(No Model.)

2 Sheets--Sheet 1.

F. MORO.

Apparatus for Casting Ingots of Uniform Weight.

No. 231,838. **Patented Aug. 31, 1880.**

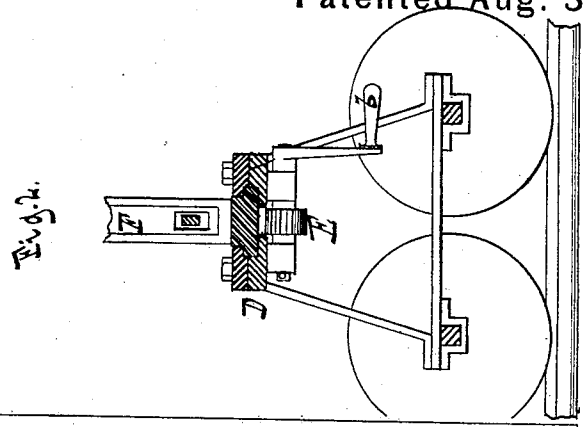

Fig. 2.

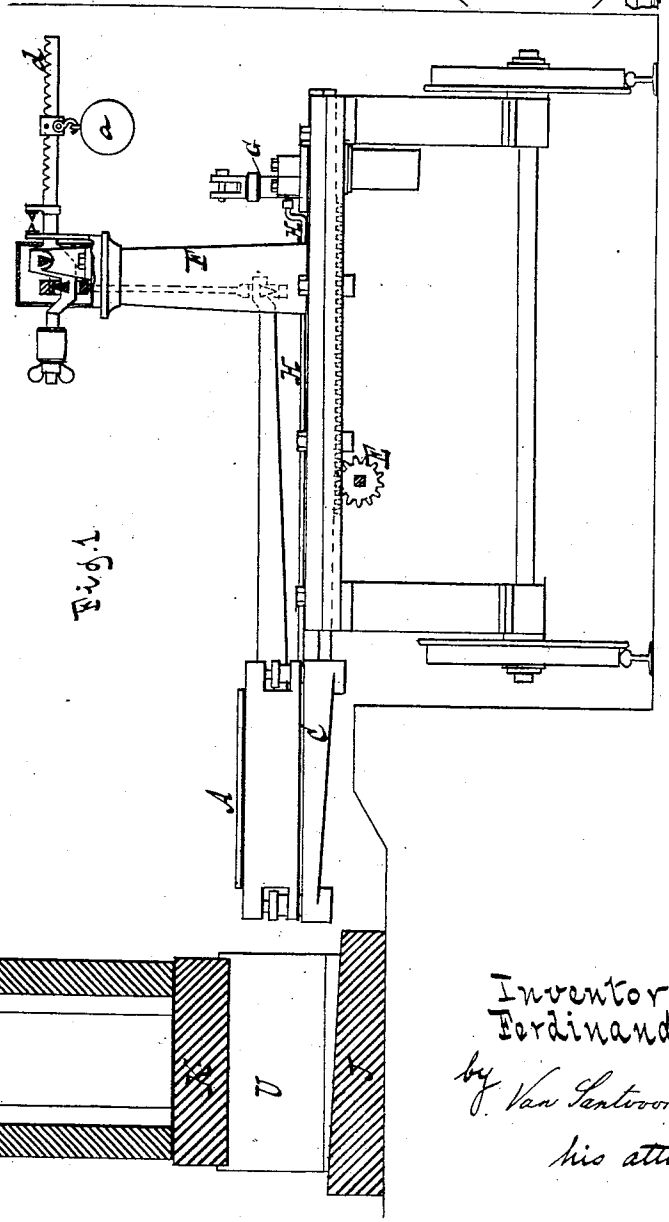

Fig. 1.

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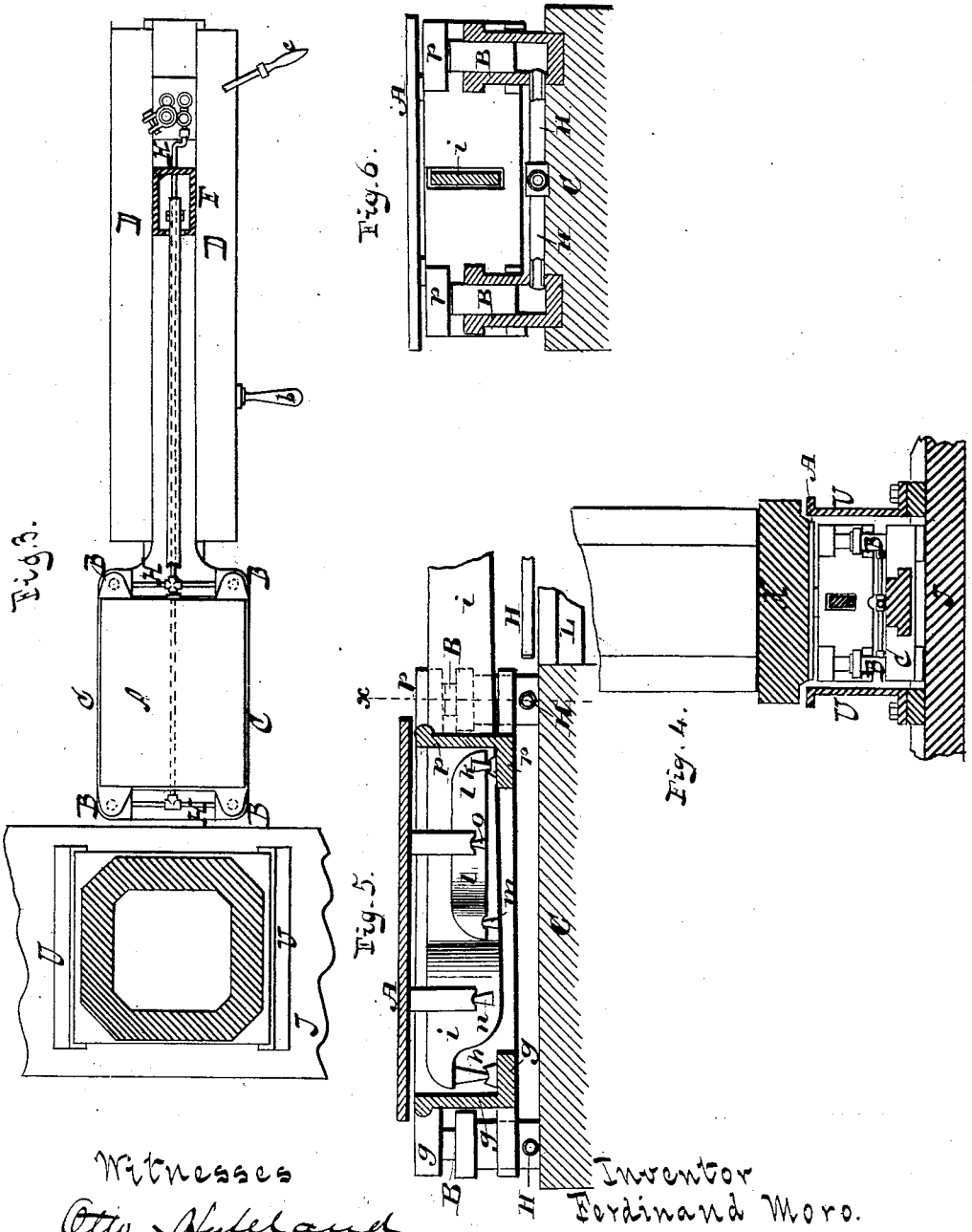

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UNITED STATES PATENT OFFICE.

FERDINAND MORO, OF KLADNO, BOHEMIA, AUSTRIA.

APPARATUS FOR CASTING INGOTS OF UNIFORM WEIGHT.

SPECIFICATION forming part of Letters Patent No. 231,838, dated August 31, 1880.

Application filed June 17, 1880. (No model.) Patented in Austria August 16, 1879.

To all whom it may concern:

Be it known that I, FERDINAND MORO, a citizen of Austria, residing at Kladno, in the Kingdom of Bohemia and Empire of Austria, have invented a new and useful Improvement in Scales for Weighing Ingots, of which the following is a specification.

This invention relates to a weighing apparatus for determining the weights of ingots, the same being adapted to be placed under a mold, and to raise the mold by means of hydraulic pressure or otherwise, whereby the mold is caused to rest on the weighing apparatus and thereby act on the same, so that the weight of said mold and its contents can be ascertained.

This invention is illustrated in the accompanying drawings, in which Figure 1 is a front view of the apparatus. Fig. 2 is an end view, partly in section. Fig. 3 is a plan view. Fig. 4 shows the mold resting on the scales. Fig. 5 shows the arrangement of lever-arms. Fig. 6 is a section in the plane *x x*, Fig. 5.

Similar letters indicate corresponding parts.

The proceeding generally employed to produce ingots from molten steel or iron, for rails, axles, sheet-iron, and the like, consists in pouring the molten metal, either directly from the furnace or from a caldron, into the molds up to a certain height indicated by a mark. According to this proceeding the weight of the ingots must vary greatly, since the exact determination of the volume of the molds and the fixing of a mark are uncertain on account of the different dimensions of cross-section of the molds; also, because the temperature of the metal to be poured varies. Consequently the expansion and contraction vary. The exact filling of the molds up to a mark placed on the inside is also difficult, and in many cases, where the molten metal forms bubbles, it is impossible to keep within this mark.

Experience shows that ingots cast in the old manner vary in weight, so that it has been necessary to make ingots which are intended for finished articles of a certain desired weight originally much heavier than would be necessary for further working, thus causing a great waste of material in order to avoid the risk of having the finished ware below the proper weight or dimensions.

To insure a rational and correct proceeding it has been necessary to introduce an improvement which alters the old manner so as to insure the production of ingots of exactly the desired weight, and thus avoid the above-mentioned disadvantages.

The proceeding invented by me is an improvement in this direction; and it consists in testing every mold into which molten steel or iron is to be cast by means of a weighing apparatus which indicates with certainty when any desired weight of metal has run into the mold, so that by means of this apparatus ingots of exactly the desired weight may be obtained. This weighing apparatus is connected with the mold, before or during casting, in such manner that during the casting the mold only rests upon the apparatus, which at the proper instant indicates the weight of metal run into the mold. Immediately after finishing one mold the apparatus is removed and brought underneath another mold. Also, in case of any danger—such as the melting through of the bottom of a mold or of the caldron, or the leaking of the latter, and the like—the apparatus must be removed immediately, as in such cases it would be destroyed by the hot metal flowing upon it.

A spattering around of the metal is of little or no consequence, as the apparatus, as well as the man attending, can be protected by a shield. Any weighing arrangement may serve the purpose—for instance, hydraulic cylinders in connection with a pressure-gage, or a common lever-balance which by some scale or mark will indicate the weight of the metal poured in, or the pressure thereof, so that the same may be read off. This new proceeding to produce ingots having exactly a desired weight, is principally of importance for the production of ingots from molten steel or iron, (Bessemer process and Siemens-Martin process,) and, of course, the apparatus necessary to my proceeding must, in detail, be so constructed as to correspond as nearly as possible to the respective existing arrangements. The best suited for this purpose may be the weighing apparatus described below and shown in the annexed drawings.

The essential features of the scale constructed for this purpose are the following:

First, the weighing mechanism may be moved forward to and withdrawn from the molds. It is moved forward when it is intended to weigh an ingot and withdrawn after the weighing has taken place, or in case of danger for the apparatus, as before mentioned.

Second, the scale-beams may be lifted by a mechanism provided therefor. By means thereof the mold is lifted vertically and rests upon the scale-beams only, which catch the mold either on the bottom or sides.

Third, in case the molds are permanently placed in a pit the whole weighing apparatus is movable upon a track, so that it can be run up in front of each mold, and the entering of the scale-beam may be successively and easily accomplished while casting.

Fourth, the molds stand, as usual, upon the bottom plates, K, and these upon supports U, which are screwed onto a ground-plate, J, common to several molds. In this manner there is sufficient room left below the molds to introduce the weighing apparatus. This consists of a lever-balance whose frame A rests on four plungers sliding in four hydraulic cylinders, B. The latter are fastened upon the plate C, which resembles a shovel, the handle or support of which is a toothed rack guided in a frame, D, and can be moved back and forward by a pinion, E, actuated by a handle, *b*. On the back of this rack are screwed or otherwise fastened the standard F for the balance and a small hydraulic pump, G, operated by a handle, *c*. The latter is connected with the before-mentioned four small cylinders B by means of a pipe, H, of copper or other fit material. The other parts of the balance are about the same as those of a common lever-balance, and therefore need no further explanation.

The weighing is done in the following manner: The molds in Bessemer works generally stand in a circle described by the outlet or pouring-hole of the caldron; but in Martin works they generally stand in a straight line, as the caldron does not hang in a crane, but is run along on a truck. The apparatus is for both cases the same—in the first it moves on a circular track, in the latter on a straight track.

During the filling the balance is in succession brought in front of the molds, passed underneath by means of the rack and pinion, whereby the slanting face of the shovel C is caused to rest against the slanting bottom plate, J. With a few strokes of the pump the balance, together with the mold, is raised, when the conical shoulder on the bottom K of the mold is easily lifted off the stand or support, Fig. 4. The weight of the empty molds, together with their plates, is now noted in succession. This preliminary weighing might be saved by making all molds and plates of the same weight; but the former method is to be preferred on account of simplicity.

After weighing the valve on the pump is opened and the pressure-water let out, the balance withdrawn and moved on to the next mold, and so on continuously. To the weight thus noted the desired weight of the ingot to be cast is now added, the sliding weight *a* on the scale-beam *d* fixed upon the corresponding total weight, and the metal poured into the mold until the beam rises.

The withdrawing and moving forward of the weighing apparatus for the purpose mentioned may, instead of by rack and pinion, also be done by hydraulic pressure. The pressure-water for the hydraulic cylinders may be led through fixed pipes, or, where the apparatus is movable, through flexible tubes.

The division of the pressure-water may be accomplished by slides or valves. Where it is not convenient to use hydraulic pressure for raising the apparatus any suitable lever arrangement may be substituted without any alteration in the principle of the proceeding.

The application of a weighing apparatus of this kind is somewhat different when the molds are stationary in the pit, or when they are placed upon cars upon which they may be moved. In the first case the weighing apparatus must be movable, as shown in the drawings, so that the whole apparatus can be moved from one mold to the other. This moving may be done by means of power or otherwise.

The weighing apparatus may be stationary, but it is in general more advantageous to have it movable.

When the shovel C has been passed underneath the mold by means of the pinion E its bottom or under part rests firmly upon the ground-plate J. When now the pump G is set in operation it forces water through the tubes H, Fig. 3, into the cylinder in which slide the pistons or plungers B, forcing the same up. The plungers B, in rising, carry up the brackets *g p*. On the bracket *g* rests the knife-edge *h*, forming the fulcrum for the lever *i*, whose other end is connected by means of a rod to the scale-beam *d* swinging on the knife-edge *j*, Fig. 1.

The bracket *p* forms the bearings for the knife-edges *k*, on which swing the levers *l*. The other ends of the levers *l* rest on knife-edges *m*, fastened to the lever *i*.

The platform A rests on the knife-edges *n* and *o*. The knife-edges *n* are fastened to the lever *i*, and the knife-edges *o* are attached to the levers *l*. From this it will be readily seen that when the pistons B are forced up they raise the brackets *g p*, and with them the levers *i* and *l* and the platform A. Any weight which is caused to rest on the platform A tends to make the lever *i* swing downward about the knife-edge *h*, thus operating the scale-beams *d*.

Of course the platform A must rest entirely on the knife-edges *n o*, as otherwise the true weight of the object resting on the platform would not be indicated by the scale-beam *d*. The advantage of this arrangement is that the weighing apparatus raises the mold off its sup-

ports a sufficient distance to enable the same to be weighed, while in former devices the molds had to be lifted onto the scales, which molds, being sometimes very hot, are difficult of handling.

What I claim as new, and desire to secure by Letters Patent, is—

1. As a means for determining the weight of ingots cast in a mold, the combination, with the movable scale-platform A, of the pillars or plungers B, supporting the brackets which afford bearings for the platform-levers, mechanism arranged to raise and lower said platform and its supports, the scale-beam *d* for indicating the weight of the ingots, and the lever-arms *l l*, serving to connect the platform with the scale-beam, substantially as shown and set forth.

2. The combination, with the platform A in a weighing-scale, of the pillars or plungers supporting brackets which afford bearings for the platform-levers, the plate or shovel C, arranged beneath the brackets *g*, and having a handle consisting of a rack-bar guided in the frame D, and the pinion E, meshing with the teeth of the said handle, substantially as shown and described, and for the purposes set forth.

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