No. 689,584. Patented Dec. 24, 1901.

J. M. HARTMAN.

APPARATUS FOR THE CONTINUOUS CASTING OF PIG METAL.

(Application filed Dec. 1, 1900.)

(No Model.)

FIG. 1.

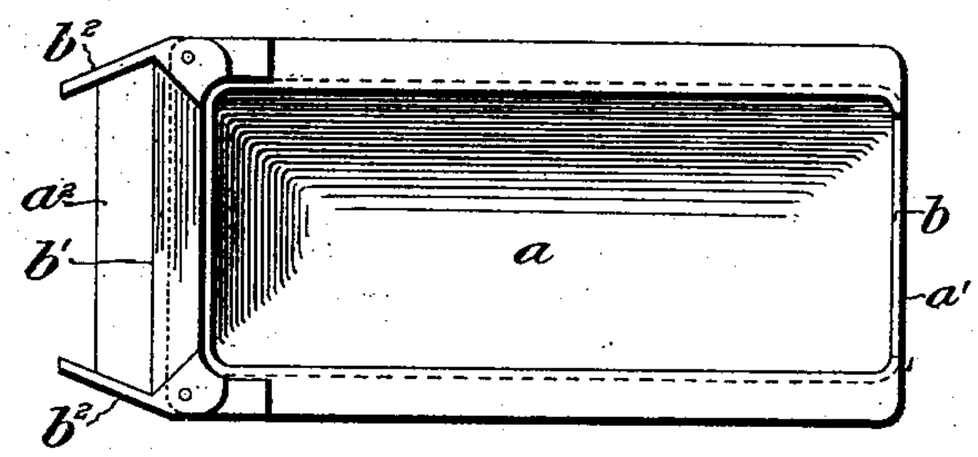


FIG. 2.

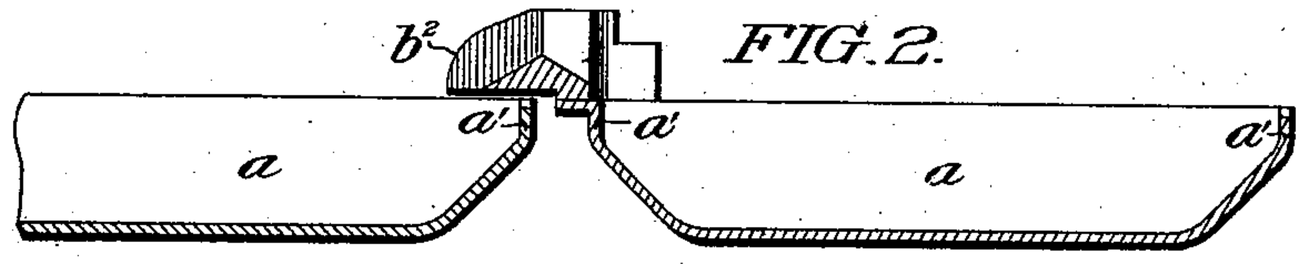


FIG. 3.

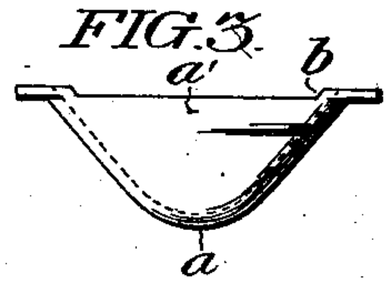


FIG. 4.

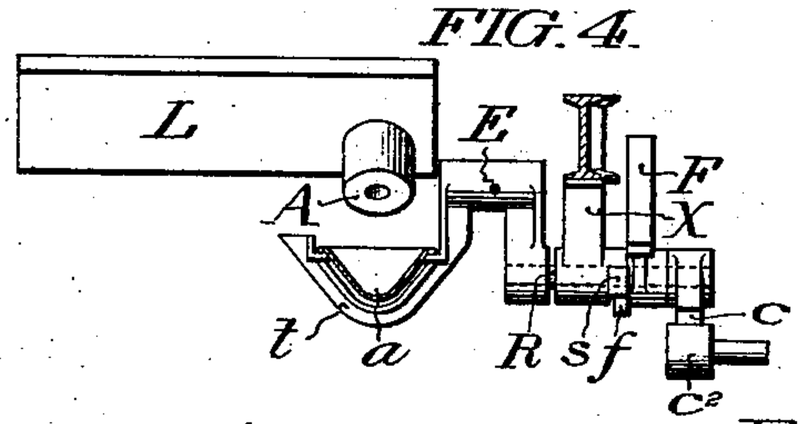


FIG. 5.

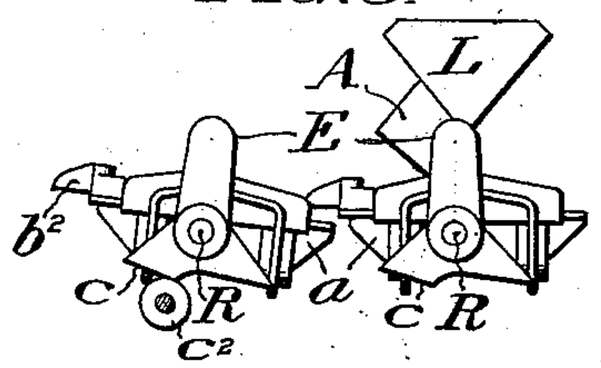


FIG. 6.

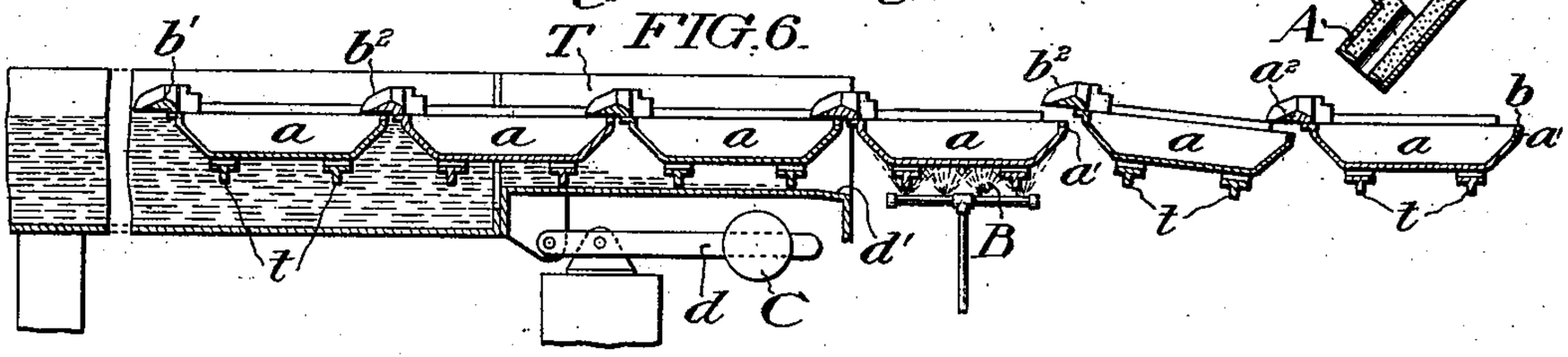


FIG. 7.

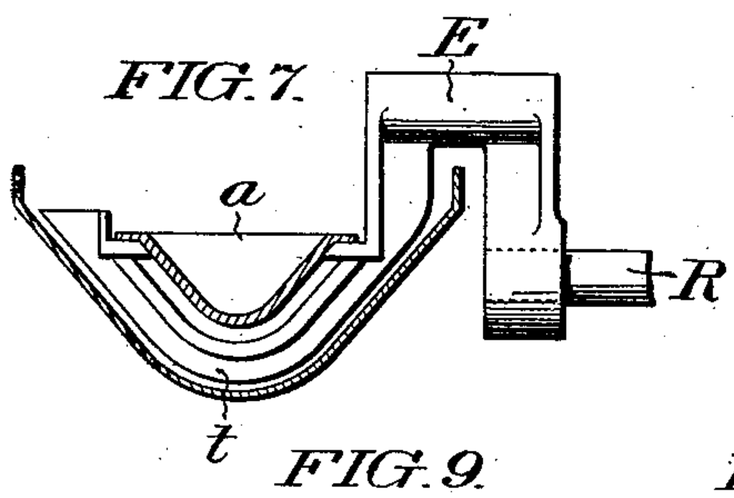


FIG. 8.

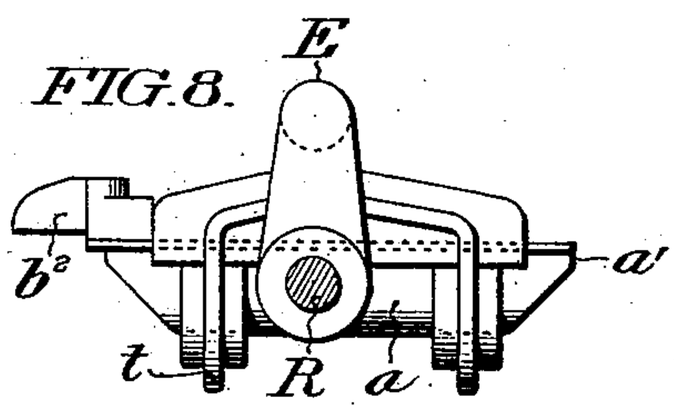


FIG. 9.

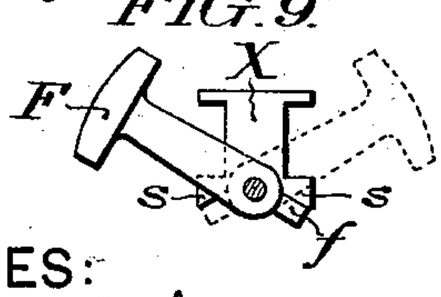


FIG. 10.

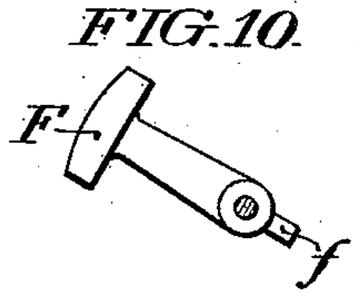
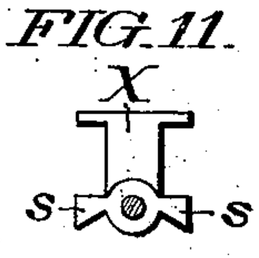


FIG. 11.



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John M. Hartman

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Treney & Paul

UNITED STATES PATENT OFFICE.

JOHN M. HARTMAN, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR THE CONTINUOUS CASTING OF PIG METAL.

SPECIFICATION forming part of Letters Patent No. 689,584, dated December 24, 1901.

Application filed December 1, 1900. Serial No. 38,316. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. HARTMAN, a citizen of the United States, residing on Gowen avenue, Mount Airy, in the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Apparatus for the Continuous Casting of Pig Metal, whereof the following is a specification, reference being had to the accompanying drawings.

My invention has relation to certain improvements in machinery for the continuous casting of pig metal in which a series of thin metal-molds is carried in continuous succession beneath the point where the metal is poured and thereafter through a water-trough in which the water stands at different levels, so that first the bottom of the mold and thereafter the entire mold and pig are cooled by the water, after which the molds are successively inverted to discharge their contents, righted, and again carried beneath the point where the metal is poured. A convenient mechanism for carrying these molds in the form of a circular table surrounded by a partial annular water-trough has been described and patented to me in Letters Patent No. 629,903, dated August 1, 1899. I will therefore not again describe the mechanism and parts which have already been shown and described in the specification of this prior patent, but will confine my description to the particular portions to which my present improvements relate.

In the accompanying drawings, Figure 1 is a top view of a metal-mold constructed according to my present invention. Fig. 2 is a longitudinal central section through one of these molds and a portion of the mold immediately in front of it. Fig. 3 is a view of the rear end of one of the molds. Fig. 4 is an elevation of the frame which carries the mold with its shaft and related parts and also showing the relation of these parts to the nozzle through which the metal is poured. Fig. 5 is a side elevation showing two of the mold-frames in their relation to the nozzle through which the metal is poured and also to the tilting roller. Fig. 6 is a diagrammatic section illustrating the advance of a succession of the molds beneath the nozzle where the metal is poured and into the water-trough. Fig. 7 is an enlarged view of the mold-frame and its hanger and shaft, showing the mold and the water-trough *in situ*. Fig. 8 is a side view, similarly enlarged, of one of the mold-frames with its mold and hanger. Figs. 9, 10, and 11 are detail views of the counterweight for balancing the mold-frame and its related parts.

I will first describe the molds as constructed according to my present invention.

Referring to Figs. 1, 2, and 3, the body a of the mold is formed of a single plate of wrought-iron or steel struck up into the shape there indicated. Roughly speaking, it forms a rectangular dish sloping from the bottom up gradually to the long sides, which are furnished with a wide flange, but having the short ends turned up more sharply and terminating in an upright edge a' a'. The reason for the difference in the inclination of the sides and the ends is this: The pig is less likely to stick to the mold and resist dumping the more the edges slope; but, on the other hand, if the gradual slope of the sides is continued all around the ends the resulting pig has formed all around it a sharp edge, which makes it exceedingly difficult for the workmen to handle it without cutting their hands. I have found that owing to the greater contraction along the line of the greatest length of the pig as it cools the danger of the pig sticking at either of its ends to the molds is much less than at the sides, and I have found that at least to the extent indicated in the drawings it is practicable to make the short ends upright without danger of the pigs sticking, and in this way I am able to produce pigs with ends blunt enough for the workmen to handle them.

The mold is provided at its front end with an overhanging lip or bridge reaching over the rear end of the mold immediately in front of it. This bridge a^2 is riveted to the top of the flange of the front end of the mold. It consists of a central part b', which is formed with a sharply-divided ridge which sheds the metal falling upon it in one or the other direction, either into the mold to which it is attached or the one in front, which it overhangs. The sides of the bridge are formed with upright edges or flanges b^2 b^2, which, as will be seen from Fig. 1, converge in both di-

rections from the ridge of the bridge, by which construction all of the metal poured upon the bridge is accurately guided into one or the other of the two adjacent molds.

The rear end of the mold has no flange formed upon it and has the upper part of its upright edge cut away, as seen at *b*, thereby forming an overflow, which prevents the mold from being overfilled and secures uniformity in the size of the pig. The molds are mounted in mold-frames in a manner similar to that shown in my previous patent, to which reference has been made. These mold-frames are preferably attached by hangers to their rock-shafts mounted radially on a revolving table, as shown in the specification and drawings of that patent. There is also provided coincidently with all but a part of the periphery of this revolving table a partial annular water-trough, as therein shown and described. I have consequently omitted to show and describe these parts, and it will be understood that the parts which I am now about to describe may be assembled as there shown, and I will confine my present description to the parts wherein my present invention differs from that which I have previously patented.

In my present invention the mold-frames *t*, the shape of which is best seen in Figs. 7 and 8, differ from those of my previous invention in the absence of any longitudinal portion, consisting simply of two suspension-ribs, within which the mold rests and to which it may be fastened, if desired, by riveting to the flange. As the molds are advanced successively under the point of pouring, which is indicated by the nozzle A in Fig. 5, they are filled up to the overflow *b*.

I have found that if the mold is filled too full any jarring of the machine may cause some escape of the metal at *b* after the mold has entered the water-trough. This is a serious danger, and to prevent it I provide a small roller c^2, fixed in position shortly in advance of the nozzle A. The shafts by which the mold-frames are carried have affixed to them a cam-incline *c*, having its cam-surface formed as indicated in Fig. 5. As the mold-frames advance this surface comes in contact with roller c^2 shortly after the mold has passed under the point where the metal is poured, and thereby a slight tip or tilt is given momentarily to the mold sufficient to dislodge and discharge over the edge *b* any surplus metal which a slight jar might otherwise thereafter cause to overflow into the water-trough with possibility of explosion.

Notwithstanding all the precautions which have just been described some of the molten metal will occasionally slop over the edge of the mold and is liable to harden on the outside of it or against the frames which carry the mold. This occasions difficulty, especially where the molds enter the water-trough. In order to prevent excessive escape of water at this point, it is necessary that the end of the trough T, Fig. 6, should possess a configuration fitting with considerable closeness around the mold-frames as they advance. The relation of the two is seen in Fig. 7, where the trough is shown in cross-section. Under these circumstances a bit of metal splashed against the bottom of one of these frames and adhering thereto is liable to jam against this part of the trough and cause the breakage of some part. I overcome this difficulty by making the end of the trough free from rigid support. The distance of this end from the nearest rigid support (see Fig. 6) is sufficient to allow of considerable flexibility and beneath the end where the molds enter the trough is upheld by the pivoted lever-arm *d*, which carries a counterweight C, thereby enabling the trough to yield at this point in the contingency which I have mentioned and avoid a break. The yielding is further facilitated by making the entrance of the trough flare, as seen at *d'*.

In order to chill the molds instantly after they have been poured, and thus prevent the buckling due to the intense heat, I place a spray of water B, as shown in Fig. 5, in such relation to the nozzle A, through which the metal is poured, that as the molds pass successively beneath the pouring-spout their bottoms immediately encounter a spray of water forced up against their under sides. This accomplishes considerable preliminary cooling prior to the entry of the mold into the water-trough and is a better arrangement than to have the trough itself too near the point where the metal is poured, for although the water at the entrance of the trough is maintained at a level an inch or more below the top of the mold, yet extreme care must be taken to allow no water to splash on top of the pig until all the occluded gas in the melted metal has escaped; otherwise the skin formed over the metal of the mold by contact with water prevents such escape, causing blow-holes or cavities in the pig. Water on top of the molds at this stage also tends to cause serious explosions. Both of these difficulties are obviated by the use of the preliminary spray, which quickly chills the metal next to the edge of the mold, forming a skin on the under side only which does not retain any occluded gas and prevents any fusion of the metal to the mold.

Each mold-frame is united to its rock-shaft R by a bracket or hanger E, formed in the shape of an inverted U. This makes it possible for the mold-frame to overhang the edge of the trough and at the same time support the mold with reference to the rock-shaft so that when full its center of gravity is not greatly below the axis of the rock-shaft, thus rendering the subsequent inversion of the mold-frame for the purpose of dumping the pig much easier. At the same time the distance between the center of gravity of the filled mold and the axis of the rock-shaft being slight, it is necessary to steady the frame

while the molds are passing through the water in order to prevent accidental rocking, with possible overflow of metal. This is accomplished by mounting the counterweight F on the rock-shaft upon the other side of the depending journal X, by which the rock-shaft is hung from its supporting-table. The lower end of the arm carrying this counterweight has a lug *f*, (see Figs. 9 and 10,) and the journal X has two projecting steps *s s*, (best seen in Fig. 11,) so placed as to come into contact with the lug *f* and limit the motion of the counterweight in that direction. In Fig. 9 the broken lines indicate the position of the counterweight when the mold has been inverted after dumping, while the solid lines indicate its position while the mold is level.

Having thus described my invention, I claim—

1. In an apparatus for casting pig metal, the combination of means for feeding molten metal at a fixed point; a series of thin metal molds; a traversing device by which the molds are carried in continuous succession beneath the point where the molten metal is fed; and a spraying device placed beneath the molds immediately in advance of the point where the metal is fed, whereby the under side of the mold is cooled as soon as it has been filled, substantially as described.

2. In an apparatus for casting pig metal, a series of elongated substantially rectangular metal-molds, each of which molds has a portion of its edge cut away at one of the short ends to form an overflow; a traversing device whereby the said molds are carried in continuous succession along the line of their greatest length beneath the point where molten metal may be fed to them; and a tilting device whereby immediately after being filled the cut-away end of each mold is momentarily given a slight depression and any excess discharged therefrom, substantially as described.

3. In an apparatus for casting pig metal; a series of elongated thin metal-molds, each of which has affixed to one end a bridge-piece which overlaps the adjacent edge of the next mold, said bridge-piece being transversely ridged and furnished with flanges at both sides which converge from the ridges; means for feeding molten metal at a given point; and a traversing device by which said molds are carried longitudinally in continuous series beneath that point, substantially as described.

4. In an apparatus for casting pig metal, a series of thin metal-molds; a water-trough; a traversing device by which said molds are carried in continuous succession beneath the point where molten metal may be fed and then through the water-trough; and a tilting device whereby immediately after being filled and before entering the water-trough the mold is momentarily given a slight inclination and any excess discharged therefrom, substantially as described.

5. In an apparatus for casting pig metal, a series of thin metal-molds; a traversing device by which said molds are carried in continuous succession beneath the point where molten metal may be fed; and a water-trough through which the said molds are carried by said traversing device after being filled, the said water-trough being provided with a yielding support at the point where the molds first enter it, substantially as described.

6. In an apparatus for casting pig metal, a series of thin metal-molds; a series of mold-frames which carry the molds; a water-trough; a traversing device with rock-shafts on which said mold-frames are mounted; and a bracket connection in the form of an inverted **U**, whereby the said mold-frames are united to the rock-shaft at a height to maintain the center of gravity of the mold and its contents not far below the axis of the rock-shaft, while the mold depends within the water-trough, substantially as described.

7. In an apparatus for casting pig metal, a series of thin metal-molds; a series of mold-frames which carry the molds; a water-trough; a traversing device with rock-shafts on which said mold-frames are mounted; and a bracket connection in the form of an inverted **U**, whereby the said mold-frames are united to the rock-shaft at a height to maintain the center of gravity of the mold and its contents not far below the axis of the rock-shaft while the mold depends within the water-trough, in combination with a counterweight on said rock-shaft and stops whereby the motion of the counterweight is limited, substantially as described.

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Witnesses:
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E. REESE.