Feb. 19, 1924. 1,484,076

J. E. PERRY

INVERTED HORIZONTAL INGOT MOLD AND PROCESS OF CASTING

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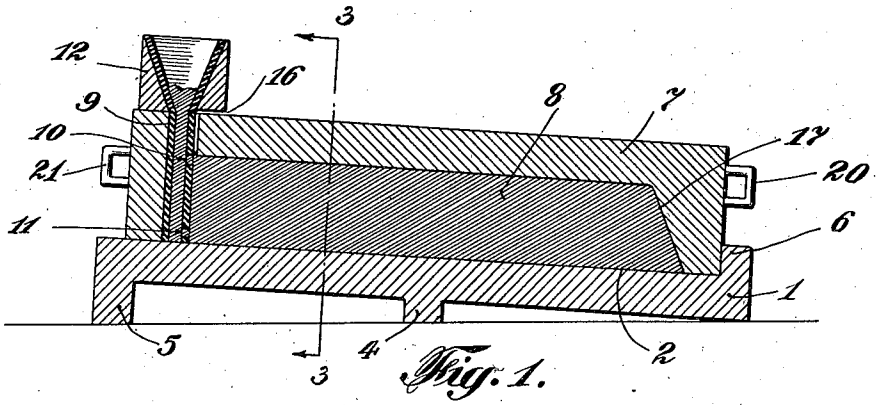

Fig. 1.

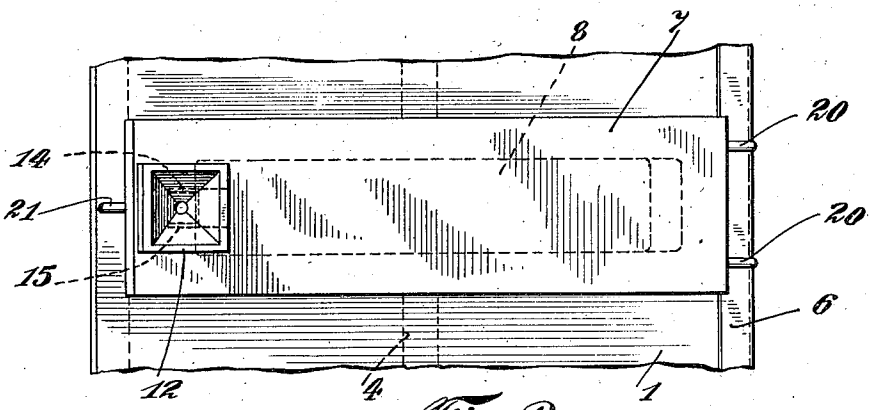

Fig. 2.

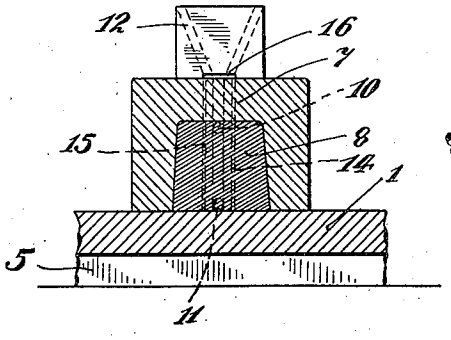

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN E. PERRY, OF SHARON, PENNSYLVANIA, ASSIGNOR TO VALLEY MOULD & IRON CORPORATION, OF SHARPSVILLE, PENNSYLVANIA, A CORPORATION OF NEW YORK.

INVERTED HORIZONTAL INGOT MOLD AND PROCESS OF CASTING.

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To all whom it may concern:

Be it known that I, JOHN E. PERRY, a citizen of the United States, and a resident of the city of Sharon, in the county of Mercer, State of Pennsylvania, have invented new and useful Improvements in Inverted Horizontal Ingot Molds and Processes of Casting, of which the following is a specification.

The present invention relates broadly to metallurgy and more specially to a method and apparatus for casting horizontal steel ingots.

The principal object of the present invention is the method and apparatus for casting horizontal ingots which are adapted to automatically strip from the mold when the mold is lifted.

Another object of the present invention is the method and apparatus for casting steel ingots wherein the ingot is cast in an inverted trough mounted on a suitable flat plate or stool upon which the ingot rests when stripped from the mold.

A further object of the present invention is the method of casting horizontal ingots which comprises providing automatic stripping molds adapted to be filled and stripped in inverted position and capable of being lifted to another position and set up for refilling.

A still further object of the present invention is the method of casting horizontal steel ingots which comprises providing an ingot chill mold having the bottom thereof open and then setting the mold upon a suitable flat chill stool with the surface inclined to the horizontal, filling the mold at the upper end thereof, stripping the mold from the ingot when the same is sufficiently chilled and re-setting the mold on a suitable flat stool to permit the mold to be re-used while the ingot is cooling.

Another object of the present invention is the method of casting steel ingots which comprises an inclined stool, inverting a chill trough over said stool, filling the trough with molten steel through a suitable opening provided in the highest portion thereof, then lifting the trough when the ingot has sufficiently cooled and re-setting the trough for another pouring operation.

A still further object of the present invention is the method of casting horizontal steel ingots which comprises providing an inverted chill trough having a runner opening in one end thereof, filling the mold with molten steel and permitting the same to chill, then raising the end of the mold opposite from the runner to break the runner column from the ingot, then lifting the mold clear of the ingot and re-setting the mold for further casting.

Another object of the present invention is a horizontal ingot mold comprising a body portion provided with a matrix adapted to form a steel ingot when filled with molten steel with the bottom portion of said matrix being open and the top portion thereof closed, and a suitable runner opening provided in the top portion adjacent one end thereof.

Another object of the present invention is an ingot mold for horizontal ingots, comprising a body provided with a matrix therein and having a covered top, a runner opening at one end of said top and with the end of the matrix portion opposite to the runner opening being inclined away from said runner opening in such manner that the inclined end when lifted by suitable means, will automatically clear an ingot molded in the matrix.

Another object of the present invention is an ingot mold comprising an inverted trough with a runner opening in one end thereof and extending through the top portion of said mold.

A still further object of the present invention is a casting plate or stool for horizontal ingot molds comprising a body portion and a ledge adjacent one edge of said body portion and adapted to engage the ends of a suitable ingot mold.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter by reference to the accompanying drawings wherein like parts are represented by like characters throughout the several figures thereof.

Realizing that the present invention may be embodied in constructions other than those specifically shown, it is desired that

the present disclosure shall be considered as illustrative and not in the limiting sense.

Figure 1 is a longitudinal sectional view through a mold, an ingot therein, and the stool on which said mold is adapted to rest;

Figure 2 is a plan view of the device shown in Figure 1;

Figure 3 is a sectional view of line 3—3 of Figure 1.

Heretofore in the art various types of molds have been proposed for casting horizontal steel ingots and such constructions have comprised multi-part molds which have not been well adapted for use in an establishment organized to cast ingots in vertical molds as is the common practice of today. In the horizontal molds heretofore proposed the mold structure has, in most cases, comprised an open trough-like member adapted to be covered by suitable covers so that in the operation of the device on a casting floor it becomes necessary to dispose of a number of pieces of the mold when stripping the ingot from the mold. In view of the fact that the parts are heavy and must be handled by cranes, such constructions involve a number of crane movements to strip a single ingot. Furthermore it is necessary to dispose of the various parts about the floor as these parts are removed. In steel plants which are established in their construction and organization, the handling of multi-parts delays the operation of the plant and increases the cost of the product. The disposal of extra mold parts often required abnormal travel of the crane and requires more space than is usually alloted for the casting floor and increases the element of danger and accident as well as the trouble of extra fitting and setting up. In factories producing steel ingots there are usually a series or chain of operations which begin with the pouring of the ingots and which may terminate in the finished product such as the rolling of structural iron, rails, or other commercial forms; or the product may be an intermediate one such as steel billets. The resulting production is controlled by that one of the series of operations which requires the longest time to perform on the material going through. It therefore follows that any manipulations or step which slows up the progress of the work greatly interfers with the final rate of production.

The present invention overcomes the difficulties of the known art by providing a horizontal ingot mold, method and apparatus wherein the space utilized on the casting floor for casting ingots in vertical molds may be adapted and used for casting ingots in horizontal molds without disturbing the final rate of production.

The present invention may be embodied in constructions other than those specifically shown and described herewith so therefore the present embodiment is more or less diagrammatic and for illustration may comprise an inverted ingot mold trough adapted to be set on suitable plates or stools so that the movable part of the mold comprises one piece which, after being filled with molten steel, and cooled, the ingot is automatically stripped from the mold by merely lifting the mold, which may be carried by a crane to a new stool or plate on which the mold may be set and made ready for another casting operation. This greatly facilitates simplicity of handling and permits the equipment to be released for re-use as quickly as the steel sets. Therefore this method requires no extra floor space for storage of parts during dissembling and assembling of a mold set-up.

Referring now to the drawings, which are more or less diagrammatic, the constructions may comprise a floor plate or stool 1 which is preferably a heavy cast iron plate of a sufficient width to support a plurality of ingot molds which may rest on the smooth top surface 2 of the stool. Preferably the stool or floor plate is inclined and to this end may be provided with supporting legs 4 and 5 of different heights. To facilitate the setting up of molds on the floor plate, a foot rail or ledge 6 may be provided adjacent the lower edge of the plate.

The mold may be formed with a body 7 which is provided with a matrix space into which an ingot 8 may be formed. Preferably this mold comprises substantially an inverted trough with the open mouth thereof comprising the bottom of the mold being closed by the upper smooth top surface 2 of the stool 1. One end of the mold body is provided with a suitable opening through which a fire clay or the like, runner 9 may extend. This runner preferably is provided with two inlet openings 10 and 11 through which molten steel may enter into the matrix space when steel is poured into the fountain 12. Preferably the opening in the mold through which the runner extends is projected downwardly and forms a groove in the end of the matrix, which groove is larger than the runner itself, thereby providing gas outlets 14 and 15 around the runner. These outlets extend through the top wall of the mold and communicate with passageways 16 provided beneath the fountain 12 so that the workmen may watch the flames of the escaping gas. When the flames stop the mold is filled. The openings 14 and 15 while sufficiently large to permit free gas escape are not large enough to cause undesirable fins to form on the end of the ingot. The end of the matrix portion of the mold opposite to the runner is preferably curved or inclined as at 17. The curve or inclination of this end is slightly greater than a curved

or arced surface which would be formed by lifting the mold by the end having the inclined surface and utilizing the runner end as a fulcrum or pivot. This rounded or inclined surface on the matrix therefore is such that when the mold is so lifted the end of the mold wall immediately clears the end of the ingot which drops from the mold. As is indicated in slightly exaggerated form in Figure 3, the side walls of the matrix portion of the mold are also inclined as at 18 and 19 to provide clearance during the stripping operation. The ends of the mold carry suitable staples for permitting engagement of the crane hooks and preferably two staples are arranged at one end of the mold and one staple at the other end. As a matter of convenience the two staples 20 may be arranged at the lower end of the mold and one staple 21 at the upper end thereof. These staples permit the crane to engage the mold at three points, thereby forming a three point suspension by means of which the mold may be definitely, accurately, and positively handled.

In carrying out the present invention the mold preferably is set on the stool or floor plate as indicated in Figure 1 with one end of the mold against the foot rail 6. The molds may be set parallel side by side with the fountains thereof in a row at one end of the floor plate. As the ladle is carried from one mold to the other the molds are filled and the molten steel therein chills on all sides equally and in a short time the molds may be removed. This is accomplished by inserting crane hooks in the staples 20 and lifting the lower end of the mold with the upper end thereof as a pivot in such manner that the mold acts as a pry to break off the runner column so that the ingot may be entirely freed when the mold is lifted away from the ingot. The double staple end may then be lowered slowly and the crane may then uniformly lift the mold entirely free of the ingot and re-set the mold in a new position on either the same or another floor plate, at which time the new fire clay runner is inserted and the mold is ready for another operation. It will be noted that the inlet for the steel and the outlet for the gases is at the same end of the mold so that the gases continue to escape through the hot fresh metal up to the instant when the mold is completely filled with molten steel and until the gas outlet is chilled.

The present invention provides a simple economical and efficient way for casting chill horizontal ingots without departing from established foundry practice and equipment, other than the mere change in mold type.

I claim—

1. As an article of manufacture an inverted mold for casting horizontal steel ingots, said mold comprising a body portion having a matrix therein of substantially the configuration of the ingot to be cast, with the edges of said mold extending along the long side thereof and being substantially co-planer to permit said mold to be set on a suitable stool, said mold being provided with a runner opening leading to the matrix and with the opening extending through the top wall of the body of the mold.

2. As an article of manufacture an inverted mold for casting horizontal steel ingots, said mold comprising a body portion having a mold matrix therein of substantially the configuration of the ignot to be cast, with the edges of said mold extending along the long side thereof and being substantially co-planer to permit said mold to be set on a suitable stool, said mold being provided with a runner opening leading to the matrix and with the opening extending through the top wall of the body of the mold said runner opening leading to a groove in the end of the matrix adapted to receive a suitable runner.

3. As an article of manufacture an inverted mold for casting horizontal steel ingots, said mold comprising a body portion having a mold matrix therein of substantially the configuration of the ingot to be cast, with the edges of said mold extending along the long side thereof and being substantially co-planer to permit said mold to be set on a suitable stool, said mold being provided with a runner opening leading to the matrix and with the opening extending through the top wall of the body of the mold, and an inclined stool upon which said mold is adapted to set.

4. A mold for casting horizontal ingots comprising a body portion forming an inverted trough a runner opening extending from the top of said inverted trough into the interior matrix opening, a channel in the end of the matrix and beneath the said opening, and, a runner extending through the said opening and setting in said channel and being smaller in size than the cross-section of said opening whereby mold gases may escape around the runner.

5. A mold for casting horizontal ingots comprising a body portion forming an inverted trough, a runner opening extending from the top of said inverted trough into the interior matrix opening, a runner extending through the said opening and being smaller in size than the cross-section of said opening whereby mold gases may escape around the runner.

6. An article of manufacture comprising a chill mold for casting horizontal steel ingots, said mold having a body portion forming an inverted trough, the matrix opening in said trough tapering toward the

mouth thereof at the sides and ends in order to permit said mold to strip from a suitable ingot and with the edges of said mold substantially co-planer to permit same to set on a suitable stool, and means to introduce molten steel into said trough, said means comprising a runner extending through the high portion of the matrix and with gas escape openings around the runner.

7. An article of manufacture comprising a chill mold for casting horizontal steel ingots, said mold having a body portion forming an inverted trough, staples in each end of said trough to enable same to be lifted, the matrix opening in said trough tapering toward the mouth thereof at the sides and ends in order to permit said mold to strip from a suitable ingot and with the edges of said mold substantially co-planer to permit same to set on a suitable stool, and means to introduce molten steel into said trough, said means comprising a runner extending through the high portion of the matrix and with gas escape openings around the runner, and an inclined stool on which said mold sets.

8. A device of the character described comprising a mold body for casting horizontal ingots with a runner opening provided at one end of the mold body, a runner in said opening and of a cross-section less than the opening to provide a gas escape around the runner, and with the matrix of the opposite end of the mold body being inclined in such manner that when the inclined end of the mold body is lifted with the runner end acting as a pivot the inclined end will clear the end of the ingot which is being stripped from the mold.

9. A device of the character described comprising a mold body for casting horizontal ingots with a runner opening provided at one end of the mold body, a vertical channel beneath the opening, and with the matrix of the opposite end of the mold body being inclined in such manner that when the inclined end of the mold body is lifted with the runner end acting as a pivot the inclined end will clear the end of the ingot which is being stripped from the mold.

10. A device of the character described comprising a mold body for casting horizontal ingots with a runner opening provided at one end of the mold body, a vertical channel beneath the opening, a runner extending through the opening and setting in the channel, and with the matrix of the opposite end of the mold body being inclined in such manner that when the inclined end of the mold body is lifted with the runner end acting as a pivot the inclined end will clear the end of the ingot which is being stripped from the mold and cause the runner to break from the channel.

11. An an article of manufacture, a mold body comprising a member having a matrix portion of the configuration of the steel ingot to be cast, with a runner at one end of the matrix portion, and extending through an opening in the top wall of the mold, the opposite end of the matrix portion being inclined in such manner that when the inclined end of the mold body is raised with the runner end acting as a pivot the inclined end clears the ingot which has been cast in the mold, and lifting means provided adjacent the inclined end.

12. As an article of manufacture, a base plate or stool for ingot molds comprising a plate body portion, means along one edge of said plate to incline the same in such manner that the upper surface of said stool is slightly inclined to the horizontal, and a supporting ledge along the opposite edge of said stool to prevent horizontal ingot molds from sliding upon the upper surface of the stool.

13. An article of manufacture comprising a stool for horizontal molds, said stool having a plate-like body portion with a smooth upper surface, supports beneath said body portion to cause the upper surface thereof to be inclined when said supports are set on substantially horizontal surfaces, and means to prevent horizontal ingot molds from sliding down said inclined surface.

14. As an article of manufacture, a suitable stool for horizontal ingot molds, said stool comprising a body portion, an inclined upper surface, and means to retain said ingot molds upon said surface.

15. The method of stripping horizontal steel ingots from horizontal molds wherein said molds are provided with runners adjacent one end thereof, which method comprises lifting the end of the mold opposite the runner end in such manner as to break the runner column from the ingot, and then lifting said mold clear of the ingot.

16. As an article of manufacture, a mold body comprising a member having a matrix portion of the configuration of the steel ingot to be cast, a runner tile at one end of the matrix portion, and extending substantially to the bottom of the matrix, and gas outlets formed between the exterior surface of the runner tile and the mold body.

17. An inverted mold for casting horizontal ingots comprising a body portion formed with an inverted trough shaped matrix, a stool having an inclined upper surface upon which said body portion is adapted to set, said body portion having an opening adjacent one end through which a runner tile is adapted to set, a runner tile extending through said opening at such an angle to the upper surface of the mold that a side wall of the opening will bear against and break the gate from an ingot cast in the

mold when the mold body is tilted endwise by lifting the end of the mold opposite the runner.

18. In a horizontal inverted ingot mold adapted to set on a suitable stool, a body portion comprising an inverted trough a runner at the head end of said body portion, and extending through an opening in said body portion, the foot end of the matrix opposite to the runner being inclined to provide clearance for an ingot cast within said mold when the foot end of the mold is lifted with the end of the mold acting as a pivot.

19. An inverted mold for casting horizontal ingots comprising in combination, a body portion having side walls, and an integral top forming an inverted trough shaped matrix, said top being provided with a relatively small opening for introducing molten metal into said matrix from above.

20. An inverted mold for casting horizontal ingots comprising in combination a body portion having side walls and an integral top forming an inverted trough shaped matrix, said top being provided at one end with a relatively small opening for introducing molten metal into said matrix from above, a stool forming the bottom of said matrix and from which said body portion is separable, and means to prevent metal poured through said opening from falling directly upon said stool.

21. The method of casting a horizontal ingot in an inverted mold, which method comprises introducing molten steel through an opening in the roof of and adjacent one end of the matrix, and continuing introducing the metal until the level of the metal at the termination of the pouring operation is above the highest portion of the roof of the matrix.

22. The method of casting a horizontal ingot in and removing the ingot from an inverted mold, which method comprises introducing molten metal through a runner opening in the roof of and adjacent one end of the matrix, said runner opening being set in the highest part of the roof of said matrix, continuing the introduction of metal until the level of the molten metal in the runner opening is above that portion of the roof of the matrix adjacent said opening, and after the metal has congealed lifting the end of the mold opposite the runner opening in such manner as to break the runner column from the ingot.

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