A NOVEL HAND CAMERA.

The remarkable progress that has been made within the past few years in the construction of hand cameras, whereby their cheapness, lightness, compactness, simplicity and accuracy are some of the predominant points, is well exemplified in the camera called the Adlake, which is the subject of our illustrations.

The well known box form of camera is adopted, and comprises at the front all of the important essentials for good work; as, for example, a lens easily removable for cleaning, a set of diaphragms quickly adjusted, a very simple yet rapid shutter, easily released, positive in its movement and quickly adjustable for time or instantaneous exposures. There are also the usual two finders for taking the picture in a vertical or horizontal position. On the rear is a space for holding twelve remarkably compact and simply constructed metal plate holders, plainly observable in Fig. 1 and in detail in Fig. 2. Each plate is exposed separately, withdrawn from the box and transferred to the rear of the series until all, or as many as desired, are exposed, each holder having stamped on it a separate number.

The construction of the plate holder and mode of operation will be observed in Fig. 2. Two vertical grooves in the box on each side hold a metal plate holder frame having a small recess cut out in each side, as will be noticed by a black space in the upper part of Fig. 2. The thin metal plate holder, just thick enough to hold one glass plate, provided with a hinge side, the latter having on its upper edge and outer corners light wire clamping or locking springs, is pushed down in the metal plate holder frame just described. Just in front of the frame are two skeleton fingers, having at their upper ends curved portions which fit into the black recess shown in the plate holder frame, and are attached to the axis of a revolving shaft at the bottom, at the end of which is also a push crank projecting through the box, the knob being seen in Fig. 1, on the side. To make an exposure the finger frame is turned into a vertical position until it fits snugly into the plate holder frame. The plate holder is then inserted, which brings the corner projecting clamping wires into the curved ends of the finger frame. The cover of the box is shut, then the knob on the outside is pushed down. This carries forward the finger frame downward in the arc of a circle which takes with it the door of the plate holder, leaving the latter in a horizontal position on the bottom of the camera. After the exposure is made the knob is pushed up tightly, which closes the door of the holder, it being secured by the three wire clamping springs. The cover of the camera is opened, the plate holder removed and another plate inserted. The plate holder is made with a thin rabbet edge, in which the edge of the plate holder door, or side, fits and excludes all light.

Referring to the mechanism of the shutter, Fig. 3, it will be noticed that the shutter is of the ordinary oscillating fan-shaped type, having an elongated aperture, working on a pivot from one side to the other in opposite directions, and that a very small movement just below its axis produces rapid movement above. To this portion is attached a link secured to the lower end of a long swinging vertical arm, or lever, pivoted at the top, seen on the left. A rapid movement of this lever near its fulcrum will give an extremely rapid motion to the shutter. Behind this lever will be seen the pivoted black operating swinging lever, on the end of which is secured the operating oscillating spring, having one end attached to the long vertical lever not far from the fulcrum.

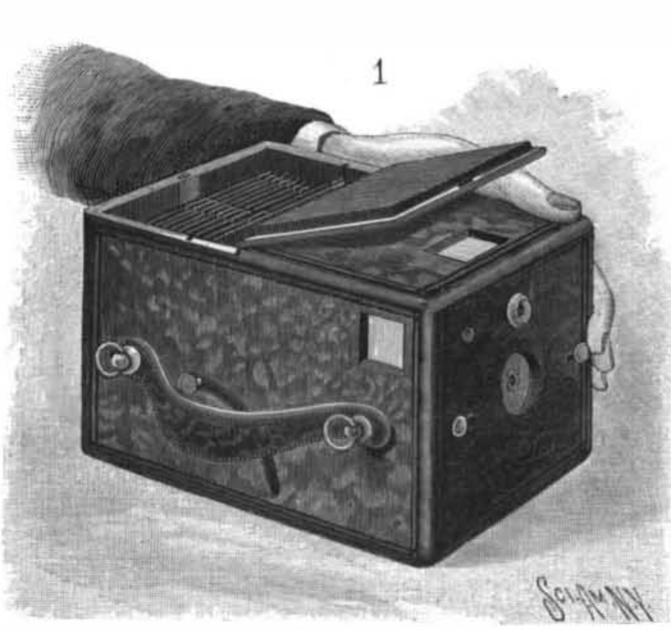
When the operating lever is pushed in one direction by the knob on the outside the spring is partly rotated until its center is above the attached end, causing the shutter lever to be suddenly pushed in the opposite direction, giving a corresponding rapid movement to the shutter. Pushing the operating lever in the opposite direction makes the spring carry the long lever to the other side. In this way a slight side pressure on the push button quickly operates the shutter without a jar or difficulty. A second pivoted lever (shown at the right, Fig. 3) pivoted at the bottom, to the axis of which is a flat spring, has a horizontal arm projecting from its center which engages with a like short arm projecting from the shutter proper. It may be called a time lever. When the button on the outside is pushed toward the lens, the arm on the lever engages the arm on the shutter and stops its movement, leaving the aperture open for time exposures. When pushed away from the lens, the lever releases the shutter and allows the latter to close.

Above the shutter and working just behind the lens will be observed a star-shaped diaphragm plate turning around its center and having three different apertures. On the surface of the plate are slight indents, which engage in the end of the horizontal flat locking springs. The diaphragm plate is attached on the front to a rotating ring surrounding the finder lens, and is thus rotated from the outside to whatever working aperture is desired.

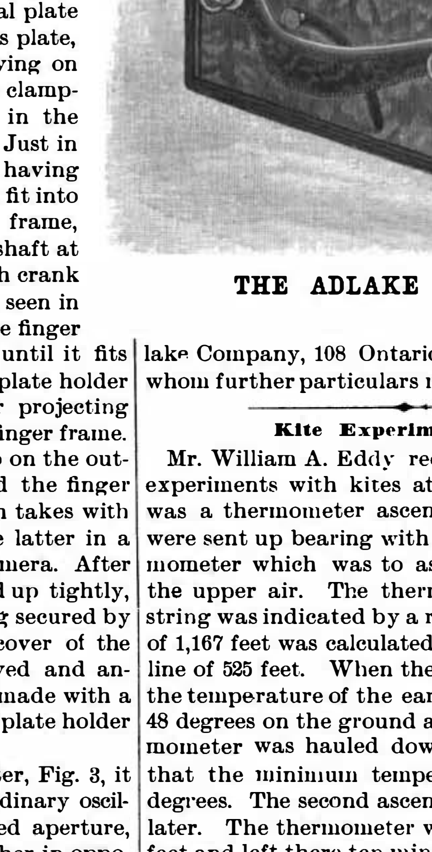
Convenient strap rings are attached to the handle of the camera for carrying it over the shoulder or on a bicycle. Pictures we have seen made with it are clear cut and distinct, showing that its cheapness is no bar to the production of good work.

Its simplicity and certainty of working are its salient features, while at the same time its strength of structure is such as to permit of rough handling without detriment.

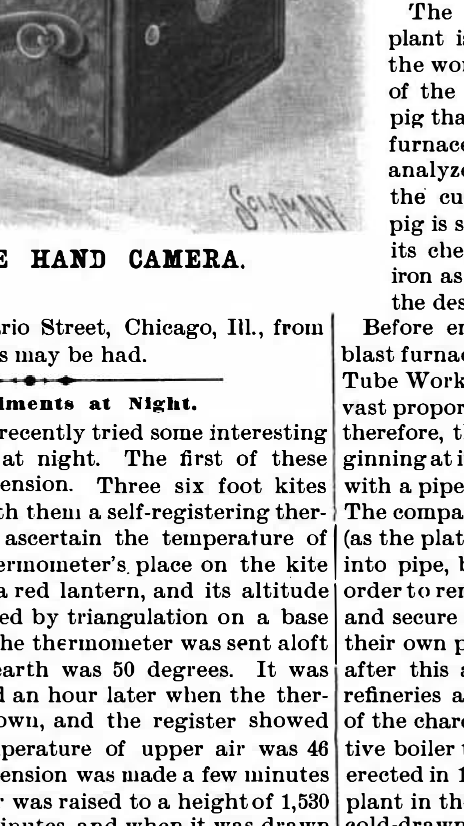
The camera is manufactured by the Adams & Westlake Company, 108 Ontario Street, Chicago, Ill., from whom further particulars may be had.



THE ADLAKE HAND CAMERA.



THE PLATE HOLDER DEVICE.



THE SHUTTER.

Kite Experiments at Night.

Mr. William A. Eddy recently tried some interesting experiments with kites at night. The first of these was a thermometer ascension. Three six foot kites were sent up bearing with them a self-registering thermometer which was to ascertain the temperature of the upper air. The thermometer's place on the kite string was indicated by a red lantern, and its altitude of 1,167 feet was calculated by triangulation on a base line of 525 feet. When the thermometer was sent aloft the temperature of the earth was 50 degrees. It was 48 degrees on the ground an hour later when the thermometer was hauled down, and the register showed that the minimum temperature of upper air was 46 degrees. The second ascension was made a few minutes later. The thermometer was raised to a height of 1,530 feet and left there ten minutes, and when it was drawn down it registered 47 degrees, while the ground temperature was 44 degrees. The minimum temperature registered in the highest strata was 43 degrees. Mr. Eddy and his associates next raised a triangular reflector, 24 by 5 inches, covered with silver paper, to watch its operation in the light of a full moon and see what it would do with the rays. One of Mr. Eddy's associates went to a point a quarter of a mile distant, and from there could plainly see the reflector, although at first it was difficult to distinguish it from the stars.

A COMPANY has been organized at Seattle, Washington, to develop the coal and oil fields recently discovered in Alaska, some 350 miles west of Juneau. Thirty thousand feet of piping has been ordered for this purpose from the Pittsburg district.

THE STEEL PIPE AND TUBE INDUSTRY.

I.—THE MANUFACTURE OF THE PIG IRON.

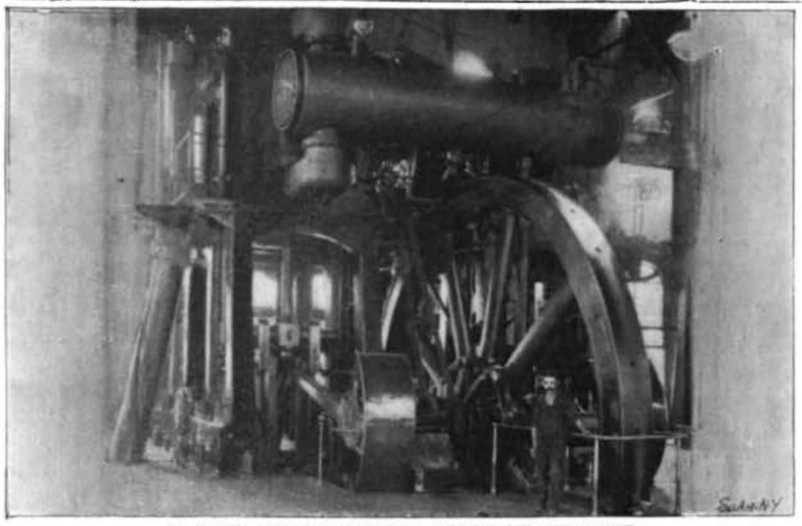
The manufacture of pipe and tubing is one of those branches of the iron industry that have been slow to discard puddled iron in favor of Bessemer steel as the raw material of manufacture. This reluctance to use the new material has been due to the difficulty in producing lap and butt welded steel pipe that would be as strong at the weld as in the body of the pipe, and it is undeniable that the earlier attempts were marked by repeated failure. The obvious advantages of strength and smaller cost in the use of steel were so great, however, as to stimulate the manufacturers to an earnest study of the problem, and of late years it has been so completely solved that welded steel pipe and tubing can now be made, and is made, that shows a larger percentage of strength at the weld than at any other point. It has been found that to procure a perfectly reliable weld a special grade of steel must be used, and that the chemical composition of the pig iron itself must be made the subject of careful study. Under the old system the manufacturers of steel tubing were apt to purchase their raw material in the shape of pig iron with very little, if any, regard to its composition; whereas it is now the practice of the best manufacturers to exercise the greatest care in the selection and mixture of the pig before it is melted down for treatment in the converters.

The National Tube Works Company, whose plant is the largest and most representative in the world, attach much importance to this branch of the manufacture, and they make every ton of pig that goes to their steel plant in their own blast furnaces. Every lot of pig that is cast is carefully analyzed and its composition recorded, and when the cupolas at the steel plant are charged the pig is selected from various casts with reference to its chemical composition, so that the molten cast iron as it is poured into the converters shall have the desired chemical proportions.

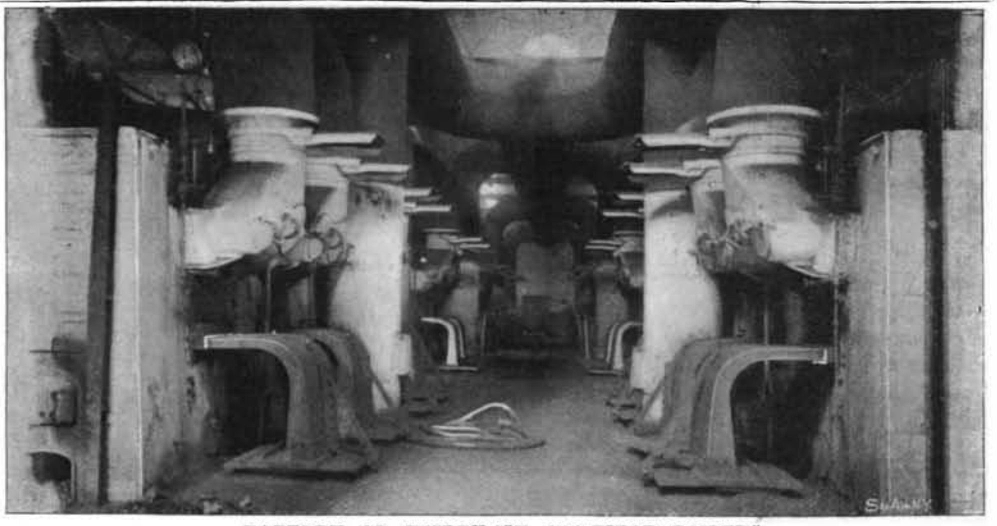
Before entering into a detailed description of the blast furnaces, it may be mentioned that the National Tube Works Company, whose plant has grown to such vast proportions, was formed in Boston in 1865, and is, therefore, thirty-two years old. It made a modest beginning at its present location, McKeesport, Pa., in 1872, with a pipe mill which employed two hundred men. The company at that time merely rolled the "skelp" (as the plates from which the pipe is made are called) into pipe, buying the skelp in the open market. In order to render themselves independent of the market and secure a more reliable material, they built in 1879 their own puddling furnaces and rolling mills. Shortly after this a forge was added, together with Swedish refineries and "knobbling" fires for the manufacture of the charcoal iron, of which the company's locomotive boiler tubes are made. The present steel plant was erected in 1893, and there is at present an entirely new plant in the course of erection for the manufacture of cold-drawn seamless tubing.

Thus has been built up the present vast establishment, which can claim to be not only the largest tube works in the world, but also one of the largest steel works of any kind in this country. Those of our readers who have never had an opportunity to visit a works of this magnitude can form some idea of its size from the following statistics: The combined steel plant and rolling mills cover an area of 90 acres and give steady employment to an army of 7,000 men. The raw material brought into the works and consumed every day averages 1,000 tons of ore, 1,500 tons of coal, 700 tons of coke and 300 tons of limestone, not to mention other material in lesser quantities. For the intershipment of material within the works there are 12½ miles of standard gage track and one mile of narrow gage. The rolling stock of this system of railroads consists of 350 cars and 11 locomotives, the latter varying in size from the smallest of their kind up to machines of 75 tons weight. The total output of tubular goods for the year is 200,000 tons.

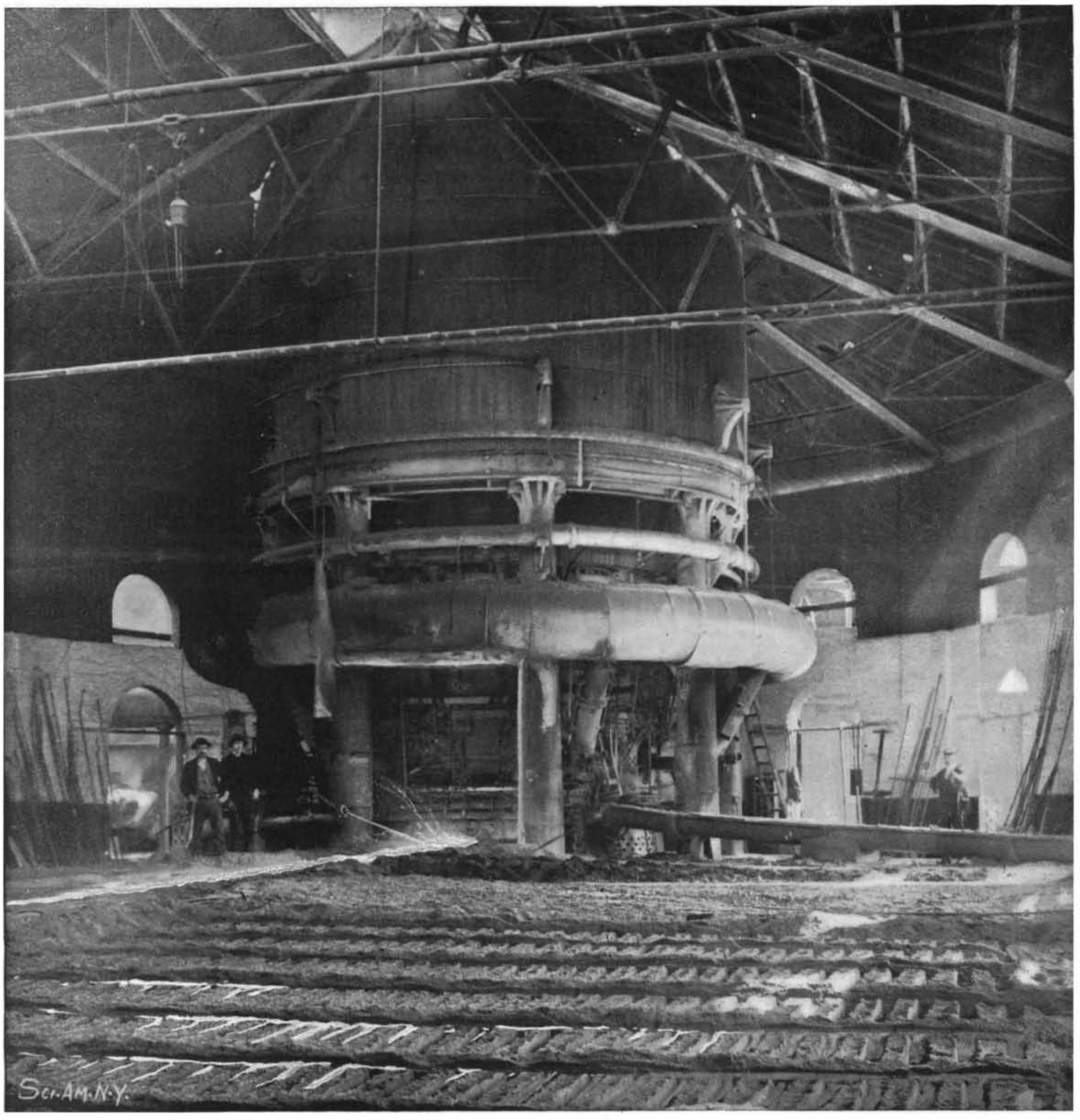
The raw material—coke, limestone and iron ore—is brought into the works on cars and run up onto raised trestles, from which it is dumped into long rows of bins. From these it is drawn off, as will be explained later, for charging the blast furnaces. The plant contains two blast furnaces, known as the Monongahela furnaces, of the latest type, with a capacity of about 700 tons per 24 hours. These furnaces, with the elevators for raising the ore, coke, etc., to the charging platform, the hot blast stoves and the foundry in which the pig iron is cast, are shown on the front page engraving. Each furnace consists of a massive cylindrical structure of brick and steel 80 feet in height and of varying diameter. At its mouth it has an internal diameter of 16 feet, and it increases in the first 60 feet of its depth to a diameter of 20 feet, the taper being



A 1,450 HORSE POWER BLOWING ENGINE.

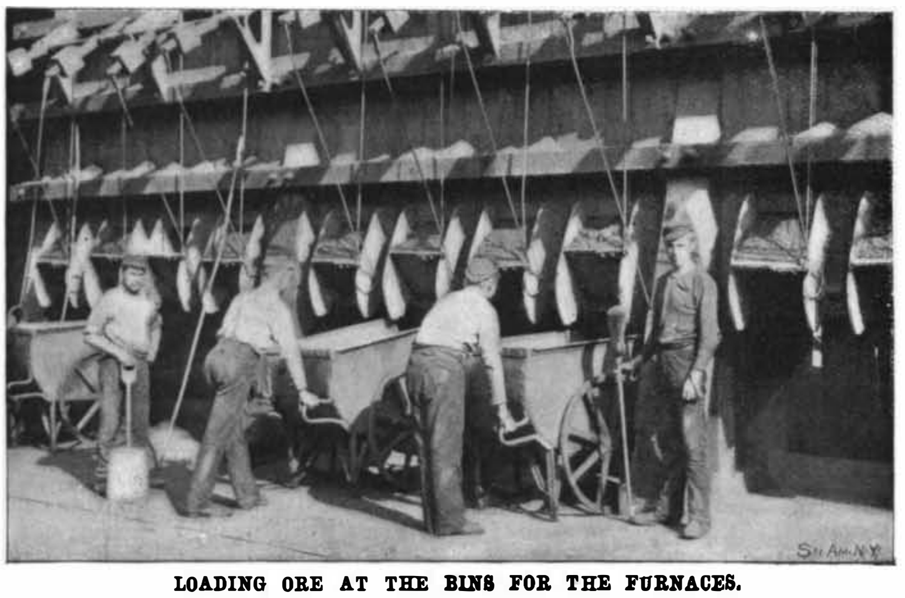


BATTERY OF THIRTY-SIX GAS-FIRED BOILERS.



THE BASE OF A FURNACE 80 FEET HIGH—CASTING THE METAL.

REMOVING PIG IRON FROM THE SAND.



LOADING ORE AT THE BINS FOR THE FURNACES.

MANUFACTURE OF STEEL TUBING—THE BLAST FURNACE PLANT.

given to allow of an easy descent of the material. The walls are 3 feet in thickness, and the greater part of their weight is carried upon a circular row of massive cast iron columns, which bear against heavy steel girders placed beneath an offset formed in the wall at this point. From here to the level of the blast tuyeres the furnace tapers to a diameter of 12 feet, and this diameter is maintained to the bottom of the furnace, 8 feet below the tuyeres. The massive walls are built of brick, with an outer casing of sheet iron and an inner lining of firebrick. It will thus be seen that a modern blast furnace presents the appearance of sections of two hollow truncated cones, placed base to base and terminating in a cylindrical chamber or basin. The upper portion is known as the "shaft" or "body," the lower portion as the "boshes," and below this is the "hearth" or "crucible," in which the molten cast iron collects. The boshes, it will be seen, lie just above the tuyeres, and as the material which they contain is exposed to the fierce blast of the furnace, the walls at this point are provided with hollow bronze castings built into the brickwork, through which a stream of cold water is constantly circulated. These extend completely around the boshes and penetrate the wall to within a few inches of its inner surface. At the bottom of the boshes the wall is pierced by seven tuyeres through which the hot blast is introduced.

In the earlier blast furnaces the hot gases were allowed to escape at the mouth of the furnace, from which great masses of flame issued continuously and gave that weird and brilliant night effect for which the iron manufacturing districts were formerly noted. This was, of course, an extremely wasteful practice, thousands of dollars' worth of fuel being recklessly burnt away to no purpose. To-day the mouth of every furnace is closed by a massive cast iron cup and cone arrangement, which is only opened when a fresh charge is to be lowered into the furnace. The cup is a massive casting, which rests upon the inner edge of the wall and extends down into the furnace mouth. The cone is suspended within the cup, its lower edge being of larger diameter than the cup, so that when it is drawn up it completely closes the opening.

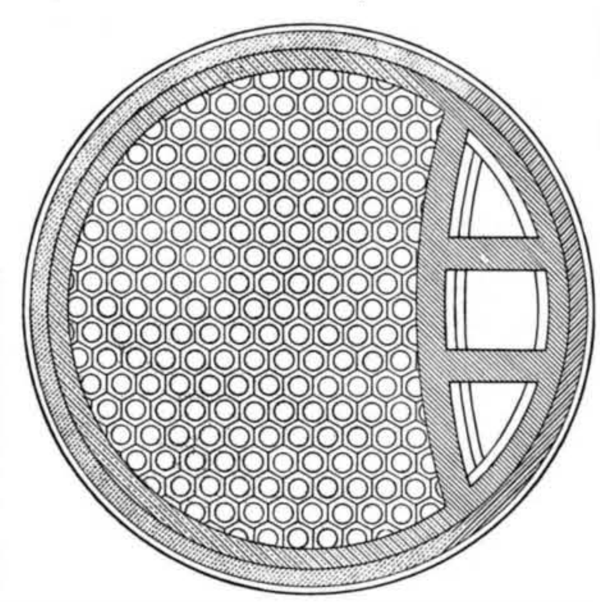
On one side of the furnace, just below the hopper, is a flue opening, through which the gases escape down a large riveted steel pipe to a dust collector, where the cinders and all solid particles remain and are taken out from time to time through a chute at the bottom. The gases are then utilized for two different purposes. Part of them is led to the Cowper hot blast stoves, where it heats the blast on its way from the blowers to the furnace, and part is conducted to the batteries of boilers, shown in Fig. 2, where it is utilized in raising steam for the blowing engines.

The Cowper stoves, of which there are seven, stand in a line opposite the furnaces. Each stove is a cylindrical wrought iron tower 20 feet in diameter and 79 feet 6 inches in height. It is closed by a dome-shaped roof, and the whole interior is lined with fire brick. On the side next the furnaces is a large vertical flue into which the furnace gases pass by a valve at the bottom. The body of the stove is taken up by a mass of fire brick pierced with innumerable small, vertical flues, extending from top to bottom and open at each end. The hot gases are ignited on entering the base of the large flue by admitting air through a valve, and the hot products pass up the main flue and down through the mass of fire brick, finally escaping to the large steel chimney, which stands between the furnaces. When the interior of the stove has been heated to a proper temperature, the gases are shut off and turned into the next stove. The cold blast from the blowers is now turned on at the bottom of the stove and passes up through the brickwork, from which it absorbs the heat, finally passing down the main flue, from which it is led to the circular blast main which surrounds the furnace just above the tuyeres. By the time it leaves the stoves the air is heated to from 1,300° to 1,400° Fahrenheit, the difference between this and the cold blast representing heat saved from the gases and restored to the furnaces.

The gases that are not used in the hot blast stoves are carried in large riveted pipes to the boiler house, of which we give an interior view, Fig. 2. Down each side of the room are arranged sixteen two-flue boilers, each of which is 54 inches diameter and 30 feet long. There are also four 250 horse power double deck water tube boilers in two batteries, making thirty-six boilers in all. All of these are fired with the furnace waste gas, which is distributed by the large pipes which extend through the boiler house near the roof From the main pipe it is led down beneath the foot plates, and there controlled by valves which admit it to the burners, which will be noticed curving over from the floor to the furnace front. Here the air necessary for combustion is admitted, and the gases are burnt in the fire box. The supply of gas is controlled by means of a rack and lever, which serves to slide the burner to and from the furnace and increase or reduce the opening by which the gas enters it.

After passing down through the long line of boilers one is prepared to find an imposing display of motive machinery in the engine house—and it is indeed a truly impressive sight that meets the eye. The blowing engines, one of which is shown in Fig. 1, are all gathered under one roof, and together they aggregate a total of nearly 5,000 horse power. On one side of the room is a group of five Allis-Corliss condensing blowing engines with 42 inch steam cylinders, 84 inch air cylinders, and a common stroke of 5 feet. Each engine develops 700 horse power, and each is provided with its own condensing pump. There is also a very handsome compound condensing blowing engine, of which we give an illustration, with a 40 inch high pressure and 76 inch low pressure cylinder, and two air cylinders 76 inches in diameter, the stroke being 5 feet. This engine develops 1,434 indicated horse power, and with the other engines brings the total up to close upon 5,000 horse power.

The 2,000 tons of limestone, coke and ore which are consumed daily by the furnaces are brought into the works by the train load. The cars are run up onto trestles, from which their contents are dumped into long rows of bins. Our illustration, Fig. 5, shows the chutes at the bottom of the ore bins, which latter are ranged down the long shed which is seen to the left in the front page engraving. The "burden," as the mixture of ore, limestone and coke with which the furnace is charged is called, is made up according to the grade of iron which it is desired to produce. It is taken from the bins in iron trucks in the proper portions, and wheeled to the large elevators shown in the engraving, which lift it in the trucks to the charging platform at the mouth of the furnace. Here it is dumped into the hopper, and as soon as the latter is filled, the cone is lowered, permitting the charge to fall into the furnace. The furnace is kept constantly filled with burden, and when it is once started it is kept burning continuously, the solids descending and the gases rising to be carried off by the flue. If we could look into and note the condition of the contents, we should find at the top a layer several feet thick of raw materials, the temperature of which was about 500°. Below this would be a few feet in which the ore was somewhat reduced by carbon. In the next layer, at a temperature of 1,000°, the limestone would be found decomposed into lime and carbonic acid. Below this would be a wider belt at from 1,500 to 1,700 degrees temperature, where the iron, now reduced from the ore, would be taking up the carbon to form cast iron. A little lower down oxides, such as silica and phosphoric acid, are reduced, the silicon and phosphorus combining with the iron. Within the boshes the iron is completely melted, as is also the slag which results from the combination of the fluid with the various impurities. The molten mass finally collects in the hearth, the slag being on the top, and the heavier iron at the bottom. The slag is drawn off through an opening at the top of the hearth, and the cast iron is tapped through a narrow slit near the bottom. The illustration No. 3 is taken from the interior of the foundry in which the pigs are cast. In the foreground is seen the base of one of the great furnaces The large circular pipe which surrounds it is the hot blast main, from which the seven smaller pipes lead to the tuyeres below. On one side is seen the trough through which the slag is drawn off, and on the other side the molten iron is being drawn off, through the tap hole. The cast takes place six times a day, and the total output of the two furnaces is about 700 tons per day. The sand is prepared by forming parallel lines of moulds which connect with the central channel down which the molten iron flows. The tap hole is opened by breaking away the clay with which it is closed, and the metal flows at a white heat down to the end of the main channel, where it spreads right and left into the moulds. The filling commences at the extreme end and finishes at the furnace.



TRANSVERSE SECTION THROUGH COWPER HOT BLAST STOVE.

When the cast has cooled off sufficiently to be handled, the pigs are broken loose and laid across each other in a position convenient for handling by the man who carries the heavy pair of tongs. (See Fig. 4.) They are then lifted, one at a time, by a gang of powerful and well-muscled men, who carry them through the open archway at the side of the foundry and load them into cars on which they are hauled to the steel-making department.

We reserve the description of this department for a later issue.

M. de Morgan's Last Discovery in Egypt.

We may give a fuller account of discoveries which we mentioned briefly a few weeks since, says The Independent, made in the Nile Valley by M. de Morgan, Director-General of Antiquities of the Egyptian government. The most important of these discoveries is an extensive tomb which appears to be the most ancient yet unearthed in Egypt. M. de Morgan began his investigations in that portion of the Nile Valley formed by the bend in the Nile between Thebes and Abydos, where he brought to light many of the oldest records belonging to early Egyptian history that have yet been found.

The first notable discoveries were a number of ancient flint arrowheads, and other implements in the shape of indented flint blades, which had probably been used as saws and sickles. All of these evidently belonged to a period considerably antedating the time of the fourth dynasty. It is thought that the sickles date from even the first dynasty, for the reason that wheat is believed by historians to have grown wild in Egypt at that time, and that these implements were evidently used for harvesting this wild cereal. M. de Morgan also found evidences that these ancient people had a religion of their own, which he believes to have been a sort of fetichism, as he can in no other way explain the curious images, the slate figures of fishes, birds and turtles which he dug up. He says:

"These figurines must have belonged either to the first dynasty or to a race and period preceding it, as I have found them only in these autochthon places."

He adds that in no other tomb of the ancient empire that has been discovered have any fragments of this kind been found.

Continuing his study of the ground, M. de Morgan made his way along the valley until he reached a point near Negada, where an extraordinary mound attracted his attention. Excavations were begun at the base of the mound, and revealed the existence of a huge quadrangular-shaped tomb, which the explorers believed to be intact. One of the solid sides of the tomb was pierced, and an opening made the size of a large doorway. On entering the tomb it was found that various galleries extended at different angles, and long passageways with rows of carved columns descended into subterranean chambers. From top to bottom the walls were covered with hieroglyphic inscriptions and with figures of men and animals cut deeply into the surfaces. Warriors in bass-relief, different from anything seen in other tombs, and images of children, kneeling as if in fear, appeared here and there on the sides of the passageway.

The main gallery led into a series of twenty-one rooms, each containing many objects, such as pieces of furniture of different designs, fragments of bronze statues and a quantity of broken vases. In the center of each room were placed sarcophagi, containing the mummified remains of the dead. The vases were cut out of alabaster, rock crystal, quartz and a substance resembling obsidian, and were carved with peculiar designs. A large central room contained a single sarcophagus, resting upon a pedestal of solid rock. Around it, crudely carved in ivory, were forms of fishes and dogs; and near the feet were the remains of what appeared to be a mammoth lion, made of countless pieces of ivory put together. At the head of the sarcophagus and facing it was a life size statue of a man, carved in wood. The sides of the room were covered with inscriptions of a period so remote that interpretation was impossible. The explorers opened the sarcophagus, and found an inner mummy case, covered with hieroglyphics. The sarcophagus was then closed and sealed, and prepared for removal to the museum at Gizeh, where the body will be carefully unwrapped. The sarcophagi in the other rooms, all of which were supposed to contain the bodies of royal persons, were also removed to the museum, where they will be opened. In all the rooms, M. de Morgan found large urns tightly closed and having on top what is known as a "banner name," or the seal of the king—a conclusive proof of the great antiquity of the tomb. These, as well as all the fragments and other loose objects, were carried to the museum.

The ceilings of the passageways and rooms were lined with what appeared to be sun-dried bricks of coarse workmanship, while the pavements of the floors were of granite. In many places the walls were in such a crumbled condition that large portions of the inscriptions had become obliterated. The royal names upon the sarcophagi consisted of a few signs; and, instead of being written in cartouches, were inscribed in a square similar to the "banner name" on the vases. The seals on the vases in the king's chamber were made from a cylinder, and not from a scarab, according to the Egyptian fashion, as found in other royal tombs. Everything bore evidences of the most remote age.

SCIENTIFIC AMERICAN

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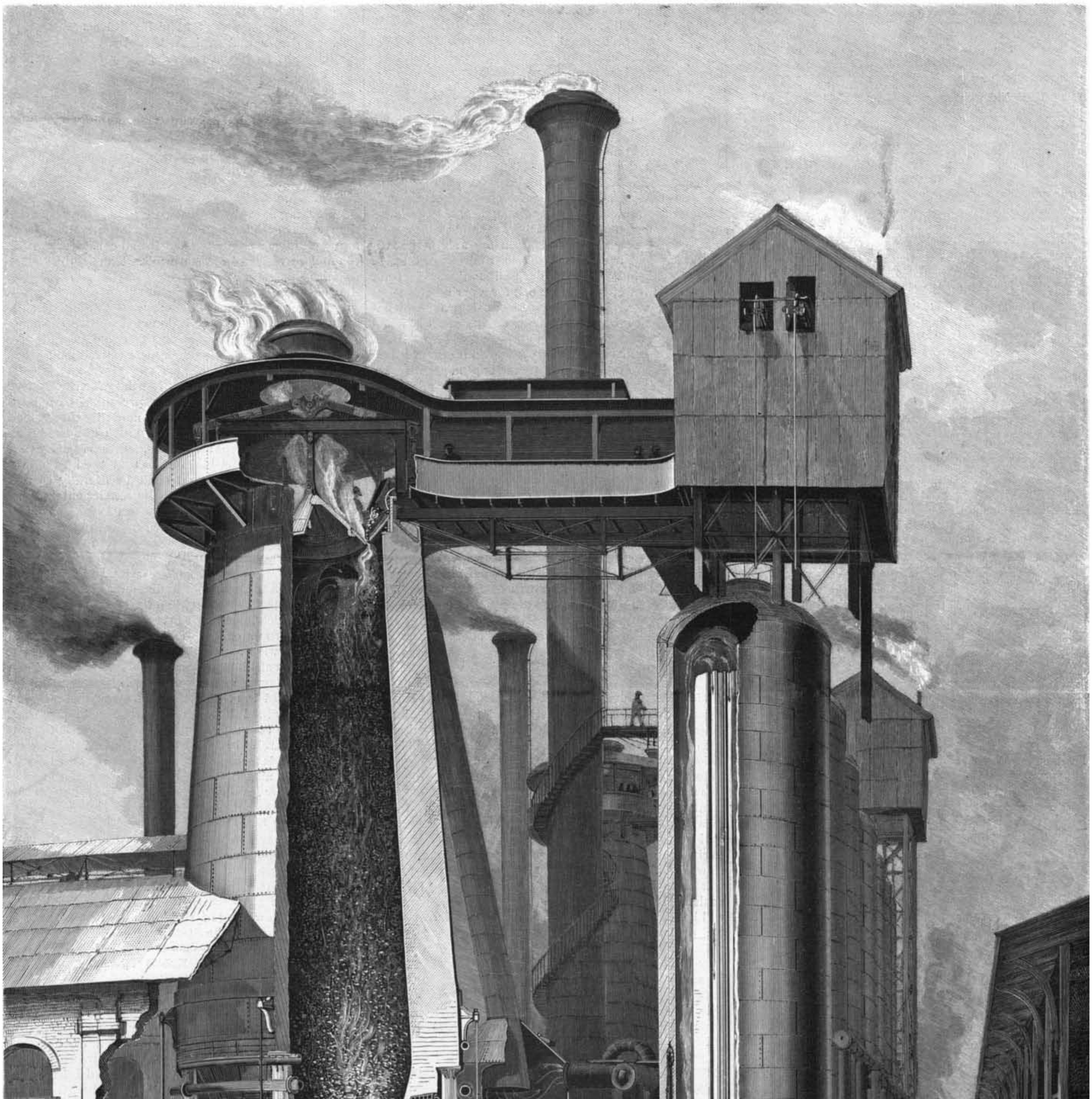

THE MANUFACTURE OF STEEL TUBING—BLAST FURNACES OF THE NATIONAL TUBE WORKS COMPANY, McKEESPORT, PA.—[See p. 264.]