No. 755,368. PATENTED MAR. 22, 1904.

R. W. HUNT.

INGOT PERFECTING MACHINE.

APPLICATION FILED MAY 20, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 3.

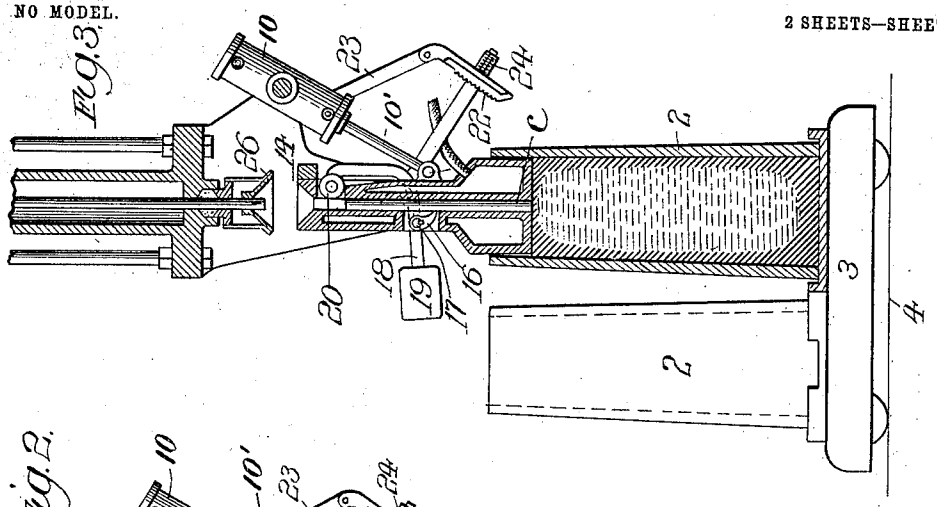


Fig. 2.

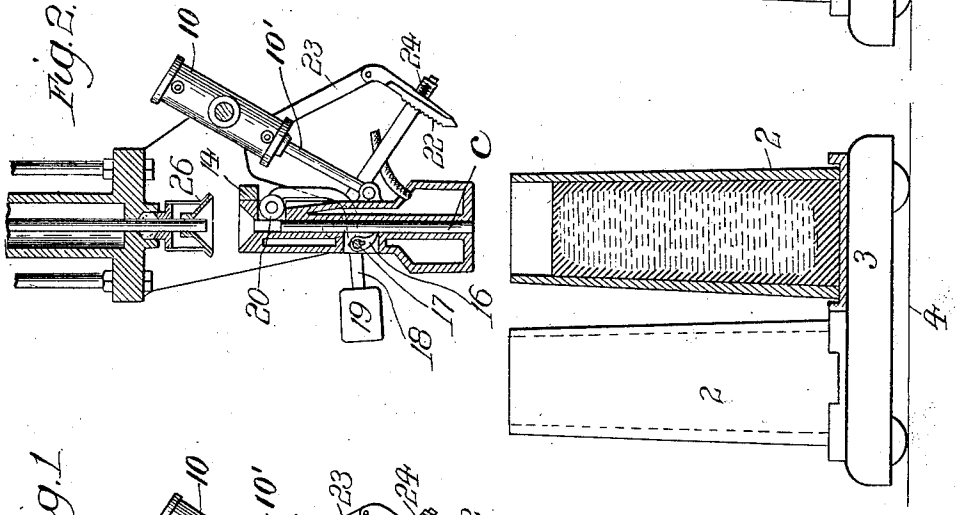
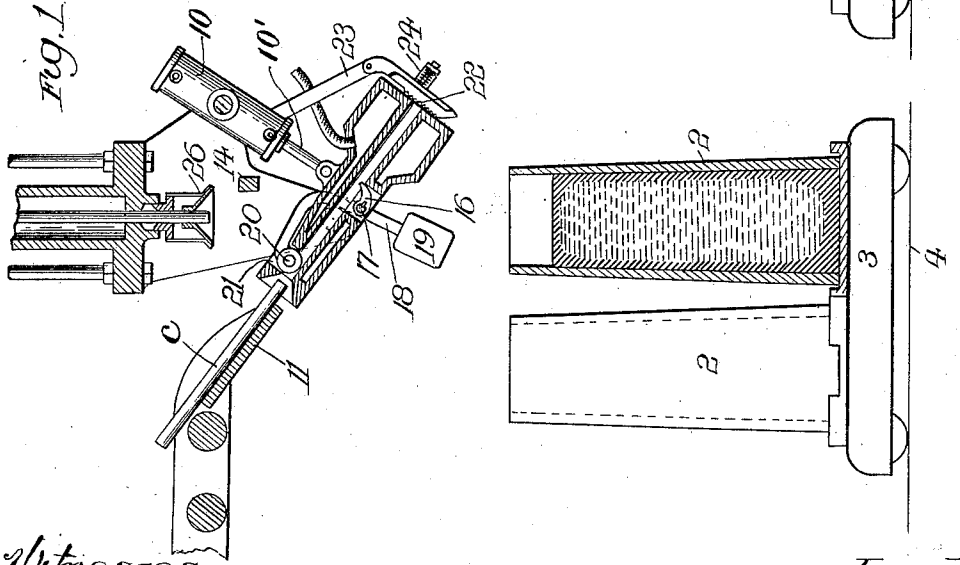


Fig. 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4

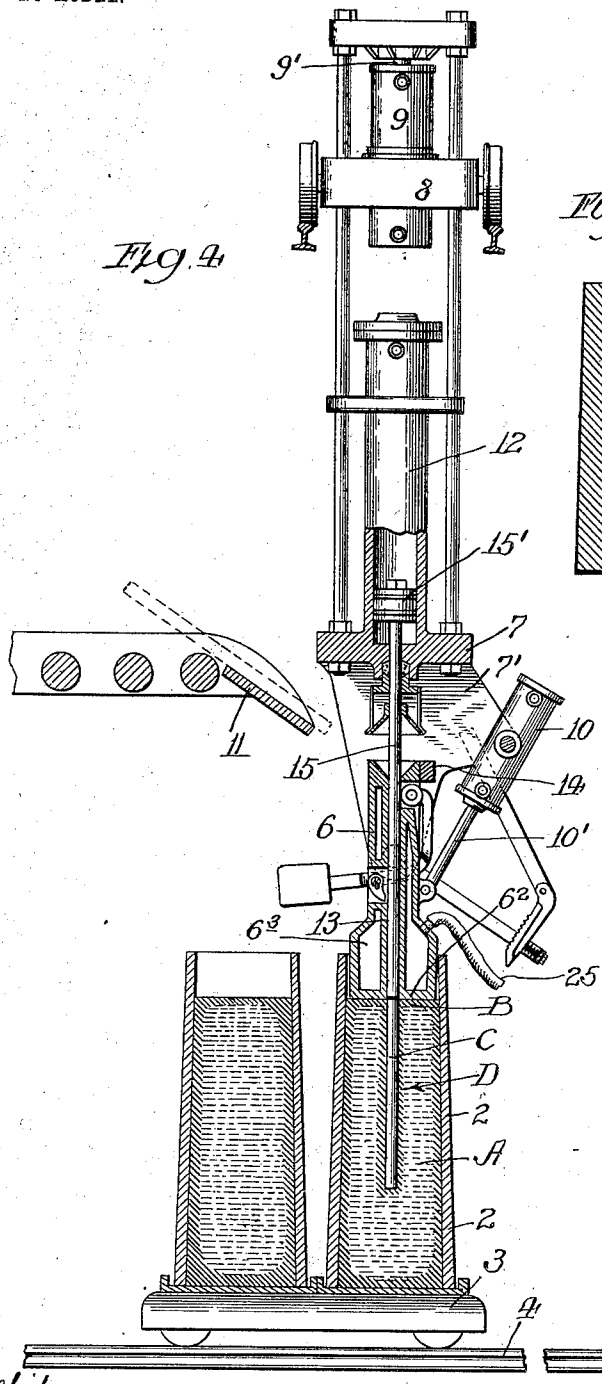


Fig. 6

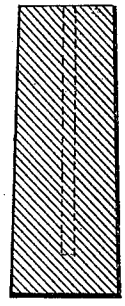
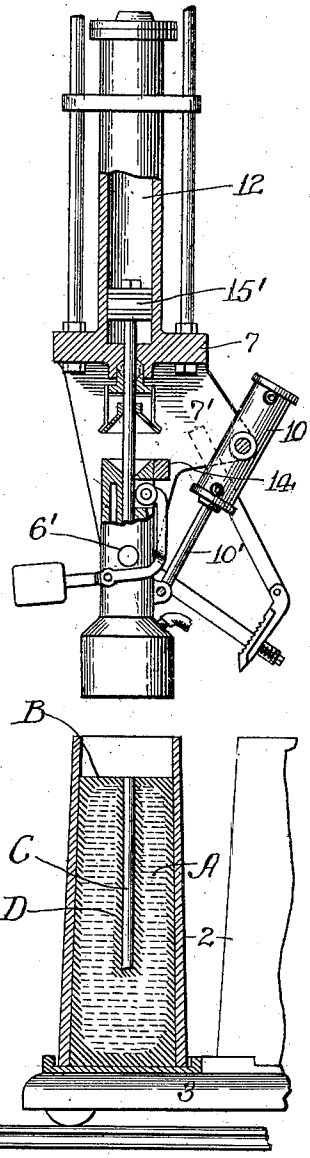


Fig. 5



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No. 755,368. Patented March 22, 1904.

UNITED STATES PATENT OFFICE.

ROBERT W. HUNT, OF CHICAGO, ILLINOIS.

INGOT-PERFECTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 755,368, dated March 22, 1904.

Application filed May 20, 1903. Serial No. 158,044. (No model.)

To all whom it may concern:

Be it known that I, ROBERT W. HUNT, of the city of Chicago, county of Cook, and State of Illinois, have invented a certain new and useful and Improved Ingot-Perfecting Machine, of which the following is a specification.

This invention relates to the perfecting or curing of steel ingots that contain pipes or cavities and which would otherwise be unfit for use.

My invention has special reference to a machine for perfecting steel ingots in rail-mills and during the time when the ingots are in transit from the converter-house to the mold-stripping station.

In the conduct of a rail-mill the molten steel is taken from the converter and poured into the ingot-mold with the greatest possible despatch. The filled mold then makes way for another and is allowed to stand until the ingot metal becomes sufficiently solid to retain its form. Thereupon the mold is stripped from the ingot and the latter is taken to the soaking-pit, from which, after being reheated, it is taken to the rolls, where it is manufactured or rolled into rails.

The present value of the manufactured product is such that the entire process of casting and rolling steel ingots to be profitable must be conducted with celerity and with as little labor as possible. Even when every care is used in casting an ingot it is likely to be piped or to contain large blow-holes, and thus be rendered unfit for use. This danger is obviously increased when even the most simple precautions are neglected. In such an establishment the rolling-mill is planned to take care of the maximum output of the converters of the plant and when in operation it is a constant drain upon the converter-house or department, the ingots being used as rapidly as they can be cast at the converters. Consequently it becomes necessary to expedite the work of molding or casting the ingots in every way that is found practicable, and nothing is allowed to interfere with the casting and sending out of the ingots. All of the known methods of treating an ingot to insure uniformity and solidity are such that they must be employed immediately after the pouring and casting of the ingot and require the expenditure of an excessive amount of valuable time in the converter-house. Inasmuch as the product of the rolling-mill is dependent upon the output of the converter or casting house, it will be readily seen that any time lost or delay suffered at said converter-house involves a heavy loss from idleness in the rolling-mill department, the productiveness of the plant as a whole being reduced. Thus it happens that the several precautions that could be adopted to prevent the development of blow-holes and pipes in ingots and better insure a solid ingot—such as slow pouring, supplemented by packing or wedging the tops of the ingot in the mold, the spraying thereof and other like methods—are dispensed with because of the cost of carrying them out. The outcome of this lack of care in casting rail-ingots is that comparatively large numbers of imperfect ingots are formed, the same containing pipes, cavities, or blow-holes of varying extent.

It is a well-known fact that the piping of an ingot is due to the shrinkage of the steel within the ingot-walls, which form quickly after the molten steel has been poured into the mold, and that the liberation of the occluded gases from the molten steel during solidification and their collection at the center and in the upper part of the ingot have much to do with the extent of the pipe or cavity therein. It is also well known that the metalloids contained in molten steel part with their heat less readily than the steel proper, and therefore as the steel cools are forced toward the central and upper parts of the ingot and ultimately face or line the walls of any cavity therein. The metalloids that may be present in a common steel ingot will be found to predominate at its center and account for the relative weakness of the metal in the axial portion of the ingot. A merely impure central portion or core in an ingot does not materially affect the make-up or strength of a rail or other article that is rolled from the ingot; but when the metalloids are segregated from the steel mass, as when they are present on the walls of a pipe or cavity, they prevent the welding together of said walls at any time thereafter.

Hence when an ingot containing a pipe or large blow-hole is reheated and rolled the cavity is simply elongated and takes the form of a wide long crack or flaw, or several thereof, greatly diminishing the strength of the finished rail or bar. In rails these flaws are usually found in the rail-web or in the lower part of the rail-head and when present render the rail unfit and unsafe for use. Rails of this character are called "piped rails," and although all rails are carefully inspected piped rails often escape detection, the cracks and flaws therein seldom being visible upon their surfaces. Such rails therefore find their way into railroad-tracks and not infrequently cause disastrous railroad wrecks by crushing and breaking under the wheel-blows and the weight of trains. It is possible to avoid the effects of ingot pipes by cutting off and discarding the tops of all ingots, as is the practice in the manufacture of finer articles, such as armor-plate; but such waste and expense prohibits the practice of this precaution in rail-mills, the operators being compelled to use the ingots whole and trust to final inspection for the discarding of the imperfect products. Quantities of rails are thus rejected and it is evident that piped ingots are a source of great loss. Nevertheless, this loss is less than would result from the readoption of the old slow method of packing the molds or the like at the converter or pouring station. It seems evident, therefore, that it is futile to attempt or propose any treatment of or operation upon the ingot which must take place at the pouring-station and require the expenditure of any considerable amount of time at that point, yet up to this time no successful method or machine has been devised for perfecting heavy ingots at any other time or place, unless the process of compression—which is too costly for use in rail-mills—be excepted.

Numerous investigators have endeavored to account for the presence of large cavities and blow-holes in cast-steel ingots; but I believe that it is generally admitted that their occurrence, size, and distribution in the ingot mass are to a great extent dependent, first, upon the chemical nature of the steel; second, upon the change which the steel undergoes while being and after it is poured into the mold; third, upon the amount or extent of shrinkage within the ingot after its walls or crusts have formed, and that the pipe develops after the top crust of the ingot has formed and after the ingot has left the pouring-station.

My conception is that the chemical nature of the steel, the changes that take place therein, and the sum-total of the shrinkage within the ingot may be entirely disregarded, provided a way and means are devised for perfecting the ingot cheaply after the ingot has partially solidified, but while its interior is still molten. A considerable period is always allowed for the natural solidification of the ingot before the mold is stripped, and I find that the ingot may be successfully treated during this period without interrupting the work of any department of the mill. The process which I employ is described in a companion application of even date herewith, filed May 20, 1903, Serial No. 158,042, and consists, primarily, in the following steps, to wit—first, pouring the molten metal into the mold and then allowing the filled mold to stand for some minutes until the top crust of the ingot forms and takes on considerable thickness and strength, then preparing a heated rod of steel and thrusting said rod through the top crust of the ingot into the central or axial portion of the ingot, thereby reducing the temperature of said axial portion and so far displacing the molten metal within the ingot as to deflate and fill any pipe, cavity, or blow-hole that may have formed within the ingot, and, finally, stripping the mold from the ingot after said bar or rod has become fixed in or incorporated with the mass of steel composing the ingot.

The primary object of this invention is to provide a machine or apparatus for rapidly carrying out the several steps of this process, to the end that the ingots may be perfected or cured as rapidly as they can be produced at the converter-house and cared for at the stripping-station.

A particular object of this invention is to provide a comparatively light and handy machine for placing, holding, and driving the rods or billets which are employed in the process, and which machine shall also be adapted to assert a considerable pressure upon the top of the ingot in the mold at the moment when said rod or billet is being driven into the same, to prevent the disruption of the ingot-crust.

Another special object of my invention is to provide a machine of the character recited which may be employed in cooling the upper crust of the ingot when need be, and still another object of my invention is to provide an ingot perfecting or curing machine that may be operated by a single person.

My invention consists generally in an ingot-perfecting machine comprising a suitable frame that is arranged above the ingot-mold stand, in combination with means for moving said frame vertically and laterally to properly position the same, a rod or billet holder provided in said frame, and a billet-driver also provided in the frame for driving the rod or billet out of said holder and into an ingot placed beneath the same.

My invention consists in further various constructions and in combination of parts, all as hereinafter described, and partly opened out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and in which—

Figures 1 to 5, inclusive, are vertical sectional elevations of my machine, illustrating the several steps in its operation; and Fig. 6 is a sectional view of my novel perfected ingot.

A thorough understanding of my machine will be facilitated by an explanation of the process in which it is employed and of the results accomplished by its use. I will therefore state the same before proceeding to the description of the machine in detail, referring meantime to the drawings.

In carrying out my process the molten steel is poured into the mold 2 and allowed to stand therein for a considerable length of time until the top crust B of the ingot A has formed and gained considerable thickness and solidity. In the meantime a pipe or cavity may have begun to form within the ingot, depending upon the quality of the steel, or, in other words, upon the quantity of gas that is contained therein and the internal shrinkage of the ingot. The non-presence or the presence and extent of the pipe or blow-hole in the ingot A may be due to many and varying conditions, all of which I am able to ignore through the employment of a bar, rod, or mold-piece C, which I preferably thrust through the top crust B of the ingot at any convenient moment before the mold 2 is stripped from the ingot A. I preferably heat this bar, rod, or billet C before thrusting it into the ingot; but it is always cooler than the molten center D of the ingot. The rod C therefore supplies any deficiency of metal within the ingot and also performs the equally important office of suddenly reducing the temperature of the central or axial portion of the ingot to more quickly render it plastic and by so doing disperse the gases and metalloids that would otherwise collect at the center of the ingot. Such dispersion is due to actual displacement by the billet and also to the expulsion of the gases and metalloids from the steel as it cools from the center outward. The thrusting of the rod C into the ingot A occupies but a moment, and as the metal quickly cools around the upper end of the rod, the means used for driving the rod into the ingot may be removed at once. The ingot then stands until it is ready to go to the stripping-machine, whereupon the mold is removed from the ingot and the latter is ready for the soaking pit or furnace. In addition to the foregoing I preferably subject the top of the ingot to pressure at the time when the rod is being driven into the ingot to prevent the eruption of the top crust B of the ingot by the pressure that is created therein by the forcible introduction of the rod C. The ingot that is produced in this manner is solid throughout and free from a pipe or blow-holes. The rod will retain its form or become blended with the metal in the ingot, according to the temperature at which the rod is introduced. If the temperature is low, the rod will simply weld with the ingot mass, in the meantime serving to dispel the metalloids, &c., from the center of the ingot. On the other hand, if the rod is quite hot when inserted it will melt and blend with the ingot metal before the center of the ingot becomes plastic through the cooling of the ingot. I prefer in most cases to use a steel rod of better quality than the steel ingot and which when melted within the ingot serves to dilute the metalloids in the ingot and correspondingly raise the quality of the steel at the center of the ingot. The rods used in different ingots need not be of the same length, and I prefer to fix the size thereof according to the internal pressure that the ingot-walls and the mold will withstand or the cubical capacity of the pipe which is likely to form in an ingot composed of steel of a given kind and quality.

Referring now to the drawings for the details of my invention, it will be observed that the ingot-molds 2 are used in pairs upon the usual mold stools or cars 3. These cars run upon a track 4, that leads into the perfecting house or station, and the portion of one track beneath the perfecting-machine is termed the "mold-stand." Means (not shown) are usually provided at this point for moving the mold-car back or forth to accurately position the mold beneath the perfecting-machine. Said perfecting-machine preferably comprises a gravity-press, by which considerable weight or pressure may be imposed upon the top of an ingot in the mold beneath the machine. In addition to being a press this machine constitutes a holder and a guide for the rod or billet C above mentioned. The machine also serves as and includes a rod or billet driver, by which said rod or billet C is forcibly driven through the crust B of the ingot A and lodged in the axial portion D thereof.

The essential parts of the machine are the guide-barrel or cozy 6, the rod-driver 15, and the frame wherein the same are arranged and the weight of which may be employed to exert the necessary pressure on the top of an ingot. Said frame 7 is suspended from and is laterally movable with the car or truck 8 and is vertically movable by means of the hydraulic engine 9, provided on said car and having its piston-rod 9′ joined to the top of the frame. (See Fig. 4.) The cozy 6 is provided with trunnions 6′ and is trunnioned between the arms 7′ of the large fork which I provide upon the lower end of the frame 7. The fork portion of the frame also carries the long fluid-cylinder 12, in which the piston 15′ of the driver 15 is arranged. The cylinder 12 and the cozy are concentric or in line when the cozy is in its normal vertical position, and said cozy is provided with a central bore 13 to receive the end of the driver or piston rod 15 when the latter is projected from the cylinder 12.

14 is a stop provided on the fork of the frame and with which the cozy engages when in its vertical position. This, if desired, may

be adjustable. The cozy is operated or swung upon its trunnions 6′ by means of the oscillating cylinder or engine 10, that is trunnioned between the arms 7′ of the fork, the piston-rod 10′ of said engine being pivoted upon the side of the cozy. By this means the cozy may be swung into the inclined position to receive a billet C, as shown in Fig. 1 of the drawings.

11 represents the roll-chute by which the perfecting rods or billets C from furnace (not shown) are delivered to the cozy when the latter is in its inclined position.

16 represents a dog or latch provided in the side of the cozy to engage the bar or billet that is dropped into the same. The dog 16 is arranged on the short shaft 17 below the trunnions 6′ and on its end is provided with a lever 18, having the weight 19 on one end and a small roller 20 on the other end, said roller operates through the side of the cozy and movably projects into the bore of the same. When either the bar C or the driver 15 enters the cozy, the roller 20 is displaced and the lever 18 is thus operated to remove the dog 16 from the bore of the cozy and permit the rod or the driver to pass. When the rod C is dropped into the cozy, its lower end strikes the stop-plate 22, which prevents the rod from falling out of the cozy. This plate is pivoted upon a light frame 23, extending from the frame 7, and is preferably held up by a spring 24, which yields to allow the cozy to swing up or down past the plate. The upper face of the plate 22 is preferably corrugated and serves as a rasp to clean the lower end of the rod at the time when the cozy is swung down or into its vertical position.

The lower end of the cozy is larger than its upper portion and conforms to the shape of the mold. The extreme lower end 6^2 presents a flat surface to the top of the ingot within the mold when the cozy is lowered thereon. The walls of the cozy are preferably tapered oppositely to the taper of the ingot-mold to avoid the sticking of the cozy in the mold. I preferably make the cozy a metal casting and provide the same with an internal chamber 6^3. To this I connect a pipe or pipes 25, whereby air or water may be supplied to the interior of the core for cooling the same whenever necessary. To protect the hot rod which may be present in the cozy, I preferably arrange a hood or water-shed 26 around the driver 15 and above the cozy. This hood is attached to the frame 7 below the stuffing-box or gland in the lower end of the cylinder 12 and serves to deflect the water which leaks through said stuffing-box, preventing the fall thereof into the interior of the cozy, where it would cool the rod lodged therein. The several hydraulic or steam cylinders 9, 12, and 10 are included in a suitable fluid-pressure system, and the actions of the frame 7, the driver 15, and the cozy are controlled by suitable levers arranged in proximity to the perfecting-machine.

The operation of my novel ingot-perfecting-machine is as follows: When a mold containing a new ingot arrives upon the mold-stand beneath the perfecting-machine, said machine will be in its elevated position. At this time, or just prior to the arrival of the ingot, the cozy, guide, or rod-holder 6 is thrown into its inclined position by means of the engine 10. In this position the upper end or mouth of the cozy is opposite the lower end of the rod-chute 11, and a heated rod or billet C is immediately supplied to the cozy. In passing or falling into the cozy the rod lifts the latch-roller 20, and thereby automatically retracts the latch or dog 16, so that the rod may drop freely into the lower part of the cozy with its upper end dropping to a point beneath the roller 20. The rod strikes upon the stop-plate 22 and will be held thereby until the cozy is swung back to its vertical position. Meantime, as illustrated in Fig. 2, the rod will have been engaged by the latch 16, the weight 19 imposed thereupon providing sufficient force to prevent the slipping of the rod in the cozy. When the foot or lower end of the cozy moves away from the stop-plate 22, the same will scrape the lower end of the rod and remove the scale therefrom. As soon as the cozy has reached its vertical position against the stop 14 the whole frame 7 is allowed to fall, and the same having been previously positioned exactly over the ingot-mold the foot of the cozy will drop into the top of the mold and rest upon the top crust of the ingot therein. If desired, the whole pressure or weight of the perfecting-machine may thus be placed upon the ingot, and such pressure serves to prevent the eruption of said upper crust when the rod or billet is driven therethrough into the molten center of the ingot. The driving of the ingot is accomplished as shown in Fig. 4—to wit, by the downward thrust of the driver 15, which expels the rod from the holder or cozy and drives it into the ingot. It will be observed that as the rod passes through the crust of the ingot the scale will be removed from the sides of the rod, so that when the rod finally penetrates the ingot it will be bright and in good condition for quick welding therewith. When necessary, a cooling fluid may be supplied to the lower part of the cozy to assist in cooling and thickening the upper crust of the ingot. I prefer in all cases to allow the cozy to remain in the mold for a short time after the rod has been thrust into the ingot, the object of this delay being to insure the chilling of the upper end of the rod in the top crust of the ingot. When sufficient time—a few seconds—has been allowed for this purpose, the frame and the cozy are lifted, and thereupon the ingot-mold, with its perfected ingot, may be removed to the stripping-station. Another filled mold is then placed beneath the perfecting-machine and the foregoing operation is repeated, the

plunger being withdrawn from the position shown in Fig. 5 before the cozy is tilted to receive the next perfecting-bar. The whole operation described need not occupy more than a minute and may be performed as rapidly as the molds can be stripped from the ingots at the stripping-station. The introduction of my machine therefore does not entail any delay or loss of time in any department of the steel mill or plant. The ingot which comes to my machine may contain a very large pipe or a number of blow-holes; but upon leaving the machine it will be solid and uniform throughout by reason of the addition of the perfecting-bar or billet, which fills the interior of the ingot to overflowing, thus closing all pipes and cavities and which as it incorporates with the ingot mass increases the strength of the central portion of the ingot.

It is obvious that numerous modifications of my invention will readily suggest themselves to one skilled in the art, and I therefore do not confine the same to the specific instructions herein shown and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An ingot-perfecting machine, comprising a suitable frame that is movable above the ingot-mold stand, in combination, with means for moving said frame, to position the same, an elongated rod-cozy carried by said frame and a rod-driver also provided in said frame, for driving a rod from said cozy into an ingot placed beneath it, substantially as described.

2. In an ingot-perfecting machine, the combination, of the ingot-mold stand, with a rod-cozy, and means for driving a rod from said cozy, as and for the purpose specified.

3. An ingot-perfecting machine, comprising an ingot-press, having a laterally-movable member adapted to guide the perfecting rod or billet, in combination, with a billet-driver operable in said member when the latter is in its normal position, substantially as described.

4. An ingot-perfecting machine, comprising a suitable frame, in combination, with a rod or billet cozy, to receive a rod or billet, a latch for holding said rod or billet therein and means for forcibly expelling the rod or billet from said cozy, substantially as described.

5. An ingot-perfecting machine, comprising a suitable frame including or provided with a movable cozy laterally movable with respect to said frame, to contain a perfecting rod or billet, in combination with means for operating said cozy and a billet-driver provided on said frame, to forcibly expel said rod or billet from said cozy, substantially as described.

6. An ingot-perfecting machine, comprising a suitable frame, in combination with means for moving said frame, a rod or billet holder in said frame, a billet-driver and scale-removing means, for brightening the rod or billet prior to its expulsion from said holder, substantially as described.

7. An ingot-perfecting machine, comprising a vertically-movable billet holder or cozy, in combination, with a billet-driver and means for cooling said cozy, substantially as described.

8. An ingot-perfecting machine, comprising, in combination, the vertically and laterally movable frame, the rod or billet chute, the cozy trunnioned in said frame to receive a rod or billet from said chute, means for operating said cozy and a billet-driver, substantially as described.

9. An ingot-perfecting machine, comprising a movable frame, in combination with means for operating the same, a billet-cozy arranged in said frame and provided with an enlarged lower end, to fit an ingot-mold, and a billet-driver, substantially as described.

10. An ingot-perfecting machine, comprising a movable frame, in combination with means for operating the same, a billet-cozy arranged in said frame, provided with a tapered lower end, to fit an ingot-mold, suitable rod-holding means in connection with said cozy, and a rod or billet driver, substantially as described.

11. An ingot-perfecting machine, comprising a vertically and laterally movable frame, in combination with means for actuating the same, a perfecting rod or billet holder movably arranged in said frame, means upon said frame for operating said cozy, a suitable latch for holding a rod or billet in said cozy, a billet-driver provided on said frame and means for projecting same into said cozy to forcibly expel a rod or billet therefrom, substantially as described.

12. An ingot-perfecting machine, comprising a suitable frame, in combination with a swinging billet-cozy arranged therein and having a central bore, to receive a rod or billet, means for operating said cozy and a corrugated or rasp-like billet-stop arranged beneath said cozy, as and for the purpose specified.

13. The combination of an ingot-mold containing a partially-solidified ingot with a power-actuated mechanism for guiding and driving an elongated billet or rod through the top and into the interior of said ingot, substantially as described.

14. The combination of an ingot-mold containing a partially-solidified ingot with a press having a pressure-foot to rest upon the top of said ingot in said mold and a mechanism for holding, guiding and driving an ingot-perfecting rod into said ingot while the same is pressed upon by said foot, substantially as described.

15. An ingot-perfecting apparatus, comprising a rod or billet holder movably supported above the ingot-mold stand and adapted to receive and temporarily support a perfecting-rod, in combination with means for driving such a rod from said holder and into

an ingot placed beneath the holder, substantially as described.

16. In an ingot-perfecting machine, a perfecting-rod cozy, movably supported above an ingot-mold stand and adapted to receive and support a perfecting-rod, in combination with means for lowering said cozy and pressing the same upon a molded ingot upon said stand, and means, independently operable, for driving a rod from said cozy into an ingot so positioned, substantially as described.

17. In an ingot-perfecting apparatus, a vertically and laterally movable frame, in combination with means for moving the same, a perfecting-rod guiding and holding device, movably arranged in the lower end of said frame, a driver provided on said frame and adapted to operate in said guide and means for operating said driver to expel from said guide a rod or billet previously placed therein, substantially as described.

18. An ingot-perfecting machine, comprising a suitable frame, in combination with means for moving the same vertically and laterally above an ingot-mold stand, a driver or plunger rod, means provided on said frame for operating said driver, and a perfecting-rod holder arranged in said frame and capable of assuming two positions—one permitting and the other preventing the movement of the driver therethrough, substantially as and for the purpose specified.

19. In an ingot-perfecting machine, a suitable frame, in combination with a driver-cylinder provided thereon, a driver projecting from said cylinder and a perfecting-rod holder arranged beneath said cylinder and movable with relation thereto, substantially as described.

20. In an ingot-perfecting machine, a suitable frame suspended above an ingot-mold stand, in combination with means for moving said frame vertically and laterally, a driver provided on said frame, means on said frame for actuating the driver, and a perfecting-rod cozy suspended in said frame beneath said driver and its actuating means, substantially as described.

21. In an ingot-perfecting machine, a suitable frame, in combinition with a perfecting-rod holder or cozy suspended in said frame and movable to first receive and then secure a perfecting-rod therein, and a rod-driver provided upon said frame above said holder, substantially as described.

22. In an ingot-perfecting machine, a perfecting-rod holder or cozy pivotally suspended above an ingot-mold stand and adapted to assume different positions, in combination with a perfecting-rod driver operable through said holder in only one of the positions of said holder, substantially as described.

23. In an ingot-perfecting machine, a perfecting-rod cozy, adapted to contain a perfecting-rod and normally occupying a vertical position, in combination with a driver operable through said cozy when in its vertical position, and means for inclining said cozy, substantially as and for the purpose specified.

24. In an ingot-perfecting machine, a suitable frame, in combination with a driver vertically movable therein, a perfecting-rod cozy that is normally in alinement with said driver, and means for moving said cozy out of alinement therewith to receive a perfecting-rod, substantially as described.

25. In an ingot-perfecting machine, a suitable frame, in combination with a driver longitudinally movable therein, a perfecting-rod holder provided in said frame and normally in alinement with said driver, means for moving said holder out of alinement with said driver to receive a perfecting-rod, and means for temporarily securing a rod placed in said holder, substantially as described.

26. In an ingot-perfecting machine, a suitable frame, in combination with a driver longitudinally movable therein, a perfecting-rod guide and holder provided in said frame, said guide and holder being normally in alinement with said driver but adapted to be moved out of alinement therewith, and a latch or securing device provided in connection with said holder and automatically operable by the movement of said driver, substantially as described.

27. In an ingot-perfecting machine, a suitable frame, in combination with a driver longitudinally movable therein, a perfecting-rod guide and holder provided in said frame, said guide and holder being normally in alinement with said driver but adapted to be moved out of alinement therewith, and a latch or securing device provided in connection with said holder and automatically operable by the movements of said holder and said driver, substantially as described.

28. In an ingot-perfecting machine, a suspended frame, in combination with a driver longitudinally movable therein, a perfecting-rod cozy arranged in said frame and normally in alinement with said driver, and means upon the frame for moving said cozy with relation to said driver, to receive a perfecting-rod, substantially as described.

29. In an ingot-perfecting machine, a suitable frame, in combination with a driver-rod, means for actuating said rod, a perfecting-rod cozy normally in alinement with said driver-rod, and a latch provided upon said cozy and operable by said driver, substantially as described.

30. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod cozy suspended therein, means upon the frame for swinging said cozy, a bottom rod-stop upon said frame and a driver also on said frame, substantially as described.

31. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod cozy movable in said frame, a driver for

expelling a rod from said cozy, a latch provided in connection with said cozy, and a bottom stop for coöperation with said cozy in one of its positions, substantially as described.

32. In an ingot-perfecting machine, a suspended frame and means for moving same vertically, in combination with a driver upon and longitudinally movable in said frame, a rod or billet holder suspended in said frame beneath said driver and means for actuating said holder and for securing the same in its normal position, substantially as described.

33. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod cozy pivotally suspended therein, means upon the frame for swinging said cozy and for securing the same in its normal position, a latch operable to secure a perfecting-bar in said cozy when the latter is in its normal position and a driver operable to free said latch and expel a rod from said cozy, substantially as described.

34. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting rod or billet holder, a latch in connection therewith for securing a rod or billet therein, and a driver for freeing said latch and expelling a rod or billet from said holder, substantially as described.

35. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod cozy movably supported in said frame, means upon the frame for operating said cozy, a yielding bottom stop provided on said frame for coöperation with said cozy, a latch provided in connection with said cozy and a suitable driver, substantially as described.

36. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod feeder, a rod-cozy provided in said frame, means upon the frame for moving the cozy beneath said feeder and for returning the cozy to its normal position, and a driver for expelling a rod from the cozy when the cozy is in its normal position, substantially as described.

37. In an ingot-perfecting machine, a vertically and laterally movable frame suspended above an ingot-mold stand, in combination with a perfecting-rod feeder adjacent to said frame, a rod cozy or holder provided in said frame and movable therewith, a rod-driver provided upon said frame and means upon the frame for positioning said cozy opposite said driver or opposite said feeder, substantially as described.

38. In an ingot-perfecting machine, a vertically and laterally movable frame, above an ingot-mold stand, in combination with a perfecting-rod feeder adjacent to said frame, a rod cozy or holder provided in said frame and movable therewith, a rod-driver provided upon said frame, means upon the frame for relatively positioning said cozy opposite said driver or opposite said feeder, and a latch automatically operable to secure a rod received into the cozy from said feeder, said latch being adapted to yield to said driver, substantially as described.

39. In an ingot-perfecting machine, a frame suspended above an ingot-mold stand, in combination with means for actuating said frame, a perfecting-rod cozy hanging from the lower end of said frame and having an open upward end, means for inserting a perfecting-rod in the upper end of said cozy and means for expelling said rod through the lower end of said cozy, substantially as described.

40. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod cozy containing a central bore and open at its upper and lower ends, a latch provided in connection with said cozy and having an operating part at the upper end thereof, whereby said latch is operable by the entrance of a perfecting-rod, and a rod-driver, substantially as described.

41. In an ingot-perfecting machine, a perfecting-rod cozy suspended above an ingot-mold stand and provided with a central bore, in combination with a latch extending into said bore, a driver, and means for positioning said cozy to receive a perfecting-bar or said driver, substantially as described.

42. In an ingot-perfecting machine, a perfecting-rod cozy suspended and laterally movable above an ingot-mold stand and provided with a lower end conforming in size and shape to the upper end of an ingot-mold, in combination with means for raising and lowering said cozy, and a driver normally removed from said cozy but adapted to operate therethrough, substantially as described.

43. In an ingot-perfecting machine, a vertically and laterally movable cozy or rod-holder, open at its upper end to receive a perfecting-rod and at its lower end to discharge such a rod, in combination with a driver for expelling the rod from said cozy, substantially as described.

44. In an ingot-perfecting machine, a vertically and laterally movable cozy or rod-holder, open at its upper end to receive a perfecting-rod and at its lower end to discharge such a rod, in combination with a driver for expelling a rod from said cozy, and said cozy having a broad lower end or pressure-foot to rest upon the top of the ingot, substantially as described.

45. In an ingot-perfecting machine, a suspended frame, in combination with means for moving the same vertically and laterally, a perfecting-rod cozy provided in the lower part of said frame, the lower end of said cozy constituting a pressure-foot, a driver provided on said frame and operable in said cozy, and means upon said frame for positioning said cozy to receive a perfecting-rod or said driver, substantially as described.

46. In an ingot-perfecting machine, a suitable frame, in combination with means for moving the same as required, a cozy suspended in the lower part of said frame, means upon the frame for operating said cozy, a driver provided in the upper part of the frame and a deflector through which said driver is operable, arranged above said cozy, substantially as described.

47. In an ingot-perfecting machine, a suitable frame and means for moving the same as required, in combination with a cozy trunnioned in said frame, fluid-actuated means on said frame for operating said cozy and a suitable rod-driver, substantially as described.

48. In an ingot-perfecting machine, a suitable frame, in combination with a perfecting-rod guide arranged in said frame, means for temporarily holding a rod in said guide, and rod-driving means provided on said frame, substantially as described.

49. In an ingot-perfecting machine, a suitable frame, in combination with means for moving said frame, a rod cozy or holder provided in the lower part of said frame, a rod-driver arranged in the upper part of said frame, means upon the frame for actuating said cozy with relation to said driver, and a yielding rod-stop provided upon the frame for coöperation with the cozy in one of its positions, substantially as described.

In testimony whereof I have hereunto set my hand, this 11th day of May, 1903, at Chicago, Illinois, in the presence of two witnesses.

ROBERT W. HUNT.

Witnesses:
C. G. HAWLEY,
JOHN H. GARNSEY.