July 9, 1935. D. KENDALL 2,007,275

INGOT STRIPPER

Filed Jan. 9, 1933 5 Sheets-Sheet 1

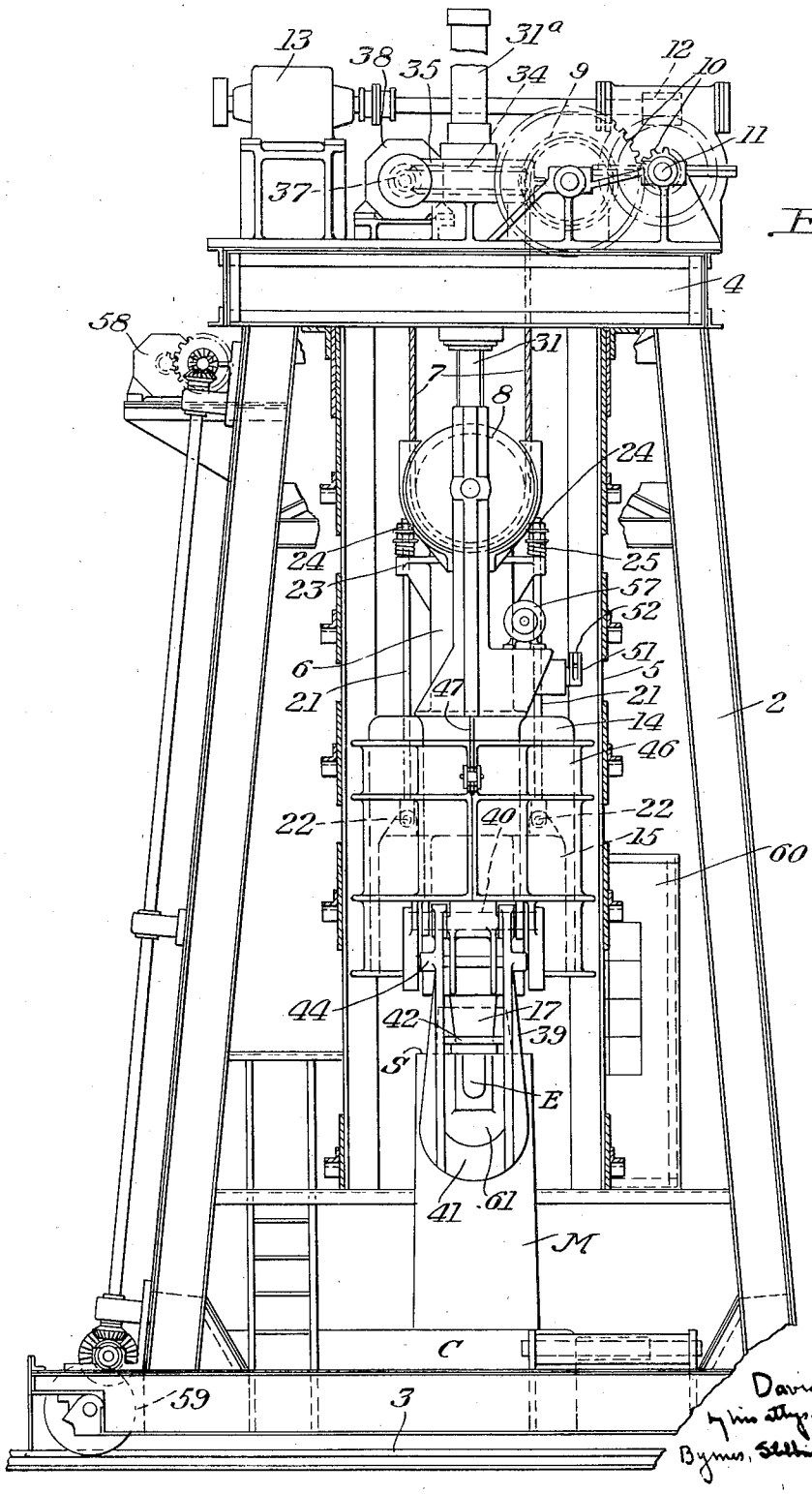

Fig1.

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INGOT STRIPPER

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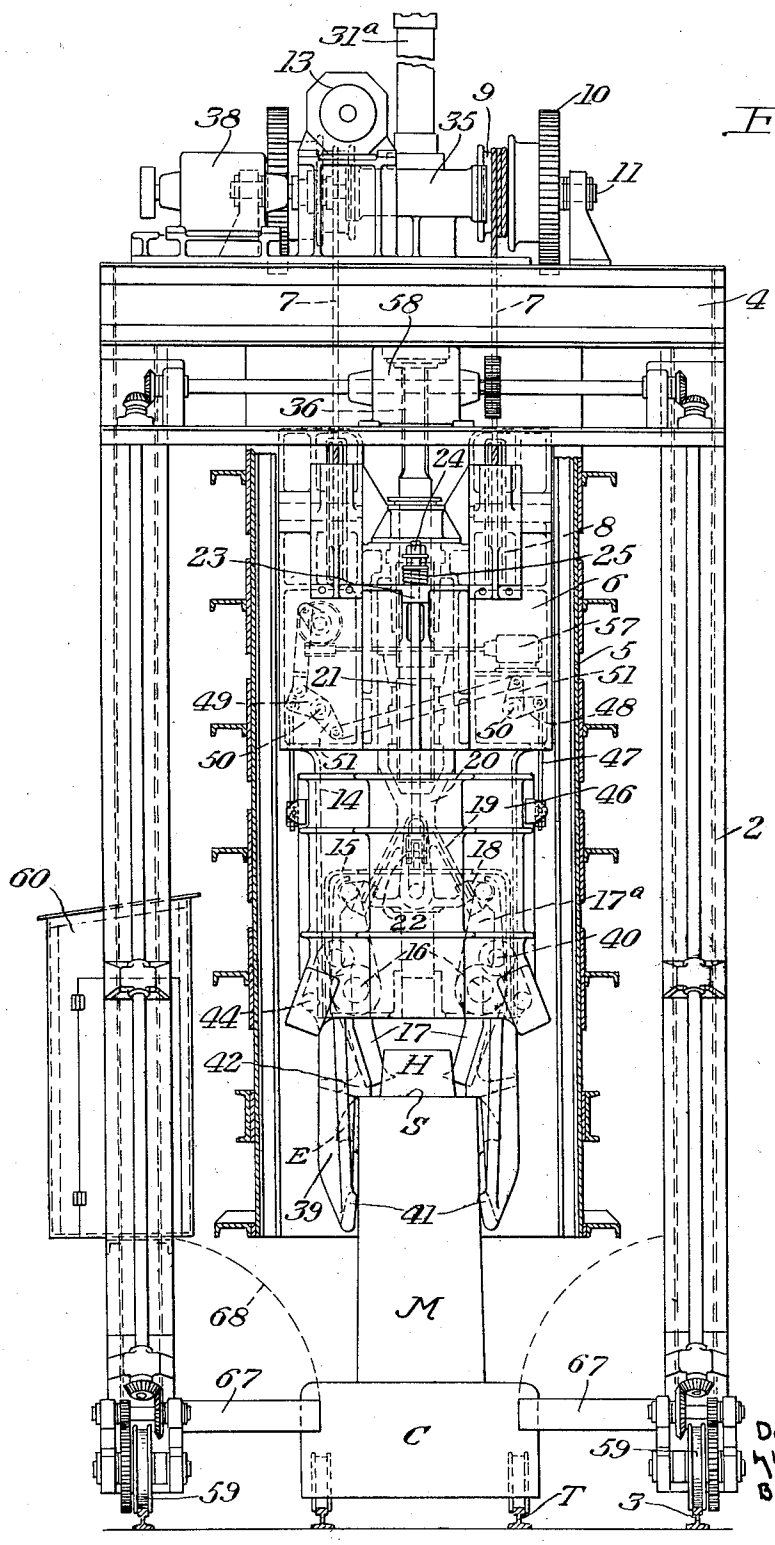
Fig. 2.



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INGOT STRIPPER

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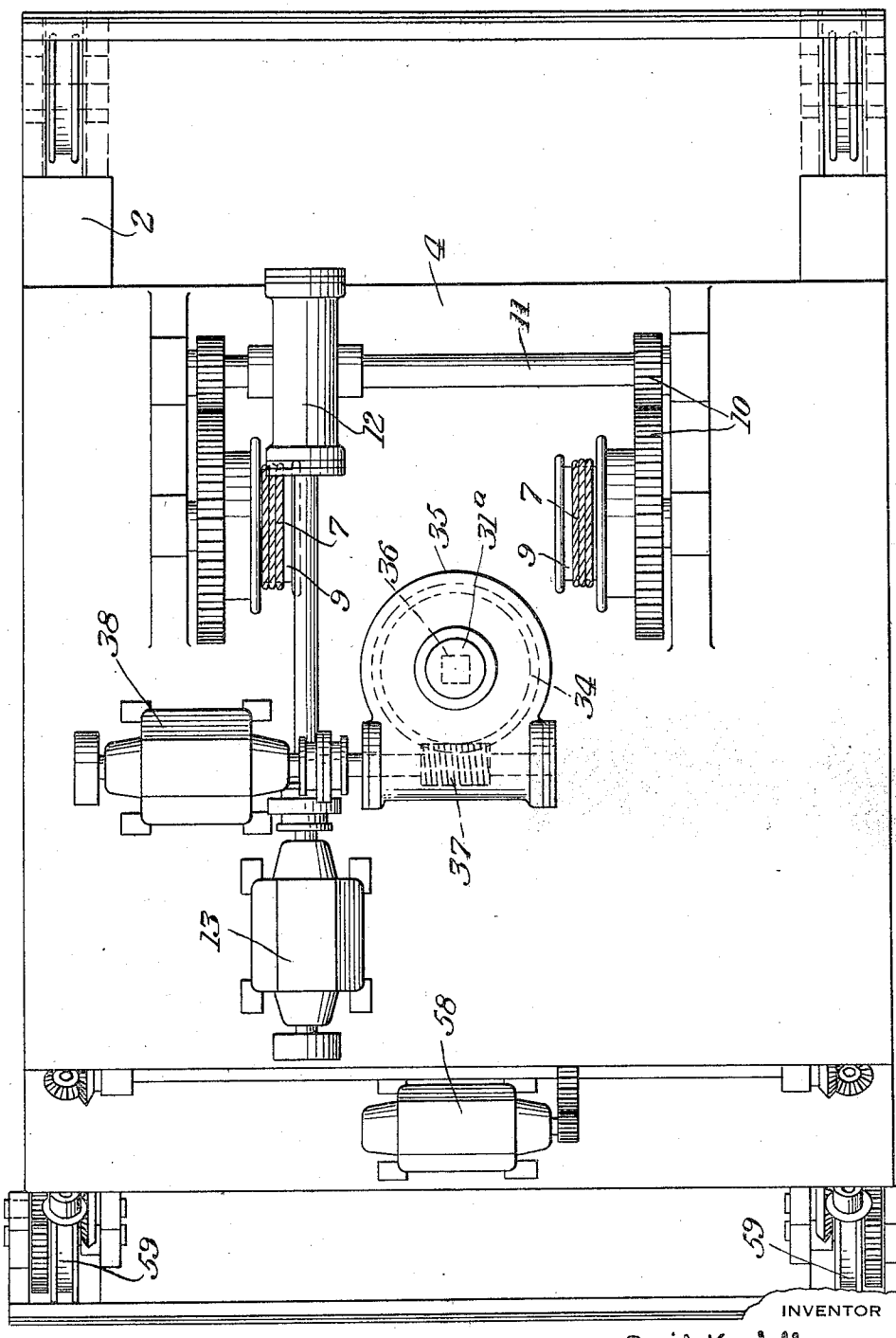

Fig. 3.

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July 9, 1935. D. KENDALL 2,007,275

INGOT STRIPPER

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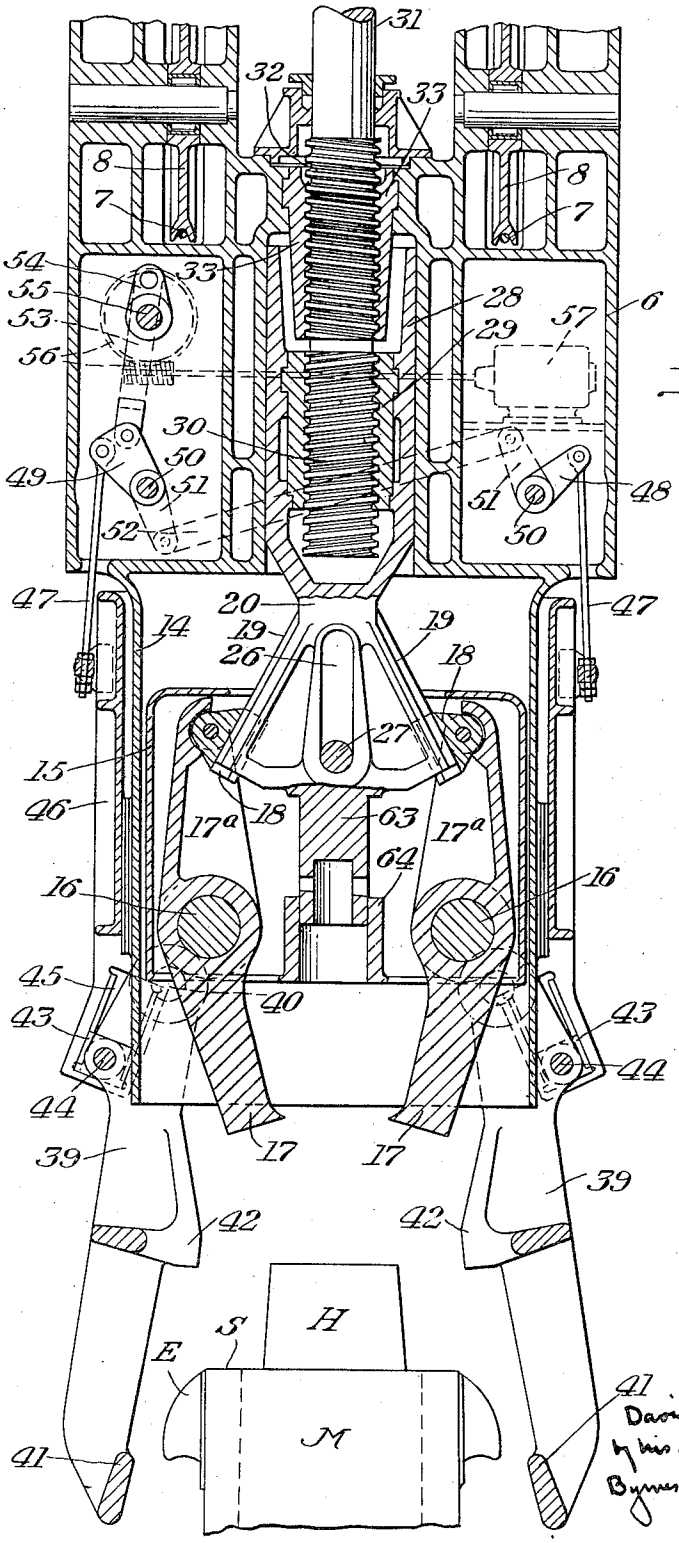

Fig.4.

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INGOT STRIPPER

Filed Jan. 9, 1933 5 Sheets-Sheet 5

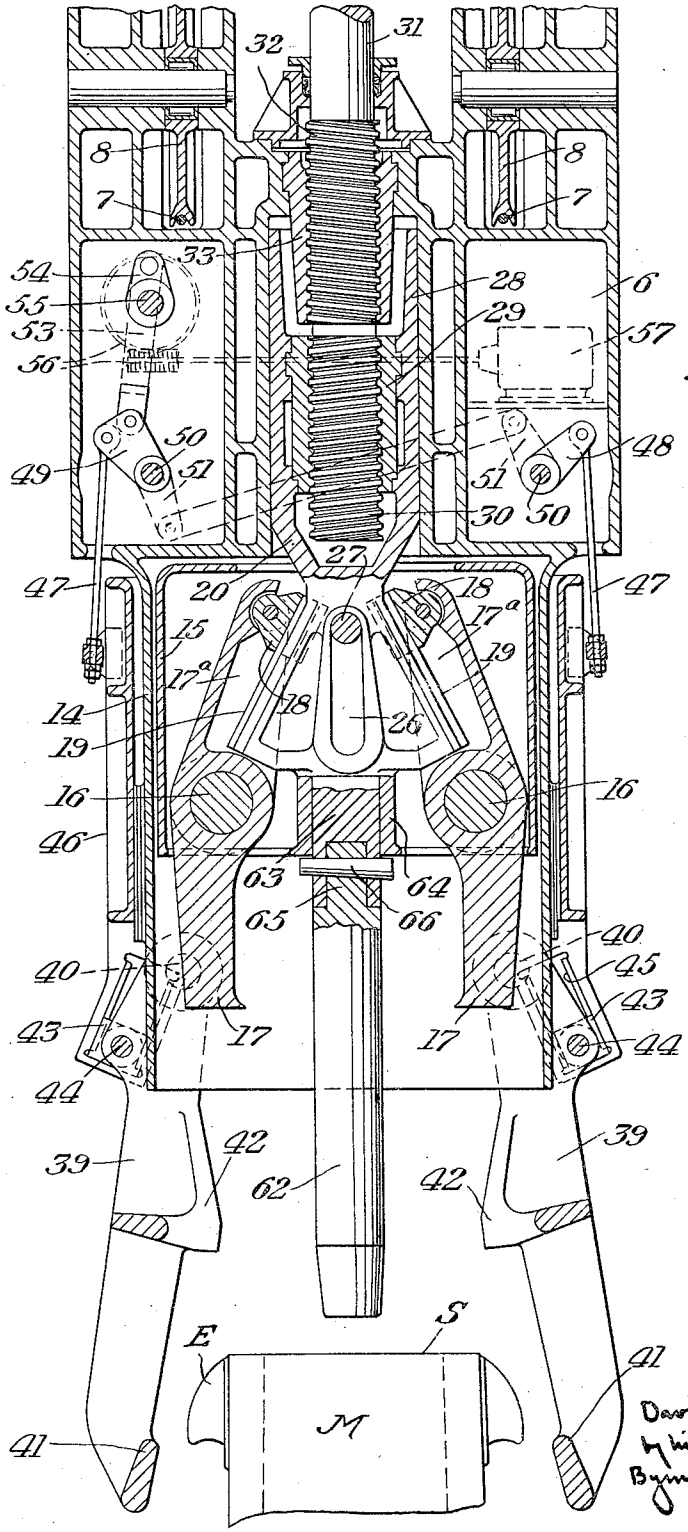

Fig.5.

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Patented July 9, 1935 2,007,275

UNITED STATES PATENT OFFICE

2,007,275

INGOT STRIPPER

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Application January 9, 1933, Serial No. 650,878

14 Claims. (Cl. 22—95)

This invention relates to ingot strippers and provides a machine which may be employed for stripping or releasing ingots from the molds in which they are cast. It is herein particularly described as applied to a machine capable of handling ingots which are cast either "big end up" or "big end down", although the invention in certain aspects has numerous other applications.

The stripping of big end up ingots is accomplished by exerting downward holding pressure on the ingot mold and upward stripping or releasing pressure on the ingot. It is customary in casting big end up ingots to use a hot top which provides a sink head extending above the top plane of the ingot mold, and this upstanding portion of the ingot provides a convenient means of applying gripping tongs for effecting the upward pull. It has been heretofore proposed to use ingot gripping tongs and mold engaging tongs which are carried by an overhead crane structure and are lowered into place to effect stripping. It has been customary to arrange the ingot tongs in a plane at right angles to the mold tongs. This has been deemed desirable from the standpoint of economy in manufacture, but I have found that in operation it is decidedly inferior to the structure herein described. I arrange the ingot tongs so that they operate in the same general plane as the mold tongs, and have found that numerous important advantages arise from such construction. In practice a stripper of this character is moved lengthwise of an ingot car track, the crane being stopped over each ingot while stripping is effected. Because of the relatively greater size of the mold tongs, they have been arranged with their pivot axes extending longitudinally of the track, while, as stated, the gripping tongs have been placed at right angles thereto. This has made it necessary to raise the crane structure for a considerable distance after each ingot has been stripped in order to raise the ingot tongs above the level of the sink head, thereby to allow clearance for the movement of the crane over the ingot just stripped. After the stripping mechanism has thus been elevated it is moved forward over the next ingot and then must be again lowered before stripping is effected. All of this takes considerable time, due to the great mass of the parts involved, and increases the expense of stripping. According to my invention the ingot tongs are rockable about axes generally parallel to the mold tongs and thereby the raising and lowering of the stripping mechanism is entirely avoided.

This construction involves certain difficulties. For example, the mold tongs must be relatively wide in order to give sufficient space for the ingot tong mechanism. I have found, however, that this may be turned to advantage by making the mold tongs in the form of a broad U, thereby allowing a good view of the operation by the cranemen.

By reason of the weight of the mold tongs, it is desirable to actuate them mechanically. This can be readily effected and much more rapidly than it would be possible to raise or lower the stripping mechanism as was required with the old constructions.

The ingot tongs are preferably actuated by a screw mechanism which serves to open and close the tongs and to raise them for the purpose of obtaining stripping power. The screw mechanism is well adapted to fit into the space available and can be well enclosed so that it operates with a minimum of difficulty even under the very severe conditions of service encountered. It is particularly desirable when used with the positively actuated mold tongs. It is also very desirable where the machine is to serve for stripping either big end up or big end down ingots. In the case of the latter it is necessary to use the mold tongs for exerting upward stripping pressure on the ingot mold while a plunger is fitted to a head for engaging the top of the ingot and exerting downward pressure thereon. The mold tongs are designed so as to engage the ears on the ingot mold, and the plunger is made so that it can be removed at will.

The stripping mechanism may be used with any type of crane structure, but it is particularly desirable to use a gantry type of crane. This type of crane may be arranged to straddle the ingot car tracks and does not require elevated crane ways. It can therefore be installed at relatively low expense and may be used either inside the mill building or in the yard, as desired. The gantry type of crane also offers the advantage that it may be used for moving ingot cars, thereby relieving the yard engine of considerable work.

In the accompanying drawings illustrating a present preferred embodiment of my invention,

Figure 1 is a side elevation of a gantry crane carrying the stripping mechanism;

Figure 2 is a front elevation thereof;

Figure 3 is a top plan view to enlarged scale;

Figure 4 is a vertical section through the head of the stripper and illustrating the mold tongs,

the ingot tongs and the operating mechanism therefor; and

Figure 5 is a similar view but showing the use of a plunger for stripping big end down ingots.

Referring first to Figures 1 and 2, I have illustrated an ingot car C on tracks T and carrying ingot molds M containing ingots to be stripped. The stripping mechanism is carried by a gantry indicated generally by the reference character 2 and running on tracks 3. The overhead platform 4 of the gantry carries a downwardly extending hollow framework 5 of structural steel which supports the stripping mechanism. The stripping mechanism is built around a body or carriage 6 which is slidable vertically in the framework 5 and may be raised or lowered to any desired position by cables 7 passing around sheaves 8. At one end the cables 7 are dead-ended on the frame, and at the other end they are secured to drums 9 which are connected through gearing 10 (see Figure 3) to an intermediate shaft 11, which shaft, in turn, is driven through worm gearing 12 by a hoist motor 13.

As best shown in Figure 4, the body or carriage 6 has a hollow extension 14 at the bottom, which extension houses an ingot tong body 15 carrying pivot pins 16 for the tong arms 17. It will be noted that the axes of the pivot pin 16 extend in the same direction as the tracks T and the tracks 3. The tong arms 17 are formed integral with operating arms 17*a* which extend upwardly and carry pivoted blocks 18 slidably engaging the inclined cam faces 19 of a head 20. The cam faces 19 make a T-slot connection with the blocks 18 so that vertical movement of the head 20 relative to the body 15 effects positive opening or closing of the tongs 17.

The tong body 15 is moved vertically relative to and within the extension 14 of the carriage 6, this movement, however, being limited by hanger rods 21 (see Figure 2). The hanger rods are connected at 22 to ears on the tong body 15 and extend upwardly through bosses 23 on the carriage 6. Nuts 24 on the hanger rods 21 limit the downward movement of the tong body 15 when they are engaged by shock-absorbing springs 25 lying above the bosses 23.

As above indicated, the head 20 is also movable relative to the tong body 15. The head is slotted, as indicated at 26 (see Figure 4), and a limit pin 27 carried by the tong body 15 lies in the slot. This pin limits the amount of relative movement between the tong body 15 and the head 20 to practically the amount of movement required for the actuation of the tongs 17. In Figure 4 the head 20 is shown in its uppermost position. The head has an extension 28 which is vertically slidable in the carriage 6. The extension 28 also carries a nut 29 for a right hand screw 30 formed on the bottom end of a vertical shaft 31. Just above the screw 30 a left-hand screw 32 is formed on the shaft 31, this screw being engaged by a nut 33 secured in the carriage 6. Rotation of the shaft 31 will obviously be effective for raising or lowering the head 20 relative to the carriage 6. Rotation is effected by means of a worm wheel 34 (see Figure 3) carried in a housing 35 on top of the platform 4. The shaft 31 is squared, as indicated at 36, so as to insure rotation while permitting adjustment of the tong mechanism vertically, as may be desired from time to time. The worm wheel 34 is driven by a worm 37 from a motor 38, which may be operated in either direction so as to positively move the head 20 upwardly or downwardly as desired. A casing 31*a* extends upwardly from the housing 35 to receive the upwardly extending portion of the shaft 31.

When the shaft 31 is driven counter-clockwise, as viewed in Figure 3, the head 20 is lowered and the tong body 15 is lowered with it until the nuts 24, engaging the bosses 23, check the downward movement of the tong body 15. The head 20 then continues to lower and thus opens the tongs 17. When the shaft 31 is driven clockwise, as viewed in Figure 3, the head 20 is raised, thereby closing the tongs 17. Upward movement of the head 20, independently of the tong body 15, continues either until the articles gripped prevents further inward movement of the tongs 17, or until the bottom of the slot 26 engages the cross pin 27, after which the head 20 and the tong body 15 with the tongs 17 move upwardly as a unit.

Mold tongs 39 are pivoted at 40 on the extension 14 of the carriage 6. These tongs are in the form of a broad U, as best illustrated in Figure 1, the lower portions 41 of the tongs 39 being arranged to engage the ears E of an ingot mold M, as best shown in Figure 4. The tongs 39 are also provided with inward extensions 42 to engage the top surface S of the ingot mold M when stripping big end up ingots. The tongs 39 are positively opened and closed. Each tong arm carries a block 43 on a pivot 44. The blocks 43 slide in inclined cam grooves 45 in a casing 46 which surrounds the extension 14. Raising or lowering of the casing 46 will obviously cause the mold tongs 39 to be opened or closed. Raising or lowering of the casing 46 is effected by hanger rods 47 connected at their upper ends to levers 48 and 49. These levers are mounted on shafts 50, which shafts carry levers 51 connected by a link 52 to insure equal simultaneous movement of the levers 48 and 49. Actuation of the levers is obtained through a link 53 connecting the lever 49 with a crank 54 on a shaft 55. The shaft 55 is connected through worm gearing 56 to a motor 57 carried on the body 6. The motor 57 may be driven in either direction, as desired, to open or close the mold tongs 39.

The mechanism, as above described, serves to strip or release ingots which are cast big end up. In operation the stripping mechanism is lowered by the hoist until the extensions 42 of the mold tongs 39 lie just above the plane of the top surfaces S of the ingot molds M. The nuts 24 are adjusted so that when the body 15 is in its lowermost position, as determined by the hanger rods 21, the points of the gripping tongs 17 lie a short distance above the top surface S of the ingot mold M so as to engage the sink head H of the cast ingot. It will be understood, of course, that the sink head H has been cast in a hot top and the hot top has been broken off prior to stripping. With the parts in this position the shaft 31 is rotated so as to raise the head 20. This movement causes the tongs 17 to grip the ingot and to lift it upwardly. Upward movement of the ingot mold M is resisted by the mold tongs 39 and the ingot is thus released from its surface adhesion with the mold. The direction of rotation of the shaft 31 is then reversed so as to release the grip of the tongs 17, the released ingot being left in the mold M for withdrawal by a crane when desired.

The releasing operation on the ingot in question being now completed, the crane is moved along the track to bring it in proper position

to engage the next ingot. This is accomplished by means of a motor 58 driving the track wheels 59 of the gantry through gears and shafts as illustrated in Figure 2. It is important to note that elevation of the stripping mechanism is not required at this time. The mere opening of the ingot tongs 17 clears them of any interference with the sink head H, and opening of the mold tongs 39 clears them of any interference with the ears E of the ingot molds M. Therefore, the stripping mechanism can be moved longitudinally without it being raised, or, alternatively, the ingot car can be moved so as to move the released ingot from under the stripper and to place another ingot in position for stripping.

I have shown at 60 in Figure 2 an operator's pulpit, and Figure 1 shows at 61 the "window" in the adjacent mold tong 39 which gives the operator a full view of the whole mechanism. Therefore he can quickly and accurately place the stripper over an ingot. This constitutes a great advantage of my invention and by reason of the fact that raising and lowering of the stripping mechanism after each operation is eliminated, and the entire operation is greatly speeded up.

Figure 5 illustrates the apparatus as it is employed for stripping big end down ingots. In the structure shown I have attached a plunger or bull-nose 62 which is secured to the head 20. When it is desired to strip ingots of this character, the head 20 is moved to its lowermost position. The head carries a boss 63 which is slidable in a collar 64 formed on the body 15, and when the head 20 is at its lowest position the boss 63 extends below the collar 64. The boss 63 is recessed to receive the shank 65 of the bull-nose 62, and a key 66 is driven in place to hold the bull-nose, tong body 15 and head 20 together. The key is of a length greater than the diameter of the boss 63, so that the projecting ends engage the collar 64. When the shaft 31 is rotated to raise the head 20, the key 66 raises the body 15 with it so that with the bull-nose in place the body 15 and the head 20 move up and down as a unit, the tongs 17 being held open and out of the way as shown in Figure 5.

When stripping big end down ingots the vertical position of the stripping mechanism is adjusted so that the bars 41 of the mold tongs 39 just clear the bottoms of the ears E on the ingot molds. When an ingot is in position to be stripped, the mold tongs 39 are closed so that the bars 41 lie under the ears E. The shaft 31 is then actuated to drive the bull-nose 62 downwardly against the top surface of the ingot. Contact being once established, continued rotation of the shaft 31 tends to drive the bull-nose down and to lift the nut 33 and hence the carriage 6 upwardly. There is thus obtained a downward force on the bull-nose 62 equal to the weight of the movable mechanism and an upward force on the mold tongs 39 equal to the capacity of the stripping machine, which effects the stripping operation.

As soon as release has been effected, the shaft 31 is rotated in the opposite direction to free the stripping mechanism and return the parts to the position of Figure 5.

Figure 2 shows arms 67 which are carried by the structural work of the crane and which may be lowered to the position shown or may be swung upwardly and out of the way as indicated by the dotted line 68. The arms 67 are adapted to engage the ingot car C, so that the crane may be used for shifting ingot cars if desired.

I have illustrated and described a present preferred embodiment of the invention. It will be understood, however, that it is not limited to the form shown but may be otherwise embodied within the scope of the following claims.

I claim:

1. A stripper comprising a rockable ingot tong and a rockable mold tong, the rocking axes extending in the same general direction.

2. A stripper comprising a movable supporting frame, a rockable ingot tong and a rockable mold tong, the rocking axes extending generally in the direction of movement of the frame.

3. A stripper comprising rockable ingot tongs and rockable mold tongs, the rocking axes of the tongs extending in the same general direction.

4. A stripper comprising rockable ingot tongs, means for positively actuating the same, rockable mold tongs, and means for positively actuating the same, the rocking axes of the tongs extending in the same general direction.

5. A stripper comprising a vertically movable head, mold tongs supported independently of the head, and ingot tongs actuated by movement of the head, the ingot tongs and the mold tongs being rockable about generally parallel axes.

6. A stripper comprising a vertically movable head, screw means for actuating the same, mold tongs supported independently of the head, and ingot tongs actuated by movement of the head, the ingot tongs and the mold tongs being rockable about generally parallel axes.

7. A stripper comprising a vertically movable head, ingot tongs actuated by movement of the head, mold tongs supported independently of the head, the ingot tongs and the mold tongs being rockable about generally parallel axes, and means for positively actuating the mold tongs.

8. A stripper comprising a movable supporting frame, a vertically movable head, mold tongs supported independently of the head, and ingot tongs actuated by movement of the head, the mold tongs and the ingot tongs being rockable about axes extending generally in the direction of movement of the frame.

9. A convertible ingot stripper comprising a vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, and means for locking the head and tong body to each other, whereby the head and tong body may be moved as a unit.

10. A convertible ingot stripper comprising a vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, means for locking the head and tong body to each other, whereby the head and tong body may be moved as a unit, and means for connecting an extension to said head.

11. A convertible ingot stripper comprising a

vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, the axes of the mold tongs and ingot tongs being substantially parallel, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, and means for locking the head and tong body to each other, whereby the head and tong body may be moved as a unit.

12. A convertible ingot stripper comprising a vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, the axes of the mold tongs and ingot tongs being substantially parallel, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, means for locking the head and tong body to each other, whereby the head and tong body may be moved as a unit, and means for connecting an extension to said head.

13. A convertible ingot stripper comprising a vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, there being a key seat for receiving a key for locking the head and tong body to each other, whereby the head and tong body may be moved together.

14. A convertible ingot stripper comprising a vertically movable carriage, mold engaging tongs pivoted on the carriage, actuating mechanism for opening and closing the mold tongs, a tong body arranged to be moved vertically relative to the carriage, a head vertically movable relative to the tong body, ingot tongs pivoted on the tong body, ingot tong actuating connections between the ingot tongs and head, means for moving the head relative to the carriage, there being a key seat for receiving a key for locking the head and an extension and tong body to each other, whereby the head, extension, and tong body may be moved together.

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