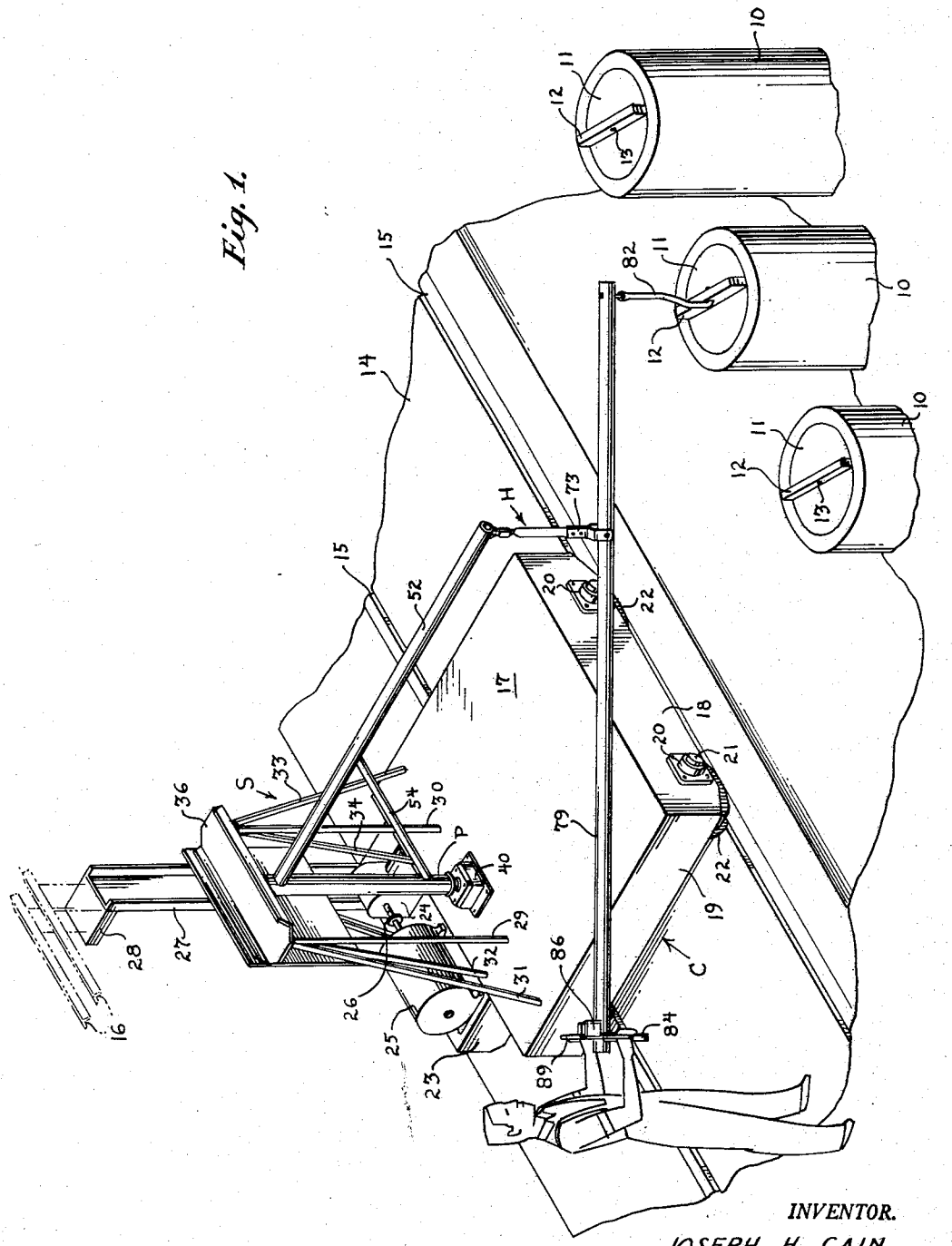
Sept. 20, 1955 J. H. CAIN 2,718,311

CAP MANIPULATING MACHINE FOR MOLDS

Filed March 27, 1952 5 Sheets-Sheet 1

Fig. 1.



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Sept. 20, 1955 J. H. CAIN 2,718,311

CAP MANIPULATING MACHINE FOR MOLDS

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Fig. 2.

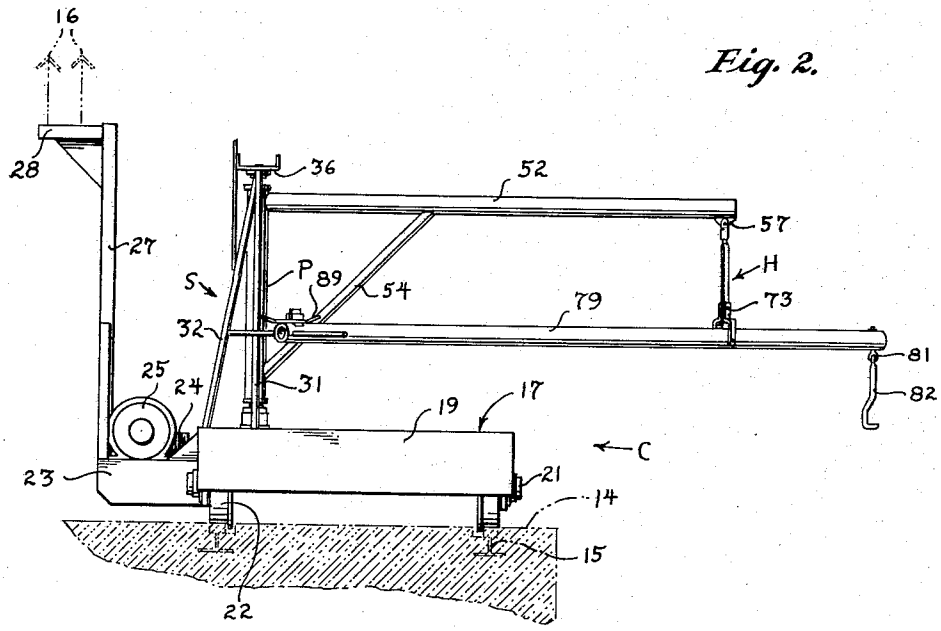
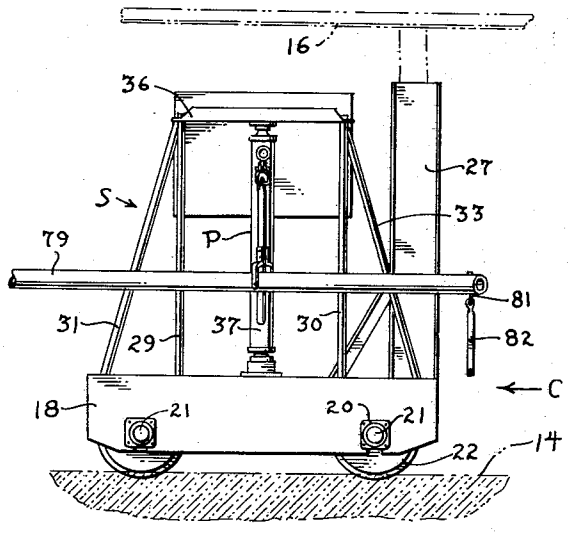


Fig. 3.



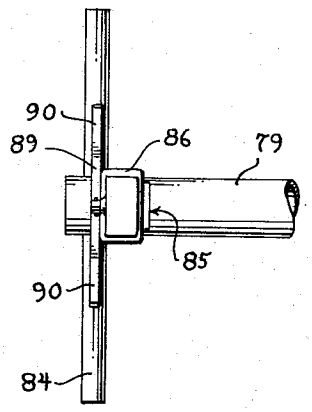


Fig. 4.

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Sept. 20, 1955 J. H. CAIN 2,718,311

CAP MANIPULATING MACHINE FOR MOLDS

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Fig. 5.

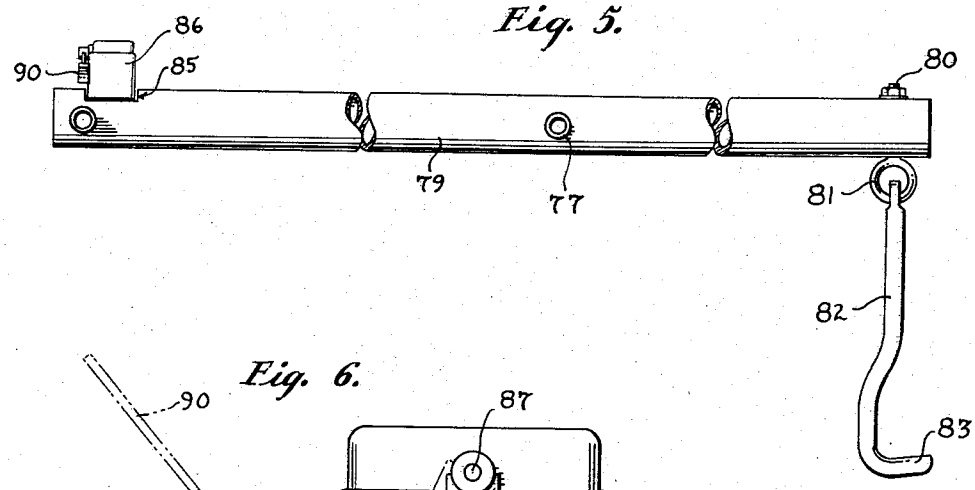


Fig. 6.

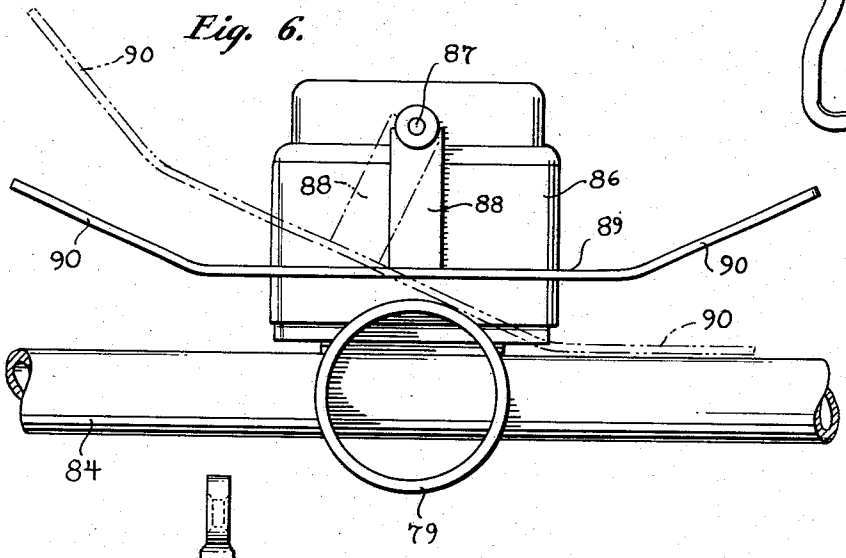


Fig. 7.

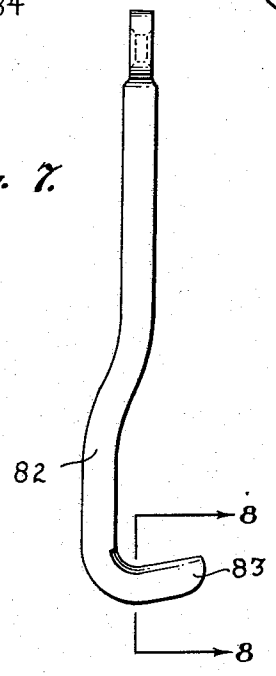




Fig. 8.

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CAP MANIPULATING MACHINE FOR MOLDS

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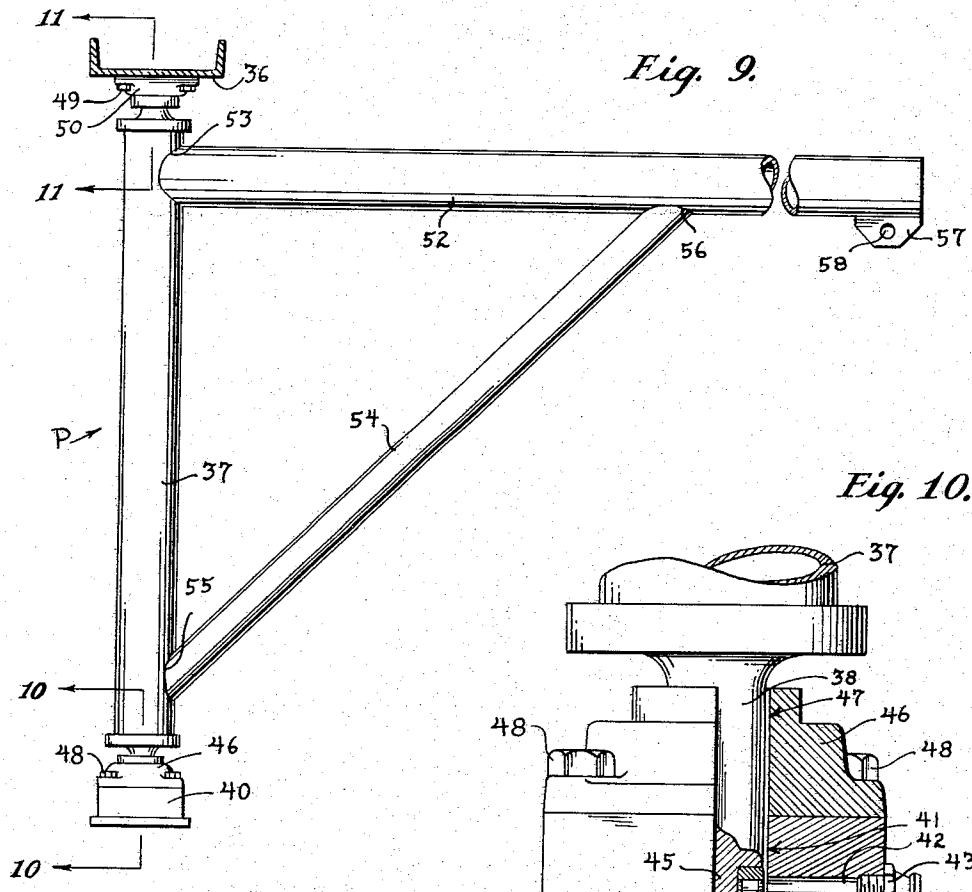


Fig. 9.

Fig. 10.

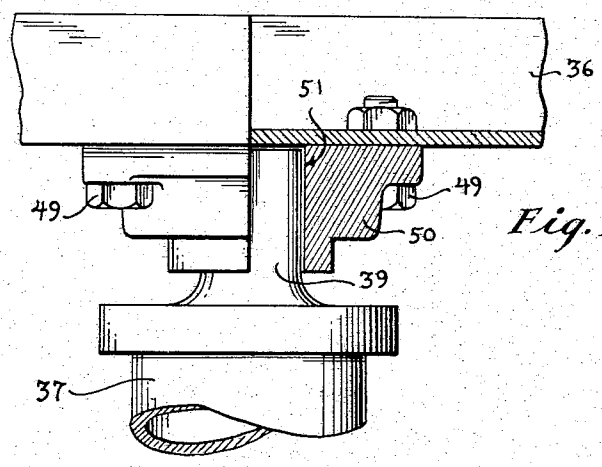


Fig. 11.

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CAP MANIPULATING MACHINE FOR MOLDS

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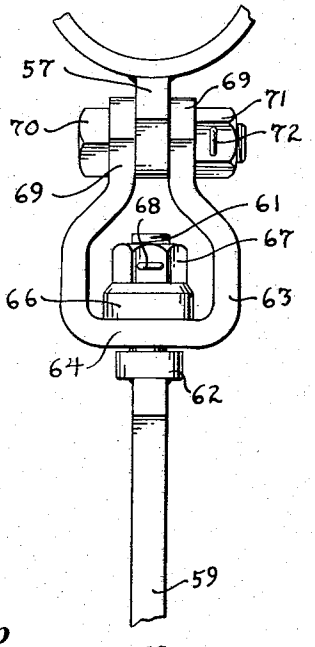


Fig. 12.

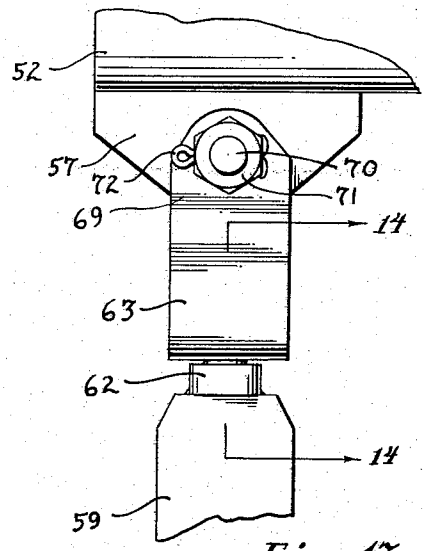
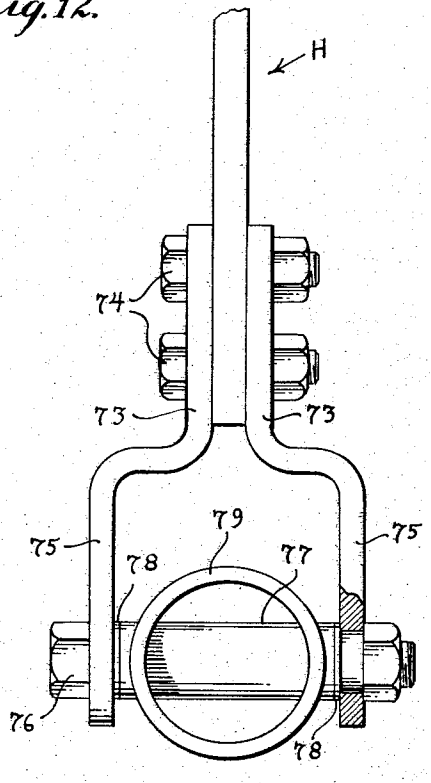


Fig. 13.



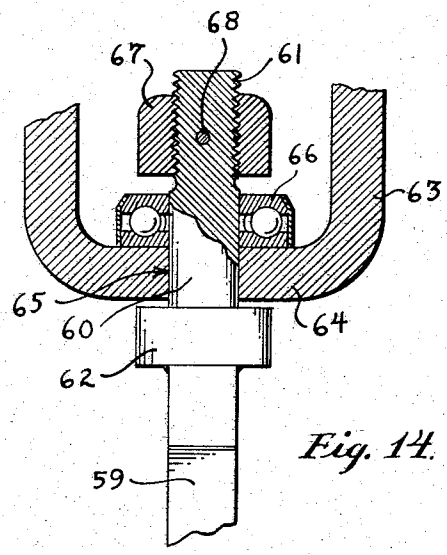


Fig. 14.

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United States Patent Office 2,718,311
Patented Sept. 20, 1955

2,718,311

CAP MANIPULATING MACHINE FOR MOLDS

Joseph H. Cain, Norristown, Pa.

Application March 27, 1952, Serial No. 278,890

5 Claims. (Cl. 212—4)

The present invention has to do with a machine designed for the purpose of manipulating caps that are commonly applied to the molds that are used in casting steel ingots, and is concerned primarily with a machine which places the operator in a remote position relative to a particular mold that is being capped or having the cap removed therefrom.

The practice of capping the molds in which steel ingots are cast is now standardized and looked upon as a conventional, necessary step in the steel industry. This capping is required because it confines gases from the molten steel within the mold, and the pressure of the gases forces the molten steel down into the mold so that there is only a small depression or cavity at the top of the ingot, the remainder of the ingot being substantially homogeneous throughout. Without the capping, a long, narrow cavity that extends an appreciable distance is formed.

In accordance with the practice that is prevalent throughout the steel industry, a workman avails himself of an overhead crane in placing a cap on a mold and in removing a cap therefrom. Such an overhead crane ordinarily presents a chain at the lower end of which there is a hook which must be applied to the cap and removed therefrom, as occasion demands. With this arrangement, it is evident that the workman of necessity, must be in close proximity to the particular mold to which the cap is being applied or removed therefrom. This close proximity is a dangerous liability and often results in serious injury to the workman.

This is particularly true in the removing of a cap from a mold. If the removal should be even slightly premature, the gases which have been confined within the mold, upon release, will blow out molten metal which upon contact with the workman, causes serious injury.

With the foregoing conditions in mind, the present invention has in view as its foremost objective, the provision of a machine which may be utilized by an operator for the purpose of manipulating mold caps and which machine inherently locates the operator at a position remote from the particular mold that is either being capped or having the cap removed therefrom.

In the modern steel mill, a large number of the molds which are used in casting steel ingots, are ordinarily arranged in a long row, and adjacent to this row of molds, there is a working platform. A further object of the invention is to provide a cap manipulating machine of the character indicated which includes as an essential element, a carriage that is adapted to travel along tracks provided on the working platform adjacent to the row of molds.

Still another object of the present invention is to provide in a cap manipulating machine of the type aforesaid, which includes a movable carriage, a boom and swivel post assembly with the outer free end of the boom having suspended therefrom, a pivot support for a dolly bar. One end of this dolly bar carries a hook that is adapted to engage a mold cap, while the other end

of the dolly bar is provided with a handle which is adapted to be grasped by an operator for manipulating purposes.

As a series of molds are either capped or de-capped, it is necessary that the carriage move along its tracks, the workman following the carriage in this movement. Thus, another highly important object of this invention is to provide in a cap manipulating machine of the character indicated, an electric motor drive for the carriage with a control switch for the motor being included in the handle of the dolly bar where it is conveniently accessible to the thumb of the operator, so that the drive may be started or discontinued as occasion demands by the operator, while his hands still grasp the dolly bar handle.

Due to the fact that the movement of the carriage is accompanied by the walking of the operator, the drive includes a gear reduction unit for causing the carriage to move at a speed that is properly co-related to the walking of the operator.

Another somewhat more detailed object of the invention is to provide in a cap manipulating machine of the type aforesaid, a hanger which is suspended at its upper end from the free end of the boom by a swivel connection having a vertical axis and which hanger carries at its lower end a fork having a horizontal pivot support for the dolly bar. With this arrangement, universal movement of the dolly bar is permitted.

The cap of a steel mold is a heavy and massive affair. Hence, provision must be made for the operator to support the cap in a suspended position, under conditions of mechanical advantage. This end is achieved by properly locating the pivot support of the dolly bar, with respect to the ends thereof. The dolly bar functions as a lever and with the short end of the lever carrying the hook which supports the cap, the longer end of the lever which is engaged by the operator will afford the required mechanical advantage.

Various other more detailed objects and advantages of the invention, such as arise in connection with carrying out the above noted ideas in a practical embodiment, will in part become apparent and in part be hereinafter stated, as the description of the invention proceeds.

The invention therefore comprises a machine intended to be used in manipulating the caps of steel molds and which machine consists essentially of a movable motor driven carriage from which upstands a swivel post carrying a boom with a hanger suspended from the outer free end of the boom, and which hanger pivotally supports a dolly bar having a cap engaging hook at one end and a handle at the other end, with a control switch included in the handle.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein:

Figure 1 is a perspective view illustrating a cap manipulating machine that is designed in accordance with the precepts of this invention and is operatively mounted on a working platform adjacent to a row of molds.

Figure 2 is a view in front elevation of the machine with a portion of the working platform shown in section.

Figure 3 is a view in side elevation taken normal to the showing of Figure 2.

Figure 4 is an enlarged detailed view taken as a top plan of the handle of the dolly bar.

Figure 5 is another detailed view taken on an enlarged scale showing the dolly bar in side elevation with the dolly bar broken away.

Figure 6 is a view in end elevation of the handle end of the dolly bar with the handle being broken away.

Figure 7 is a view in side elevation of the cap engaging hook per se.

Figure 8 is a detailed section through the bill of the hook being taken about on the plane represented by the line 8—8 of Figure 7.

Figure 9 is a view in side elevation of the swivel post and boom assembly with the boom being broken away.

Figure 10 is an enlarged detailed view partly in elevation and partly in section of the swivel mounting at the lower end of the post. This view is taken about on the plane represented by the line 10—10 of Figure 9.

Figure 11 is a view similar to Figure 10 of the swivel connection at the upper end of the post and is taken about on the plane represented by the line 11—11 of Figure 9.

Figure 12 is an enlarged detailed view taken as a front elevation of the hanger per se with the hanger bar broken away.

Figure 13 is a detailed view in elevation of the upper end of the hanger bar and the swivel connection thereat, this view being taken normal to the showing of Figure 12.

Figure 14 is a detailed section taken about on the plane represented by the line 14—14 of Figure 13.

Referring now to the drawings wherein like reference characters denote corresponding parts, and first more particularly to Figure 1, those portions of a steel mill which are pertinent to the claimed cap manipulating machine are shown as including a row of molds 10 in each of which a steel ingot is adapted to be cast.

Each of the molds 10 has an open, upper end that is closed by a cap 11. It will be noted that each cap 11 has upstanding from its top face, a rib 12 formed with a transverse opening 13 centrally thereof. It is this opening 13 which receives the bill of a hook carried by the dolly bar, as will be later described.

The molds 10 are arranged in a row along side of a working platform indicated at 14. The top surface of this platform 14 is provided with a pair of spaced tracks 15 which take the form of conventional rails. At the side of the platform remote from the row of molds 10 and spaced above the upper surface of the platform 14, are a pair of power mains 16 which assume a direction substantially parallel to the rails 15. The machine of this invention is intended to travel over the rails 15 with the power for its movement being taken from the mains 16.

The machine includes as an essential element, a carriage which is referred to in its entirety by the reference character C. This carriage C comprises a flat body 17 from which depend side flanges 18 and end flanges 19. Carried by the side flanges 18, are journals 20 with each pair of journals on the opposite flanges receiving a shaft 21. Each shaft 21 carries a pair of wheels 22 which ride on the rails 15 in a well known manner.

At the side of the carriage C remote from the molds 10, the side flange 18 carries a side extension 23. Mounted on this extension 23 is a gear reduction unit 24 which is drivably connected to one of the shafts 21 which is in alignment therewith. The wheels 22 on this shaft 21 are also drivably mounted thereon so that a driving relation is established between the gear reduction unit 24 and the wheels 22 on this shaft 21. Gear reduction units of this type are now well known and available as such on the open market. The present invention is not concerned with the details of this gear reduction unit and they are, therefore, neither illustrated nor described.

The side extension 23, also carries an electric motor 25, the drive shaft of which is operatively connected to the gear reduction unit 24 by the coupling shown at 26. Thus, the motor 25 drives the gear reduction unit 24. Upstanding from the outer side of the side extension 23 is a channel bar 27, the upper end of which carries a table 28 that is located immediately beneath the power mains 16. A pantograph or similar device (not illustrated) is carried by the table 28 and engages the power mains 16 so as to take power therefrom which is delivered to the motor 25.

Upstanding from the main body 17 of the carriage C at the side adjacent to the extension 23, is supporting structure which is referred to in its entirety by the reference character S. This supporting structure S comprises two vertical standards 29 and 30. The standard 29 is supported by the inclined braces 31 and 32, while the standard 30 is supported by the braces 33 and 34. The standard 29 and its braces 31 and 32, meet at the top while the standard 30 and its braces 33 and 34 also meet at the top. Extending across the tops of the standards 29 and 30 and secured to the upper ends thereof, is a bridge 36 which may have the upstanding side flanges illustrated, whereby it is adapted to carry certain articles such as electric resistors.

A swivel post is mounted between the standards 29 and 30 in a vertical position. This swivel post is referred to in its entirety by the reference character P. Its lower end is pivotally connected to the main body 17 of the carriage C and its upper end is pivotally connected to the bridge 36. Referring now to Figures 9, 10, and 11, the swivel post P and its pivotal connections will be described in detail.

The main body portion of the post P, which is identified by the reference character 37, is of tubular construction and carries a trunnion 38 at its lower end and another trunnion 39 at its upper end. A journal block 40 is secured to the carriage body 17 in any preferred manner and this block is formed with a recess 41. Communicating with the recess 41 is a lubricant passage 42, having a lubricating fitting 43 at its outer end. Received in the lower end of the recess 41 and opposite to the inner end of the passage 42 is a bearing assembly 44. The lower free end of the trunnion 38 is reduced as indicated at 45, and this reduced end is received within the bearing assembly 44. A complemental journal block 46 has a bore 47 in alignment with the recess 41 and through which the trunnion 38 passes. The journal block 46 may be secured in position on the block 40 in any preferred manner such as by the screw bolts shown at 48.

Secured to the under face of the bridge 36 in any preferred manner such as by screw bolts 49 is a top journal block 50 having a bore 51 which receives the trunnion 39. From the foregoing it is apparent that there are swivel connections at the upper and lower ends of the swivel post P, with the swivel connection at the lower end being provided with bearings.

Outstanding from the upper end of the main body portion 37 of the swivel post P is a boom 52 which preferably is tubular. The inner end of this boom 52 may be connected to the post P in any preferred manner, such as by a welded joint indicated at 53. A diagonal brace 54 has its lower end connected to the lower end of the post P in any preferred manner as by welding indicated at 55 and its upper end to the journal 52 as indicated at 56. Depending from the journal 52 at its outer free end, is a bracket 57 formed with an opening 58.

Suspended from the bracket 57 is a hanger which is referred to in its entirety by the reference character H. Referring now more particularly to Figures 12, 13, and 14, the hanger H is shown as comprising a main body portion 59 in the form of a flat bar with the upper end of the bar 59 taking the form of a cylindrical trunnion 60 that terminates in a threaded stud 61. Immediately below the trunnion 60 there is a cylindrical embossment 62. A bearing bracket 63 has a bottom wall 64 formed with a bore 65 that receives the trunnion 60. The top face of the bore 64 carries a bearing assembly 66 through which the trunnion 60 also passes. A nut 67 is threaded onto the stud 61 and maintains the assembled relation. A cotter pin shown at 68 passes through aligned passages in the nut 67 and stud 61 to lock the nut in position.

The bearing bracket carries at its upper end a pair of complemental ears 69 which engage the bracket 57 on the opposite sides thereof. These ears 69 are formed with openings which align with the opening 58 and a headed

bolt 70 passes through the aligned openings. A nut 71 is screwed onto the threaded end of the bolt 70, and is locked in position by the pin 72.

From the foregoing it is apparent that a swivel connection having a vertical axis is provided at the upper end of the hanger H.

Clamped against the opposite faces of the hanger bar 59 at the lower end thereof, are complemental pivot brackets 73. Bolt and nut assemblies shown at 74 may be employed in securing the pivot brackets 73 to the hanger bar 59. The pivot brackets 72 have outwardly offset portions 75, between which extend a pivot bolt 76. This pivot bolt 76 carries a bearing sleeve 77 which is journalled therein. A spacing washer shown at 78 may be located between each end of the bearing sleeve 77 and the inner face of the offset portion 75 of the bracket 73. A dolly bar 79 is of tubular construction and the bearing sleeve 77 extends transversely therethrough and is secured thereto.

The dolly bar 79 is shown in detail in Figure 5. It is also clearly depicted in Figures 1, 2, and 3. This dolly bar 79 is pivotally mounted on a horizontal axis at an appropriate point intermediate its ends by the sleeve 77 and pivot bolt 76, the point being determined by the mechanical advantage which is desired. At what might be called its outer end, that is the end which is intended to be disposed over the molds 10, the dolly bar 79 carries a vertically positioned eye bolt 80 presenting and eyelet 81. Connected to this eyelet 81 is a hook 82 having a bill 83 that is adapted to be received in an opening 13 of the rib 12 of the cap 11.

It is evident that this eye bolt 80 is susceptible of angular adjustment, so that the bill of the hook will be presented in a position most favorable to its manipulation by an operator handling the other end of the dolly bar.

At the end remote from the eye bolt 80, the dolly bar 79 carries a handle in the form of a transverse bar 84. This handle is adapted to be grasped by an operator standing on the platform 14 as illustrated in Figure 1.

The handle 84 is of tubular construction and just inside this handle, the dolly bar 79 is cut away as indicated at 85, in Figure 5, to provide a recess for receiving a control switch 86. The control switch 86 includes a control shaft 87 from which depends an arm 88. The lower end of this arm 88 carries an operating bar 89 which presents thumb engaging portions 90 at the opposite ends thereof.

It is evident that with an operator grasping the handle 84, with both his hands, either thumb may be conveniently moved into engagement with the portion that is immediately adjacent thereto to rock the bar 89 and thus rotate the shaft 87 and thus operate the control switch 86.

Illustrating the foregoing invention as applied to an actual case, to lift a cast-iron mold cap weighing approximately 250 lbs., a dolly bar 13 ft. long, made from 3 in. O. D. circular steel tubing, is pivotally suspended from the hanger bar 59 on a horizontal axis so that a minor portion of the dolly bar 3 ft. 8 in. in length extends outwardly of said pivot in the direction of the molds and a major portion 9 ft. 4 in. in length extends inwardly of the pivot under the control of the operator, the ratio of the major portion to the minor portion of said dolly bar about said pivot forming the desired mechanical advantage for lifting the cap. The boom 52 from which the dolly bar 79 is suspended is preferably made from the same size tubing as the dolly bar, except that it is 6 ft. 9 in. in length with 2 ft. 9 in. thereof extending outwardly beyond the end of the platform.

Operation

While the manner of using the cap manipulating machine of this invention is believed to be obvious from the illustrations of the drawings and description of parts given, it may be briefly outlined as follows.

It will first be assumed that the tops of all of the molds 10 are open and molten steel has been poured thereinto from a crucible in a well known manner. The caps 11 will be in position along one side of the working platform 14. The operator standing on the platform grasps the handle 84 with both his hands and manipulates the dolly bar 79 so as to cause the bill 83 of the hook 82 to engage in the opening 13 of the cap 11.

By further manipulation this cap may be lifted from the surface on which it rests and moved into position over the open top of a mold, whereupon it is lowered into position, closing the open top and the bill of the hook removed.

The operator may now operate the control switch 86 to cause the carriage C to travel into position for manipulating the next cap. This operation is repeated until the molds are capped, the operator moving down the line with the carriage.

After a required amount of time has elapsed, the operator again moves up the line, removing each cap by manipulating the dolly bar and causing the carriage C to travel, as occasion demands.

It is evident that the operator is at all times removed a safe distance from the particular mold on which he is working. Thus, any danger from injury by the molten metal in that mold, is completely avoided.

While a preferred specific embodiment of the invention is hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exact constructions, mechanisms, or devices illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. In a machine for manipulating a mold cap, a movable carriage adapted to move along a pair of rails, an electric motor and a gear reduction unit mounted on said carriage for driving the carriage, an upright upstanding from said carriage and having means engaging power mains to deliver power to said motor, a swivel post upstanding from said carriage at one side thereof, a horizontal boom carried by said post, a hanger suspended from the free end of said boom by a swivel connection, a dolly bar pivotally mounted on the lower end of said hanger on a horizontal axis, a cap engaging hook at one end of said dolly bar, a handle in the form of a crosspiece at the other end of said dolly bar, and a control switch for said electric motor carried by said dolly bar in close proximity to said handle.

2. In a machine for manipulating a mold cap, a movable carriage, an electric motor and gear reduction unit carried by said carriage for causing travel thereof, an upright upstanding from said carriage and having means engaging power mains to deliver power to said motor, supporting structure carried by said carriage and comprising a pair of spaced standards, braces for said standards and a bridge spanning the upper ends of said standards; a swivel post mounted in a vertical position between said standards having its lower end connected to said carriage by a swivel mounting, and its upper end to said bridge by a swivel mounting, a boom outstanding from said post, a hanger suspended from the free end of said boom, a dolly bar pivotally mounted on the lower end of said hanger, a cap engaging hook at one end of said dolly bar and a handle crosspiece at the other end of said dolly bar, and a control switch carried by said dolly bar in close proximity to said handle.

3. In a machine for manipulating a mold cap, a carriage movable along a track and having a main body portion and a side extension, an electric motor and gear reduction unit on said side extension for driving said carriage, means for taking power from power mains and delivering it to said motor, a horizontal boom mounted for swinging movement in a horizontal plane on said main body of said carriage, a dolly bar pivotally suspended from the free end of said boom, a cap engaging hook at one end of said dolly bar, a handle crosspiece

at the other end of said dolly bar, and a control switch for said motor carried by said dolly bar in close proximity to said handle, and including an operating lever adapted to be engaged by the thumbs of an operator grasping said handle.

4. In a machine for manipulating a mold cap, a carriage moveable along a track and having a main body portion and a side extension; an electric motor and gear reduction unit on said side extension for driving said carriage; means for taking power from power mains and delivering it to said motor; supporting structure carried by said carriage adjacent to said side extension comprising two vertical standards, inclined braces supporting said standards, and a bridge extending across the upper ends of said standard and having upstanding side flanges; a swivel post mounted in a vertical position between said standards having its lower end connected to said carriage by a swivel mounting and its upper end to said bridge by a swivel mounting; a boom outstanding from said post and fixedly secured thereto; a hanger suspended from the free end of said boom by a swivel connection; a dolly bar pivotally mounted on the lower end of said hanger; a cap engaging hook at one end of said dolly bar and a handle crosspiece at the other end of said dolly bar; and a control switch carried by said dolly bar in close proximity to said handle.

5. In a machine for manipulating a mold cap, a carriage moveable along a track and having a main body portion and a side extension; an electric motor and gear reduction unit on said side extension for driving said carriage; a channel bar upstanding from the side extension; a horizontal table mounted on the upper end of said channel bar; means carried by said table for engaging power mains so as to take power therefrom and deliver it to the motor; supporting structure carried by said carriage adjacent to said side extension comprising two

vertical standards, inclined braces supporting said standards, and a bridge extending across the upper ends of said standard and having upstanding side flanges; a swivel post mounted in a vertical position between said standards having its lower end connected to said carriage by a swivel mounting and its upper end to said bridge by a swivel mounting; a boom outstanding from said post and fixedly secured thereto; a hanger suspended from the free end of said boom by a swivel connection; a dolly bar pivotally mounted on the lower end of said hanger; a cap engaging hook at one end of said dolly bar and a handle crosspiece at the other end of said dolly bar; and a control switch carried by said dolly bar in close proximity to said handle.

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