H. H. HOSACK.

APPLIANCE FOR CASTING METAL INGOTS INTO MOLDS.

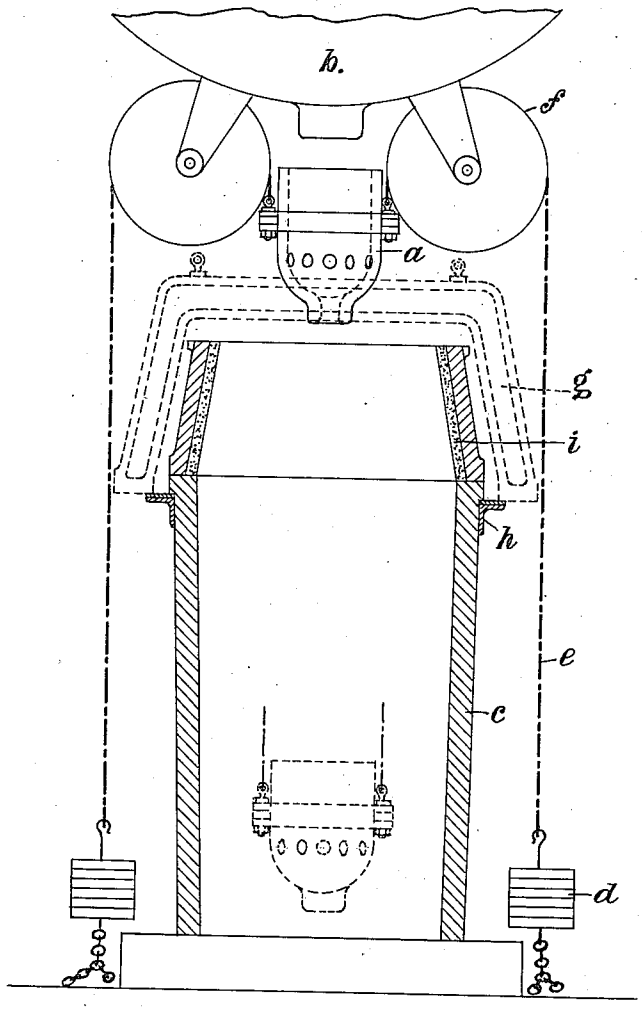
APPLICATION FILED AUG. 28, 1919.

1,375,589.

Patented Apr. 19, 1921.

2 SHEETS—SHEET 1.

FIG. 1.



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2 SHEETS—SHEET 2.

FIG. 2.

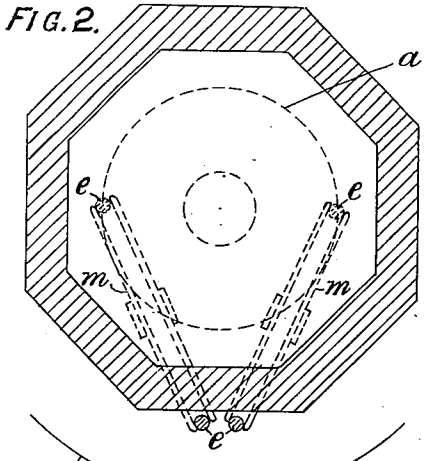


FIG. 3.

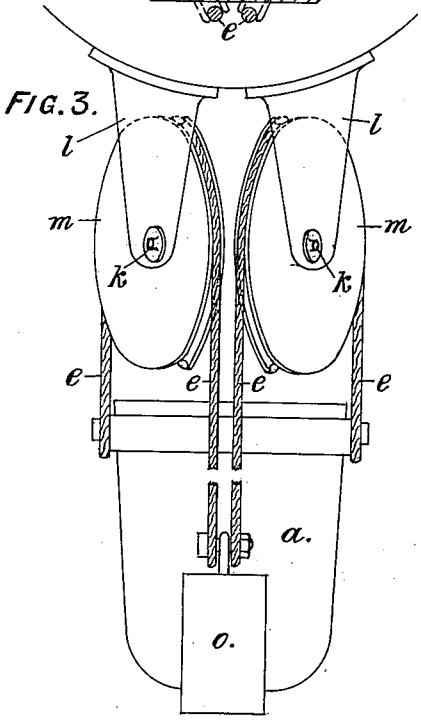


FIG. 4.

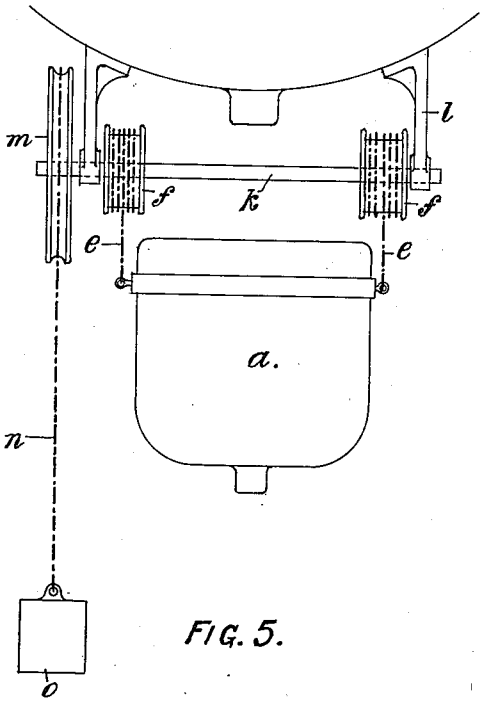


FIG. 5.

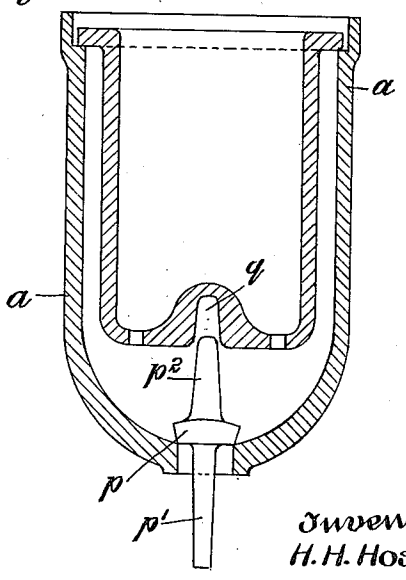
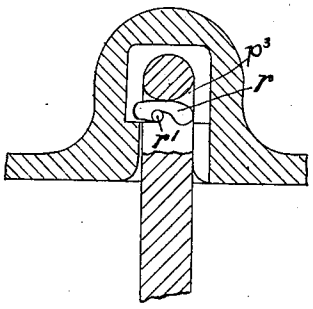


FIG. 6.



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UNITED STATES PATENT OFFICE.

HAROLD HERON HOSACK, OF TWICKENHAM, ENGLAND.

APPLIANCE FOR CASTING METAL INGOTS INTO MOLDS.

1,375,589. Specification of Letters Patent. Patented Apr. 19, 1921.

Application filed August 28, 1919. Serial No. 320,422.

To all whom it may concern:

Be it known that I, HAROLD HERON HOSACK, a subject of the King of England, residing at Twickenham, in the county of Middlesex, England, have invented new and useful Improvements in Appliances for Casting Metal Ingots Into Molds, of which the following is a specification.

This invention has reference to the pouring or teeming of molten steel and other metals into molds generally called ingot molds; and it has primarily for its objects and effects to diminish or obviate splashing of the metal when poured into the ingot mold from above, and thereby to diminish as far as possible the oxidization of the metal, and other deteriorating effects upon or in the metal due to such splashing, and the present method of pouring or casting.

According to this invention, the molten steel (or other metal) which is run from a furnace into a movable casting ladle or container, is not directly run or delivered from this ladle or container into the mold, but is introduced into it through the intermediary of a vessel—which may be called a "pilot ladle"—which is adapted to rise and fall and receives it from the main ladle or container, and in turn delivers it, when at or near the bottom of the mold, into the mold, so that its discharge or delivery is at a very small head, and quietly and as the mold fills, the pilot ladle is caused to rise, so that the splashing and carrying down of air bubbles into the metal, is to a very large extent obviated.

According to one mode of carrying out this method or system of pouring or casting, the vertically movable pilot ladle (which will come directly under the main ladle, and may be supported therefrom or from the upper part of the ingot mold) is counter-balanced, the weights being such as to keep it when empty, in its uppermost position at the required position under the ladle pouring spout; but when it receives metal from the ladle, which is delivered to it by lifting a plug as usual, the weight of the molten metal and that of the pilot ladle exceeds that of the counter weights, and the pilot ladle falls, lifting the weights; and it is carried down to near the bottom of the ingot mold; and the metal from the pilot ladle flows relatively slowly in a quiet stream or streams from the pilot ladle into the bottom of the mold. As the level of the metal rises in the mold, and reaches the pilot ladle, the diminution of the specific gravity of it, due to the pressure of the molten metal of the mold, will cause it to rise as the mold fills; and when it is completely filled, and the stopper or plug of the main ladle or container closed, the pilot ladle will empty itself, and rise clear of the mold, being pulled up by the counterbalance weights.

When an ingot mold has been filled, the ladle is moved over another mold, and the operations above described will be repeated.

In some cases, the pilot ladle may be of ordinary metallurgical crucible material; while in other cases it may consist of a metal shell, with a fire brick or refractory material lining.

According to a modification, the vertically moving pilot ladle may, instead of being entirely automatic, partly automatic that is controlled by an attendant; or it may be moved down and up into and out of the ladle by hand operated or mechanical, say an electrically operated means.

Also in some cases, a valve or plug device may be used in the pilot ladle, which will be operated and opened at the right time, when the pilot ladle is at the required depth or position in the mold. Also this ladle may be heated to any desired degree before pouring takes place.

The mold may have a sinking head on its upper end of any known suitable kind.

The system according to this invention is illustrated in the accompanying drawings, in which Figure 1 is an elevation in section showing one arrangement of parts. Figs. 2 and 3 are plan and elevation showing a modified arrangement; and Figs. 4 and 5 are two other modifications; while Fig. 6 shows a detail.

Referring first to Fig. 1, *a* represents the pilot ladle, *b* the traveling pouring ladle, and *c* the ingot mold. *d* are the counterbalance weights, and *e* the chains or ropes connecting the pilot ladle with the weights, they being passed over the pulleys *f* on the bottom of the ladle *b*. The sinking head is marked *i*, and is provided with a sand internal lining as shown.

The dotted part marked *g* represents a hollow jacket or hood, the interior space of which would be exhausted of air, and put under a vacuum. This hood stands over the sinking head, and the lower edge of it rests

on an asbestos or other packing, carried by the angle iron ledge *h* on the mold.

The pilot ladle *a* has a hole in its bottom, and in some cases a plurality of holes around it, as shown, in Fig. 1, so that it discharges its contents in a multiplicity of quiescent streams.

Before pouring, the pilot ladle takes the upper position shown in the drawing; and when the main ladle stopper is lifted, the metal pours into the pilot ladle, and the combined weight of this metal and ladle causes the latter to fall to as near the bottom as desired, say about the position shown in the dotted lines in the drawing; and so the length the streams from the holes in it, falling on to the bottom of the mold is short.

As the metal in the mold rises, its action on the pilot ladle in rising is to take off weight from it; and the counterbalance weights *d* being then slightly heavier than the weight of the pilot ladle, will cause it to rise as the metal rises; and the metal from the orifices of the pilot ladle flows quietly and evenly without splashing, or carrying down of air into the cast metal, from the commencement of pouring to the end; and when the mold is entirely filled, and the main ladle stopper shut down, the weights *d* will pull the pilot ladle clear of the sinking head *i*, when it is ready for a similar operation with the next mold in the bench of molds.

Having by these means cast an ingot, as free from splashings, and inclusions of air as possible, this advantage is followed up by providing means of feeding the contents of the mold with hotter steel or metal than is contained in it; and this is effected by the employment of the vacuum hood *g*, which immediately after casting is placed over the sinking head, as indicated in the drawing; the conduction of heat by the hood away from this portion of the mold, being prevented or reduced by the asbestos or like joint of the supporting ledge *h* above specified. The metal in the upper portion of the ingot is then kept liquid for as long a period as possible, and serves to feed the main bulk of the ingot, as the metal cools from the bottom upward.

In the modification shown in Figs. 2 and 3, instead of there being separate weights, only one weight *o* is employed, both chains or ropes *e* passing over the pulleys *f* which are inclined toward one another as shown.

In the arrangement in Fig. 4, the pilot ladle *a* is supported by chains or ropes *e*, and pulleys *f*, from a shaft *k*, carried in bearing supports *l* from the bottom of the ladle *b;* and this shaft has fixed upon it a chain or rope pulley *m*, the rope or chain *n* of which has a weight *o* on the bottom, so as to counterbalance the pilot ladle *a*. On or connected with this gear or tackle, any desired form of brake (not shown) may be used, so that the operation of the pilot ladle may be governed or controlled.

In the case of the invention being applied to casting of large ingots in large molds, the pilot crucible *a* should be as large as possible; and in operation, in some cases, it is first filled from the main ladle or container, while in the upper position, being held when filling by a brake or equivalent gear on the mechanism, hand or mechanically operated; and when full the main ladle stopper should be closed, and the pilot ladle *a* may be lowered to the bottom of the mold. This ladle *a* may have a discharge control stopper or valve, operated by hand from above, similarly to an ordinary casting ladle stopper, or automatically as hereinafter described, by striking the bottom of the mold; and when the pilot ladle is near the bottom of the mold and the valve or stopper is opened, the metal will pour from the lower pouring spout in its bottom, quietly onto the bottom of the mold, and flush the lower portion of same. As soon as the metal is released from the pilot ladle, the main ladle stopper may be opened so as to discharge into the pilot ladle, which being acted upon by the rising metal run into the ingot mold, will by means of the counterbalance weight acting upon it, be lifted as the metal rises, similarly as above described.

In some cases, however, it may be preferred that the upward or downward movement or both of the pilot ladle may be effected mechanically as by an electric motor, or by hand, and when the mold is filling it will be lifted, which can be indicated by a floater device in the mold, or other means; but so far as the first operations of the system are concerned, these may be controlled by a brake, or pawl and ratchet, or the like.

In Fig. 5, a double construction of pilot ladle is shown, having an automatic stopper or valve *p* in the bottom of the outer part with a lower stem p^1, and an upper stem p^2, the latter of which when lifted, due to the stem p^1 striking the bottom of the mold in lowering, will be pushed up into the tapered socket hole *q* of the inner ladle, and so thereby held. The molten metal will be received by the inner vessel of the ladle, and passed through the holes in the bottom, of which there are a multiplicity, and then out by the central hole in the bottom of the outer ladle wall.

By this means the quiescent falling of the liquid metal, and its discharge into the ingot mold is promoted; and the avoidance of the carrying down of air into the metal in the mold is accomplished.

Instead of the plug or valve *p* being held up by friction as just described, it may be held

up by a detent as shown in Fig. 6. The detent in this case is in the form of a weighted pawl r, supported on a cross pin r^1, in a recess or opening in the upper stem p^2. When the stopper is being lifted, the nose of this pawl will be pressed into the recess p^3 in the stem p^2, by passing over the surface of the material around the hole q, and when the nose of the weighted pawl enters the enlarged upper part q^1 of the hole q, it rises, and projects into the hole, so that when the stopper lower stem leaves the bottom of the mold, the stopper will be held up in the open position.

To lower the stopper, it is turned around so that the nose of the pawl r comes over a vertical groove or slot way q^3 through the material forming the lower part of the hole q, so that it can fall down; and then afterward, it is turned around so that the nose would be away from this slot q^3, and in a position ready for the stopper being lifted.

From the above description it will be apparent that the pilot ladle in effect floats upon the surface of the molten metal and is elevated by the buoyancy added by the counterweights. The counterweights will of course assist in holding the pilot ladle upright and operating to maintain its position about centrally of the main mold.

What is claimed is:—

1. The herein described method of casting metal from a ladle, consisting in delivering the metal from said ladle into a pilot ladle counterbalanced to maintain said pilot ladle floating on the surface of the metal rising in the mold, whereby to maintain the pilot ladle constantly at the level of the rising metal in the mold to deliver the metal from the pilot ladle at or near the surface of the metal in the mold.

2. A means for delivering molten metal into a mold comprising in combination a pilot ladle adapted to receive the molten metal from a supply, and mounted for movement vertically in the mold, and means for counterbalancing the pilot ladle to maintain said pilot ladle as a floating element on the surface of the metal in the mold.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HAROLD HERON HOSACK.

Witnesses:

GEO. P. S. KELSEY,

ERNEST PASK.