THE MANUFACTURE OF GUNS AND ARMOR AT THE BETHLEHEM STEEL WORKS.

III.—HARVEYIZED ARMOR.

The present article is devoted to a description of the manufacture of Harveyized armor plate, as this represents the most modern method of making armor that is open to public inspection, the secrets of the Krupp process being still jealously guarded in every country where Krupp armor is made.

One of the early steps in the process is the casting of the open hearth ingot in a specially prepared mould. It is cast with a considerable excess of metal at the top, known as the "sinking head," which, as explained in a previous article, serves the double purpose of supplying molten metal to run down and fill the cavities which would otherwise be formed in the heart of the ingot in cooling, and of affording a convenient handle, as it were, by which the enormous mass of metal may be lifted and generally manipulated during the process of forging. The excess of metal in an ingot over that to be found in the armor plate is greater than in any other large mass of metal product, on an average less than forty per cent of the original mass appearing in the finished marketable plate. Some of these ingots are truly enormous masses of metal, the largest of which weigh as much as 275,000 pounds. The particular ingot which is shown in our engravings in the process of being forged weighed more than 125 tons in the rough. It was cast for the front or port plate of the new battleship "Alabama," and by the time it had been worked down and machined to its finished state, less than 30 tons, or about 24 per cent of the original 125 tons, remained.

After casting, the ingot is cleaned and taken to the forge, where the upper end of it is placed in a massive cast-steel sleeve, from the other end of which projects a long steel bar, provided with a sliding balance-weight. The sleeve is supported in an endless sling chain, which is hung from a gear-controlled block, as shown in the engraving. The block in turn is carried at the lower end of a vertical shaft, which is suspended at its upper end from the trolley of a massive, overhead traveling crane. The ingot, sleeve, counter-balance bar, etc., will weigh, in the case of the heaviest work, in the neighborhood of 250 tons. After the ingot has been heated to a white heat in a regenerative furnace of the kind shown in our illustration, the furnace doors are lifted, and the mass is carried out and placed on the working anvil of the 14,000-ton hydraulic press. This press is truly of massive proportions, and rivals in size the great 125-ton steam hammer which it has replaced. It requires for its operation a pumping engine which is not only the largest of its kind in the world, but in addition enjoys the distinction of being the most powerful land engine in existence. It has three cylinders, working under a steam pressure of 130 pounds to the square inch, developing a maximum of 15,000 horse power. The total height of the press, above ground, is somewhat over 42 feet. The stroke of the press is recorded upon a circular dial, which is within sight of the operator who controls the forging levers. Other operators, who control the overhead cranes and other manipulating mechanism, are stationed within sight of the forgeman. The staff of men, after years of experience, have become so well trained that in obedience to a few simple motions the massive forging is lifted, turned over and generally manipulated with an ease which must be seen to be appreciated. The ingot, in this first forging operation, is roughed down to a rectangular cross-section similar to that of the finished armorplate, but considerably thicker. It is then prepared for cementation.

To accomplish the cementation, the forging is placed in a carbonizing furnace in such a manner that the gas flames can play entirely around it, the face to be hardened being brought in contact with a layer of carbonaceous material. These furnaces are fired by the regenerative principle, as explained in our first article on the open-hearth process. The heat of the furnace is gradually raised until the proper temperature is attained. This temperature varies with the size of the plate, and is determined only by experience. The plate is maintained at the proper temperature for a period of from three to four weeks, during which time the carbon is absorbed by the face of the plate to a depth of from 1 to 1½ inches. After the absorption of the proper amount of carbon, the plate is taken out of the furnace, cleaned and scaled, the loss due to oxidation being considerable.

Later it is returned to the forge, brought to a bright heat, and reduced under the hydraulic press to the desired thickness.

The plate is then sent to the machine shop, where test specimens, which represent the physical qualities of the plate, are removed and subjected to tensile tests in the presence of navy inspectors.

Notable among the many operations to which the plate is subjected is the proper forming or shaping of the plate. This is accomplished by means of a 7,000-ton bending-press, where skilled artisans, after exercising a vast amount of patience, finally succeed in reducing it to the desired form.

Again and again this mass, which, it must be remembered, weighs as much as a locomotive, is placed on cars and transported from one building to another, to be subjected to operation after operation, until at last it is prepared for the final hardening operation.

When this stage is reached, it is transferred to a room where it is placed on a trolley and run into the hardening furnace. When it has reached the proper temperature, it is removed from the furnace and hardened by spraying with water. The amount of water that is necessary per hour to properly harden one of the large plates is more than is consumed per day by a city of 30,000 inhabitants.

After the plate has been oil-tempered it is again carried to the bending press, where it is heated by a special process, and "rectified" to the proper shape.

The plate then resumes its travels, journeying to the machine shop, where additional tests are taken for the information of the navy inspectors, and where it is subjected to its finish machining by means of grinding machines. We have seen that in a previous operation the plate was rough-machined. In accomplishing this the various tools, however, only work down to a point at which the carbonized face commences, this face being so hard that the finishing cuts can only be laboriously taken off by means of grinders, the hardest steel tools which can be produced refusing to cut it. All warped surfaces, such as those at the port holes and the sighting holes, have to be chipped and finished by hand with files, etc., the outer hard portion being ground.

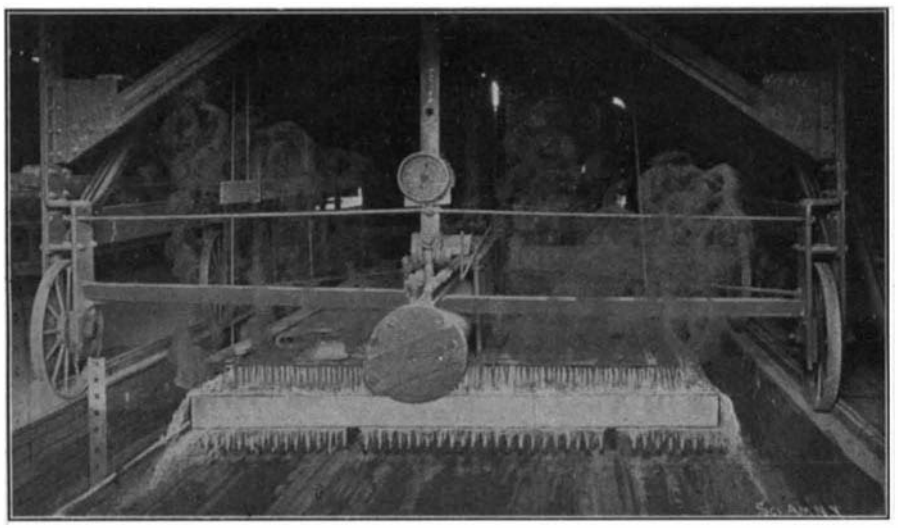
The holes for the bolts by which the armor is fastened to the backing and framework of the ship are now drilled. These holes are drilled, of course, by machinery, several distinct operations being required for each one. The accuracy required is such that the final tapping of the thread is subsequently done by hand.

Tapping the bolt holes being the final machining operation, the armor plates are collected for what is known as assembling or erecting, which consists in joining the plates, just as they are intended to be erected on the ship. Two of our illustrations show this work being done, one of them representing the side armor of the Russian battleship "Retvizan," and the other the forward turret of the battleship "Alabama." The joints are finished with electrically driven emery grinders, and in spite of the great weight and size of the plates, the fitting of these joints is remarkably close and accurate.

As soon as the armor is assembled and the bolts tried in the holes, it is inspected in all its details by a corps of United States navy inspectors, after which the armor is taken down, the armor bolt holes are filled with a mixture of tallow and white lead, and the plates are stamped under the supervision of the navy inspectors with the name of the ship and the particular location in which the plates are to be placed.

The final operation consists in taking the plates to the weighing machine, where the inspectors make a careful record of the weight of each plate.

In tracing the course of an armor plate through this elaborate process from the time it is cast as an ingot to the time that it is weighed and shipped from the works, the reader must have noticed how frequently the material is transferred from shop to shop for the different processes necessary to produce a modern, high-class plate. The buildings required for the various steps in the manufacture are such in dimensions that every round trip of the plate from the bending press to the machine shop, for instance, involves a journey of 4,000 feet. Another mile is covered in the transfer from the forging press to the machine shop, or from the tempering plant to the machine shop, and two miles are covered in the journey from the open-hearth furnaces to the forging press. It is further to be borne in mind that, while an ingot at the commencement of its journey will weigh 125 tons, the weight of the finished product, upon which the payment for the plate is based, will be only 30 tons, or say 24 per cent of the ingot weight. A further element of expense is the large percentage of losses which are liable to occur, owing to the risks of failure in the various processes. The plant, moreover, is of an exceedingly costly nature. An important element of cost is due to the fact that improved methods of armor-plate manufacture are liable at all times to be devised, with the result that the existing plant may become obsolete long before it has turned out sufficient armor to cover the cost of installation. Krupp armor, for instance, has shown such vast superiority over Harveyized armor, that the latter has become practically obsolete, and is only being manufactured in this country as the result of the prejudice



The plate is heated in a furnace and then sprayed on both sides with water under pressure.

Hardening the Plate.

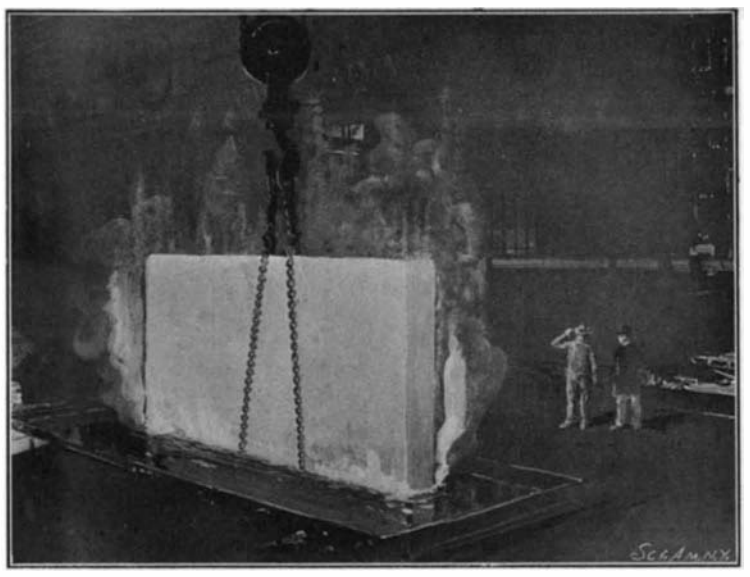


Plate is heated and lowered bodily into a bath of oil.

Oil Tempering.

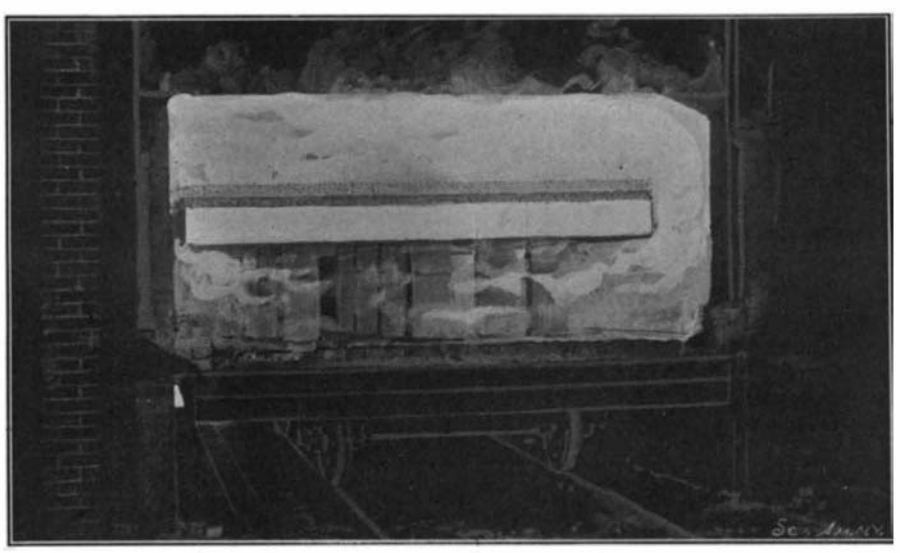


Plate is placed face upward in furnace, covered with a layer of carbonaceous material, and maintained at a predetermined temperature for from 20 to 30 days.

The Cementation Furnace.

MANUFACTURE OF GUNS AND ARMOR AT THE BETHLEHEM STEEL WORKS.

SCIENTIFIC AMERICAN

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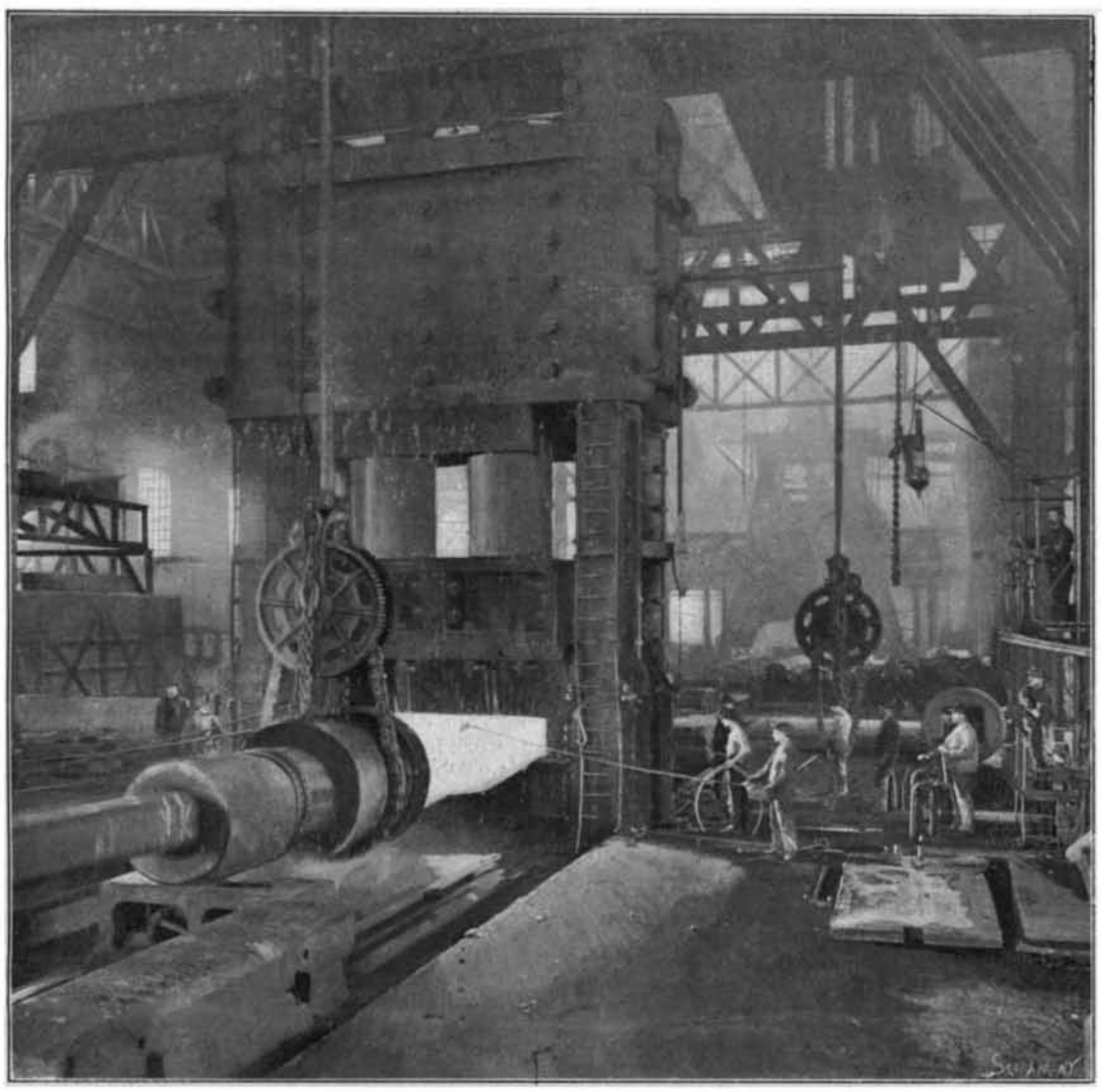
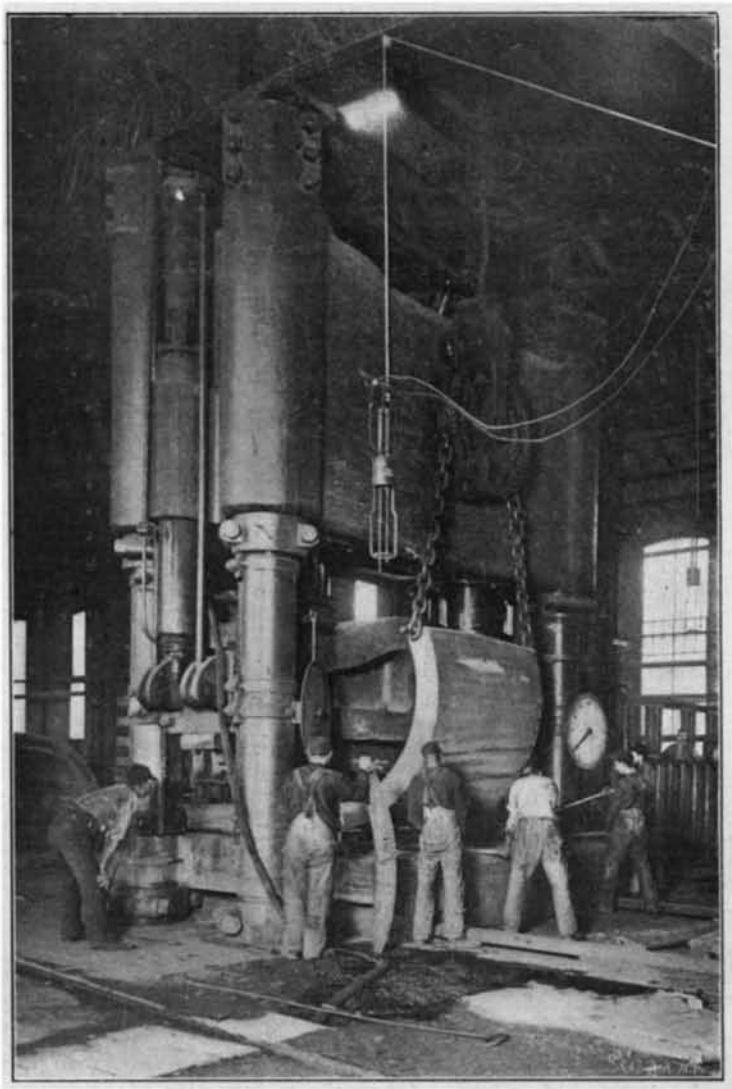
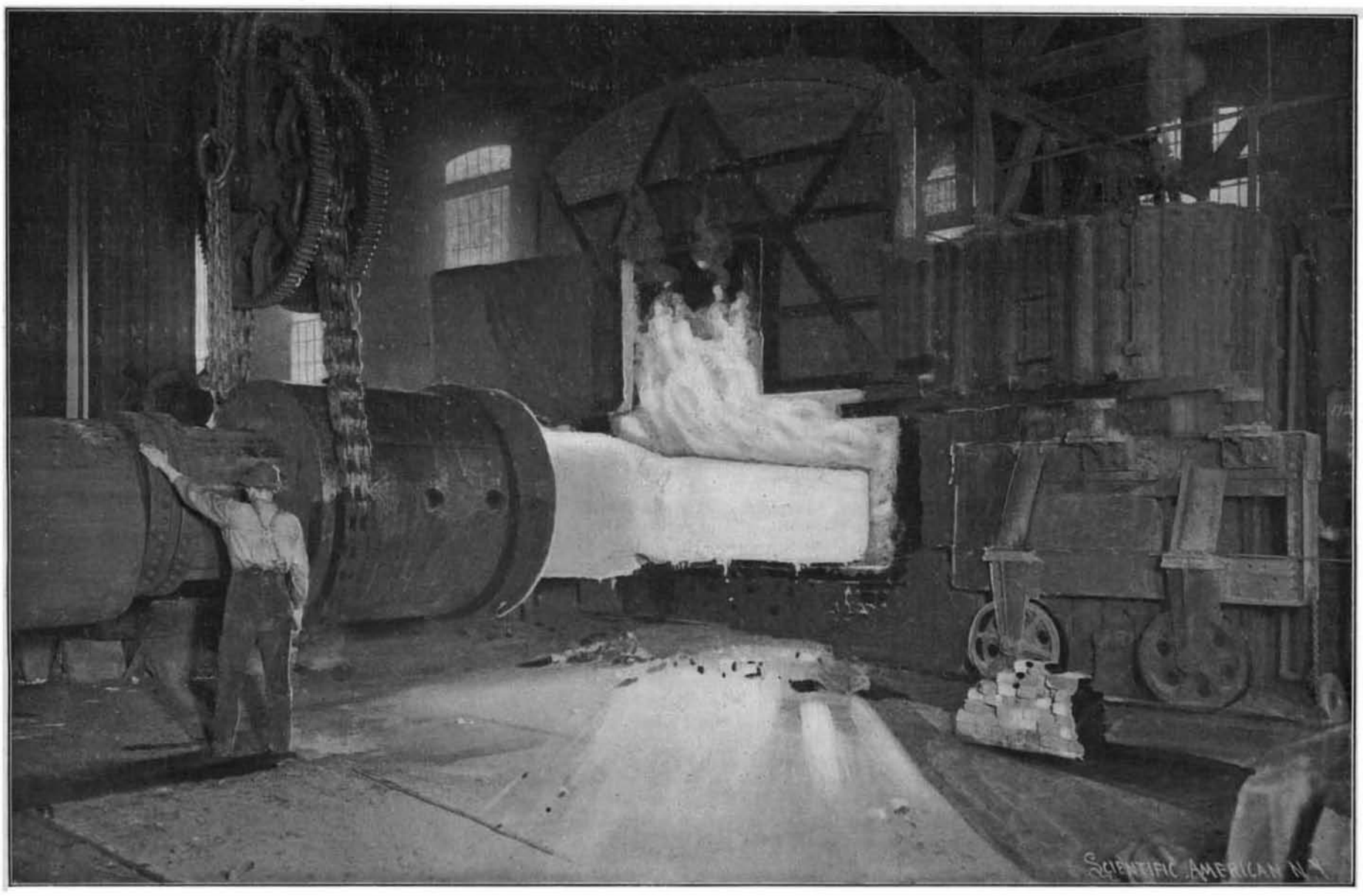


Forging a Port Plate of the "Alabama" Under the 14,000-Ton Press.



Bending Armor Plate Under the 7,000-Ton Press.

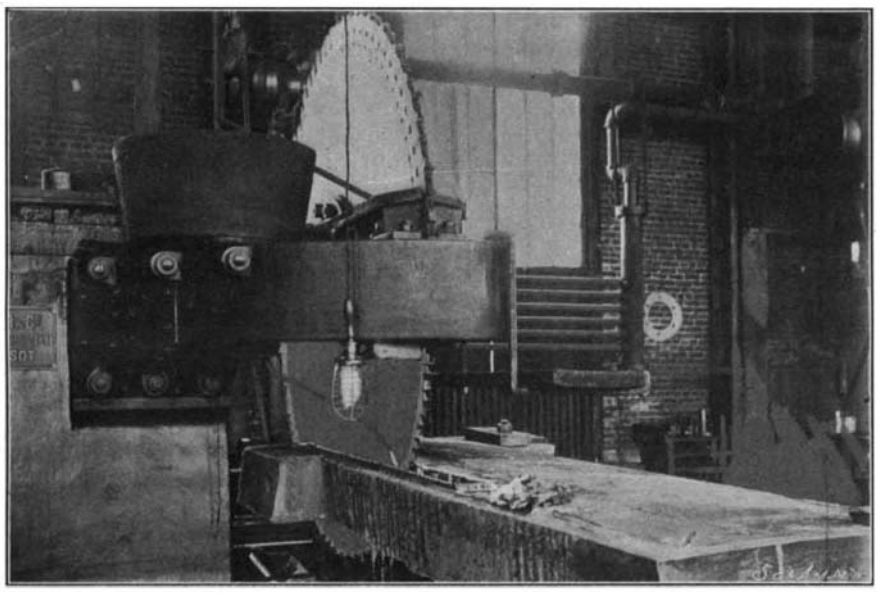


Transferring the 125-Ton Forging for a Port Plate of the "Alabama" from the Furnace to the 14,000-Ton Press.

MANUFACTURE OF GUNS AND ARMOR AT THE BETHLEHEM STEEL WORKS—III. HARVEYIZED ARMOR.—[See page 24.]

displayed by Congress in its refusal to pay the necessary price for Krupp armor.

The greater cost of Krupp armor is due to many causes. The composition contains expensive alloys which are not found in Harveyized steel; it is much more sensitive to error in treatment, and the percentage of loss is considerably greater. While there are about a score of general operations in the Harveyized process, there are something like double that number of separate steps in the Krupp process, and in a case where one heat would be sufficient for the forging of Harveyized plate, four or more separate heats would be required to do the same work on a Krupp ingot. Conclusive evidence of the superiority of the Krupp to the Harveyized steel is given in the fact that while Harveyized side armor for the American battleship "Illinois" weighs 700 tons, the same protection will be afforded to the sides of the Russian battleship "Retvizan," now building at the Cramps, by only 548 tons of Krupp steel. The difference between these two represents the disadvantage under which the United States battleships are being placed by the unreasonable opposition of Congress in a matter upon which it has never taken the trouble to obtain proper technical information.



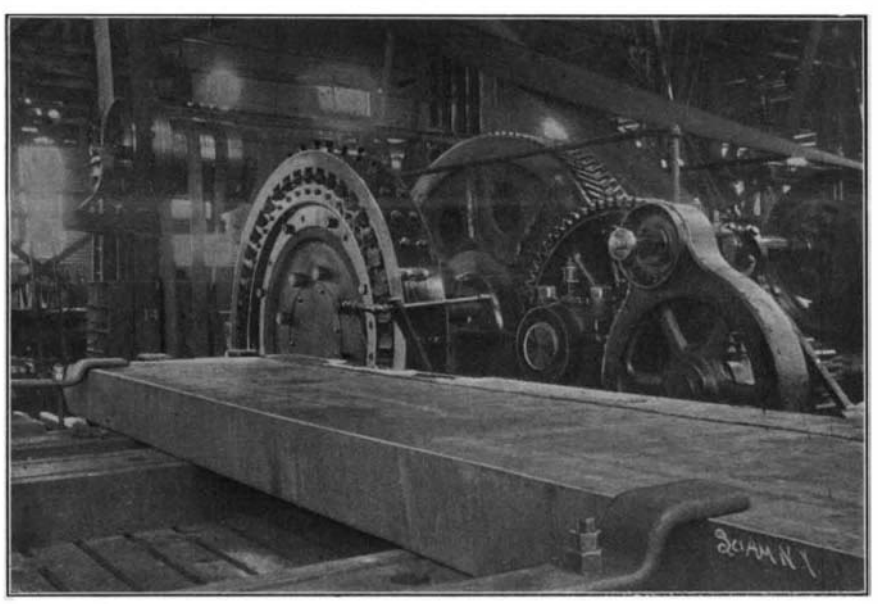
Body of saw, 84 inches diameter. Will saw through plate 24 inches thick and 83 feet long.

Rotary Saw.

Holland's Fight with the Waters.

One of the best books on Holland, which has appeared in a number of years is Mr. David S. Meldrum's "Holland and the Hollanders" and we take pleasure in giving some facts taken from this book which are not generally known. The history of Holland is the history of a continual fight against the waters and a chronicle of a reclamation of land from the sea. It is little wonder that in Holland hydraulic engineering is a profession of the first order. A very small portion of Holland lies above the level of the sea, and the rivers that flows into it. The provinces of Brabant, Limburg, a section of Utrecht, Gelderland, Overijssel and Drenthe and a part of Groningen are alone above the level of the sea or rivers. This may give some idea of the enormous amount of work which had to be accomplished to make Holland habitable, and the precautions to keep it so are never-ending. Since the Middle Ages the Dutch have been reclaiming sections of the country. The greatest work of this kind was the draining of the Harrlemmer Meer; the result is that 41,675 acres, in all, were reclaimed.

A canal was dug encircling the Haarlem Lake and a dike was built on the inner side, then engines were planted at different points on the dike and in four years the lake was dry. Eight hundred million tons of water were pumped out of the lake. The pumping engines were built in England and were enormous affairs, although they could only develop 500 horse power each. The first engine built worked eleven pumps, 63 inches in diameter, and the stroke was 10 feet. The two other engines were even larger. After the water was pumped out canals were dug and the whole area was further divided into sections by small canals, and in two years the fields were covered with colza. The total cost of the work was about $4,000,000. Of course, pumping engines still have to be employed to take away the excess of rainfall, and the water which infiltrates. Naturally after the Haarlem Lake was drained with such good success the Dutch people turned longing eyes toward the Zuyder Zee and many schemes were proposed with this end in view. There seems to be no immediate prospects of any of them being carried out. The island of Wieringen supplies the natural starting point for the works. From mainland to mainland the distance is about 35 miles and an embankment, 216 feet wide, would have to be built. This would carry a railroad and also provide for traffic. It is thought that this embankment could be built in ten years. Access to the canals would be obtained by lakes between Wieringen and North Holland. If the work should be begun now 800,000 square miles might be under the plow by the middle of the twentieth century and the estimated cost would be $150,000,000. Of course, if this were done like all polders, it would be necessary to keep them dry from hour to hour and day to day for ever afterward. A "polder" is any basin made dry, and the greatest polder of all is the "lowlands" of Holland, for right below the level of the outer water there was a swamp, if not the sea; just as the smaller polder was drained, it has to be kept drained, so the whole of the lowlands reclaimed from the waters are kept only by continual and strenuous labor, and it is a perfectly true saying in Holland that its safety may be questioned merely by half an inch of water.



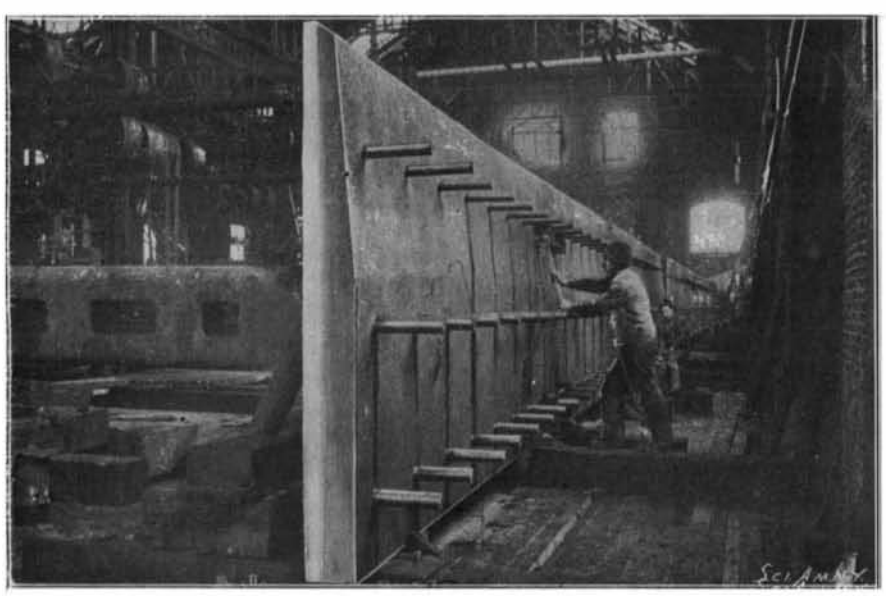
Will take 6-inch cut from edge of 10-inch plate faster than saw will cut off a 6-inch strip from same plate.

Rotary Planer.

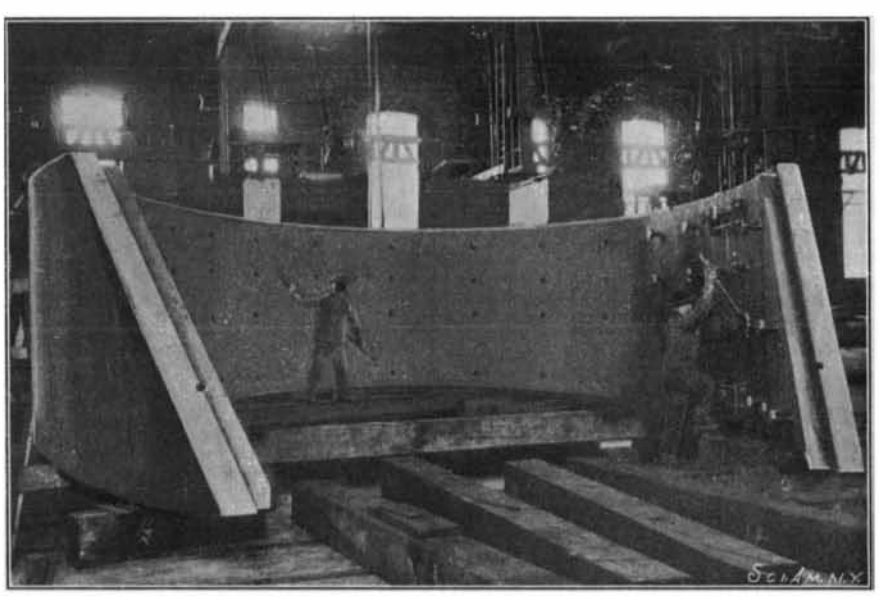
A system of impoldering from the sea by the conjoint action of nature and of man is being accomplished in various parts of the country. The ocean leaves against the dike faces, rapidly at first, more slowly as the deposits mount higher, layer upon layer of clay, and at last keeps a dry head above the waters save at high tide. Once lifted above the sea level the embryo dike becomes covered with a growth, and while agriculture is not possible, for the high tide still overruns them, sheep and cattle are allowed to graze upon them and at length when the soil has mounted sufficiently high to seem to justify impoldering, they are encircled by dikes, and the work of reclamation goes on. Farmers assist the work of nature by digging ditches which catch the mud and thus begin the operation. When a dike is threatened by a flood it is protected by osiers placed upon its face, and if the waters appear likely to mount over the dike then the dike slopes are temporarily heightened by planks and the polder proprietors have to supply laborers as in feudal days the proprietors supplied soldiers. Property of all kinds may be appropriated, and where very heroic measures are required even houses have been destroyed. Naturally every care is taken to regulate the rivers as far as possible. The canals of Holland are its salient feature, and they assist not only commerce, but also the schemes of drainage. The North Holland Canal which cost over $6,000,000, is the most famous, but Ymuiden Canal is, while not picturesque, the one principally used. It is called the North Sea Canal. The new lock at Ymuiden is 735 feet in length, 82 feet wide, 33 feet deep.

The whole story of the fascinating fight of the waters forces upon us the consideration that, however, brilliant and daring and successful it has been, if it had not an enduring and ennobling influence upon the national character, then it would have been in vain. No estimate of Holland and the Hollanders is complete that omits the consideration of the picture of the whole nation going about their daily work peacefully, below the level of the sea, secure in the constructive skill and patience and daring which have bridled its powers and opposes a barrier to its assaults.

THE following formula is given for obtaining phosphorescent prints upon paper: Water, 500 cubic centimeters; white gelatine, 125 grammes; glycerine, 1 gramme. The solution is made over a water bath, and while the mixture is well stirred, 350 grammes of phosphorescent sulphide of calcium, mixed with a little sub-nitrate of bismuth, is added. The paper is coated with two layers of the mixture, and afterward a layer of copal varnish or shellac may be given if it is to be much exposed. This process is said to succeed very well either with negatives or superposed objects.



Assembling the Side Armor (Krupp) of the Russian Battleship "Retvizan."



The port plate (see first-page engraving) will be laid on the inclined edges.

Turret Armor (Harveyized) of the United States Battleship "Alabama."

MANUFACTURE OF ARMOR PLATE AT THE BETHLEHEM STEEL WORKS.

Automobile News.

A trip from Berlin to Paris has been made by Herr Arthur Reuter, who started from Berlin on the 27th of May, and reached Paris on the 5th of June. The route followed included the cities of Madgeburg, Brunswick, Hanover and Cologne; Aix-la-Chapelle and Liegé; Namur, Givet and Rheims, making a total distance of 715 miles. Herr Reuter stayed two days at Aix-la-Chapelle, and at Liegé; he covered the distance from Liege to Paris in 21 hours.

At the last general meeting of the Automobile Club of France a number of questions were warmly discussed. The opposition party contended that the club should do more for the encouragement of the automobile industry, seeing that it has a large revenue at its disposal, and the other party maintained that it was to meet the expenses connected with the establishment; this and and other questions led to a stormy discussion. After the general meeting, a number of prominent members handed in their resignations as committee men, and decided to found a new club, this to receive the name of Moto Club of France.

An important agreement has been concluded between the seven principal French railway companies and the Belt Railway of Paris, by which the conditions have been fixed for accepting vehicles of all kinds as ordinary baggage. The text of the agreement is as follows: The following will be accepted as baggage under the usual conditions established for baggage of all kinds, especially that their dimensions are such that they may be easily put into the baggage car, namely, motocycles, automobile tricycles and automobile carriages; when unpacked their weight is not to exceed 330 pounds; when packed in boxes, the weight is limited to 220 pounds.

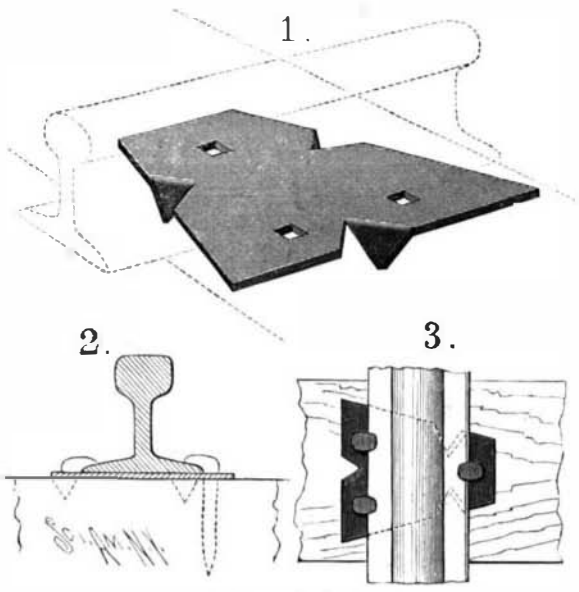
A number of experiments will soon be made by the German army with different types of automobiles for military service; the railway brigade has charge of the matter and are to make a series of trials in the open country, in the neighborhood of Eberswalde, a small town about 25 miles from Berlin; the trials will be made under the supervision of the lieuteuant-general, nine officers of the general staff, eleven captains, two officers of the engineering corps, a number of subordinate officers, artificers and privates. In France a series of grand maneuvers will take place this year in the eastern part of the country, in which a number of different types of automobile will be tried, such as petroleum and electric vehicles, motocycles, besides a number of heavy Scotte traction engines for the transportation of freight and baggage. The experiments are to be carried out on a large scale, and the organization has been entrusted to Mr. Journu, who has been for some time past engaged in the special study of applying the automobile to military purposes.

An interesting automobile fête has been held recently at Vincennes Park, which closed the contest of touring vehicles; it was the first official fête organized at Vincennes by the Exposition Administration, and served in some measure to inaugurate this annex to the Exposition, which is to contain many of the automobile exhibits. The race track around the lake was filled with various types of automobiles, their number being estimated at 300, representing a total value of 3,000,000 francs. The fête consisted of different displays of skill by the conductors, evolutions of automobiles, and tests of the brakes, and a procession of all the vehicles, many of which were decorated with flowers. In the tribune were many persons prominent in automobile affairs, among whom were the Baron de Zuyler, President of the Automobile Club; Messrs. Jeantaud, Forrestier, Krieger, E. M. Mix, Postel-Vinay and others. Most of the machines were of the petroleum type, a notable exception being a heavy covered freight wagon, made by the Postel-Vinay Company, which also constructs the Thomson-Houston material for France. It was conducted by Mr. E. M. Mix, chief engineer of the company. The motors are of peculiar design, and are placed in the extreme rear; the accumulator box is placed between the front and rear axles. The touring races, which were held previous to the fête, were not satisfactory, owing to the restrictions as to speed, etc., made by the authorities, and it has been decided that a fresh competition will take place within a month.

Among the electric automobiles especially remarked at the eighth annual exposition which has been recently held at Brussels, is the four-seated phæton constructed by the Lefert Company of Ghent. It is capable of making a run of 43 miles at a speed of 19 miles per hour. The body of the vehicle is constructed of polished Canada birch, giving it a pleasing appearance. It is provided with a motor of the Lundell type, of 3½ horse power, which is supplied by a set of forty-two Tudor batteries. The weight of the vehicle is 1,200 kilogrammes and that of the accumulators, 600. The capacity of the batteries is 150 ampere hours at a rate of discharge of 13 amperes, at a discharge of 22 amperes, 110 ampere hours are given. A large electric gong, whose contact is operated by a pedal, gives a loud signal and replaces to advantage the trumpet with rubber bulb generally used in Europe. Two pedal brakes are provided, one of which, the weaker, acts directly upon the differential, the other being a strong brake of the band type. The different speeds are obtained by the displacement of a lever whose operation is very simple and the four points are used for the starting or for the speeds of 9, 18 or 25 miles per hour. Another type of electric automobile, shown at the exposition, is a hotel omnibus of eight places, built by the Société l'Electrique. Its rear axle is provided with two Westinghouse motors of 4 horse power. The accumulators used are of the Julien make of an improved pattern; of these 40 cells are used. The total weight of the omnibus is 4,180 pounds, and the accumulators weigh 1,540 pounds. The capacity of the batteries is 150 ampere hours; a speed of 9 miles per hour may be reached, which permits the omnibus to cover a distance of 25 miles without recharging.

A COMPENSATION TIE-PLATE.

To prevent the uneven settling of rails in softwood or partly-decayed railroad ties and reduce the consequent tilting of rails or spreading of track in curvature a tie-plate has been designed and patented by Mr. Henry Herden, Chief Engineer of the Buffalo and Susquehanna Railroad, Galeton, Penn., in which the two ends of the plate when in position under the rail, present different areas of contact with the tie at the inner and outer edges of the rail base. These contact areas conform more proportionally to the different loads to which the ties at the base of the rail are subjected, the greater loads taking effect at the outside of the rail. The plate having greater area at the outside of the rail will offer more resistance to penetration into the wood than the opposite end, causing the plate to settle more uniformly, whereby, it is claimed, that the rails are assisted in maintaining their position at right angles to



A NEW TIE PLATE.

the surface of the tie when soft wood is used or material which has become defective from age or service, and that tilting of the rail and spreading of track is prevented. The life of the ties as well as of the rails and wheels is therefore prolonged. The economical distribution of material in this plate reduces its weight, there being no surplus material used next to the inside of the rail, as our illustrations show. The plate is provided with three triangular lugs, cut out and bent at right angles to the plate and designed to penetrate the fibers of the wood in a diagonal direction.

The Operations of the Kiel Canal.

The administration of the Kiel Canal, Germany, has lately published a report for the year included between April 1, 1898, and March 31, 1899. The number of vessels which have passed through the canal during that period reached 25,816, of which 11,005 represent steam vessels and 14,811 sailing vessels, etc. The total tonnage is estimated at 3,117,840. These figures show an increase over the preceding year of 2,708 vessels and 648,000 tons. The receipts of the canal during the year amount to about $400,000, which is an increase of $80,000, or 20 per cent. As to the different nations using the canal, Germany naturally takes the lead with 87 per cent of the total number of vessels, and 68 per cent of the tonnage; England has about 9 per cent, which is an increase over the preceding year. Denmark and Sweden have respectively 6·9 and 5·7 per cent, showing a slight diminution. Russia, whose proportion was 2·54 per cent in 1897–98, has now 2·29. From a financial point of view, the situation is considerably better than for the preceding period, the deficit being but $108,000 against $245,000. The receipts have increased about 26 per cent and the expenses diminished 9 per cent. The report brings out the fact that as the Kiel Canal has been constructed mainly from a strategic point of view, it is not to be expected that it will give any considerable profit; nevertheless, the constant increase in the revenue leads one to expect that the receipts may in time come to equal and even exceed the expense of maintenance.

Electrical Notes.

Electric lights are being installed experimentally in the Imperial Court, at Tokio, Japan.

A New York company is to establish a factory in Milan for the purpose of the manufacture of electric traction material.

It has been found by experiment that a thick coating of nickel can be obtained by using the ordinary plating solution and passing both alternating and direct currents through the bath.

A wireless telegraph service has been opened between the German island of Borkum and the Borkum Reef Lightship, in the North Sea. Ships are reported by this means between the hours of 6 A. M. and 8 P. M.

A Viennese dentist while experimenting at the Hygienic Institute at Wurzburg, claims to have discovered the successful application of electricity for the destruction of bacteria. It is said that the treatment is very simple.

The overhead trolley system not only damages underground pipes, but it also injures trees. Wherever a cable touches a branch it rapidly decays and the tree eventually dies. Serious complaints of this nature are made at Bay Ridge, N. Y.

The South Chicago Street Railway Company has introduced whiskbrooms and clothes brushes on its cars. They are kept in a small cabinet in the forward end of the car, and passengers are invited to use these articles on the rear platform.

The technical school for the textile industry at Aix-la-Chapelle has recently been fitted with machinery for dyeing, bleaching and printing fabrics. The machinery is on a considerable scale. Electrical bleaching is also done, platinum-iridium electrodes being used. Great attention is paid to the strengthening of the fibers before and after testing.

The principal switch towers and cabins on the London and Northwestern Railway are to be provided with electrical motive power for working the switches and signals. At present it requires sometime and considerable exertion to pull the weight of a long length of rod or chain. The new system will enable the switches to be worked much more rapidly.

All vessels passing through the Suez Canal must satisfy the agents of the Canal Company that they have on board one electric searchlight of a power sufficient to illuminate the channel for a distance of 4,000 feet ahead, and constructed so as to admit of rapid splitting up of the beam into separate segments with a dark sector in the middle, and also, says The Electrician, with electric lights capable of lighting up a circular area 700 feet in diameter.

A miniature electric railway is in course of construction in a small private park at Macon, Mo. The railway is a mile in length and the gage is 3 feet 2 inches. Each car will accommodate eight passengers. and the train will be lighted by incandescent lamps. Current will be supplied from a nearby academy power plant. The railway is being built for the benefit of children of wealthy families, one of which owns the park through which the line runs.

In the yards of the Atchison, Topeka and Santa Fé Railway, at Fort Madison, Iowa, electricity is used to light the signals. The ordinary switch lamp is used with an 8-candle power incandescent lamp inside fitted to a socket. The current is brought to the signal post or switch stand in underground conduits, and is arranged so as to enter the lamp at the top. The experiment is said to be highly satisfactory, and it does away with lamp tenders. The electric lights are very safe from extinguishment by wind or the jar of a passing train.

A brief digest of an article relating to electroscopes appears in the Elektrotechnische Zeitschrift, the author describing a vacuum electroscope which he had had constructed for experimental purposes. The apparatus has the form of a pear about 12 cm. in length, its top consisting of a hollow aluminium ball which rests upon an aluminium wire welded into the glass. The wire projects into the interior of the electroscope, where it takes the form of a flat ribbon, to which the broad pendulum leaves are attached, these latter being of aluminium foil about 1 cm. long and 1½ mm. broad. In the lower portion of the glass bulb are two platinum wires welded into the sides of the bulb, the distance between them amounting to about 0·4 mm. Experiments with the instrument proved the vacuum to be a perfect insulator, and that intensive electrostatic effects might be obtained in the same. The ordinary electroscope experiments succeeded when applied to the apparatus, though the heavy charges on the glass walls which occurred during these experiments had a disturbing influence. When the apparatus was observed in a dark room, no trace of luminosity was apparent in it during the occurrence of strong electrostatic effects. Discharges of electricity into a vacuum are therefore dark, from which it may be concluded that the phenomena of light are dependent upon the presence of ponderable material.