the encounter. The unfortunate elephant, however, had one of its back legs broken, and was so severely injured internally that it could only lie in the side drain of the slight cutting in which the train overtook the herd. On the train returning the next morning, it was lying dead in the same place. The driver stated that he counted eight elephants in all, and that a young one as well was knocked down, but apparently it was not much hurt, and with the others made off through the forest with loud trumpetings. This is not the first occasion on which a train has encountered wild elephants in Nambar Forest at night.

JUPITER STEEL.

We present a series of illustrations of a plant which possesses especial interest from the fact that it is devoted to a new process of steel-making which promises to exert something of a revolutionary effect in certain branches of the steel industry. Jupiter steel, as the product is called, is an exceptionally high grade of cast steel which is made from wrought-steel scrap, with a liberal mixture of certain other metals during the process of melting. The manufacture is carried on under several patents granted to Andres G. Lundin, and the composition of the steel, the methods of manipulation in the furnace, the special materials and careful work in the molding, have resulted for the first time in the history of the art in the production of a cast steel which, in tests carried out at the navy yard at Boston, has proved to possess qualities of strength and ductility equal to those of forged steel. These excellent results are obtained, moreover, with but little sacrifice of the high economy which distinguishes ordinary cast steel. Perhaps the best evidence of its remarkable qualities is found in the fact that cold-chisels and hatchets, cast to the finished shape in this steel, will, after being put on the emery-wheel, perform their work and hold their edge with perfect satisfaction; and one of the most striking evidences of what might be called the wrought-steel qualities of this cast-steel product is the fact that at the request of the writer two of these cast chisels were placed end to end and welded with perfectly satisfactory results.

The Lundin patents have been acquired by the United States Steel Company, whose plant—which forms the subject of our front-page illustration—is located on the Malden River, West Everett, Mass. The stock yard, which extends for several hundred feet on either side of a spur track from the Boston & Maine Railroad, is the first object of interest at these works. The stock consists of a large variety of mild-steel scrap, among which may be seen boiler-plate clippings, borings from the gunshops, the scrap from sheet-steel works, old crankshafts, and, indeed, any kind of steel that possesses the necessary composition to make up the furnace charge. The melting is carried on in a large furnace house, the steel for the smaller castings being melted down in crucibles and the metal for the larger castings being melted in 25-ton Siemens open-hearth furnaces. The preparation of the furnace charge and the introduction of various ingredients during the furnace treatment is carried out in the manner and proportions indicated by the following example, which will serve to show the proportions, but not, of course, the actual amounts which are treated at one time in the furnaces, the latter having, as we have said, a capacity of 25 tons.

A hundred pounds of steel scrap is placed in a crucible in the furnace and melted to a boiling-point of about 4,000 deg. F. When the boiling-point has been reached, from 1½ to 2½ pounds of ferrosilicon, containing 12 per cent silicon, is introduced into the molten metal. As soon as the ferrosilicon has melted, 2 to 8 ounces of ferromanganese, containing 80 per cent manganese, is mixed with 3 pounds or less of aluminium, and this mixture is introduced into the molten metal, where it quickly melts. After the resulting composition is thoroughly melted, it is tapped into ladles, carried to the various flasks and poured into the molds.

Although the excellence of Jupiter steel castings is, of course, mainly dependent upon the composition and the furnace treatment as above described, particular care is taken in the preparation of the molds. The molding sand is composed of a sharp silica sand, crushed rock, fireclay and molasses, which are mixed in the following proportions: Sixteen shovelfuls of hard silica sand, 4 of crushed rock, 1 of fireclay, and 1½ pints of molasses water, the molasses being diluted with water in the proportion of one to one. The molasses is used to give a bonding effect to the sand during the molding, while the fireclay serves the same purpose during the pouring of the hot metal. After the pattern has been drawn from the mold the latter is carefully dressed up and the finished surfaces are treated with a wash consisting of 99½ per cent of pure silica, ground fine and mixed with molasses water. The flasks containing the completed molds are placed in the baking furnaces, and are then ready for the pouring. The two 25-ton furnaces are utilized for the larger castings, and after the heat is ready it is tapped off into ladles which vary in capacity from 10 to 25 tons. These ladles are handled by a pair of overhead, traveling, electric cranes, one of 30 tons, and the other of 20 tons capacity; they travel the full length of the foundry, which at present measures 130 feet in width by 200 feet in length. The building is being extended to a length of 300 feet, and an additional 15-ton crane will be installed. One of our illustrations shows the metal being tapped from the furnace into one of the larger ladles.

When the castings are cooled, they are cleaned by the sand blast, and then all the rough edges are carefully chipped down until the finished casting conforms perfectly to the original pattern furnished by the customer.

In tests recently carried out by the government this steel has shown a tensile strength of 67,300 pounds to the square inch and an elongation of 25 per cent in 8 inches, while in the bending tests a one-inch-square bar of this cast steel was bent cold through an arc of 93.5 deg. without fracture. As a result of these excellent qualities, Jupiter steel is finding a wonderfully wide range of usefulness in the industrial arts. Thus, the shipwork which is being done for the government and private shipbuilding firms includes the rams for the new United States battleships "Rhode Island" and "New Jersey," each of which castings will weigh 43 tons, and the stern frame, keel and sternpost for the same vessels. Other castings include horseshoes for marine engines, engine thrust bearings, knees, and many small parts ordinarily made of forged steel for the interior construction and fittings of ships, engine beds, engine cranks, crossheads, gear wheels, etc. The castings for the battleships "Rhode Island" and "New Jersey" alone will equal in weight over a million pounds.

Niagara River Development.

Steps preparatory to the development of power on the Canadian side at Niagara are progressing with reasonable rapidity. Already a shaft 185 feet deep, 16 feet long and 10 feet wide has been sunk, and now comes the announcement that A. C. Douglass has been awarded the contract for constructing the tunnel that is to serve as a tail-race from the wheel-pit to the lower river. This new tunnel will be about 2,200 feet long and built in the form of a horseshoe, the same as the tunnel on the American side of the river, where the development of the Niagara Falls Power Company has become so notable. The section of the new tunnel, however, will be slightly larger than the tunnel now in use, the section of which is 21 feet high and 18 feet wide approximately. The new tunnel will be lined with brick, and it will discharge into the lower Niagara River a short distance below the Horseshoe Falls. The contract states the tunnel must be completed by January 1, 1903. The cost will be over half a million dollars. Work will progress night and day, and the method of construction will be similar to that employed in the construction of the present tunnel on the American side. Shifts of men will no doubt work toward each other from both ends. The tunnel on the American side is over 7,000 feet long, and it would seem from the shortness of the tunnel required on the Canadian side that it would not cost so much to develop power on that side. Contracts for the construction of the wheel-pit are to be awarded. The minimum capacity of this wheel-pit will be 100,000 horse power. The first section of the wheel-pit to be built will be about 250 feet long and 200 feet deep, having a capacity of 50,000 horse power. The electrical and hydraulic installation first to be installed will have an output capacity of 25,000 horse power. A supplemental agreement made between the commissioners of Victoria Park, in which the station is to be located, calls for the expenditure of $1,500,000 within two years, but the Canadian Niagara Power Company is prepared to expend this sum quicker if it is possible in the development of the proposed power.

The officers of the Canadian Niagara Power Company are: President, William H. Beatty; vice-president and treasurer, William B. Rankine; secretary, A. Monro Grier; assistant secretary-treasurer, W. Paxton Little. Executive committee: William B. Rankine, William H. Beatty and Wallace Nesbitt.

A New System of Wireless Telegraphy.

A new system of wireless telegraphy has been devised by an English electrical engineer, Mr. Johnson, of London. It possesses several important features which should recommend its adoption, the most salient of which is the complete obviation of tapping the messages in transmission, which at present constitutes one of the principal disadvantages of Marconi's system. The Johnson device is entirely different to that of Marconi, though it can be applied to the latter's apparatus. High masts are entirely dispensed with. At present owing to the patent arrangements not having been quite completed but little information regarding the principle of the invention is given out, but it is understood to be devised somewhat upon the same principle as a stringed musical instrument. The transmitting apparatus comprises chiefly a battery and induction coil, to which is attached a disk which may be adjusted to revolve at any desired speed, which revolves, and which is fitted at the edge with a number of vibrating reeds. The receivers, of which there are two, contain a series of tuning forks capable of being modified to any number of oscillations. The receivers are joined together by means of a wire. The disk of the apparatus is also capable of adjustment to any number of vibrations. The electric waves are transmitted at a certain number of vibrations. The tuning fork arrangement in the receiver is attuned to the same number of vibrations, so that the message during its passage through the air, although it may come into contact with other receivers, unless they are synchronized with the transmitting apparatus, will have no influence upon the waves. The system has been experimented over a distance of three miles with perfect success, but owing to the invention being only in its initial stage it has not been subjected to any severe tests. An experimental station is to be set up at the Earl's Court Exhibition in London and a graphic illustration rendered of its possibilities. The inventor states, however, that he can transmit the messages over the same distances that have been covered by Marconi. The question that arises is what is the range of tuning? Mr. Johnson states that he can produce over 30,000 vibrations per second with a low voltage. The range of combination by this system is so vast that it would be almost impossible to tap the messages. The British Admiralty have submitted the invention to a severe test, and the experts who carried out the examination are stated to be favorably impressed with the invention. It is stated that a trial is to be made with the apparatus by installing the system upon four battleships. It will then be possible to ascertain to what extent the vast amount of steel present upon a battleship, and the extensive range of electric appliances that are used, will interfere with the instruments, so that a conclusive idea of the utility of the invention may be gained.

Automobile News.

A titled automobilist was recently fined a pound for allowing his vehicle to emit steam while passing through the streets of a town.

An attempt has been made to introduce motor wagons on the African caravan route. Sixty were built especially for the work and have been abandoned.

An automobile took fire recently at Springfield, Mass., and the driver, with great presence of mind, ran the burning machine to the nearest fire house and asked the firemen to extinguish the flames. The firemen were quite surprised at having a fire brought to their doors.

One English contemporary, The Motor Car Journal, notes what might have been a serious accident to the motor car which runs between Bishop Auckland and Crook. As it was carrying a load of passengers it was upset by running into an obstruction which had been deliberately laid on the road. Fortunately no one was seriously injured. An examination of the roadway showed that a V-shaped wall had been built across it with stones from a neighboring pit heap, and this at a spot where there was a sloping bend in the road.

The French government has issued a decree settling the question of motor carriage speeds. The carriages are divided into two classes. First, those capable of a speed under 30 kilometers, and, second, those capable of a speed over 30 kilometers per hour. The latter must always carry in the front as well as in the rear, by night and day, a special number. The makers are required to make a declaration of the speed of every machine intended to travel on French roads. Racing on the high roads is forbidden, but in the open country a speed of 18 miles an hour will be allowed. Elsewhere the speed is limited to 12 miles per hour.

The automobile has been put to a novel use upon the Continent. M. Deutsch suggested that at bull fights the picador ride in an automobile, and the scheme was put into operation at Bayonne, September 29, but ended in a fiasco. The automobile was one of 12 horse power, and was all sheathed in with iron to prevent the bull from catching his horns in it. It was intended to have the picador stand on the seat of the car. The bull, however, did not care to come in contact with the strange looking vehicle and devoted his attention to the matador. Finally the bull was induced to make one onset and he struck the front wheel, coming in contact with the iron plate. One of the wheels of the automobile caught one of the hoofs of the bull, laming him. The crowd exclaimed in indignation at the loss of their sport, and the motor carriage had to be removed from the ring and the bull was killed in the ordinary way.

Engineering Notes.

The old wooden boat bridge over the ancient Oxus, on the line of the Transcaspian Railroad, is to be replaced by an iron bridge 5,000 feet long, supported on twenty-four piers. The estimated cost of the structure is $2,600,000.

An industry which should be established in Spain is that of manufacturing gas motors. For use in Spain the motors should be light and simple, so that they could be easily managed by those unaccustomed to the use of machinery.

The first railway systems of the world were inaugurated in the following years, says The Mechanical Engineer: England, September 27, 1825; Austria, September 30, 1828; France, October 2, 1828; America, December 28, 1829; Belgium, May 3, 1835; Germany, December 7, 1835; Russia, April 4, 1838; Italy, September 4, 1839.

An order was recently issued by Admiral Gervais to the crews of the French fleet, congratulating them on the rapidity with which the coaling was accomplished, and on the excellent average attained, says The Trade Journals' Review. Thus the average of the "Gaulois" was 185 tons, and that on the "Saint Louis" 172 tons per hour. On board all the vessels of the fleet, thanks to the enthusiasm of the officers and men, directed by the commanders, the rapidity with which the ships were coaled exceeded all previous results. In conclusion, the Admiral says that in a short time they will have nothing to learn in this respect from the foreigner.

For the prevention of collisions at sea during a fog, Capt. Brinkworth, of Gloucester, England, has designed a novel compass card. The object of his device is that a certain signal should be sounded to denote from what direction the vessel is approaching. He has drawn up a list of signals corresponding to various points of the compass, and when a vessel signals in a certain manner a glance at the card denotes its position and course. The present system of blowing frequent long blasts is extremely unsatisfactory, since it does not signify the course of the approaching vessel. It may be coming end on or broadside. By means of Capt. Brinkworth's compass card each vessel would know the course of the other, and would thus be enabled to avoid a collision.

Prof. Robinson, of the Lafayette Institute of Mechanical Engineering, Lafayette, Ind., read at the last meeting of the American Society of Mechanical Engineers a paper upon some experiments he made with an engine using natural gas as the motive fluid, from which it appears that with a Westinghouse three-cylinder gas engine, having cylinders 13 inches diameter by 14 inches stroke, working single-acting, four-cycle, he obtained a maximum of 142½ horse power, and an average of 113 horse power during a six-hour test; the mechanical efficiency was 79 per cent. The consumption of gas was, per horse power, 10½ cubic feet per hour. The revolutions per minute were about 260; the temperature of the exhaust gases was 1,500 deg., and the ratio of air to gas was 13 : 7.

A drawing of a special stop cock of very simple construction is illustrated in The Iron and Coal Trades' Review. In this stop cock, the plug is reversed, being larger at the bottom than at the top, and it is maintained tightly in its position by a spiral spring let into the large end of the plug. The advantage of this over the ordinary form is that there is no possibility of workmen leaving it loose, as they often do in the common form, and thus cause a great loss of compressed air. Workmen frequently loosen the bottom nut, and knock the plug up slightly in order to loosen it, and then leave it in a leaky condition. That cannot be done in this case. If the plug does not turn easily by the squared end on top, a slight knock on the top is sufficient to loosen it and allow it to turn readily; but it will not be left in a leaky condition, for the spring comes into play and keeps the plug perfectly tight in its seat.

Now that superheated steam is occupying much attention as an economical agent in engines practical difficulties in its action are being discussed. One of the most serious is the friction of the piston in the cylinder, the great heat rapidly dissipating by burning any oleaginous compound that is introduced. A prominent British firm who have used superheated steam for many years, at a temperature of 550 deg., says that the wear in six years of the piston packing was only ⅛ of an inch, the packing being of the Ramsbottom type. Against this testimony, however, a correspondent of a technical journal states that he tried many agents to reduce the wear of the packing, which was very serious indeed (graphite for one, which was blown out of the cylinder quickly) and finally employed a mixture of mica, grease, and graphite, which answered well and was adopted. It seems that superheated steam requires a special piston, which is described as one with cast iron rings of the eccentric type, not snapped in but having bull-rings and a follower, so that the rings may be put in place without distortion.

Electrical Notes.

Electric light is being installed in Buckingham Palace, which is being refitted throughout.

Wireless telegraphy seems to have a great future in the Sahara Desert, as communication can be readily set up between the oases—and there are no wires to steal.

Arrangements are practically completed for running parlor and sleeping cars from Cincinnati to Columbus, Ohio. Sleeping cars for street railways will be a novelty. It is expected that the running time between Columbus and Cincinnati will be about six hours.

The Eastern Telegraph and Cable Company is constructing a third cable from Zante via Patras and the Corinthian Gulf to Syra, the object being to offer a more direct wire communication between Europe and India and Australia. The two old cables will be devoted principally to local needs, the volume of business having greatly delayed rapid communication. There is also under serious consideration the construction of a telephone line between Patras and Athens. The business done between these two places will undoubtedly warrant the undertaking.

American electrical engineers have scored another victory in England. The firm of J. G. White & Company has been awarded a contract to build the corporation tramways of Bournemouth at a cost of £152,000 ($760,000). Especial interest attaches to the proposed lines for the reason that they will be the first ever constructed in Great Britain combining conduit and overhead trolley sections. If the system proves satisfactory it will be adopted by a number of British municipalities. The Bournemouth lines will be constructed by an English company organized by Americans.

Bangkok, Siam, now has an electric light plant and a tramway six miles long, and is laying a second line of equal length. The service is fairly good. The telephone system, however, is decidedly bad. It is owned by the government, and there are some 200 instruments of German make. Bangkok is a city of magnificent distances and as the Siamese are particularly intelligent people they would undoubtedly patronize a good telephone system were it once established. There should be at least 1,000 instruments instead of 200, and this number would, of course, be increased as the system was better understood.

It is distressing to see teams with heavily-laden trucks attempting to ascend the steep inclines of ferry bridges during low tide. At the Pennsylvania Railroad Company's Desbrosses Street ferry a 20 horse power electric gypsey has been installed. When a team is unable to ascend the bridge a rope is attached to the tongue of the truck. A couple of turns are taken around the gypsey and the power is applied by means of a controller. A second one is now being made for the same ferry. Two electric gypseys have also been installed at the Oak Point pier of the N. N., N. H. & Hartford Road. The water there is very deep and the current strong, and they will aid in pulling the boats up to the wharf.

A comparison of the mileage of telegraph line and wire in operation in the United States and Europe is interesting, says The Western Electrician. The Western Union Telegraph Company has 192,705 miles of line and 933,153 miles of wire; the Postal Telegraph-Cable Company has 29,882 miles of line and 184,933 miles of wire in the United States. This makes a total of 222,587 miles of line and 1,118,086 miles of wire. According to the latest statistics of the international bureau of Berne, Switzerland, there is in all Europe 425,600 miles of line and 1,585,267 miles of wire. The United States, therefore, possesses over one-half as much line as all Europe, and over two-thirds as much wire. In comparing the mileage of wire to population, America has one mile of wire to every 77 persons; Great Britain and Ireland has one mile to every 130 persons; Belgium, one mile to every 321 persons, and Switzerland has one mile to every 222 persons.

The electrical rolling stock and equipment for the underground Great Northern and City Railway, from Moorgate Street to Finsbury Park, London, is being supplied by the British Thomson-Houston Company. The service is to be a 3-minute one, and each train will consist of seven cars. Profiting by the experience of the Central London Electric Railroad, electrical locomotives will be supplanted by motors carried on the two end and the central cars. The generating plant is to comprise four vertical cross compound condensing engines developing 1,250 indicated horse power as a normal load, and 1,875 indicated horse power maximum when making 100 revolutions per minute. Each engine will be coupled direct to an 800-kilowatt generator, mounted between the cranks, each generator having 14 poles and giving 525 volts at no load, and 575 volts at full load. The third-rail single-unit system is to be utilized, as in the case of the other London electric railways.

Science Notes.

Eight hundred Japanese will be taken to Dawson to work in placer diggings this coming winter. It is believed that the employment of Japanese at low wages will enable the mines to be worked much more economically.

Lombardy, at one time holding in Europe the highest reputation for its productions in silk and linen, has recently presented to the Pope, for his private altar, an altar cloth, Gothic-Venetian in style, which for pattern and texture is pronounced to be a marvelous piece of work, surpassing by far anything previously turned out in Italian art weaving.

The German census, which started December 1, 1900, and has just been finished, gives some interesting facts. There are 442 cities with a population between 10,000 and 100,000 each. In 1816 the German Empire had 24,833,000 inhabitants; in 1855, 36,114,000; and in 1900, 56,345,000. In the year 1816, Prussia had 13,709,000 inhabitants; in 1855, 21,320,000; and in 1900, 34,463,000. The enormous increase in the large cities of Germany is said to be due to the retrograde movement in agriculture, which has driven people from the country.

An Indianapolis dentist has given up the use of forceps for pulling teeth and has adopted the primitive method of the Chinese, using nothing but his thumb and index finger. He considers that the sight of the forceps themselves is responsible for much of the harrowing part of tooth-pulling and that many nervous persons are greatly shocked by the sight of these instruments. The pain is also said to be less. He can take out the most firmly rooted double tooth in a few seconds. He learned this art from a Chinese practitioner.

While large shoe factories in Germany have combined, independent shoemakers are seeking to obtain the advantages of production on a large scale without giving up their individuality. A meeting was recently held in Frankfort to discuss the advisability of establishing a central workshop for the local shoe concerns and a committee was appointed to devise a plan. It proposed to start a factory with the most modern machinery where every member can have his work done. This is said to be the first attempt in Germany at a co-operative factory. The work will be pushed and the provincial government will materially assist the new enterprise.

Prof. D. McAlpine enumerates the species of fungus, twenty-one in all, in which luminosity (often incorrectly termed phosphorescence) has been observed. Of the species eleven belong to the genus *Pleurotus*, and five are peculiar to Australia. The luminosity is not due to the presence of phosphorescent bacteria, but to a process of combustion in the fungus itself, confined to the living tissue. It is altogether dependent on the presence of oxygen, as also on a sufficiently high temperature, but is not affected by moisture. In all probability the light is given off not within the organism, but from luminous excreted metabolic products. It is probably useful to the fungus in attracting insects which assist in the dissemination of the spores.—Proceedings Linnean Society of N. S. Wales.

It may not be generally known that M. Santos-Dumont, who came so near to winning the Deutsch prize of $20,000, has himself offered a prize of 4,000 francs, this being a year's interest on the Deutsch principal to which he was entitled. He promptly placed this sum at the disposal of the Aero Club for the foundation of a prize bearing his name, to be awarded to any member of the Aero Club who, before October 31, 1901, will start from the club grounds at St. Cloud, travel around the Eiffel Tower and return to the point of departure, without any limit as to time and without having touched the earth, and solely by such means as he may have on board his airship or balloon. If the prize is not granted during 1901 it remains open until a competitor is successful. The prize cannot be won by its founder, nor by any competitor using a balloon or airship designed by M. Santos-Dumont.

In the case of *Hordeum distichum*, R. Kolkwitz finds the amount of CO_2 given off to depend to a remarkable extent on the moisture of the atmosphere, says The Pharmaceutical Journal. When air-dried the grains contain from 11 to 12 per cent of water, and the amount of CO_2 then given off does not exceed 0.33 to 1.5 mg. per kilogramme per hour. With an increase of moisture in the air, the respiration increases very rapidly in intensity, until, when it has reached 33 per cent, the amount of CO_2 given off has increased to 2,000 mg. per kilogramme per hour. Even when crushed or cut into small pieces, the faculty of respiration is not altogether lost. Dr. A. Jencic determined that when seeds have been air-dried, exposure to a very low temperature (—18 deg. C.) accelerates their power of germinating, as is also the case with potato tubers. This is probably due to the conversion, under the influence of severe cold, of insoluble into soluble carbohydrates.

SCIENTIFIC AMERICAN

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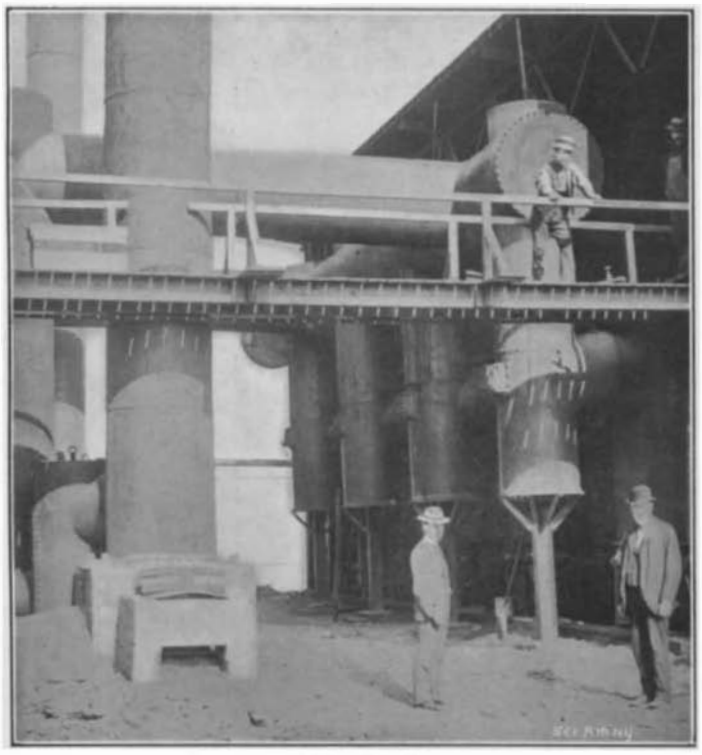
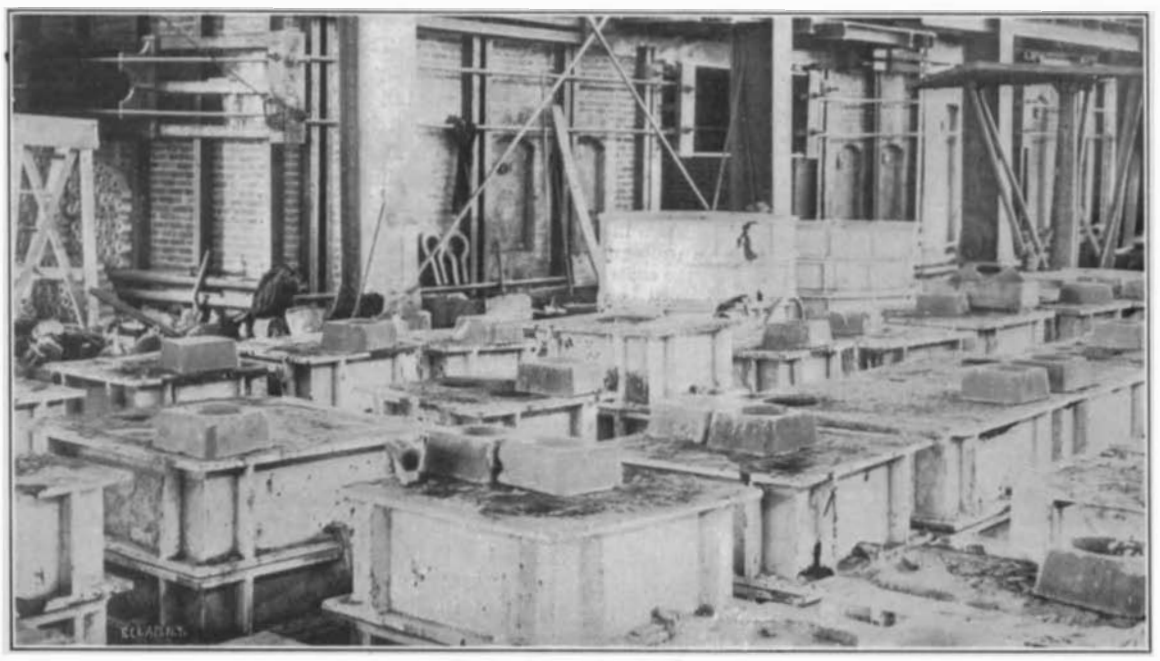


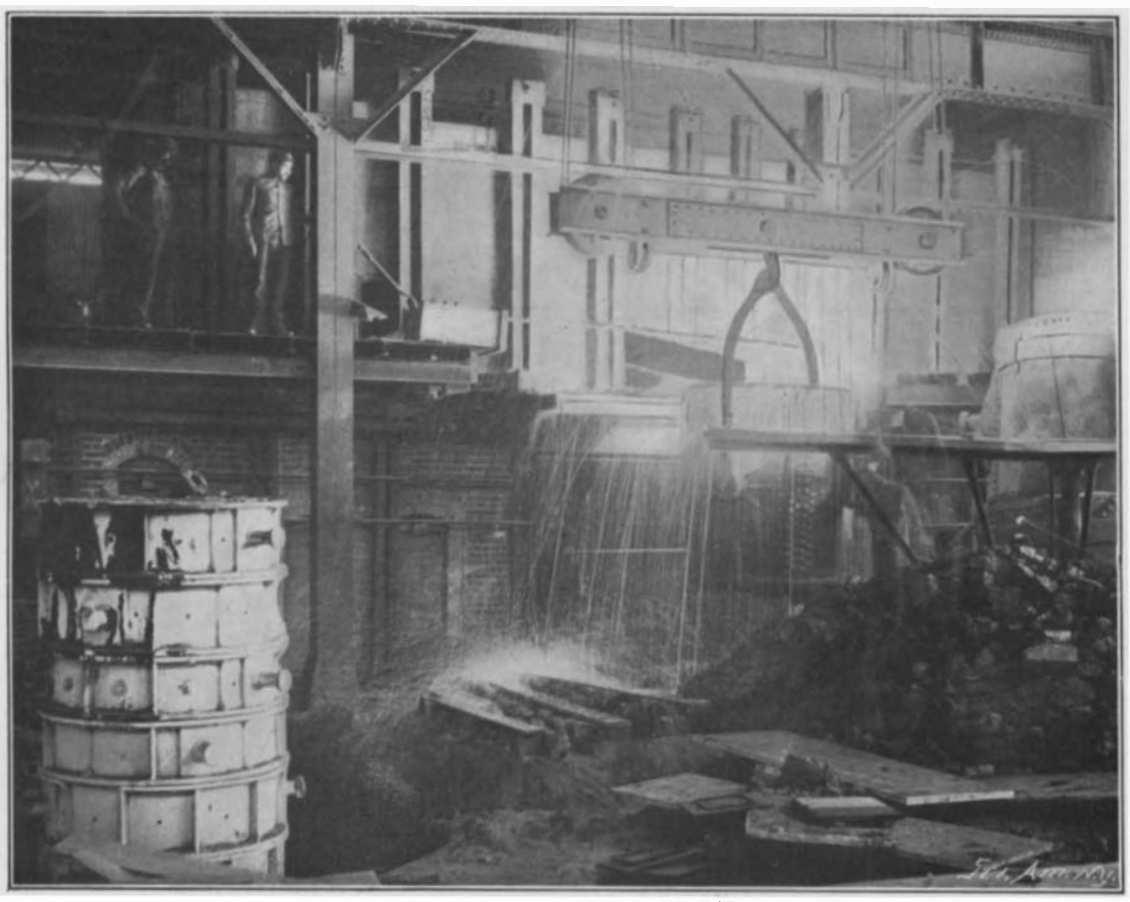
The Gas Plant.



Flasks Ready for Casting.

Finishing a Mould.

Finishing Mould for Locomotive Driving Wheel.



Pouring Molten Metal into Ladle.

Pattern for Ram of Battleship.

Cleaning Castings by Sand-Blast.

THE MANUFACTURE OF HIGH-GRADE CAST STEEL.—[See page 230.]