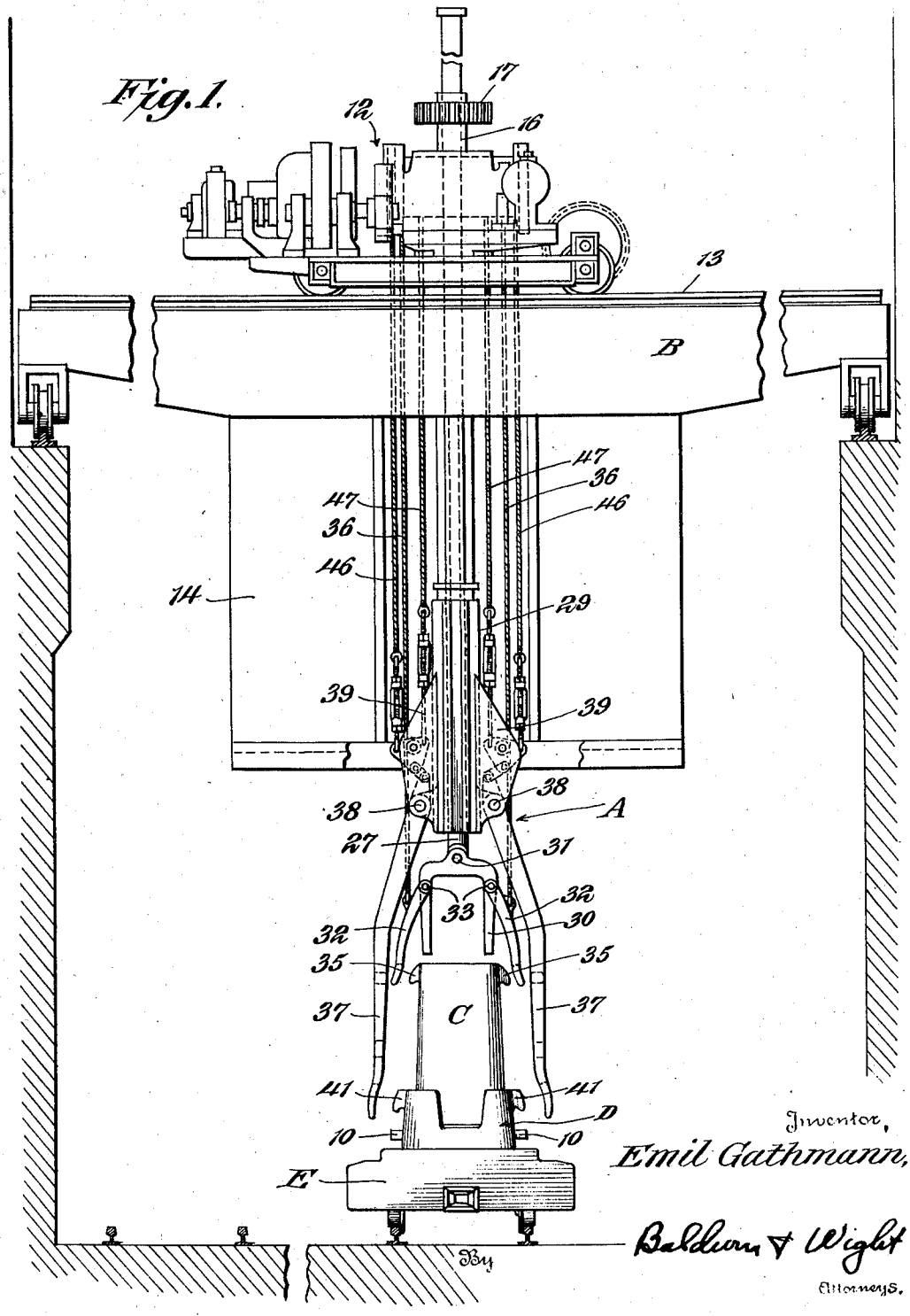
May 17, 1938. E. GATHMANN 2,117,311

APPARATUS FOR STRIPPING INGOTS FROM MOLDS

Filed May 13, 1935 4 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR STRIPPING INGOTS FROM MOLDS

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Fig. 2.

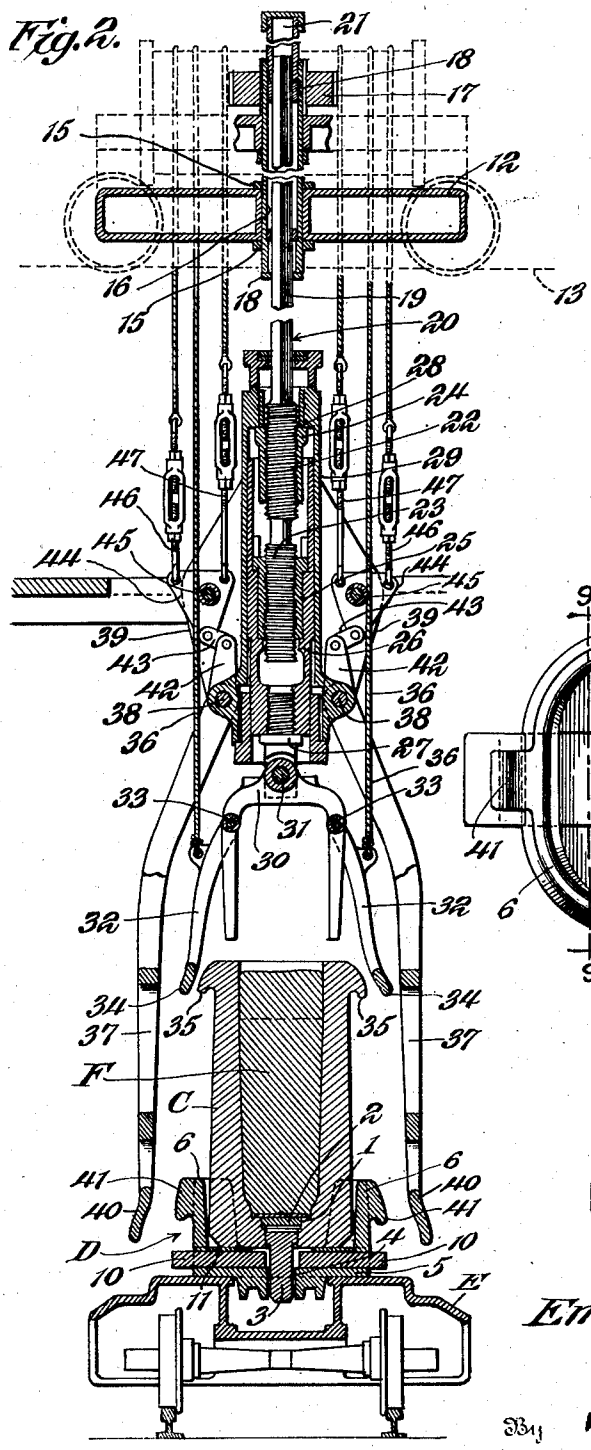


Fig. 6.

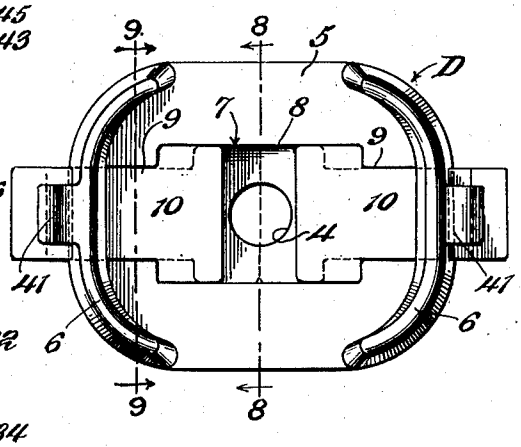
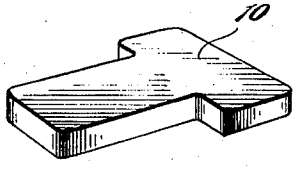


Fig. 7.



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APPARATUS FOR STRIPPING INGOTS FROM MOLDS

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Fig. 4.

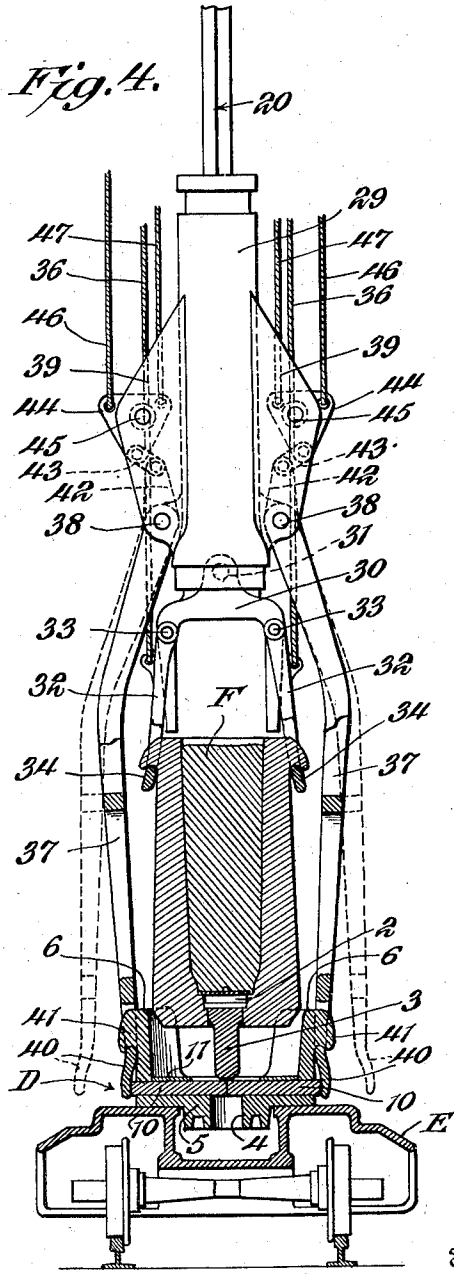
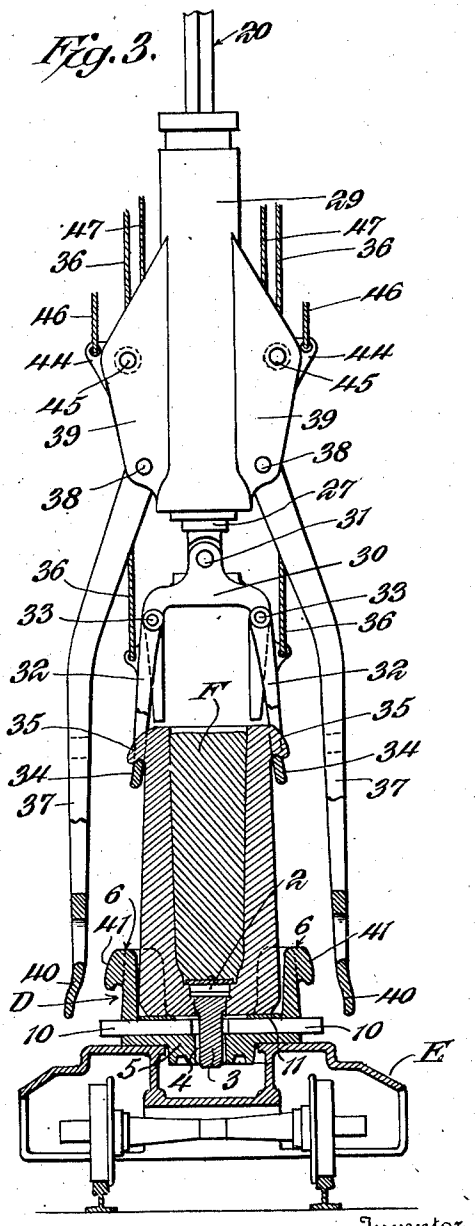


Fig. 3.



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APPARATUS FOR STRIPPING INGOTS FROM MOLDS

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Fig. 5.

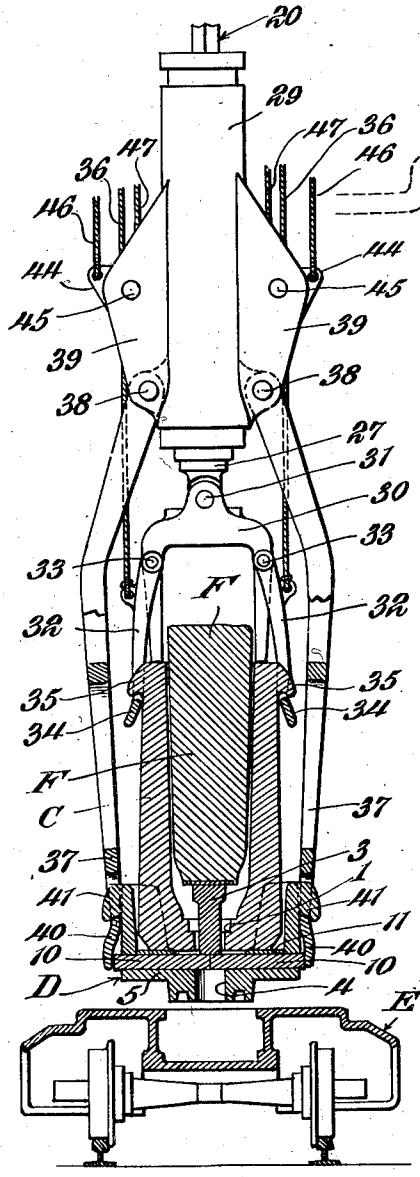


Fig. 8.

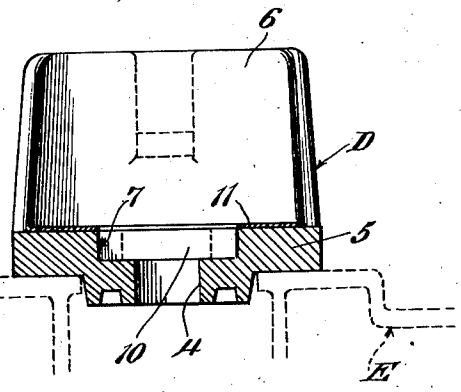
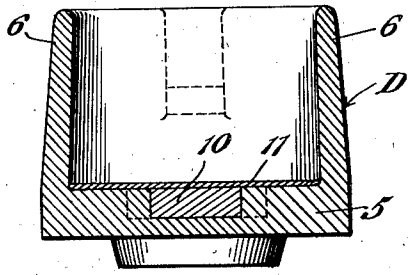


Fig. 9.



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Patented May 17, 1938

2,117,311

UNITED STATES PATENT OFFICE

2,117,311

APPARATUS FOR STRIPPING INGOTS FROM MOLDS

Emil Gathmann, Baltimore, Md., assignor to Gathmann Research Incorporated, Catonsville, Md., a corporation of Maryland

Application May 13, 1935, Serial No. 21,246

11 Claims. (Cl. 22—95)

This invention relates to methods of and apparatus for stripping ingots from molds and more particularly to methods of and apparatus for stripping ingots from big-end-up ingot molds, such, for example, as molds of the type now well known in the art as the Gathmann mold.

Heretofore several different kinds of stripping apparatus have been proposed and are fully disclosed in prior United States patents. For example, apparatus for stripping ingots from big-end-up molds of the Gathmann type are disclosed in my prior Patents 1,059,667 and 1,059,668, both of April 22, 1913; 1,890,777, of December 13, 1932; 1,897,696, of February 14, 1933; and 1,931,187, of October 17, 1933. Apparatus for stripping ingots from big-end-down molds are shown in numerous United States patents; for example, the patents to Morgan et al. 656,416, of August 21, 1900; Taylor 788,339, of April 25, 1905; and Taylor 806,208, of December 5, 1905. These latter patents disclose the type of stripper at present in use in several large steel plants and known in the steel industry as the Morgan stripper.

Up to and including the present time more ingots have been produced in big-end-down molds than in big-end-up molds, but since better ingots can be produced in big-end-up molds the use of such molds is increasing rapidly. In order to provide for the economical stripping of big-end-up ingots with a minimum of investment in new plant equipment, it has been proposed to modify and adapt the present Morgan strippers for stripping big-end-up molds. An adaptation of this type, suitable for use only in stripping big-end-up ingots cast with a sink head or hot top, is disclosed in the C. L. Bigler et al. Patent 1,807,275, of May 26, 1931, issued to the Morgan Engineering Company, of Alliance, Ohio, as assignee.

One object of the present invention is to provide an improved stripping apparatus adapted for stripping ingots from big-end-up molds regardless of whether the ingots be cast with or without shrink head or hot top portions.

Another object is to provide a stripping apparatus comprising a novel adaptation and supplementing of the strippers now in use and known as the Morgan stripper whereby the existing stripping mechanism, as adapted and supplemented by my invention, may be used for stripping ingots from big-end-up molds.

A further object is to provide a stripping apparatus of the kind referred to above in which the timing of certain of the parts is such as to assure safe operation.

Another object is to provide a mold stool and associated stripper-operating means embodying improvements over the stool and stripper-operating means disclosed in the patent to McLaurin 1,963,307, of June 19, 1934.

A still further object is to provide an improved method for stripping ingots from big-end-up molds.

Other objects will become apparent from a reading of the following description, the appended claims, and the accompanying drawings, in which:

Figure 1 is a view in side elevation of stripping apparatus constructed and arranged in accordance with the present invention and showing a mold in position ready for the contained ingot to be stripped therefrom;

Figure 2 is a central vertical sectional view of stripping apparatus and a mold and ingot in stripping position, all on an enlarged scale;

Figure 3 is a view similar to Figure 2 but showing only portions of the stripping apparatus in elevation, certain of the parts being shown in positions different from those occupied in Figures 1 and 2;

Figure 4 is a view similar to Figure 3 but with certain parts shown in still different positions;

Figure 5 is a view similar to Figures 3 and 4, the parts being shown in still different positions;

Figure 6 is a top plan view of a mold stool assembly constructed in accordance with the invention and drawn on an enlarged scale;

Figure 7 is a detailed perspective view of an ingot stripping abutment drawn on an enlarged scale;

Figure 8 is a section on the line 8—8 of Figure 6; and

Figure 9 is a section on the line 9—9 of Figure 6.

The accompanying drawings illustrate a practical and the now preferred form of apparatus embodying the invention as comprising overhead stripping apparatus generally designated A carried by a mobile bridge B; a big-end-up mold C; and a stool D carried by a car E and provided with stripping mechanism to be described hereinafter. An ingot F cast without a shrink head or hot top portion is shown in the mold C, although it will be understood that the apparatus may be employed for stripping ingots from molds provided with shrink head portions.

The mold C is provided with a bottom opening 1 closed by means of a closure device 2 terminating above the bottom of the opening 1. A stripping rod 3 is mounted with its head in the lower portion of the mold bottom opening 1

and extends down through an opening 4 in the stool D. During the stripping operation the rod 3 is moved relatively upward through the mold bottom opening in a manner to be described later, engaging the closure device 2 and forcing the ingot F relatively upwards through the mold.

An important feature of the present invention resides in the method of and apparatus for producing such relative movement, and in the apparatus shown the stool includes a base 5 and sides or guides 6 which serve to assist in lowering the mold directly on the stool with the mold bottom opening 1 in registration with the stool opening 4. The stool base is formed with a depression or recess generally designated 7 and comprising a large rectangular central portion 8 and smaller end portions 9 which extend respectively from the opposite ends of the central portion 8 underneath the side guides 6. A pair of T-shaped stripping instrumentalities or stripper rod abutments 10 is mounted for sliding movements in the stool recess 7 as shown most clearly in Figure 6, the several vertical walls of the recess 8 providing guides for constraining the movement of the abutments 10 to defined paths.

When the mold is set up preparatory to pouring, the abutments 10 are moved to their outer or full line positions as shown in Figure 6, whereby their heads will be disposed on opposite sides of the stool opening 4. The mold is then placed on the stool with the bottom opening 1 in registration with the stool opening 4, and the stripper rod 3 placed in the position shown in Figure 2, wherein the rod extends between the abutments 10 and down through the stool opening 4. In operation, after the ingot has solidified sufficiently to permit its being stripped, the mold is raised in a manner later to be described, causing the stripping rod 3 to be lifted to a position above the plane of the tops of the abutments 10, after which the abutments are moved in under the stripping rod and the mold then forced downwardly while the stool is held stationary. During such downward movement of the mold, the stripper rod will engage the abutments, which will block its further travel, so that continued downward movement of the mold will effect relative upward movement of the stripping rod and ingot.

It is possible that, due to carelessness of workmen, the closure device 2 may be seated imperfectly while the mold is being set up preparatory to teeming, and this may result in some leakage of molten metal. In order to prevent any metal which leaks past the closure device from running down between the abutments 10 and the associated guiding walls of the stool recess 7, I prefer to provide cover plates 11 secured on top of the stool base and extending across and covering the recess 8 and abutments 10, with the exception of the extreme central portion of the stool, i. e., the portion directly above the stool opening 4. By employing these cover plates, any molten metal leaking through the mold bottom opening will be prevented from running into small clearances between the abutments 10 and the associated guiding walls of the stool recess, it being possible for molten metal to leak only into the relatively large open space at the central portion 8 of the recess 7 between the opposed adjacent faces of the abutments 10. It is obvious that any metal leaking into this open space can easily be removed therefrom after it solidifies.

The mechanism for raising and lowering the mold and ingot to effect the stripping operation in the manner generally described above will now be described.

The overhead stripping apparatus A includes a trolley or carriage 12 mounted on rails 13 for travelling across the bridge B. An operator's cage 14 provided with suitable controls for motors and winding drums or other similar mechanism mounted on the carriage depends from the carriage and is so positioned as to enable an operator in the cage readily to observe the positions and movements of the mold, ingot, and associated parts during the stripping operation. The carriage 12 is provided with bearings 15 which mount a rotatable sleeve 16 to which is secured a worm wheel or other power-transmitting element 17, the arrangement being such that the sleeve is rotatable with respect to the carriage but is held against vertical movement relative to the latter. Secured inside of the sleeve 16 are bushings 18 which are rotatable with the sleeve and which are provided with square central openings receiving for sliding movements the square upper portion 19 of a staff generally designated 20, the arrangement being such that rotation of the worm wheel 17 will effect simultaneous rotation of the sleeve 16 and the staff 20, while at the same time the staff 20 may be moved vertically with respect to the sleeve and worm wheel by means later to be described. A tube 21 is connected to the top of the sleeve 16 and closed at its top in order to prevent dust from entering in between the sleeve 16 and staff 20.

The lower end of the staff is formed or provided with mutually reversed threads 22 and 23 engaging respectively with travelling sleeves or nuts 24 and 25. The lower nut 25 is secured within a sleeve 26, which, at its lower end, has threaded connection with a stem 27 the purpose of which will be referred to later. The upper nut 24 engages under a shoulder 28 on an outer sleeve 29 which surrounds and is slidable with respect to the sleeve 26 previously referred to. In operation, rotation of the staff 20 will, by virtue of the reverse direction of the threads 22 and 23, cause the nuts 24 and 25 and consequently the respectively connected sleeves 29 and 26 to move in opposite directions. The parts of the overhead stripping apparatus A thus far described are substantially the same as those employed in the well known Morgan stripper as shown for example in the patents previously referred to, and per se do not constitute the present invention.

As previously stated, one feature of the present invention resides in its adaptability to the Morgan stripper already employed in some steel plants. In order to modify and augment and thus adapt the Morgan stripper for the stripping of big-end-up ingots cast either with or without shrink head portions, I preferably provide a mold pushing yoke 30 pivotally connected to the stem 27 as at 31, the spaced legs of the yoke being adapted to engage the top of the mold C on opposite sides of the latter so as to push the mold positively downwards. For use in plants where the molds to be stripped differ in size, the yoke may comprise means for adjusting the legs laterally with respect to each other, for example, as shown in my prior Patent 1,931,187 of October 17, 1933. For lifting the mold, I have provided a pair of bails 32 pivotally connected to the yoke as at 33 and having gripping portions 34 adapted to engage under lugs 35 on the mold. It is desirable to maintain the bails 32 in the outer position shown in Figures 1 and 2, i. e., clear of the mold, in order to enable the latter to be moved directly

under the yoke 30, or, conversely, if desired, to move the yoke over the mold. For moving the bails to the desired positions, I provide suitable drums or winding mechanism on the carriage 12 as indicated in dotted lines in Figure 2, and control mechanism located in the operator's cage by means of which cables 36 connected to the bails may be raised or lowered so as to position the bails in their outer position or allow them to drop by gravity to mold-engaging position as indicated in Figure 3. It will be understood that, after the mold has been positioned directly under the yoke 30 as shown in Figure 2, the staff 20 will be rotated to lower the yoke 30, after which the cables 36 are slackened in order to permit the bails to move inwardly by gravity, bringing the gripping portions 34 of the bail into mold-engaging position underneath the lugs 35 on the mold. The parts then are ready to effect lifting of the mold and ingot to the position shown in Figure 4.

As previously stated, after the mold has been raised, the abutments 10 are moved in under the stripper rod and the mold pushed down, bringing the lower end of the stripping rod into engagement with the abutments. In order to provide an inflexible driving connection and also to prevent any of the stripping pressure from being exerted on the car E, I provide means connected to the sleeve 29 and adapted to engage and hold the stool against downward movement. An important feature of the invention resides in the provision of stool-holding means so constructed, arranged, and timed with respect to movements of the other parts of the apparatus as to move the stripping abutments 10 into their inner or blocking positions substantially simultaneously with movement of the stool-holding means into stool-holding position. By virtue of this arrangement, it is not possible to exert stripping pressure until after the stool-holding means has been moved to stool-holding position. In the embodiment shown, the stool-holding means comprises a pair of bifurcated arms 37 pivoted as at 38 to wings 39 integral with the sleeve support 29, the lower ends of the arms 37 being formed with gripping or stool-holding portions 40 adapted to engage the lower faces of lugs 41 on the stool. Because of the pivoted connection of the arms at 38, the arms are adapted to be swung to an outer position as shown in Figures 1 and 2, or to an inner stool-holding position as shown in Figures 3, 4, and 5. For effecting such swinging movements to these two positions, the arms 37 are provided with upper extensions 42 pivotally connected to links 43 which in turn are pivotally connected to bell cranks 44 mounted on pintles 45 carried by the wings 39 on the sleeve 29. Cables 46 are connected to the bell cranks 44 outside of the pintles 45, and cables 47 are connected to the bell cranks inside of the pintles 45. In order to swing the arms 37 outwardly to the positions shown in Figures 1 and 2, the inner cables 47 are drawn up by means of the drums on the carriage 12, and the outer cables let down from the drums. Conversely, when it is desired to swing the arms inwardly, the outer cables 46 are drawn up and the inner cables 47 let down. All these operations of course are under the control of the operator located in the cage 14.

The stool-holding portions 40 of the arms 37 are made sufficiently large or are extended downwardly so as to be adapted to engage the outer projecting ends of the abutments 10 when the arms 37 are moved inwardly. In operation, assuming the parts to be in the positions shown in Figure 3, the staff 20 is rotated in a direction to cause the nut 25, the sleeve 26, the yoke 30, and the bails 32 to be raised, thereby moving the mold to the position shown in Figure 4. Simultaneously with such movement of the mold, the nut 24, sleeve 29, and arms 37 will move downwardly, bringing the arms to the positions shown in dotted lines in Figure 4. Thereafter the cables 46 and 47 will be manipulated to move the arms 37 inwardly to bring the gripping or stool-holding portions 40 under the stool lugs 41. While moving to this position, the stool-holding portions 40 will engage the abutments 10 and move them to the positions shown in Figure 4, wherein their inner ends will lie under the stripping rod 3.

After the parts have been moved to the positions shown in full lines in Figure 4, the staff 20 will be rotated in reverse direction, causing the nut 24 to move upwardly and the nut 25 to move downwardly, and in consequence the yoke 30 will be moved positively downwards and the arms 37 will be moved upwardly. Thus there are effected relative upward movement of the stool, the abutments 10, the stripping rod 3, and the ingot F, and relative downward movement of the mold C, whereby the ingot will be stripped and moved to the position shown in Figure 5. Thereafter the staff 20 will again be reversed and rotated until the stool and mold are deposited upon the car E, after which the bails 32 and the arms 37 are moved to their outer inoperative positions as shown in Figure 2. The car and supported mold and ingot may then be moved to a position near the soaking pit and the ingot withdrawn from the mold by tongs or the like.

It is apparent that by my invention strippers of the Morgan type now in use for stripping big-end-down ingots can easily and with little expense be converted and adapted for stripping ingots from big-end-up molds regardless of whether the ingots be cast with or without shrink head portions. The timing operation of the stripping and stool-holding means is such as to assure holding of the stool before stripping pressure can be exerted, whereby there will be no danger of applying stripping force to the mold car. Although the apparatus and method disclosed by way of example embody the invention in a practical and the at present preferred manner, changes may be made without departing from the invention as defined in the claims.

I claim:

1. Apparatus for partially stripping an ingot from a big-end-up mold having a bottom opening and supported on a stool comprising means for positively moving the mold in two mutually opposite directions; a stripper rod mounted in said bottom opening; a stripper rod abutment mounted on said stool for movements into and out of cooperative position relative to said stripper rod; and means including a stool-engaging and holding member and a support for mounting said stool-engaging member in cooperative position relative to said mold moving means and for movement into stool-engaging and holding position and out of stool-engaging and holding position, said stool-engaging and holding means being adapted, when moved to stool-engaging and holding position, to engage said abutment and move it into said cooperative position.

2. In apparatus for partially stripping ingots from molds, the combination of a mold stool; means for positively moving the mold in two mutually opposed directions; movable means for holding the stool; means mounting said movable

stool-holding means adjacent to the stool; and stripping means including an abutment mounted on said stool for sliding movements substantially perpendicular to the direction of stripping from inoperative position to operative stripping position in response to movement of said holding means.

3. Apparatus for partially stripping an ingot from a big-end-up mold having a bottom opening and supported on a stool, said apparatus comprising a stripper rod mounted in said bottom opening; a pair of stripper rod abutments movably mounted on said stool and normally positioned on opposite sides of said stripper rod; means for lifting and lowering the mold; and stool-holding means comprising a pair of lifting arms mounted for movements to stool-engaging position and adapted when so moved simultaneously to engage said abutments and move the latter under said stripper rod, and a support for mounting said lifting arms in cooperative positions relative to the mold lifting and lowering means.

4. In apparatus for partially stripping ingots from ingot molds, a mold stool assembly comprising a stool proper formed with a horizontal guideway T-shaped in plan; and an abutment also T-shaped in plan and slidable in said guideway, said abutment having an extension projecting outwardly through and beyond an outer face of said stool.

5. In apparatus for partially stripping ingots from ingot molds, a mold stool assembly comprising a stool proper having a base and a side and formed with a horizontal guideway extending in said base and through said side; an abutment slidably mounted in said guideway; and a cover for a portion of said guideway and abutment adjacent to said stool side.

6. In apparatus for partially stripping ingots from ingot molds, a mold stool assembly comprising a stool proper having a base and oppositely disposed sides, and being formed with horizontal guideways extending in said base and through said sides; a pair of abutments mounted in the respective guideways for sliding movements towards and from the center of the stool; and covering means carried by said stool and disposed above portions of said guideways and abutments adjacent to said stool sides.

7. In apparatus for partially stripping ingots from ingot molds, a mold lifting and lowering mechanism including a yoke adapted to push the mold downwardly; a pair of mold-lifting bails pivotally connected to the yoke; means for raising and lowering said yoke together with said bails; and means for swinging said bails about their pivots on said yoke.

8. In apparatus for partially stripping ingots from ingot molds, a mold lifting and lowering mechanism including a yoke adapted to push the mold downwardly, a pair of mold-lifting bails pivotally suspended from the yoke, means for raising and lowering said yoke together with said bails, and means for swinging said bails about their pivots on said yoke; and a stool-holding mechanism supported adjacent to said mold lifting and lowering mechanism and comprising a pair of stool-engaging arms, vertically movable means upon which said arms are mounted for movements into and out of stool-engaging position, means for moving said arms into and out of mold-engaging position, a support upon which the vertically movable means are carried, and means for raising and lowering said vertically movable means.

9. Apparatus for partially stripping an ingot from a big-end-up mold having a bottom opening and supported on a stool comprising a stripper rod mounted in said bottom opening; a stripper rod abutment carried by said stool and normally positioned in inoperative position at one side of said stripper rod; a mold lifting and lowering mechanism including a yoke adapted to push the mold downwardly, a pair of mold-lifting bails pivotally suspended from the yoke, means for raising and lowering said yoke together with said bails, and means for swinging said bails about their pivots on said yoke; and a stool holding mechanism supported adjacent to said mold lifting and lowering mechanism and comprising a pair of stool-engaging arms, vertically movable means upon which said arms are mounted for movements into and out of stool-engaging position, means for moving said arms into and out of mold-engaging position, a support upon which the vertically movable means are carried, and means for raising and lowering said vertically movable means, one of said arms being adapted when moved to stool-holding position to engage said abutment and move it under said stripper rod.

10. In apparatus for partially stripping an ingot from a big-end-up mold supported on a stool, means for pushing the mold downwardly; means supported adjacent to said stool and movable from inoperative position into operative position in engagement with the stool for holding the latter against downward movement; and stripping means including an abutment shiftable from inoperative position to operative stripping position in response to such movement of said stool-holding means for blocking downward movement of the ingot.

11. In apparatus for partially stripping an ingot from a mold, the combination of a mold stool; means for positively moving the mold in two mutually opposed directions; stool-holding means mounted for movements into and out of stool-holding position; and stripping means including an abutment carried by the stool and being movable from inoperative position to operative stripping position with respect to both the mold and stool simultaneously in response to movement of the holding means to stool-holding position.

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