THE INDUSTRIAL USE OF THE LIFTING MAGNET.

BY W. FRANK M'CLURE.

Although the lifting magnet is by no means new, during the last two or three years in particular its uses have multiplied to such an extent that many new and widely different types have been designed to handle the multitudinous shapes of metal produced. The magnet is fast being adapted to handle all forms of iron and steel from iron dust, scraps, or small junk to weights of 20,000 pounds. In fact, the world's largest magnet will lift as much as 50,000 pounds. Thus the toy magnet of our boyhood is converted into a useful instrument in the workshop.

Used at first chiefly in carrying iron and steel to and from cars or storage piles, the lifting magnet is now utilized in breaking up imperfect castings, in holding sheets of metal in position while being riveted in the construction of ships, in lifting a "sow and pigs" at the furnaces, also as a gigantic broom to sweep both the large and small pieces of iron, and in many other ways. A half dozen kegs of nails may be seen traveling through the air, held by magnetic lines of force despite the wooden coverings of the kegs. Even two or three men are sometimes lifted from the ground, their feet resting upon a metal sheet, which is firmly held by the magnet.

Lifting magnets are usually operated from an electric overhead traveling crane, but they may also be operated from a locomotive crane. Within the magnet are coils with which the service wires are connected, just as an incandescent lamp is connected to service wires. The winding is, of course, insulated. When the magnets handle hot material, they are wound with fireproof wire. The movements of the magnet are directed by the operator of the crane. The opening or closing of a switch, turning the electricity on or off, causes the magnet to pick up or release its load.

The 20,000-pound weight referred to as a typical large lift made by magnet power is in the form of a "skull cracker ball," used to break up imperfect metal that is to be remelted. The magnet used for this lift is 52 inches in diameter, and its weight 4,800 pounds. It requires 4 feet 6 inches headroom. When this great weight has been lifted high in the air and the current is turned off and the "skull cracker ball" has fallen, the magnet again picks it up easily and quickly without any assistance from anyone on the ground.

This type of magnet consumes an average of 35 amperes at 220 volts for excitation, which is the equivalent of ten electrical horse-power. It is used also in the handling of iron and steel in many other forms, as illustrated in several of the accompanying photographs, and is the invention of Arthur C. Eastwood. Ten years ago the magnet was used chiefly in handling plates and billets.

The amount handled depends much on the shape of the material to be lifted. In the case of the 20,000 pounds, the lift of course is in one great compact ball, though some weights are elongated rather than round. In the case of sand-cast pig iron, where many different pieces must cling to the magnet or to one another, the load lifted by the magnet in unloading cars, for example, is 1,700 to 1,800 pounds. This load is slightly increased in handling from stock piles instead of cars, by 100 pounds. Also 100 pounds more machine-cast pig iron can be handled than sand-cast.

Again, the amount lifted in some cases depends upon whether the material is in an indiscriminate pile or stacked evenly. In accordance with this, as well as the dimensions of each, the average lift of billets or slabs runs from 1,200 to 12,000 pounds.

As a rule, a man on the ground is not necessary where a lifting magnet is employed, for the reason that there are no chains, slings, or hoisting blocks to be fitted about the weight to be lifted. However, there are a few instances where a ground man facilitates the work of the magnet. One of these is in the lifting of an ingot, say of 6,000 pounds. If a ground man places the magnet, two of these ingots can be lifted; otherwise only one at a time. For if two ingots are to be lifted simultaneously, they must be in proper position, on account of their weight, for the magnet to grip them in the right place.

In picking up scrap material with this same magnet, 1,400 to 1,600 pounds of what is known as "busheling scrap" will cling to it, while with loose tin scrap but 500 to 700 pounds is the average lift. Of miscellaneous junk dealer's scrap the lift ranges from 600 to 1,100 pounds, and boiler-plate scrap 1,000 to 1,400 pounds. Loose tin scrap is particularly difficult to handle. Tin is non-magnetic, and by tin scrap is meant the tinned sheet iron used for cans, etc.

Instead of the round magnet just described, a rectangular magnet is used in lifting a "sow and pigs" at the furnaces. When thus lifted from the sand they are not white hot, but just a dull red. Hot metal in the form of billets is also lifted by a special magnet to a conveyer, and taken to where it is sheared or cut into shorter lengths or to where it may be stamped out by a hydraulic press into car wheels and finished upon a lathe. A rectangular type of magnet is also used for holding steel plates in place to be riveted in the construction of ships. For two or three years past a number of these magnets have been in use at the imperial shipyards in Yokohama, Japan. The magnets are fastened to an I-beam, and are mounted on rollers, so as to be adjustable along the beam for different-sized plates. The flat type of magnet will also pick up metal sheets, perhaps two to six at a time, one under the other, the number depending on their thickness. These may be dropped by the magnet one at a time at the will of the operator, if he is skilled in throwing the switch at just the right intervals.

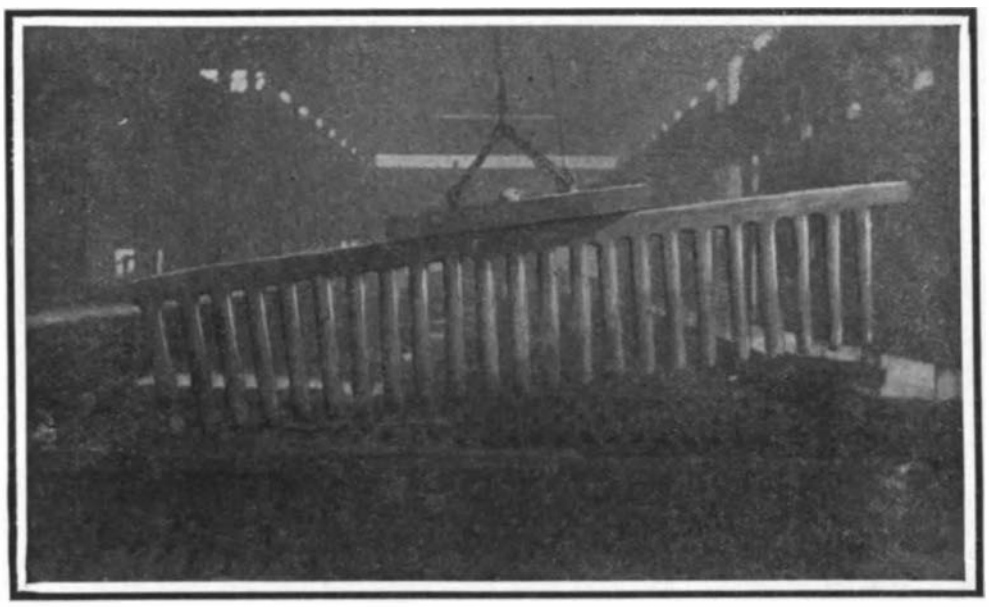
Another interesting sight is afforded in the lifting of a very long metal sheet by one magnet applied at the sheet's center. The ends of the sheet may dip down to an angle of 45 degrees, and still the sheet be held tightly by the magnet.

The use of the lifting magnet makes it possible to pile scrap iron in storage piles of unusual height with ease. It is not uncommon to see storage piles of this kind 25 feet high, and the work of piling is done with great rapidity. In loading from wagons to storage piles, the work of hours when done by hand is reduced to a few minutes by the use of the magnet.

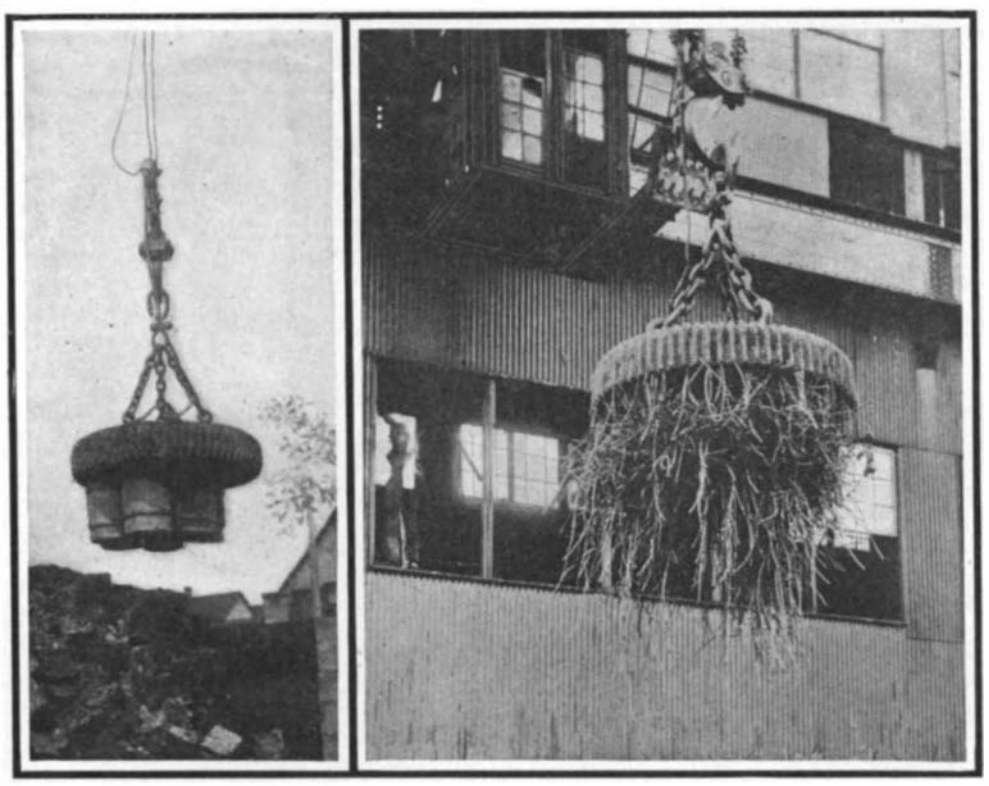
With the 52-inch magnet previously referred to, 600 to 800 tons of scrap are easily handled in a day of twenty-four hours at an open-hearth furnace, even when four hours are allowed for delays. When thus operated day and night, the magnet takes the place of fourteen laborers. If operated with a specially fast crane, the amount handled is still further increased.

In the loading of charging boxes at the open-hearth furnaces the use of the magnet effects a notable economy. Even the small amount of material which falls outside the boxes is later picked up by the magnet, and in the cars it cleans up even the smallest chips and metal dust. The cost of handling melting stock used in these furnaces, both from cars to stock piles and from the piles themselves to the charging boxes, has been reduced from eight cents a ton with hand methods to two cents, and where handled only once, to less than one cent, where the magnet is used. Also at the blast furnace cast house the small metal particles known as "shot" are removed from the beds of sand by simply sweeping the magnet over the bed; otherwise, the sand would have to be riddled.

The magnet mentioned as the most powerful in the world is 60 inches in diameter and will handle "skull cracker balls" weighing 30,000 to 50,000 pounds.



Magnetically lifting a "sow and pigs" from sand in a blast furnace cast house.



Lifting six kegs of nails. Magnet handling wire scrap.

THE INDUSTRIAL USE OF THE LIFTING MAGNET.

A Wireless Apparatus for Airships.

The latest invention for sending and receiving wireless messages is an outfit small enough to be carried and successfully operated aboard a dirigible airship. Such an apparatus has been perfected by the United States Signal Corps under the direction of Lieut. Lahm.

Ever since the Marconi wireless method came into existence, the U. S. Signal Corps has kept abreast with the science of transmitting and receiving messages through the air, and some time ago it perfected a wireless apparatus that weighed about two hundred pounds and could be transported on a packmule for field service. This was a great advance over the Morse system, where it was necessary to string wires and then restring them as the army progressed. With the advent of the airship, however, it became necessary to devise some means of wireless telegraphy to be installed on them, if such craft were to be successfully used in time of war. To this end Lieut. Lahm has been working with all his ingenuity for a long time.

His apparatus had to be made extremely light, for the weight-carrying capacity of the dirigible is limited. Then, too, provision had to be made to guard against the airship's catching fire from the sparks when the apparatus was in operation; besides, ground wires and receiving poles had to be considered. All of these obstacles were overcome, and the completed wireless outfit for airships weighs only seventy pounds, including the batteries necessary to work it. The whole apparatus is so compact, that it occupies only a space as large as a small steamer trunk.

To do away with the danger of the airship's catching fire from sparks, provision was made for confining the sparks in a wooden box and a glass case, so that there is absolutely no danger from that cause. The network of the wires which support the car of the airship, it was discovered, could be quite successfully used as the "ground" wires; and, instead of the very tall pole necessary on ground stations to catch the radiations when messages are sent and received, the simple expedient was adopted of dropping a wire some three hundred feet long from the airship, so that the waves instead of being caught above a station, are caught below. While such an apparatus seems like a mere toy, it has a working radius of ten miles.

With all our scientific accuracy, we do not seem to be able to secure from the manufacturers of electric apparatus any idea of the time in which a motor running at full speed in one direction will reverse to full speed in the opposite direction. There ought to be some reason for that lack of knowledge. Such information would be very useful to engineers.

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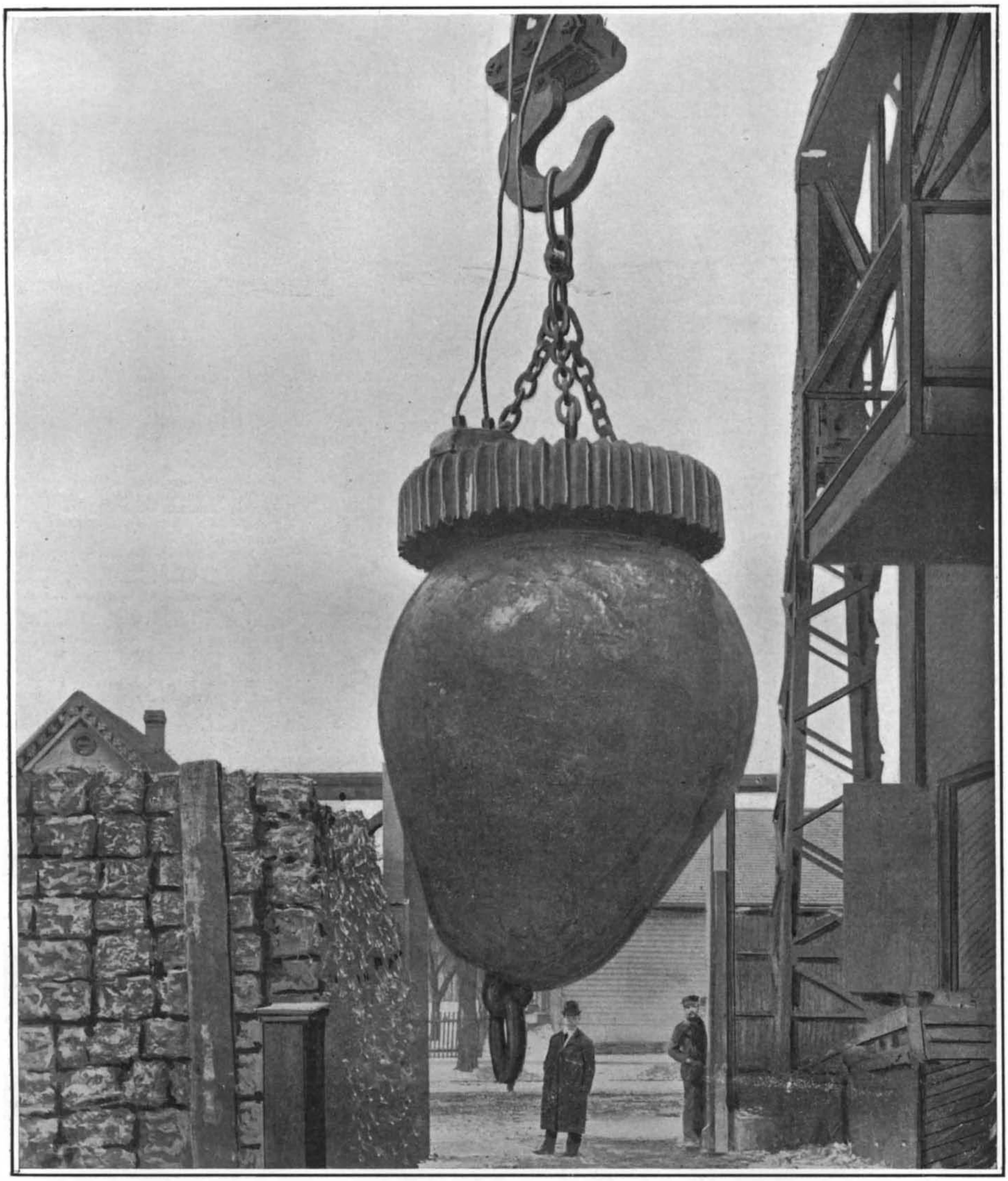

This magnet is 60 inches in diameter and will handle "skull cracker" balls weighing 50,000 pounds.

THE BIGGEST LIFTING MAGNET IN THE WORLD.—[See page 112.]