CHAPTER XXII.

HANDLING MATERIAL AT THE REHEATING FURNACES.

Charging Furnaces Horizontally.—If the ingot does not exceed 10 to 20 cwts., it is even now frequently lowered by the ingot crane which removes it from the casting pit, on to a hand bogie, consisting of a small truck on two wheels, the top, say, 3 feet square and standing 2 to 2½ feet above the floor, so as to be at about the same level as the bottom of the heating furnace. The truck is provided with a long handle, by means of which the workmen push it before them, and are able to guide it easily round any corners. As the mill floor is paved with cast-iron plates, the

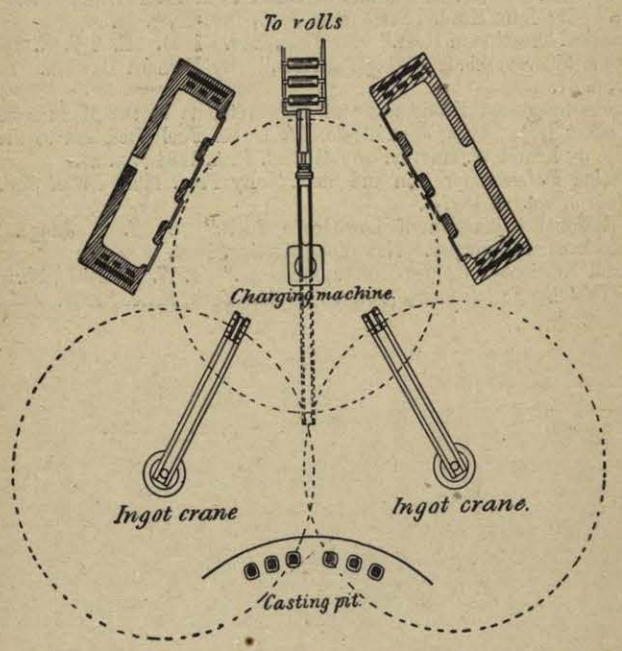

Fig. 320.—Relative positions of Casting Pit, Ingot Charger, Heating Furnaces, and Live Roller Bed.

ingot is more easily transported than might be supposed by two to four men, according to its weight. At the door of the heating furnace, a little higher than its bed, a small loose roller is fixed, which much facilitates pushing the ingot in. In some works small rollers form the top of the bogie, and the men run the bogie with the ingot upon it against the open doorway of the furnace sufficiently fast for the ingot to shoot from the bogie on to the bed of the furnace, where it can easily be further adjusted by a hand spike. The heated ingot is withdrawn by means of a pair of tongs attached to a chain, worked in some convenient manner from a winch, or by a hydraulic cylinder provided with a multiplying gearing by which the

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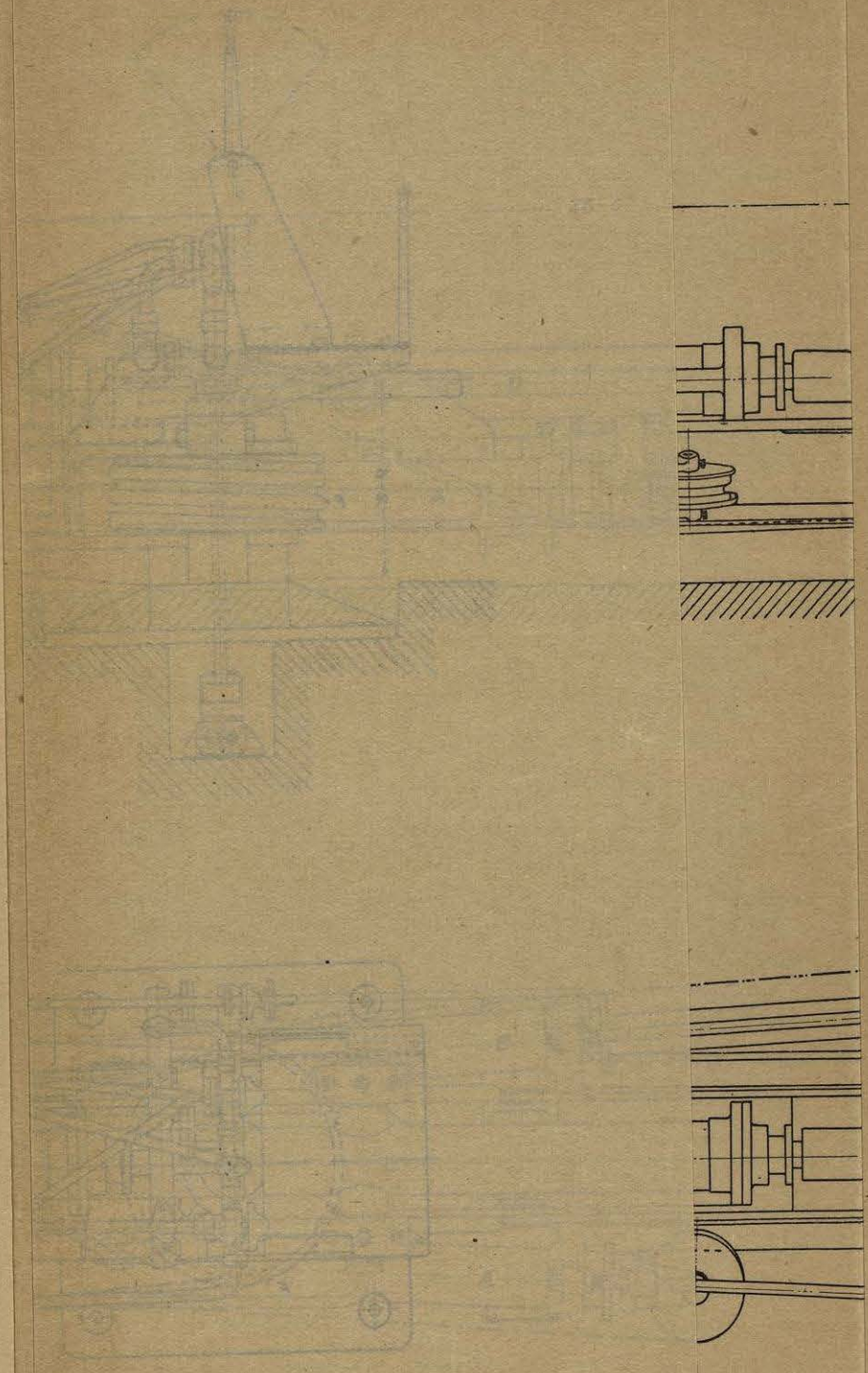

chain is caused to travel more rapidly than the ram. The ingot is by this means dragged out on to a similar bogie, which is then run to the mill, where the ingot is tipped on to the fore-plate or on to the live rollers, if the mill is fitted with the latter.

Such primitive methods of handling are too costly for ingots over a ton in weight, and for heavier ingots some mechanical handling appliance becomes a necessity. When the heating furnaces are sufficiently near to the casting pit for the ingot cranes to lift the ingots direct on to a charging machine, the simplest perhaps which can be employed is that used in some of the English works (fig. 320). This consists of a horizontal frame standing a little higher above the mill floor than the bed of the heating furnace, one end of the frame turning on a vertical pivot, and the other carried on wheels capable of describing a circle round this pivot. This framework is usually formed of two rolled joists, and on the pivot end is fixed a horizontal hydraulic cylinder. The ingot is lifted by one or other of the ingot cranes on to the bed of the charging machine, which is swung round to face one of the doors of the heating furnace, and the hydraulic cylinder pushes the ingot into the furnace, from which, when sufficiently heated, it is withdrawn on to a bogie by tongs and chains. Another arrangement is to provide on the pushing head a pair of tongs (fig. 321) which can be closed by a right- and left-hand screw, by which the ingot can be drawn out on to the end of the charger. The tongs are then released and the whole arrangement swung round to face the end of the bed of live rollers leading to the mill, on to which the heated ingot is pushed by the cylinder, the live rollers taking it away to the mill.

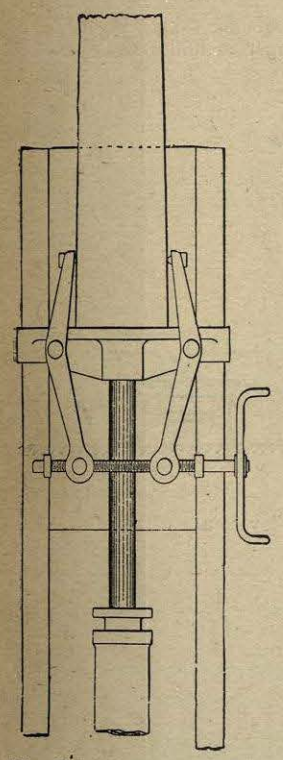

Fig. 321.—Screw Tongs for Horizontal Ingot Charger.

Hydraulic Charger.—Figs. 322 and 323, Plate xxv., show a more elaborate hydraulic charging machine on the same principle made by the Lowca Engineering Company of Whitehaven. To charge the furnace the ingot is laid by the crane on the peel, C, which is cottered to the end of the piston-rod working in the cylinder, D. The machine is slewed round in the requisite direction by admitting water to one or other of the cylinders, A or B, which haul on chains wrapped round the fixed drum, F, keyed on the centre pivot. When opposite the furnace door the peel, C, is raised slightly by the cylinder E, the cylinder D being carried on trunnions to admit of this movement. Water is then admitted to the left end of cylinder D, and the peel with the ingot on it travels forward into the furnace, the peel passing between rows of fire-bricks laid on the furnace hearth. The water is released from cylinder E, and the peel falls, leaving the ingot resting on the fire-bricks, and the peel can be withdrawn by admitting water to the right-hand end of cylinder D. To remove the heated ingot the process is reversed, and the machine carrying the ingot is slewed round into such a position that the peel can be placed above the line of live rollers leading to the cogging mill. A notch is formed in the first few rollers into which the peel can sink sufficiently for the weight of the ingot to rest on the rollers,

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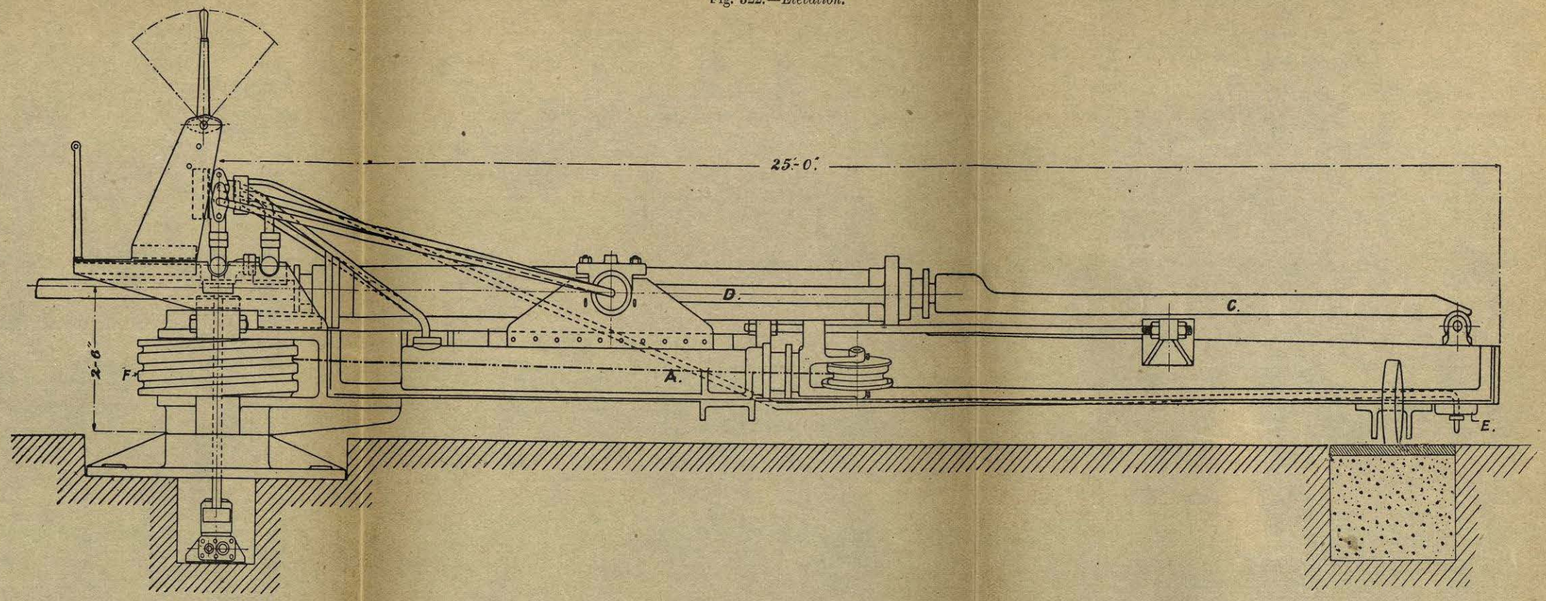
PLATE XXV.—Hydraulic Charger.

Fig. 322.—*Elevation.*



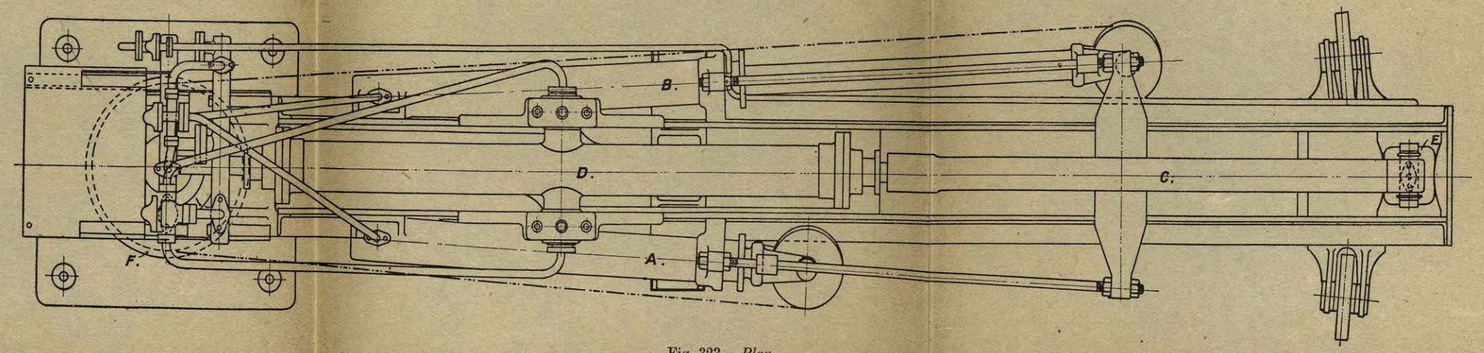


Fig. 323.—*Plan.*

The whole machine revolves around the pivot on the left, in either direction required, when water is admitted to the cylinders, A or B, which haul on chains wrapped round the grooved drum, F.

C, Peel keyed on piston-rod, working in cylinder, D.

E, Cylinder for lifting the peel.

which then carry it away to the mill. If, however, the mill is some distance away from the furnaces, the ingot is deposited on a small bogie (fig. 324), which is run down an incline or pulled by a wire rope so as to strike the end of the roller bed sharply, when the momentum imparted to the ingot, which rests on rollers on the bogie, causes it to shoot forward on to the roller bed.

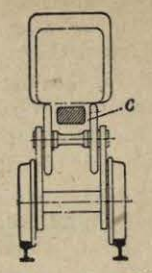


Fig. 324.—Bogie for taking Ingot from Charger to Roller Bed.

As there is not room enough to place many furnaces round a circle, this form of charger is not generally applicable to works requiring to handle much more than 1,000 tons of ingots per week, though by putting two chargers, with the centre pivots a short distance apart, and arranging half the furnaces to the radius of one charger, and half to suit the radius of the other, a more rapid handling can be ensured, with little increase of space. Fig. 325 taken from the special volume of the *Proceedings of the Iron and Steel Institute in America in 1890*, shows a charging machine arranged on this system, which was then in use in the Homestead Works, the ingots being brought up on a narrow gauge railway, and, after heating, transferred to the bed of the mill. In this case the charging cylinder is hung from a horizontal jib, and the man travels with it, instead of working from the centre in one fixed position. This machine has to lift the ingot from the truck, and has a gripping appliance and lifting arm somewhat similar to that of the machine to be next described.

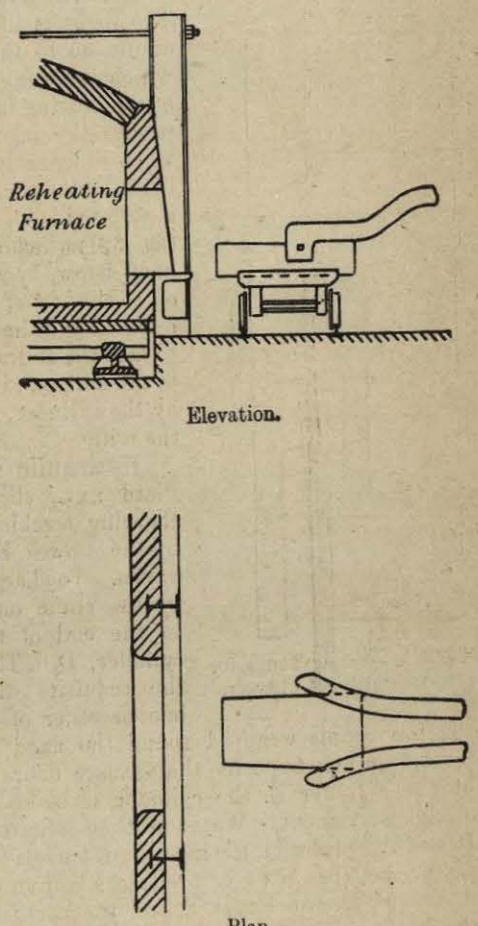


Fig. 325.—Gripper for lifting Ingots into Heating Furnace.

The advantage of a charger which can travel in a straight line instead of having to radiate round a fixed centre, is that it can serve any number of furnaces in a row, additional furnaces being added as required by an increase in the business. A number of different arrangements have been used, the earliest of which is the Wellman charger, which was the fore-

ling Ingot Charger. [*To face p.* 564.

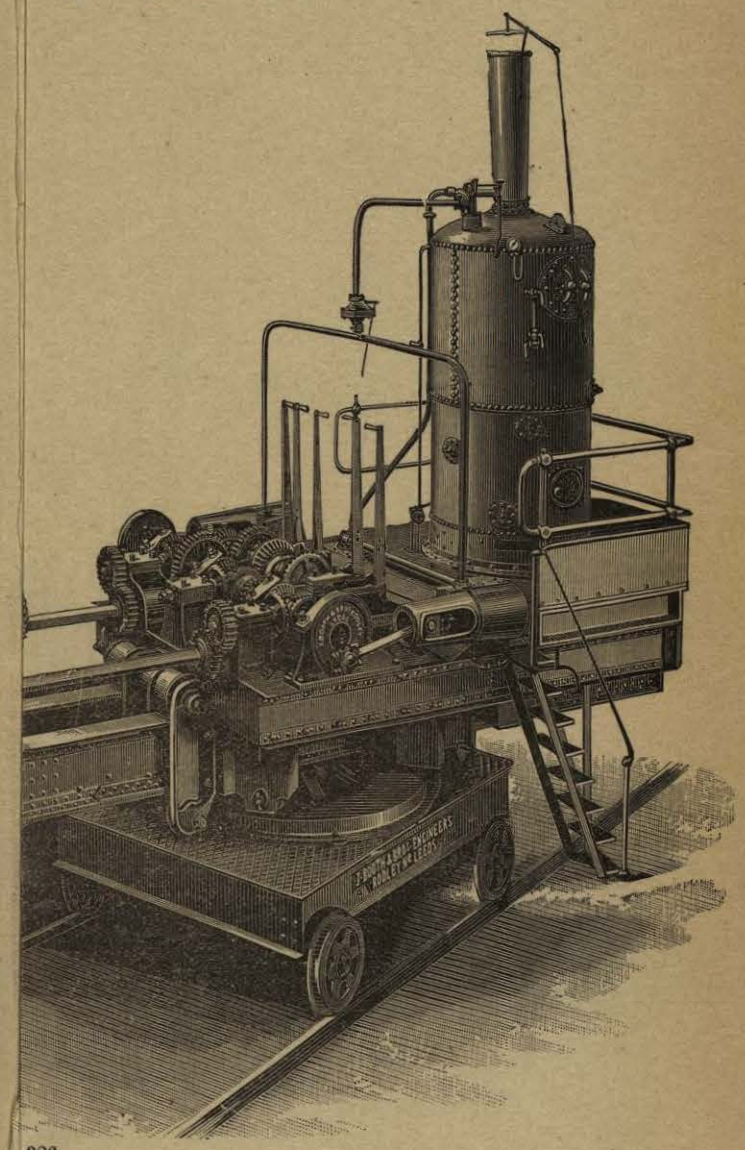


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PLATE XXVI.—Traveling Ingot Charger.

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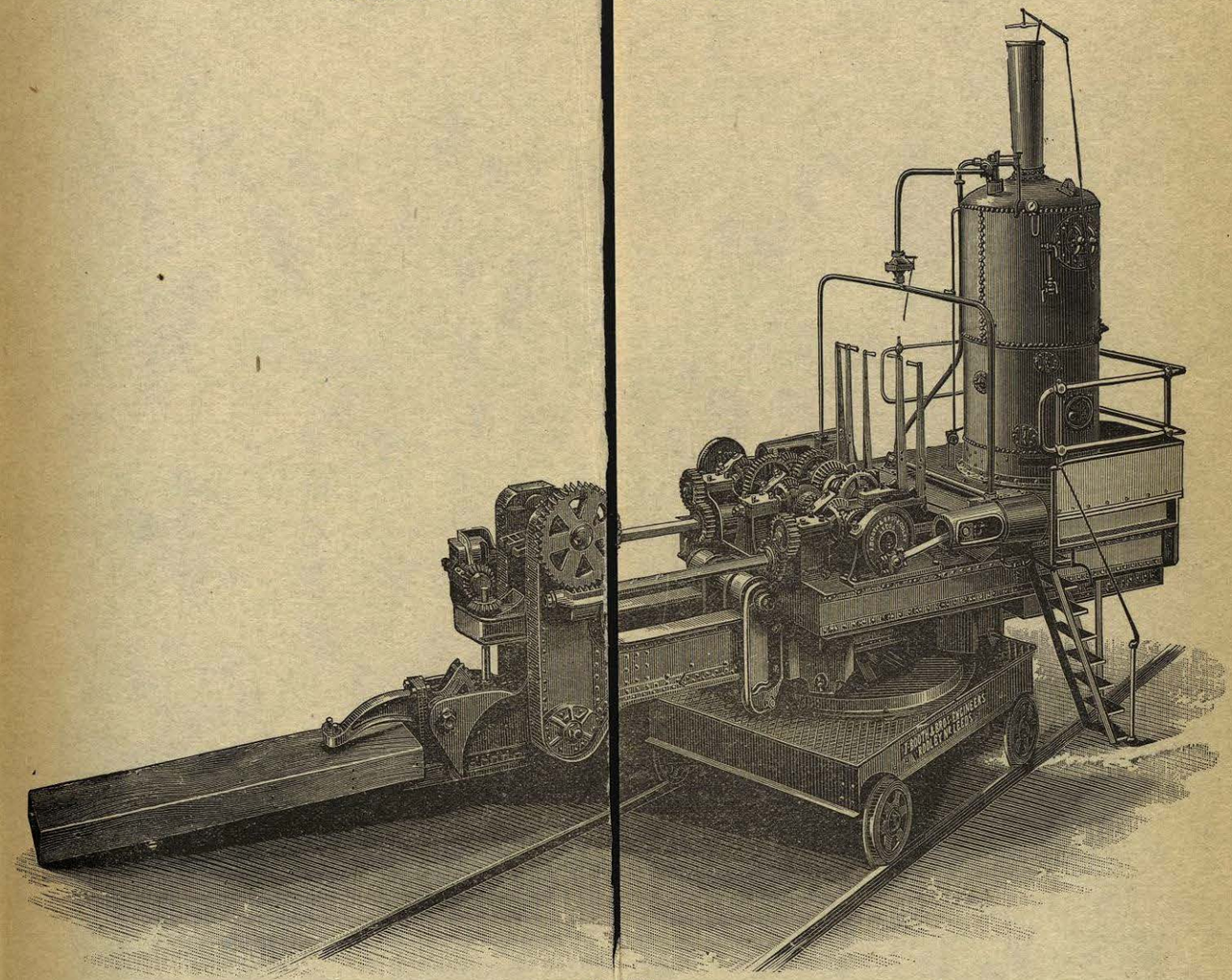

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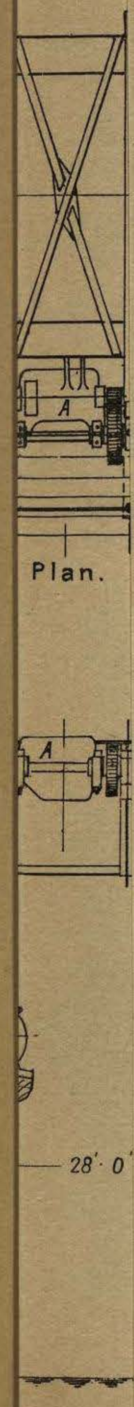

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PLATE XXVII.—The Wellman-Seaver Charging Machine.

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Fig. 327.

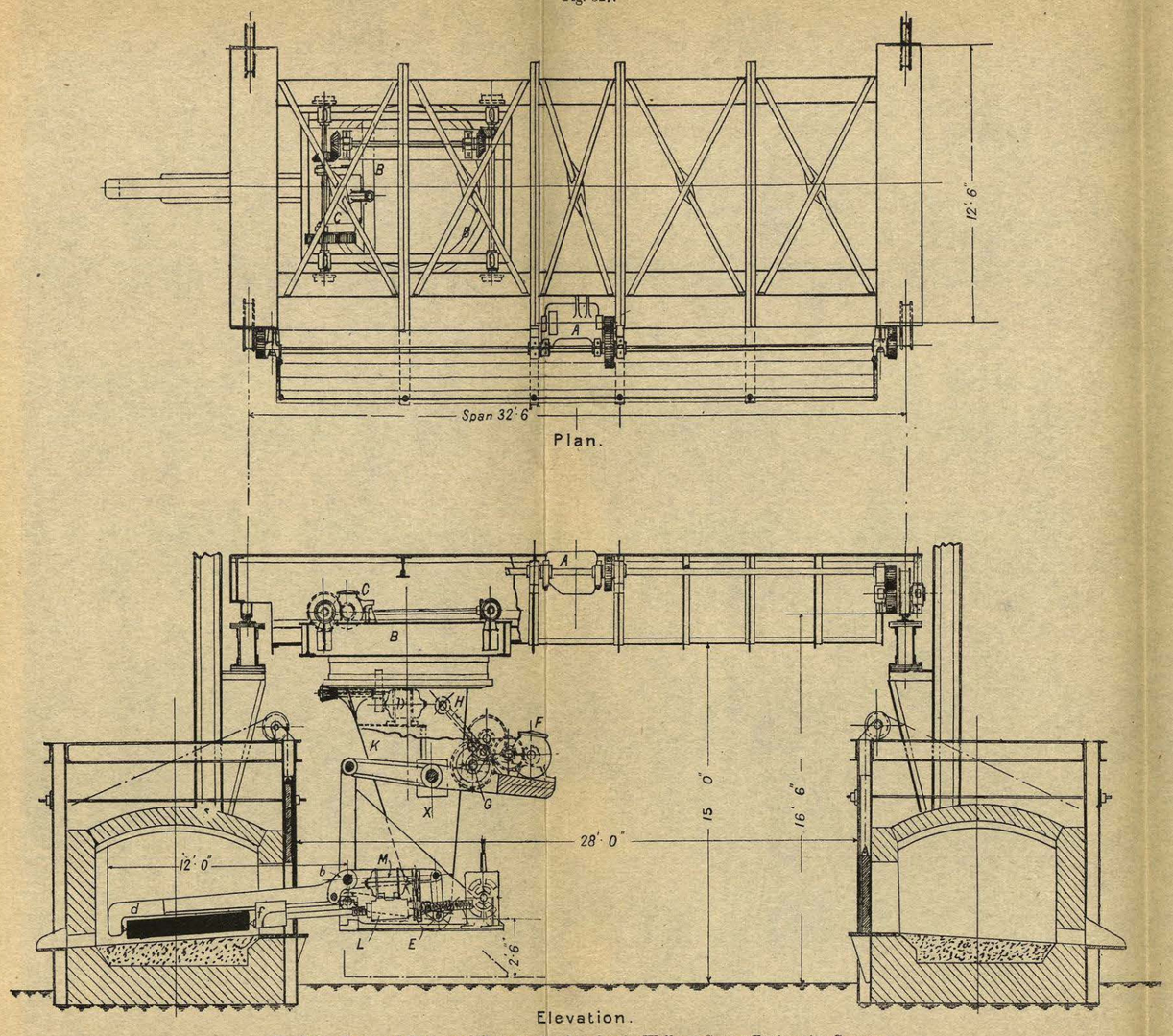

Fig. 328.—Overhead Horizontal Charging Machine by the Wellman-Seaver Engineering Company.

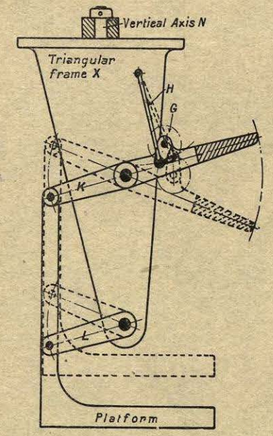

Fig. 329.—Adjustable Platform of Wellman-Seaver Charging Machine.

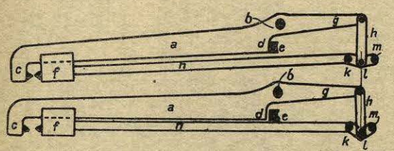

Fig. 330.—Gripper of Wellman-Seaver Charging Machine.