently, will be transmitted directly to the arches and carried by them to the columns.

In the case of the main 130-foot span, the two longitudinal plate girders were necessarily of massive proportions, as can be seen from the small engraving showing one of them in place upon the cars on which it was transported. They are 130 feet long, 10 feet deep and 3 feet wide, and each weighs 62½ tons. Necessarily the work of raising these masses of metal to their place on the columns was a difficult piece of work, which was aggravated by the fact that only a limited number of hours was granted by the street railway company for the necessary interruption of traffic during their erection. The accompanying illustrations show the method by which the spans were lifted into position. A series of trestles, built up of 12 by 12 timbers, was erected at the northern end of the arch, and a pair of powerful erecting derricks was built upon the floor of the viaduct at the southern end of the span. Four hoisting engines were engaged in lifting each span, and at a given signal the huge mass was lifted the necessary 75 feet into the air and moved easily into place on its abutments. What rendered this operation particularly difficult was the fact that the exigencies of

erection demanded that one of these 130-ton spans and four of the longitudinal, intermediate girders should be suspended in the air at one time, and held there long enough to allow a certain amount of bolting and riveting to be accomplished. The total amount of girder work thus suspended at one time was 220 tons.

The designer of the structure, Francis Stuart Williamson, M. Am. Soc. C.E., of this city, is to be congratulated on the appearance of the viaduct, which, judging from that portion of it which is now completed, promises to be an attractive feature in one of the most picturesque localities on Manhattan Island.

Engineering Notes.

The public buildings of the United States have cost, since the foundation of the government, exclusive of the buildings in Washington and those employed by the Army and Navy, $154,775,384. Of this the sites have cost $22,755,167, and there remains $23,843,574 to be expended on these buildings before they are completed.

Two types of moving stairways for the Manhattan Elevated stations in New York city are to be put on trial shortly. One is a ramp consisting of an endless rubber band running over drums. In the other type regular steps will take the place of the nearly smooth incline, so that a passenger always stands on a level surface.

A special car for invalids is being built for the Saxon State Railroads for the transportation of those who can afford the expense of a whole car. It consists of three apartments, with a corridor on one side. One is for the sick person, and one of the others for the physicians, and the third for attendants. Cooking apparatus and refrigerators are provided. It may be hired for use on any railroad in Europe provided it is not needed at home.

The question of the scarcity of fuel in Russia has long occupied the attention of Russian scientists. Coal is found only in small quantities, while wood is by no means sufficiently abundant to warrant extensive consumption. It is proposed to surmount the difficulty by turning the enormous quantities of peat to account. In many districts the turf comprises almost the staple fuel. Its calorific power is said to be double that of wood. The turf is compressed into small briquettes and sent to the market. It is estimated that the cost of manufacturing the turf for commercial purposes is about six dollars per ton, which compares very favorably with the price of coal.

A new fire-proof substance was recently tested in England at the station of the British Fire Prevention Committee. The material, which is known as "gypsine" is manufactured of plastic hydraulic lime, mixed with coke or sand, and asbestos. It is compressed into bricks. In the experiment to prove its fire-resisting qualities, a partition 10 feet in length by 7 feet 9 inches in width was constructed with these bricks, which were laid in hydraulic mortar with joints ¼ inch thick. The side of the partition exposed to the fire in the test hut was coated with a thin layer of fire clay. The fire was maintained for an hour, during which time the temperature rose to 2050° Fahr. Notwithstanding, this tremendous heat the material successfully resisted the flames. At no period of the test did the temperature of the exterior surface of the partition attain a height sufficient to ignite a match.

It is a well-known fact that in all carbide works a vast amount of material is manufactured that is of such inferior quality that it cannot be employed in connection with acetylene, and so far has been regarded as waste. Now, however, a French engineer, M. Hubou, has invented a process by which he can convert this unsalable material into a commercial article in the form of acetylene black. When acetylene is decomposed the carbon is liberated in an absolutely pure and finely-divided state. It is immeasurably superior to lampblack, and would prove a valuable substitute for that substance in the manufacture of lithographic ink were it not for the fact that it is so exceedingly expensive that it would not pay for its manufacture. M. Hubou, by his new process, however, is able to convert the carbide residue into the black at a very small cost, so that it can compete in price with the ordinary lampblack. His process is simplicity itself. The acetylene is forced into an explosive vessel, filled with hydrogen, until a pressure of about 75 pounds is attained. The substance is then exploded by firing a coil of platinum wire, that has been previously inserted into the vessel, to a white heat. Owing to the presence of the hydrogen in the receptacle the heat generated by the acetylene in the process of decomposition is reduced, so that the highest pressure recorded during the explosion is no more than 370 pounds per square inch. One cubic foot of acetylene yields 1 oz. of black, while also a cubic foot of pure hydrogen is produced. There is no reason why the latter article should not also be turned to commercial account. It could be easily stored in cylinders and could be employed for æronautical and other purposes.

Science Notes.

In Paris a journal is published for theater physicians. Nearly every special branch of medical service now has its own particular organ.

The Monthly Weather Review denies the authenticity of a paragraph, which is going the rounds of the press that the Weather Bureau is utilizing piano wire kite strings in developing a new method of wireless telegraphy.

Gutta percha in Sumatra and Borneo is being exhausted owing to the reckless and primitive way in which the trees are treated. The Philippine Islands will prove an excellent place for profitably growing gutta percha.

Of the 46,988 deaths which occurred in Paris in 1899, as many as 12,314 are attributed to tuberculosis, or more than one-fourth. A more striking result is obtained by observing the figures for the different ages; thus for 100 deaths the figures for the ages from 1 to 20 years attributes 37·2 to tuberculosis; from 20 to 40 years, 60·2; from 40 to 60 years, 30·5; 60 years and over, 3·3. It will thus be seen that from the age of 20 to 40, tuberculosis counts for three-fifths of the total mortality.

The Board of School Superintendents for the Boroughs of Manhattan and Bronx have recommended the abolition of the vertical system of penmanship. The objection against the system is that it makes slow penmen. The advantage of the vertical penmanship is said to be that the attitude in which a pupil produces the vertical writing is far more healthful than for slanting writing. Roundness and legibility of vertical writing, as well as the usual angle in its execution, are asserted to be much more favorable to the eyes. If abandoned later for a more rapid style it is thought to be best to teach the child vertical writing as a foundation for his future chirography.

In a communication recently made to the Agricultural Society of France, M. Vassiliére gave an account of a new process of preserving wine from the action of microbes which attack it when in the cask. When the wine is placed in a cask which has been left empty for some time, it is subject to deterioration owing to the action of the different microbes, these being propagated when the wine is in contact with the air. The expedient generally in use consists in burning sulphur in the empty cask to purify it. The experimenter proposes to remedy the difficulty by covering the wire with a layer of carbonic acid gas, which, being more dense, drives out the air and takes its place. The carbonic acid is liquefied in tubes of chrome steel provided with a reservoir in which it takes the gaseous form before passing into the cask; the reservoir is provided with a rubber tube which descends into the cask and also with a pressure gauge by whose indications the supply of gas is regulated. By this method very good results have been attained and at a small cost.

The English government is conducting an interesting and unique experiment in connection with the foreign trade of Great Britain. For some time leading manufacturers have complained and suffered a good deal of inconvenience from their inability to obtain any information exclusively for their own benefit, regarding commerce in foreign countries. For instance, when an English firm received a contract from a foreign source they experienced considerable difficulty in endeavoring to ascertain the financial status of their client, unless they dispatched their own agent, which they were not in a position to do. Now the government has appointed commercial agents in Russia, Switzerland, the United States, and Central America, for the sole purpose of answering inquiries and forwarding any information that may be desired by English firms. By this means, English manufacturers will be able to obtain private, confidential, and exhaustive information regarding any particular process, bona fide character, or otherwise, of contracts; in short, exactly the same information as if they had dispatched their own representative to the country to conduct the investigations. The government intends to try the experiment for two years. If it proves successful, it will doubtless be continued and extended. Of course a small charge is made for all information supplied, varying according to the character, and time expended in the investigation, but taken on the whole the charges are so moderate that no complaint as to their exorbitance can be made. For instance, the charge levied upon an ordinary inquiry is $1.25; for inquiries as to trades, $5.25; for extended inquiries involving long reports and information of an exceptional character, up to $25. If the agent has to undertake a railway journey, the cost of same must be defrayed, together with $5 a day for his expenses; $2.50 for a broken day, and $5 per night for subsistence. British firms requiring any such information, can obtain, if necessary, an estimate of the cost of obtaining same, by application to the Embassy or Legation of the country in which they desire the investigations to be conducted. The agents will also forward complete and detailed reports upon commerce, industries, and so forth, to the home government, at various intervals.

Electrical Notes.

In Egypt the telephone operators are all men, and they are required to be expert linguists, speaking English, French, Italian, modern Greek, and Arabic.

A Portugal paper gives details of an invention for facilitating fox and badger hunting. It consists of a small electric lamp fixed to the collar of the dog, which is to enter a burrow. The effect of this light is to frighten the animal and cause him to come out of his burrow.

In Germany considerable attention is being devoted at present to the application of electricity in agriculture. One of the most recent movements in this direction is the formation of a syndicate in the district of Ochsenfurt, Bavaria, for the establishment of an electric system for use in agricultural work. The current will be furnished by a central station, which will use hydraulic and steam power; the distribution of current will be made at high potential, 5,000 volts, to the territory where it is to be used. In each farm will be located a sub-station, provided with a distributing switchboard, and the current will be utilized to operate threshing machines, root-cutters, crushers, etc. The electric motors are of simple construction and sufficiently solid to stand wear and tear, and are operated without difficulty. The current will be also utilized for the lighting of the villages in the neighborhood.

A new theory of atmospheric electricity has been established independently by Messrs. Elster and Geitel, on one hand, and by J. J. Thomson and Wilson on the other. This theory is based on the properties of ionized gas. The solar light, and especially the ultra-violet rays, produce in the atmosphere the phenomenon known as ionization, giving rise to an equal number of ions charged positively and ions charged negatively. As these are in equal number in dry air, their charges do not develop an electric potential of an appreciable value; but when the air has been cooled below the dew-point, it appears that the negative ions serve as nuclei for the condensation of the humidity into drops, and these, in falling, take with them the negative ions, soon leaving an excess of positive ions in the air. This causes a rise in electric potential due to the presence of these ions, and hence the electrical phenomena which accompany rain. A number of laboratory experiments have been made which seem to bear out this theory.

Two new telephone stations have been erected at Vienna, which replace the old installation, this having proved insufficient to meet the demands. The two central stations make connection at present with 12,000 subscribers in the city and suburbs, and have a maximum capacity of 30,000 subscribers. The surface occupied by the two new buildings is about 14,000 square yards each; they have four stories and cellar, the latter being reserved for the machines and for the general distributing boards into which the subscribers' lines enter. The ground floor is occupied by various offices and public telephone cabinets, and the first floor contains the sets of accumulators which furnish the current for the system. On the upper floor are several large halls, well lighted and ventilated, which contain the intermediate switchboards and the connecting boards of the station. In one of the stations there are 48 of the latter, corresponding to 144 operators; in the second station there are 36 boards and 108 operators. The construction of the buildings, ground included, has cost about $400,000, and an equal sum has been expended for the telephone lines and apparatus.

The city of Alexandria is provided with a system of electric railways, which has been in successful operation for some time past. The central station is located near the canal of Mahmoudieh, which is fed from the Nile. The various buildings cover an area of 15,000 square yards. The dynamo room is provided with three sets of dynamos, besides a switchboard and the necessary connections for the feed circuits. The first set of dynamos includes two railway generators of the Walker type, having a capacity of 350 kilowatts each; they are direct-connected to compound engines of Belgian make. The second set consists of two 100 kilowatt generators of the same type, with tandem compound engines, and the third group is a dynamo of 150 kilowatts, with a 200 horse power engine. The boiler room contains five boilers, of which one is used as a reserve. The switchboard is of black marble, divided into seven panels, six of these being used for the different feeder connections; the seventh is arranged for a battery of 225 accumulators, whose charge assists the dynamos at times of heavy traffic. The batteries are of the Sellon-Volckmar type, having a capacity of 1,500 ampere hours. The system of electric roads in Alexandria has a total length of 18 miles, not including 12 miles of road which is now operated by steam, but will soon be changed to the electric system. At present the road employs 50 motor cars and 40 trailers, each of the motor cars having two motors of 35 horse power. A foundry and machine shop have been constructed at the central station to make repairs and different pieces of apparatus.

LONDON'S NEW UNDERGROUND ELECTRIC RAILWAY.

In a few weeks' time the new electric railway in London will be opened for traffic. This system, called the Central London Railway, which is the third and largest of its kind constructed in the English metropolis, opens up one of the most thickly populated suburbs, which has always urgently required a rapid means of transit to the city. The line is six and a half miles in length, and stretches from the Bank of England, the focus of all London's trade, to Shepherd's Bush, in the West, passing under some of the busiest arteries, such as Cheapside, Newgate, Holborn and Oxford Streets, in its progress, with stations conveniently situated for reaching the most important centers, such as the General Post Office, the British Museum, Regent Street, etc.

It is only within recent years that the possibilities of underground electric traction has dawned upon British engineers. The City and South London Railway, which was opened in 1890, proved that the idea was not so chimerical as it had at first appeared. That experiment was attended with such prodigious success that other similar railways were rapidly projected. Now there is every reason to believe that in the near future the length and breadth of the English metropolis will be honeycombed with electric railways. Not that there is any danger of London being oversupplied in this direction, since such an event would be well nigh impossible. At the present time, considering its importance and commerce, the intercommunication of the great city is very inadequate and unsatisfactory.

It was the most cherished ambition of the late Mr. Greathead—the inventor of the shield, which has done yeoman service in the accomplishment of successful tunneling for subterranean railways—that London should be supplied with an efficient and thorough system of intercommunication. Unfortunately, there were several things which militated against the realization of such a desire. First, there was the question of vested interests, which proved an almost insurmountable difficulty. To tunnel through private property, even at a depth of eighty feet, could only be performed after the payment of exorbitant compensation to the owners of that property. When the bill for this Central London Railway was brought before Parliament in the usual course, it was passed upon the express stipulation that the railroad followed the lines of the streets, and did not encroach upon private property at all. By this means heavy expenditure in the way of compensation has been almost entirely obviated, with the result that the total actual cost of the whole work has been about $10,500,000 or only a little over $2,500,000 per mile.

The stations on the average are placed half a mile apart. The track is arranged so that in leaving a station the train is on a down grade and is on an up grade in approaching a station. After leaving a station the track descends in a gradient of 1 in 30 for a distance of about 300 yards; and similarly rises at 1 in 60 for about 600 yards to the next station. By this system of construction the stations are placed about 10 feet above the center of the intermediate sections of the track. The advantages accruing from this principle are obvious. Standing in the station on the brow of an incline, the locomotive does not have to exert the same amount of power in starting that it would have to exert were the track level. Then, when running into a station, the incline naturally retards the speed of the train, so that excessive application of the Westinghouse brake, with which the train is provided, is not necessary to bring the train to a standstill in the station, while the danger of over-shooting the platform is considerably minimized.

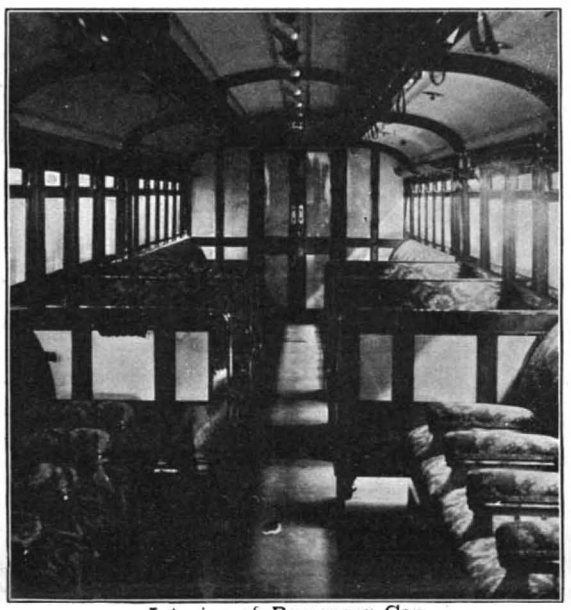
The platforms are each 325 feet in length. The stations are lined with glazed tiles and illuminated with electricity. The electrically worked lifts giving access to platforms, three to five of which are provided at each station with the exception of the termini, were constructed by Messrs. Sprague & Company, of New York. In the event of an accident rendering the lifts abortive, and for the convenience of the small minority who do not care to use them, a wide spiral staircase is provided. There are thirteen stations throughout the entire system, including the two termini. At the latter there are two large cross-over tunnels in which the arriving trains cross over to the departure platforms.

It was originally intended that the electric locomotives should be of English manufacture, but no engineering firm could guarantee delivery within the stipulated time, so the Electric Traction Company placed their contracts for the electric equipment with the British Thomson-Houston Company, of London. The locomotives, which were built by the General Electric Company, of Schenectady, are eight-wheeled, nearly 30 feet in length, and 48 tons in weight. They are equipped with four gearless electric motors, one applied to each axle. The driver's cab is placed in the center of the engine, thus providing a splendid lookout both in front and behind. The current is conveyed to the locomotive by the third rail, while the return current is carried back to the generating station through the ordinary rails. The third rail is steel, of 80 pounds weight to the yard, laid on porcelain insulators, while the joints are bound with flexible copper bonds. The track rails weigh 100 pounds per yard and are laid on longitudinal sleepers.

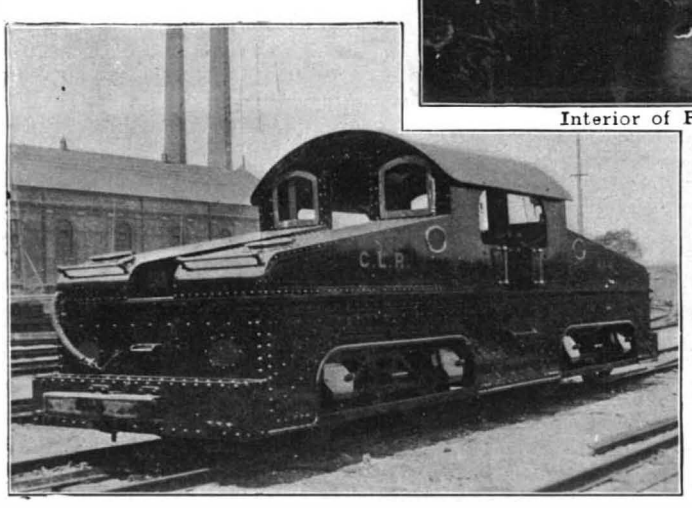
The depot is at Shepherd's Bush, the western terminus of the line. It covers a space of 800,000 square feet. The generating house measures 200 feet by 86 feet. The necessary plant was installed by the British Thomson-Houston Company, of London, and comprises six gearless compound condensing engines, each developing 850 kilowatts. The three-phase system has been adopted as the most satisfactory in this particular instance. Each engine registers 94 revolutions per minute and indicates 1,300 h. p. The boiler house occupies 13,050 square feet, and contains 16 Babcock & Wilcox water-tube boilers, arranged in pairs. The heating surface of each boiler is 3,580 square feet; hourly evaporation of water 12,000 pounds; pressure 150 pounds to the square inch. The furnaces are fed with mechanical stokers. These are supplied by a cold storage tank at the top of the boiler house and fed by a coal conveyor, which also performs the dual office of removing the ashes. In addition there are the necessary locomotive and carriage sheds and repair shops, while three miles of sidings have been laid down. The erection of these buildings has been greatly facilitated by the utilization of numerous electrical devices for the transport of the material. The electric installation was designed by Mr. H. F. Parshall, and was carried out under his supervision, acting for the British Thomson Houston Company.

It is proposed that a frequent and rapid service of trains shall be inaugurated. Trains will run every 2½ minutes and will complete the entire journey in twenty-five minutes. The weight of the train is 105 tons, exclusive of locomotive, and it will carry 336 passengers. The cars are constructed on the American principle, with the corridor extending down the center and the seats ranged on each side. Only one class of accommodation is provided. A mean speed of 14 miles per hour will be attained, though fast traveling is somewhat prevented by the short distance between the stations. The fare will be 2d (about 4 cents) and up to 8 o'clock in the morning it will be possible to cover the journey for 2 cents. The service will be for twenty hours of the day, commencing at 5 A. M. and finishing at 1 the next morning. It was hoped that an incessant day and night service would be possible, but this scheme was frustrated by the Board of Trade, who stipulate that the permanent way should be examined daily, and, as this is impossible while the trains are running, the early hours of the morning will be set aside for this purpose. The ventilation of the tunnels is perfect. The trains almost fit the tunnels, and thus act as pistons, so that there is a constant current of fresh air in circulation. The temperature is also very even—cool in summer and warm in winter.

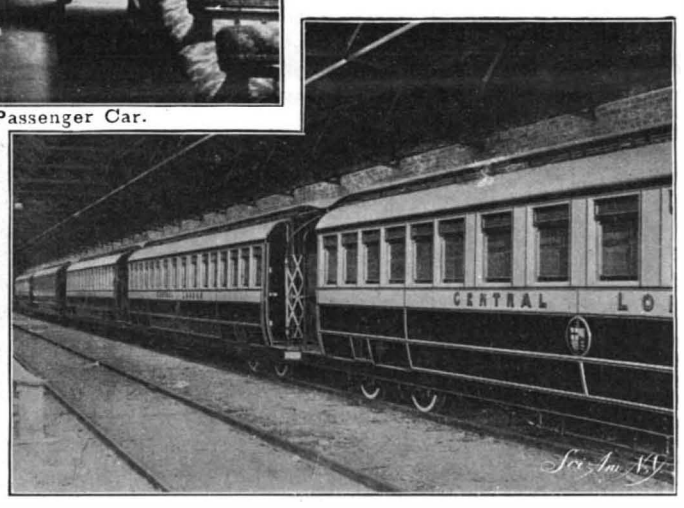
In a future article we shall illustrate the engineering features involved in the construction of the road.



Interior of Passenger Car.



One of the 48-ton Electric Locomotives.



Train of Cars in the Terminal Sheds.

LONDON'S NEW UNDERGROUND ELECTRIC RAILWAY.

Strategy of the Ants.

Says The New Orleans Times-Democrat: "There are a good many ants of different varieties on the lot at my country place near Covington," said a New Orleans business man, "and last year I began to make a systematic study of their habits. I found it a most fascinating pursuit, and have resumed it with much enthusiasm during several visits this year. A little investigation will convince almost anybody, I think, that the ant approaches nearer to man in point of intelligence than any of the lower animals. Some of the things I have seen are so marvellous that I would hesitate to speak of them if similar wonders had not been fully recorded by trained scientists. Near one of my flower-beds is a colony of small red ants that are extremely industrious in collecting food, and they frequently performed the most astonishing engineering feats in transporting heavy burdens to their homes. Not long ago I watched a party of about a dozen, that had found the body of a small spider and were dragging it toward the nest. The spider had hairy legs, which stuck out in every direction and caught on obstacles, greatly retarding progress. For several minutes the ants rolled away with their awkward booty, and then stopped and seemed to hold a council. A minute fragment of dry leaf was lying on the ground, presently they all laid hold and pulled the spider on top of it. They then seized the edges and slid it along without difficulty. On another occasion I saw a large body of these same ants start out for a raid on another colony. They marched like an army, with scouts thrown out at the sides, and, when several feet distant from the nest, divided into two parties. One kept straight on and was soon engaged in fierce combat with the other tribe, while the second detachment made a detour and fell upon the hill from the rear. The result was a great victory for the invaders. Anybody who feels interested in the subject and who will put in a little time at close study will be certain to witness exploits fully as astonishing as those I have described. I doubt whether there is any line of scientific research so attractive to the amateur."

A New Star in Aquila.

From an examination of the Draper Memorial photographs, Mrs. Fleming has discovered, says Prof. Pickering, a new star in the constellation Aquila. It was too faint to be photographed on 96 plates taken between August 21, 1886, and November 1, 1898, although stars as faint as the thirteenth magnitude are visible on some of them. It appears on eighteen photographs taken between April 21, 1899, and October 27, 1899. On April 21 it was of the seventh magnitnde, and on October 27, 1899, of the tenth magnitude. Two photographs taken on July 6 and 9, 1900, show that the star is still visible. Photographs taken on July 3, 1899, show that its spectrum resembled those of other new stars, while the photograph taken on October 27, 1899, shows that the spectrum resembled that of the gaseous nebulæ. On July 9, 1900, the object was observed with a 15-inch equatorial by Prof. Wendell, who estimated its magnitude as 11·5 to 12·0 and confirmed the monochromatic character of its spectrum.

In the month of March, upon the railroads of the United States, there occurred 82 collisions and 116 derailments and 6 other accidents, killing 37 passengers and injuring 168.

ATTACK ON THE COAST-DEFENSE SHIP "BELLEISLE."

It is a curious fact, that although Great Britain possesses such an enormous navy, greater, indeed, than that of the two next largest naval powers, she has never had an opportunity to submit her theories of attack and defense, as embodied in her modern fleet, to the practical test of war. It has been the lot of the two youngest in the modern navies of the world to gather in the priceless experience which is to be reaped from a naval campaign. Japan at the battle of the Yalu, and the United States at Santiago and Manila, gained more practical experience than could be gathered in a whole decade of proving-ground experiments.

In the recent costly trial with the "Belleisle," the British Admiralty endeavored to reproduce as far as was practical, the conditions of an actual sea fight, selecting in this vessel one of the many obsolete battleships, which appear in the lists of the British navy under the head of "Coast Defense Ships." The "Belleisle," which was completed in 1878, is an iron vessel of 4,870 tons displacement, with engines of 2,600 horse power, giving a trial speed of 11·9 knots. She is protected by a continuous belt of armor, which varies from 12 to 6 inches in thickness. Amidships is an octagonal redoubt and battery, which is protected by armor varying in thickness from 9 inches to 5 inches, and carried within this redoubt, at the four angles, are four 12½-inch muzzle-loading guns; above the battery are six 6-pounders, a few smaller rapid-fire machine-guns being scattered throughout the vessel. The "Belleisle" was moored off Selsey Bill, not far from the Portsmouth dockyard, and above what is known as the Medmerry Shoals, shoal water being selected to insure that in case the vessel foundered, she would sink but a few feet before touching bottom. To give the test its full value, and reproduce actual fighting conditions, the ship was cleared for action. Splinter nets were spread, torpedo nets were run out, and the ship's boats were left upon the davits. To determine the effect of gun-fire upon the crew, dummy sailors were placed about the guns in positions corresponding to those which would be occupied in an engagement. The fire-fighting hose was run out and the pumps were started, the decks being kept continuously wet during the bombardment.

The first-class battleship "Majestic" was selected to make the attack. This is one of the most formidable vessels of the British navy, with a displacement of about 15,000 tons, and an armament of four 12-inch breech-loading rifles, twelve 6-inch rapid-fire guns, eighteen 3-inch rapid-fire guns, and twelve 3-pounders. The "Majestic" approached the "Belleisle" from astern, and at a distance of 1,700 yards turned to port and opened fire. She steamed on an elliptical course around the port side of the vessel, the range varying from 1,700 yards astern, to 1,300 yards abeam and 1,700 yards ahead. The speed of the "Majestic" was 12 knots an hour. The attack was made with the whole available battery and lasted just 9¼ minutes. It is estimated that during this time the "Majestic" fired eight rounds of 12-inch common shell, about the same number of 12-inch armor-piercing shell, two hundred rounds of 6-inch shell, half of them being loaded with lyddite, and half of them being common shell; also between four hundred and five hundred projectiles were fired from the 3-inch guns and between seven hundred and eight hundred from the 3-pounders. The result is shown in

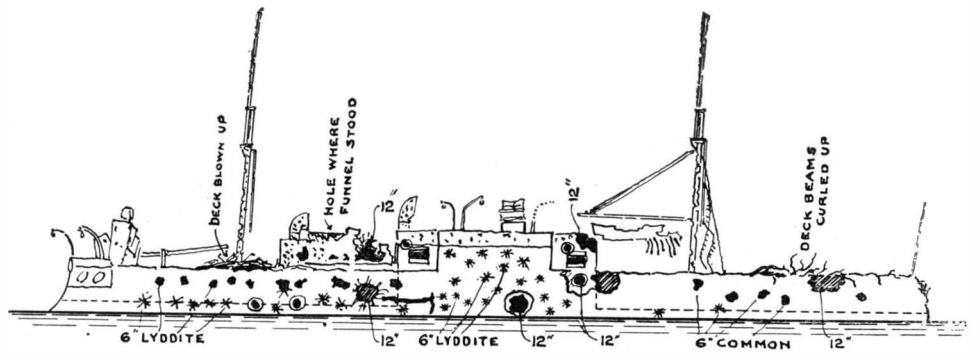
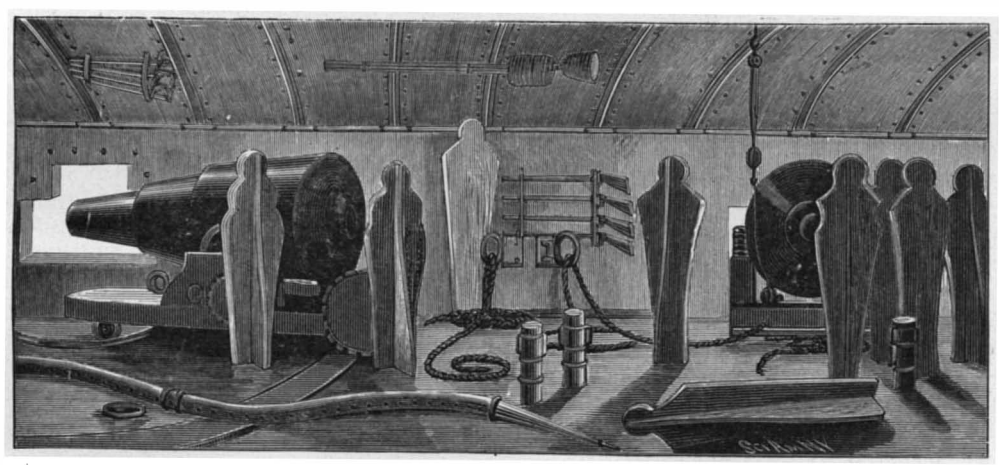
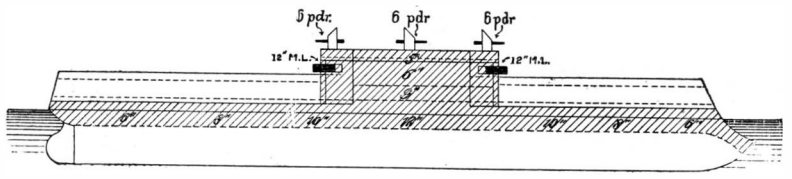


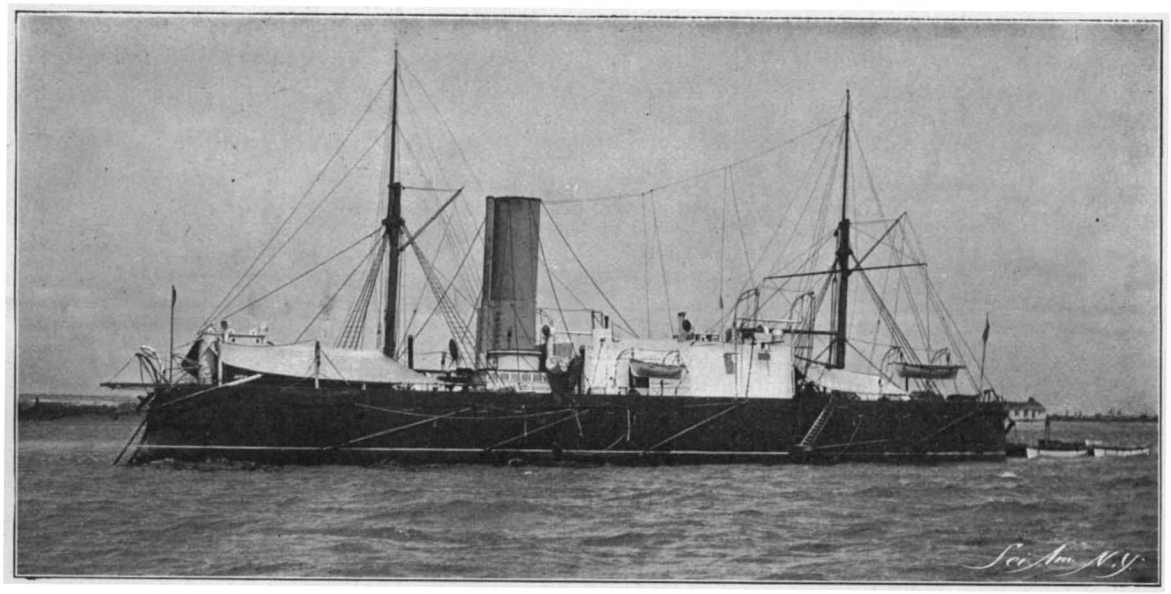
DIAGRAM SHOWING HITS WITH 6 AND 12-INCH SHELL.



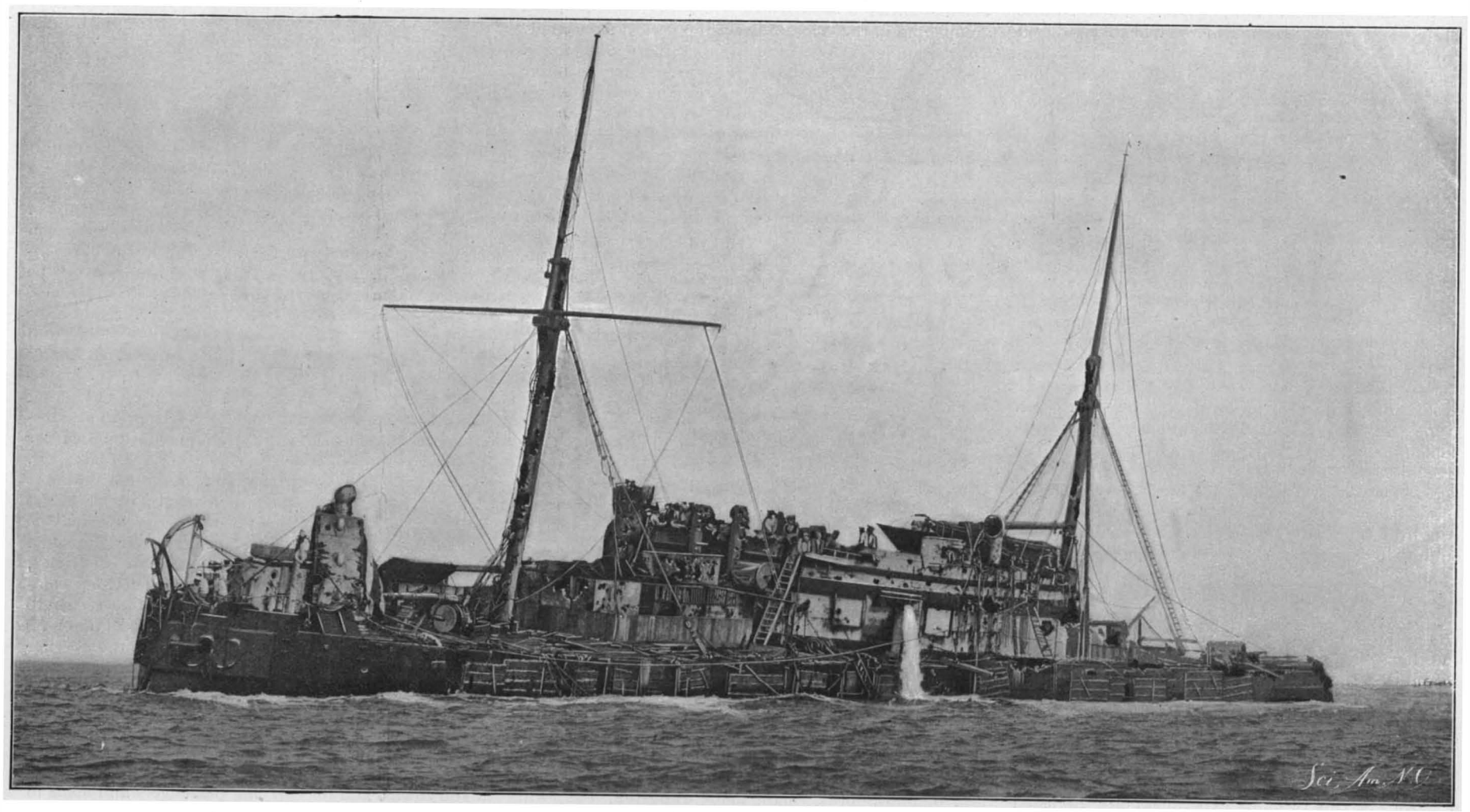
INTERIOR OF BATTERY, SHOWING 12½-INCH MUZZLE-LOADING GUNS AND DUMMY CREW.



ARMOR DIAGRAM.



COAST DEFENSE SHIP "BELLEISLE," SELECTED FOR THE EXPERIMENT.



CONDITION OF "BELLEISLE" AFTER 9¼ MINUTES' ATTACK BY FIRST-CLASS BATTLESHIP "MAGNIFICENT."

the accompanying photograph by Symonds & Company, of Portsmouth, which was taken after the shot-holes had been plugged and mattresses placed over the huge rents which had been blown through the vessel's sides—precautions which were necessary to prevent her from foundering on the trip to Portsmouth.

Among the voluminous data, of more or less technical accuracy and value, published concerning this remarkable experiment, by far the best is that which appeared in The Engineer, London, to which we are indebted for the accompanying diagram of hits recorded after the bombardment. As was to be expected, the greatest destruction was wrought by the 12-inch guns. Commencing at the bow and comparing the views of the ship taken before and after attack, it will be noticed that the deck structure at the bow, erected for the accommodation of seamen, has been blown away and thrown over on end, presumably by a 12-inch shell. In the after part of the funnel-casing there is a huge gap apparently made by a 12-inch shell, and as the funnel has entirely disappeared it is probable that it was blown away by the same projectile. Below this hit, at the upper edge of the belt, is a large indentation probably caused by a 12-inch common shell which, though it did not go through, opened a long, lateral crack about 6-inches in width in the armor. The most serious 12-inch hit, and the one that ultimately sunk the vessel, struck directly beneath the battery at the top of the belt, passed entirely through the armor, and blew a considerable portion of the side entirely inwards, one fragment of the armor being driven up through the flat armored deck, which, at this point, is 3 inches in thickness. The side armor here is 12-inches thick and is backed up with 16 inches of oak. Strange to relate, no damaging fragments seem to have passed into the engine room. It should be mentioned that this shot struck very obliquely.

Another 12-inch shot struck the after angle of the redoubt. It burst and blew out a hole about 12 feet square on the side and deck of the vessel, the head of the shell making a penetration in the armored face of the redoubt. Above this shot-hole is a clear penetration through the 6-inch armor of the battery, while adjoining it a 12-inch shell has broken out a fragment of the armor. Well aft on the quarter deck a 12-inch common shell has blown in a considerable portion of the side of the vessel and torn up a large area of the deck. The deck beams are described by an eye-witness as being curled up like a lot of shavings, the cabins in the locality of this hit being reduced to matchwood.

In the earlier moments of the bombardment the 6-inch rapid-fire guns attacked the after portions of the vessel with common shell, scoring the hits shown in the accompanying diagram. As the "Majestic" drew abreast of the "Belleisle," 6-inch lyddite was substituted for 6-inch common shell, the attack being directed at the midship battery, the redoubt and the bow. It seems that the destruction by the lyddite was enormously greater than that by common shell. Both, penetrated the unarmored ends, but neither was able to do any damage to the armor plate. When lyddite shells passed through the unarmored end they reduced the interior woodwork to splinters; but with this difference, that while the common shell split up the woodwork, the lyddite is described as having pulverized it completely, nothing remaining of it but dust. Where the 6-inch common shell burst between decks, the deck above shows but little signs of the explosion, but where lyddite burst, not only are there huge holes blown up through the deck, but the entire deck in the neighborhood of the explosion has been lifted. Although the deck beams were plentiful, their resisting power against lyddite seems to have been practically nothing. In the diagram of hits, the penetrations are marked in full black, and the bursts of the 6-inch lyddite and common shells against the armor are marked by stars.

Summarizing the minor damages, it may be said that the masts are almost cut in two, and the ship's boats are so completely torn to pieces as to make it certain that no ship's boats will be available after a severe action. The bridge is much bent and twisted, and the bridge searchlight blown away; although the conning-tower escaped injury. The upper works were blown to pieces, the 6-pounders being either carried away or blown over sidewise, some of their fittings curiously enough being melted. Although the big guns inside the main battery were unhurt, the gun sights were destroyed; while the dummies which stood around were all burned.

When the boarding party reached the ship they found that water was still being pumped through the hose and that the decks were flooded. Contrary to expectation, no fire had broken out on the vessel. Too much importance, however, must not be attached to this fact, for the ship being stationary, there was no draft of air to assist a fire, as there was in the case of the Spanish cruisers that were destroyed at Santiago. The lessons of this valuable experiment are discussed in our editorial columns.

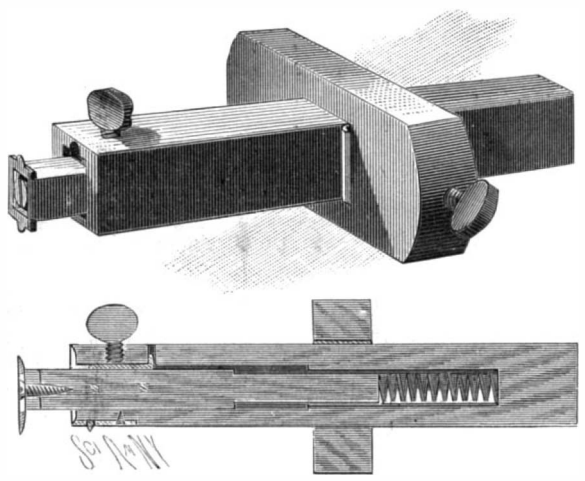
Tips for Inventors.

The Keystone, devoted to the interest of jewelers and opticians, published monthly in Philadelphia, suggests that the inventors of the future will be those who carefully study the natural world. The stones of the mills are another style of the molar teeth. The hoofs of horses are made of parallel plates, like carriage springs. The jaws of the tortoise and turtle are natural scissors. The squirrel carries chisels in his mouth, and the hippopotamus is provided with adzes, which are constantly sharpened as they are worn. The carpenter's plane is found in the jaws of the bee. The woodpecker has a powerful little trip-hammer. The diving-bell imitates the water-spider, which constructs a small cell under the water, clasps a bubble of air between its legs and dives down into its submarine chamber with the bubble, displacing the water gradually, until its abode with fishes contains a large, airy room surrounded by water. In leaving its eggs on the water the gnat fastens them into the the shape of a lifeboat, which it is impossible to sink without tearing it to pieces. The iron mast of a modern ship is strengthened by deep ribs running along its interior; a porcupine's quill is strengthened by similar ribs. The frame work of a ship resembles the skeleton of a herring. When engineers found that hollow pillars were stronger than solid ones, they only discovered a principle that is very commonly seen in nature. A wheat straw, if solid, could not support its head of grain.

AN IMPROVED MARKING-GAGE.

Our illustrations present a novel marking-gage, provided with means for automatically adjusting one marking-point relatively to the other, thereby saving time in making adjustments. The inventor of the gage is Julius Opland, Calumet, Mich.

The device comprises a hollow stock upon which the usual head-block is adjustably carried. Within the stock is a spring-pressed adjustable point-carrier, held in any desired position by means of a set-screw passing



A GAGE WITH ADJUSTABLE MARKING POINT.

through the stock and engaging a bearing-plate provided with an upwardly-extending lug, which enters an opening in the stock to prevent outward movement. To the under side of the stock, a plate carrying a marking-point is secured; and screwed to the outer end of the spring-pressed carrier is another plate provided with two marking-points, so that when one is worn away, the other can be used.

In making a double line with this gage for marking out a mortise, or the like, the set-carrier is released so that it can be moved outwardly by its spring. By holding the stock in one hand and a finger of the other hand against double-point plate, the carrier can be readily stopped at the proper measurement on the rule and locked in place by the set-screw.

When it is desired to use only the marking-point on the stock, the double-point plate on the end of the carrier is moved up and its lower point seated in a notch in the stock. By this arrangement the outer surface of the plate will be flush with the end of the stock.

Electro-Chemical Congress at Paris.

The Fourth International Congress of Applied Chemistry, which will be held at Paris from the 23d to the 28th of July, will include ten sections, of which the tenth, devoted to electro-chemistry, promises to be of especial interest. M. Henri Moissan is president of the committee, which also includes other well-known scientists. The provisory programme for the electro-chemical section includes the following subjects: Batteries, dynamos, accumulators; galvanoplastic processes and material; production and use of ozone; production of chlorine and of soda, chlorates of potassium and sodium, etc.; electrolytic production of metals, copper, nickel, chromium, etc.; aluminium and its alloys, magnesium, sodium and its alloys; organic compounds. The subject of electric furnaces will form an important part of the programme, and the production of phosphorus, manganese, tungsten, etc., will be considered, as well as that of metallic carbides and carborundum. Among other subjects are the preparation of carbide of calcium, industrial furnaces and their efficiency, fabrication of acetylene, conditions of use, and purification, also generators and burners. Electric bleaching, disinfection, and other subjects will complete the programme.

Automobile News.

Charging stations for electric automobiles have been established at several points between Oxford and London.

The Prince of Oldenburg has recently made a remarkable trip in the Caucasus; he traveled in an automobile of the Gardner-Serpollet make, which obtained the prize for the handsomest vehicle at the last exhibition at Monte Carlo. He gives an account of his trip in the following telegram sent to M. Serpollet, dated from Pati, in the Caucasus: "I have just finished with brilliant success on your automobile, in the presence of the Minister of Roads and Bridges, the distance from Novorossik to Sookhoom, more than 312 miles, in the Caucasus Mountains, over an unfinished route, with steep grades and sharp turns, crossing the rivers by fords and rafts. The machine, carriage, and pneumatics were faultless."

An interesting series of races has been held from Nuremberg to Bamberg. The race for motor cycles was won by Herr Hasemann; that for automobile carriages was won by Herr Schmidt, who covered the distance in 2 hours and 9 minutes, with Baron Scarisbrück second; the third competitor, Herr Bender, of Mannheim, had an accident with his tire, and thus lost his position in the race, but deducting the time lost for making repairs, he covered the distance in 1 hour and 38 minutes. Of the touring machines that of Herr Finders, of Nuremberg, won the race, the time being 2 hours 41 minutes and 47⅘ seconds. The race for road wagons had six competitors. It was won by Herr Wegelin, of Augsburg, in 2 hours and 37 minutes.

Inter-communication with the various manufacturing centers of Lancashire, Eng., has always been deficient or expensive. With a view to overcoming the difficulty, the Liverpool Self-Propelled Traffic Association are encouraging the utilization of the automobile wagons for the carriage of goods from one place to another. Next June it is proposed to hold a series of experiments under the auspices of this association for the purpose of ascertaining what types of vehicles are best adapted for road haulage traffic. The competition is to be divided into three classes as follows:

Class.	Load.	Maximum Tare.	Minimum Level Platform Area.	Minimum Width of Driving Tyres.	Speed.
	Tons.	Tons.	Sq. Feet.	Inches.	Miles per Hour.
A.....	1½	2	45	3	8
B.....	5	3	75	5	5
C.....	5 (minimum)	No limit.	95	6	5

A Lancashire syndicate is being formed for the purpose of taking over the type of wagon best suited for road work, and this syndicate proposes to inaugurate a service of road transport between Liverpool and the other principal manufacturing towns of the county.

The automobile industry, though still in its infancy in Germany, is being rapidly developed, and, in the opinion of the United States Consul at Leipzig, is destined to become an important factor in the manufacturing industries of the country. The large amount of capital and energy which is being expended upon this branch of industry indicates that the German business men have great confidence in the future of automobilism. Last year there were about 1,000 men employed in and around Berlin in the automobile industry, and it is expected that this number will be more than doubled during the present year. In France, the results which have been aimed at for the most part have been to obtain excellence in sporting and luxuriantly appointed automobiles, while in Germany just the opposite state of affairs has existed; the manufacturers have given more of their attention to making motor vehicles for the carriage of goods, and not without success, as was shown at the International Motor Wagon Exhibition, which was held in Berlin last year. For motive power, electricity and gasoline are almost exclusively employed; the use of steam power is as yet hardly out of the experimental stage; the same may be said of the employment of compressed and liquefied air, and of combined systems (gasoline and electricity, etc.). Electricity as a motive power has a strong competitor in gasoline; the electric automobile seems to be preferred to the gasoline type on account of its simple mechanism, less noisy running, and the absence of unpleasant odors. The gasoline automobile is used principally in transporting heavy loads, where great speed is desired, in the case of long distances, heavy grades, and where other difficulties are likely to occur. Hence, its adoption in Germany for brewery wagons, drays, omnibus lines connecting railway stations with inland towns, and for carrying passengers and loads in the country.

THE STATUE OF LAFAYETTE AT PARIS.

Our engraving gives an excellent idea of the statue of Lafayette presented by the people of the United States to France. It was unveiled at Paris on July 4. The statue was modeled by Mr. Paul W. Bartlett, an American sculptor of prominence. Lafayette is represented as offering his sword and services to the American colonists in the cause of liberty. He is attired in the rich embroidered costume of an officer of the nobility. His Flemish steed is represented with its mane knotted and tail dressed in the style of the time. An equestrian statue of Lafayette is particularly appropriate, for, after landing at South Carolina, he rode from Charleston to Philadelphia on horseback and there offered his services to Congress. The statue has been erected in the Place du Carrousel in the space partly enclosed by the buildings of the Louvre. The pedestal was designed by Mr. Thomas Hastings, and the whole monument is intended to harmonize with the richly ornamented surroundings of the Louvre. The work has been carried out under the direction of M. Redon. The height of the statue is 15 feet, and that of the pedestal 26 feet.

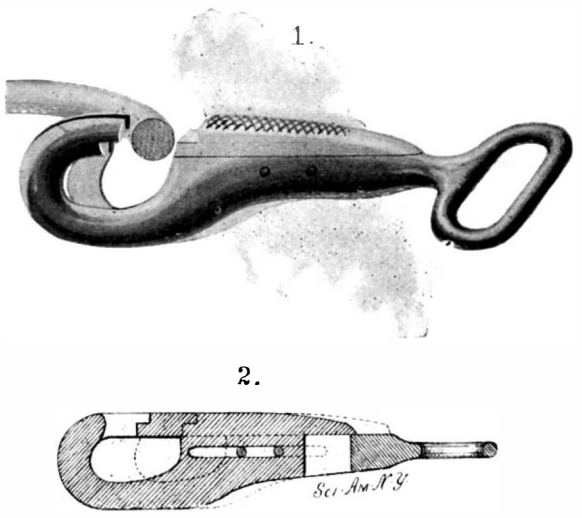
Never before was the Fourth of July so enthusiastically celebrated in Paris, not only by Americans, but by the French. Everywhere the American and French flags were entwined and a gigantic American flag floated from the Eiffel Tower, and even the street venders did a brisk business selling the Stars and Stripes. The Washington statue had been unveiled on July 3, and the Lafayette statue was unveiled on July 4. It was presented to France by American children. The statue and pedestal were erected in staff, following the excellent French custom, for when statues are not entirely completed, they exhibit and unveil the model, and the statue is placed in position subsequently. Around the plaster model a large stand had been constructed and was occupied by prominent French and American persons. Sousa's band played the "Marsellaise" on the arrival of President Loubet, who was received by General Horace Porter, the Americam Ambassador to France. General Porter addressed the audience in French and English. A speech was also made by Commissioner-General Peck. President Loubet accepted the statue in the name of France and two boys unveiled it. There were other speakers, and Archbishop Ireland made a fine dedication address. A reception was given by Ambassador Porter in the evening, and a banquet was held at the Chamber of Commerce. The day closed with the playing of Sousa's band in front of the Opera House.

Experiments in Temperature of Explosives.

In a communication recently made to the Royal Society, Messrs. Macnab and Ristori, continuing their researches upon modern explosives, give an account of a series of experiments to determine more exactly the temperature reached by explosives in a closed chamber. Previous experiments have shown that a thin platinum wire is melted by the heat developed during the explosion, while a thick wire is unaffected; this proves that the temperature exceeds the fusing point of platinum, but the duration of the maximum is very short. The experimenters use for the purpose a thermo-electro couple of rhodium and platinum wires having different diameters, and thick enough not to be melted by the explosion. The deflection of the galvanometer would then vary inverse ratio to the thickness of the wire forming the couple, and it would then be easy to calculate the deviation which would be caused by a couple infinitely small which would absorb all the heat in a time infinitely short; this deviation, expressed in degrees, would represent the temperature reached. In the experiments a series of thermo-electric couples formed of wire of platinum and an alloy of platinum with 10 per cent of rhodium were used, whose diameter varied from 0·25 to 1·1 millimeter. Each couple was successivly fixed in the interior of a shell, and the deviation of the galvanometer was registered by the photographic method. It was thus found that guncotton is the explosive giving the lowest temperature; then follow in order cordite ballistite (70 per cent fulmicotton with 30 per cent nitroglycerine), then another form of ballistite, with equal parts of cotton and nitroglycerin. The experiments are now being made to determine the elements necessary to convert the deviation of the galvanometer, expressed in degrees, into degrees of temperature.

A SPRINGLESS HARNESS SNAP-HOOK.

A snap-hook made without springs, and therefore more certain in its action than most similar devices, forms the subject of our engraving. The hook comprises a main portion and a keeper. The main portion has a hook projected from the shank and a longitudinal slot extending into and through the shank. The keeper consists of a thumb-plate with a plane under face lying snugly on the plane top face of the main portion, the front end of the thumb-plate being projected in position to engage the point of the hook, so as to close the hook. On the under face of the thumb-plate is a longitudinal web lying friction-tight in the slot of the main portion. The web has a front extension forming a hook and lying adjacent to the hook of the main portion. The keeper is slidably mounted on a pin extending through a slot in the web (Fig. 2). In using the hook, the keeper is moved to the position indicated by dotted lines in Fig. 2, and the eye or ring which is to be engaged is dropped into the hook of the web below the point of the hook of the main portion. Strain is then placed on the hook, so that the keeper and its web are made to move to the position shown in full lines in Fig. 2, thus preventing the disengagement of the snap-hook from the eye or ring of the harness with which it is connected. Since the keeper is friction-tight on the body of the snap-hook, it cannot move accidentally to open the hook. Moreover, the strain of the harness will cause the keeper to remain in closed position. To open the hook, it is necessary only to push the thumb-plate back, to move the parts to the position shown by dotted lines. The device is the invention of James A. Gavitt, Waitsburg, Wash.



A SPRINGLESS SNAP-HOOK.

STATUE OF LAFAYETTE UNVEILED AT PARIS ON JULY 4.

A New Antarctic Expedition.

The International Meteorological Committee, which held its last meeting at St. Petersburg, gives an account of the projected expedition to the South Pole, which will be under the direction of Herr von Drygalski. The expedition will leave at the end of August, 1901, and go at once to the Cape of Good Hope, stopping only to make soundings from time to time in the South Atlantic. The equipage will be completed at that point, if necessary, and the magnetic observations will be begun. From the Cape the expedition will pass by Prince Edward and Crozet Islands to Kerguelen, where at least one series of magnetic observations will be made. During the sea voyage, meteorological observations will be made every four hours, and between 11:30 A. M. and 1 P. M. a number of temperature readings will be taken, so as to determine more exactly the maximum temperature of the air above the ocean. At Kerguelen it is proposed to establish an auxiliary station, which will contain a registering instrument for magnetic variations, magnetometers and an inclinometer, and meteorological observations will be made there, using automatic registering instruments. In November, 1901, the main party will proceed eastward to 90° longitude, then to Termination Island, going from there to the hypothetical west coast of Victoria Land; it is proposed to establish there the principal observing station, which will be in operation from February, 1902, to the same period of 1903; the return trip is then to be made. In February, 1903, the expedition will proceed westward toward Wedell Sea, if possible, and from there pass by Georgia toward Tristan da Cunha. Starting from Kerguelen, the magnetic and meteorologied observations will be made during the trip; at the main station will be established a complete set of instruments for magnetic variations and a set for absolute magnetic measurements. From the station a series of observation trips will be made in sleds, and magnetic readings will be taken with the portable instruments. The vessel carrying the expedition is constructed of wood, with a complete rigging of sails and an auxiliary steam engine. The latter, with its accessories, will be placed in the rear so as not to disturb the magnetic observations, which will be made on the captain's bridge. The use of iron will be avoided for a distance of six yards around the observation posts.

Old Spiral Car Springs.

A use has been discovered for old spiral car springs, says The American Railroad Journal. It has been found that these often contain enough carbon to permit of making cold chisels. Forging into the necessary form is easy and the additional carbon required may be added by the cementation process. Cold chisels made in this way cost half as much as the high grades of steel which were formerly used.

Correspondence.

A New Calcimine Deposit.

To the Editor of the SCIENTIFIC AMERICAN:

South Dakota has long been noted for the diversity of her mineral deposits, the Black Hills country being especially rich in gold, silver, and countless other minerals. The eastern part of the State is now about to become a mining country also, through the recent discovery of a large bed of carbonates. In boring a well near Antelope Lake, a few miles from Webster, Day County, a Mr. Hartsough brought to the surface a sort of jelly-like substance, of dark slate color, and soon found this underlaid by a vein of pure white of similar nature. It is in the form of a stiff paste, absolutely without grain or grit, and on exposure to the air soon dries and hardens. Experiments show it to be an excellent material for polishing all sorts of metals, and it is pure enough to be used as a tooth-powder or any similar purpose. Samples were taken to chemists in St. Paul and the analysis is as follows:

Per cent.		Per cent.
Calcium oxide—lime, 47·70	Combined as—	
Magnesium oxide.... ·87	Carbonate of lime.....	85·18
Carbonic acid..... 38·43	Carbonate of magnesia.....	1·82
Aluminium oxide.....		1·18
Insoluble residue—mostly silica, 8·85		8·85
Moisture.....		2·97
		100·00

It shows 85·18 per cent. of pure carbonate of lime and 1·82 per cent. carbonate of magnesia. Mixed with water, it makes a perfect calcimine, which readily takes the most delicate tints, dries quickly, and will not crack, flake, or rub off. Mixed with oil it makes a fine quality of putty. It is proposed to at once put a force of men to getting out the material and preparing it for market as calcimine.

The bed is supposed to cover an area of about three acres, several test borings having been made. The formation is peculiar, as the ground had been used for years as a sand pit, from which large quantities of plastering sand have been removed. At about eight feet from the surface a layer of coarse black sand is found, unfit for use, and this had never been penetrated. Mr. Hartsough had noticed that trees seemed to flourish in this part of his farm, and concluded that there must be water near the surface, and made the borings, with the above results. Under the whiting is found coarse gravel and abundance of water. Mr. Hartsough thinks the entire bed is made up of decomposed shells, as on the top of the layer can be found the forms resembling snail shells, which soon crumble to powder, and form the same substance as the main body. The find is certainly curious, and contains the possibilities of a profitable industry. The owner says that almost the entire amount of material of this kind now used in the United States is imported from Italy, and that this is superior in every way to the imported article.

J. M. PATTON.

Aberdeen, S. D.

Simple Photographic Lens Adaptor for Orthochromatic and Telephoto Work.

The use of orthochromatic plates for producing better color values in negatives, especially in the more accurate rendering of the different colors in a painting, is now quite extensive.

But to the average amateur photographer provided with a folding camera of popular size, like a 4 × 5 or 5 × 7, the extra bother of carrying additional plates and holders for obtaining such results is annoying. Nearly as good pictures may be obtained by photographing through colored screens on ordinary plates. The same reason is applicable in the taking of distant or telephoto views, for which usually a special additional expensive lens is required.

To assist the amateur in greatly varying and utilizing the lens he already possesses to the uses above described, including several others, Mr. U. Nehring, of this city, has lately introduced what is termed multichromatic ampliscope lenses arranged to be inserted adjacent to the diaphragm of the lens used. These lens adapters have the property of changing the character of the focus of the regular lens, either by elongating or shortening it, thereby adapting the lens to take a view with a less or greater angle than it ordinarily would.

The front lens in the lens tube is unscrewed out and the adapter lens dropped in next to the diaphragm, after which the front lens is rescrewed in place, the change being made very quickly. When one is cramped for the proper distance to secure a picture, the adapter will shorten the focus sufficiently to enable the operator to obtain a picture the right size at a wider angle. Special colored lenses are inserted in the same way for photographing paintings and other colored objects adapted to secure the best effects. Other adapters render the lens suitable for copying at short distances, and for enlarging. In adapting a lens for telephoto work a special tube is provided which is slipped over the regular lens tube and carries a negative lens for extending the cone of rays, thereby greatly lengthening the focus and magnifying the image of the distant object.

There is also an angular disk which will cut off half the picture when thrown upon the plate, so that duplicate or so-called double pictures can be easily made. A focusing lens is also included. In all something like a hundred different combinations, it is said, can be made with the several lenses and tubes, and all put in a box small enough to be readily carried in one's pocket.

This collection of auxiliary lenses and adapters promises to be very serviceable in the hands of amateurs, in consequence of the varied quality of work that can be done without the need of expensive different lenses.

Developer for Underexposed Plates.

A developer which has been used with success for underexposed plates is given in the following formula:

Water.....	1,000	cubic centimeters.
Metol.....	4	grammes.
Hydrochinon.....	2	"
Sulphite of soda.....	60	"
Carbonate of soda.....	60	"

This solution is to be recommended, as it will keep for a long time and does not stain the plate.

The Current Supplement.

The current SUPPLEMENT, No. 1281, has many articles of unusual interest. "California Hydraulic Mining Under the Caminetti Act" is an elaborately illustrated article dealing with the subject in an authoritative manner. "Electric Ignition of Gas and Gasoline Engines" is by P. P. Nungesser. "Foreign Power Section of the Paris Exposition" is accompanied by a large engraving. "The Means of Defense in Animals," by Prof. Philip P. Calvert, of the University of Pennsylvania, is concluded in this issue. The five articles have been of unique interest. "Archæology of Lytton, British Columbia" is by Harlan I. Smith.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CORN HARVESTER AND SHOCKER.—JOHN FEDDERMAN, 1249 Market Street, Harrisburg, Penn. The object of the invention is to provide a corn-harvester of simple construction and practical operation, which permits two rows of corn to be quickly cut, gathered into a shock, and then dropped in vertical position and bound before being released from the machine. The features of novelty are to be found in the means for supporting the stalks of corn while being gathered into a shock, and the mechanism for dropping the bundle and holding it within the machine in vertical position, but resting on the ground, while being bound into a shock.

CORN-HARVESTER.—WILLIAM J. LANG, Oyens, Iowa. The machine is so constructed that the ears of corn are husked and detached while the stalks are standing in the field. The ears are positively fed to the husking mechanism so that they are broken from the shuck and subsequently conveyed to an elevator. The husking mechanism can be adjusted so that the machine is adapted for various conditions of the corn. The bearing-wheels can be adjusted to arrange the body of the machine relatively to the corn. In a word, every provision has been made to simplify the work of the operator and to produce a machine which will perform its functions with an efficiency that leaves nothing to be desired.

PLOW-BEAM. — RICHARD H. PURNELL, Rosedale, Miss. The beam is formed of a section of pipe doubled closely upon itself. Couplings secure the doubled portions of the pipe rigidly together. On the forward, doubled end of the beam, is a clevis through which a bolt is passed, extending between the doubled portions of the beam. The doubling of the pipe forms a non-circular clevis end without further labor. The bolt passed between the pipe portions obviates the necessity of drilling a hole through the beam.

Mechanical Devices.

WINDMILL-GEAR.—GIDEON J. MOORE and FRANK E. COOK, Eureka, Cal. The inventor has simplified the driving mechanism of a windmill. He employs gearing in such a manner that the driving motion of wind-power is simultaneously and well-nigh directly applied to the pump-rod at opposite sides. The construction is also such that the cranks, crooked arms, or walking-beams to be found in almost all windmills to bring the pump-rod to the center, are dispensed with.

BOAT-LOWERING MECHANISM.—CARL SCHNEEMANN, Bremen, Germany. This invention comprises a motor and a movable davit. A drum is geared directly to the motor, and a push-rod is geared to the motor through the medium of a clutch. The push-rod serves to throw the davit outboard, and a connection between the drum and davit throws the davit inboard. Tripping devices are driven in time with the push-rod and serve automatically to throw the clutch and motor-controlling device in time with the push-rod.

DRIVING MECHANISM.—ANTON E. H. J. THOELLDEN, Ansonia, Conn. The driving mechanism is intended for use in connection with machinery, motor-vehicles, bicycles, and the like. Ratchet-wheels are mounted on a driving-shaft, with which wheel-levers coact. A vertically-swinging pawl is carried by each lever and is engaged by a spring pressed thrust-pin in a boxing on the upper side of each lever. Owing to the short fulcrum of the levers, a small amount of power will be greatly increased when applied to the short members, and this increased power will be considerably augmented by the ratchet-wheels.

PEDAL-ACTION.—ROBERT K. THUMLER, Manhattan, New York city. The inventor has so secured the pedals in their piano-cases that they can be readily removed and replaced, and has provided them with spring-hinge supports, so that they will be noiseless in operation.

MACHINE FOR CLEARING SILK OR OTHER TEXTILE THREADS.—CHARLES G. DIEDERICHS and MARIE A. E. MARQUELET, Ste. Colombe les Vienne, France. This machine rapidly clears threads and frees them from defective knots, wisps, irregularities in thickness, doublings, and the like. On one side of a winding-spool, driving mechanism is arranged, and on the other, a brake. The thread is adapted to pass through a trimmer movable by irregularities of the thread. An operative connection is provided, whereby the movement of the trimmer will throw the winding-spool from an engagement with the brake. Only a minimum force is required for disengagement. The result is that the machine suits all kinds of thread, even the very finest. Stoppage is immediate and does not involve a risk of breaking the thread.

RAISIN-SEEDER.—FRANK H. PETERMAN, Manhattan, New York city. The machine is arranged to insure a complete separation of the seeds from the pulp without unduly injuring the latter by tearing. The operative parts consist of a cylinder with an opening; a flexible belt passed over the cylinder and having its ends passed through the opening and secured to the inside face or periphery of the cylinder; and pins mounted on the flexible belt. A member is attached to the cylinder and fits in the opening to form a continuation of the periphery of the drum. Pins for impaling the raisins are attached to the member.

COTTON-PRESS.—ALBERT L. TREESE, Jennings, Oklahoma Territory. The purpose of the invention is to provide a cotton-press for forming cylindrical bales by rolling a continuous length of batting. By this arrangement not only is a more compact and easily-handled bale produced, but also one less liable to become fired.

Railway-Appliances.

CATTLE-GUARD. — ROBERT F. ADAMS, Oakman, Ala. This novel cattle-guard is designed to be placed along the line of a railroad-track at the abutting ends of a division-fence, where a break in its continuity must necessarily occur in order to give passage to the railway-tracks. The invention consists in a peculiar construction and arrangement of gates arranged to be automatically operated by the animal.

LOCOMOTIVE-EXHAUST.—EBENZER N. SLOCUM, Fort Smith, Ark. In order to insure a free escape of the exhaust-steam from the engine cylinders without danger of creating back-pressure, to provide a perfectly-balanced non-pulsating draft in the fire-box and smoke-flues, and to reduce the consumption of fuel, Mr. Slocum increases the distance from the base of the draft-pipe or stack to the tip of the exhaust-nozzle, so that it requires considerable time for the unrestrained steam to travel from the nozzle to the stack.

LOCOMOTIVE-PILOT RIGGING.—JAMES F. DUNN, Salt Lake City, Utah. The invention relates to means for mounting a coupler on a locomotive-pilot, so that the coupler may be raised to inoperative position or lowered into line with the face of the pilot. The pilot is thus permitted to operate effectively. The invention also embodies means for mounting the coupler draw-head, such means serving to brace the buffer-beam against the cylinder-saddle.

Puzzles, Games, and Toys.

PUZZLE. — ALBA C. BOOTH, Burlington, Vt. The puzzle is based upon the story of Jonah and the whale and is designed to afford considerable amusement and to require considerable skill in its solution.

GAME-BOARD. — WILLIAM H. HILLYER, Atlanta, Ga. The essential feature of the invention is to be found in the use of four permanent horseshoe magnets. It is the object of the game to strike a steel ball with a mallet, so that the steel ball will be made to adhere to one of the magnets.

MECHANICAL TOY.—GEORGE WALE, Jr., Everett, Mass. The toy is made in the form of a football player, the arms of which hold a ball. The arms, moreover, are releasably held and work with a swinging leg, also releasably held, so that when the arms are made to drop the ball, the leg is thrown to kick the ball.

Miscellaneous Inventions.

BOILER-TUBE CLEANER.—WORTHINGTON H. INGERSOLL, Hamburg, N. J. The cleaner is a member of that class of devices in which a steam-jet is employed. A twirling motion is given to the steam-jet, which produces suction, whereby air is drawn into the flue. This air, instead of being thrown directly into the flue, is deflected outwardly and finally discharged toward the center, near the periphery of the flue. Thus the inventor secures a plentiful supply and effective distribution of the heated air. The blast of steam and hot air is very effective where it is most needed—that is, at the periphery.

DEVELOPING-TRAY.—STUART B. MOORE, Manhattan, New York city. The invention comprises a tray which is adapted to receive the plate to be developed without exposing that plate to white light. The tray is provided with a reservoir so arranged that the solution can be admitted to the chamber containing the plate and then discharged when desired. The tray is also provided with oppositely-located windows, which are provided with a plate of any transparent, non-actinic material (ruby glass or celluloid), so that the progress of development can be observed in broad daylight.

SPLINT. — JAMES G. HUGHES, Sheboygan, Wis. This splint is especially adapted for use on the lower limbs, but may also be employed on the upper limbs. The construction is such that the splint can be simply and readily applied, and that the fractured member can be examined at any time and the wound properly dressed, without disturbing the union of the parts. The splint can be adjusted to secure perfect extension and fixation without pressure on any part of the limb, thus preventing shortening or deformity after a fracture. Pneumatic or hydraulic pads are employed to distribute the pressure evenly.

FENCE-WIRE LOCK.—EDWIN L. FROGGATT, Spearfish, S. D. The lock consists essentially of a tongue on the fence-post, opposed to which tongue is a recess whose wall is provided with a longitudinal slot and a transverse slot. The wire is placed between the tongue and the vertical wall of the recess, entering the transverse slot. The tongue is then driven to an engagement with the walls of the recesses, so that a rib on the tongue will enter the longitudinal slot and kink the wire.

PROCESS OF TREATING MINERAL WOOL.—ALEXANDER D. ELBERS, Hoboken, N. J. Though mineral wool has been widely used as an insulator of heat, cold and sound, few devices have thus far been either made known or put into operation, whereby this material can be applied in a practicable and marketable manner, except to pack it in its loose state into the spaces to be deafened. This method is both costly and defective, for which reason Mr. Elbers prefers to mold the wool into bricks or sheets, which he finds are far more efficient that the loose material, in addition to their being less expensive.

COG-WHEEL WITH DETACHABLE TEETH.—GEORGE DORNAUF, Frankfort-on-the-Main, Germany. This cog-wheel consists of a wrought-iron or steel rim of great strength, cogs of wood or metal, and wedges securing the cogs in place. The invention is designed to permit the cogs of such wheels to be attached, detached, and exchanged with despatch, and to render the construction of such wrought cog-wheels simpler and cheaper than those now in use.

CATTLE-STANCHION.—WALTER D. CASE, Granby, Conn. The purpose of this invention is to provide a cattle-stanchion by which the stock can be securely yet comfortably held and which can be easily manipulated. This purpose is attained by providing the stanchion with upper and lower end sections adapted to be shackled to the sills of the stable and having each a semicircular shape. These end sections carry side sections, one of which is hinged to the lower end section and secured to the upper end section by certain novel devices forming an automatic latch.

WINDOW.—PASQUALE C. PASCALE, Manhattan, New York city. This invention relates to stationary, sliding, pivoted, or hinged sashes for windows. The sashes are provided with hinged frames which are opened in such manner as to uncover the entire space within the boundaries of the members of the sashes. When two sashes are employed, the upper member of the hinged frames of one sash and the lower members of the hinged frames of the other sash constitute the meeting-rails of the sashes.

When one sash is in front of the other, the hinged frames of each sash can be freely manipulated. The hinged frames can be locked in any position.

THROAT-FRAME FOR MAIL-BAGS. — CHARLES BATEMAN, Gales Creek, Ore. The inventor has devised an ingenious throat-frame for mail-bags, which holds the mouth of the bag open at full extent in rectangular form for the free reception of the mail-matter, and also forms a secure closure for the bag-mouth. The improvement, although primarily designed for use upon mail-bags, is also applicable to other bags.

COVER CLAMP AND HANDLE FOR FRUIT-BASKETS.—MAJOR TUCKER, Brockton, N. Y. The device performs the dual function of serving as a handle for a fruit-basket and as a means for securing the cover of the basket in place. This combined clamp and handle can be readily sprung to proper position upon the different sizes of baskets usually employed for packing grapes and known upon the market as "climax baskets." The device tends materially to strengthen any basket to which it may be applied.

SCRAPER.—WILLIAM H. ONION, New Orleans, La. The purpose of the invention is to provide a scraper which may be easily dumped and handled, to which end novel mechanism is employed for holding a bucket in active position and for raising it, so as to carry its load to the dump, and then for readily and quickly inverting the bucket to discharge its contents.

STRAPPING-TOOL. — WILLIAM MAX, Brooklyn, New York city. To provide a tool for conveniently draining and stretching metal straps across the side of a box before nailing is the object of the invention. The tool is composed of an elongated handle and a fixed gripping-jaw, which are formed integrally. To the fixed jaw a movable jaw is pivoted, provided with a tail-piece extending back on the handle. A movable fulcrum-block is arranged in a guide-socket in the under side of the handle and has a foot or shank which passes through the handle, is secured therein, and is adapted to work in contact with the tail-piece of the movable jaw.

ADJUSTABLE BOOK-REST OR TABLE.—MAJOR MILLER, Lowell, Wis. Upon a stand a jointed arm is mounted for horizontal movement; and upon the arm a table is carried for adjustment independently of the adjustment of the sections of the arm or of the arm in its entirety. The table is designed to be used as a rest or support for a book, for manuscripts, music, and the like. The supporting-arm and its table are vertically adjustable.

HOSE-COUPLING. — JENS C. MARTIN, Spokane, Wash. The coupling is composed of two parts adapted to engage and automatically lock together. The parts are duplicate; and each has a locking mechanism of peculiar construction and an annular elastic gasket, which is securely held in place by a peculiar construction and is expanded by water-pressure, so as to form a perfectly tight joint under all conditions.

Designs.

TRIMMING.—PAUL GUMBINNER, Manhattan, New York city. The trimming includes a series of scallops at opposite sides of a longitudinal line, the scallops of one series being opposite the space intervening the scallops of the opposing series.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

DER MEISTER VON PALMYRA. Dramatische Dichtung in fünf Aufzügen. Von Adolf Wilbrandt. Edited with introduction and notes by Théodore Henckels. American Book Company. 1900. 12mo.

It can safely be said that every teacher of the German language has been wishing for a long time that this masterpiece of Adolf Wilbrandt might be prepared and edited for class use in American schools and colleges. The work is modern, classical, and free from that excess of realism which often makes many books unsuitable for the class-room. Der Meister von Palmyra is a mysterious Faust-like poem, full of meaning and beauty, and the study of it should be a constant delight to both teacher and pupil; it is admirably adapted for the class-room. In the introduction the student will find a good account of the poet's life and works, and a synopsis of the "dramatic poem." In the notes all difficult expressions are clearly and concisely explained.

LES PLAQUES DE BLINDAGES. Par M. L. Baclé. Paris: Vve Ch. Dunod. 1900. Quarto. Pp. 233. 197 illustrations.

This monograph on armor plates is devoted to a history of steel armor, manufacture of the plates, and tests which have been made both in Europe and America. The author writes with the authority and self-confidence of one who is thoroughly familiar with his subject. Although his work has but little new to offer, it is worth while reading for the reason that it describes very thoroughly what has been accomplished in the metallurgy of armor-plate making and in the way of producing steel which presents the utmost possible resistance to the modern high-power projectile. The numerous illustrations, diagrams, and table provided admirably serve to elucidate the text.

UEBER DEN HYDRAULISCHEN STOSS IN WASSERLEITUNGSROHREN. Von N. Joukowsky. St. Petersburg. 1900. Price $1.

The action of the so-called "hammering" in water mains is so little known that Prof. Joukowsky, of the Moscow Imperial University, determined to conduct a series of experiments which would add something to our knowledge and supplement the work of Prof. Carpenter, of Cornell, who investigated hammering in small pipes. The results of the Moscow professor's experiments are exhaustively described in the present monograph.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7919) G. W. asks: 1. What length of spark must my induction coil produce to make an X ray apparatus for examining objects such as a leg or arm? A. A coil giving an 8-inch spark will answer for the thinner parts of the body, but for every kind of service one giving a 14-inch spark should be had. 2. What kind of tube would be the most suited for this work? A. There are many makers of tubes, whose advertisements are frequently to be found in our columns. A higher vacuum is required for use with a coil than for use with a static machine. All good tubes are now made with adjustable vacuum. 3. Can you give me directions for making a fluoroscope? A. You had better buy your fluoroscope.

(7920) O. M. S. asks: 1. How may opaque objects be seen under the microscope? A. By the use of the bull's-eye condenser. A lens which will focus the light of a lamp upon the upper surface of the object. One of these usually accompanies a microscope. 2. How can the glimmering of artificial light be overcome? A. If the light is too strong, turn the reflecting mirror till the field is illuminated to suit your eye. Shaded glasses can be had from dealers in microscopes which cut down and also color the light agreeably. These may be blue or gray. They are also made so that they are deeper in color in one portion than in another, and a nicer adjustment may be made of the illumination. 3. Will the best window or plate glass do for glass slips to use with a microscope of sixty-five diameters? If not, why? A. Any sort of glass will answer if it is smooth. It is better to buy the regular slips. These are 3×1 inch and are polished on the edges. They present a much better appearance than pieces of glass cut and left rough. 4. What proportion should the liquid, zinc and carbon be for a bichromate cell? A. A good bichromate mixture is composed of water 100 parts, potassium bichromate, 17 parts, and sulphuric acid 10 parts, all by weight. The zinc and the carbon may be of any size which the battery jar will hold. It is better to have a carbon on each side of the zinc, two carbons to each zinc. This gives a larger current and utilizes the action on both sides of the zinc. 5. How to make an induction coil which will not induce a current strong enough to kill a person. A. A good induction coil is described in SUPPLEMENT, No. 160, price 10 cents. It is not necessary to injure one's self with a large coil. A simple rule for safety is to put the left hand in your pocket or behind your back when doing anything to the coil with the right hand, if the coil is running. 6. What are the preserving fluids used in the museums and laboratories? A. Alcohol is the fluid ordinarily used in museums for preserving specimens in jars and bottles.

(7921) L. F. S., Vancouver, Wash., writes: I wish to know what horse power would be developed by a stream of water, which, if dammed would give a head of 130 feet or more. The amount of water flowing over a 4-foot weir is 8 inches, weir being rectangular 4 feet equals breadth, 8 inches equals depth. What size steel pipe or iron pipe would this water fill if it were to be carried to a turbine at distance of 1,200 feet? What is the cost of such pipe a running foot? Also, what would be the cost of a dynamo to utilize power thus developed by turbine. Suppose it were necessary to transmit power to a manufacturing plant at a distance of 4½ miles from power house. What would be loss of power in transmitting and what approximate cost of motor and wiring for such a plant? Kindly tell me where price list of motors and dynamos may be obtained? A. The capacity of your weir is 432 cubic feet of water per minute. This with 130 feet fall will give a theoretical power of nearly 3½ million foot-pounds or 112 horse power. From this must be deducted the loss by friction and the water wheel which, if of the Pelton type, should net you 80 horse power. The size of steel pipe for conveying this amount of water 1,200 feet with a loss of less than 2 feet head will be 24 inches in diameter, and will cost about $1 per foot. A Pelton wheel and connections will cost about $400. The dynamo will cost about $2,400. A motor on a 4½-mile line will cost about $,000, and should net 60 horse power at 4½ miles distance. We refer you to the water wheel companies for estimates of a complete power plant.

(7922) Y. N. W. writes: As it is your aim to disseminate useful information we make the following statement which will interest all photographers: We recently purchased one of the new aluminium trays and lately undertook to intensify a negative in it, using a three solution intensifier: Bromide of potassium, bichloride of mercury, and sulphite of soda, in the order named. Upon applying the mercury solution the chemical growth (which we had forgotten all about) of which a detailed description was given in the SCIENTIFIC AMERICAN of March 10, immediately began, and we were unable to check it until to-day, when we happened to think of using muriatic acid. We immediately applied a dilute solution of the acid to the tray, using a cloth to take off the black coating. After rinsing we applied a solution of soda and other tests without any action of the mercury. We would, therefore, advise our brother photographers to never use an aluminium tray for intensification, but if they have already spoiled a tray by it to try the acid, which we think will prove effective in every instance. A. We suppose it is not possible that every one who has to do with chemicals should first study their chemical actions sufficiently to avoid the mistake of our correspondent of putting a chemical into his tray which would dissolve it. He knows the fact regarding aluminium now and is not likely to repeat the experiment. Experience is a good schoolmaster, though her instruction comes high, it has been said.

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