

(No Model.)

2 Sheets—Sheet 1.

J. B. LAUGHLIN.
APPARATUS FOR CASTING METAL.

No. 584,691.

Patented June 15, 1897.

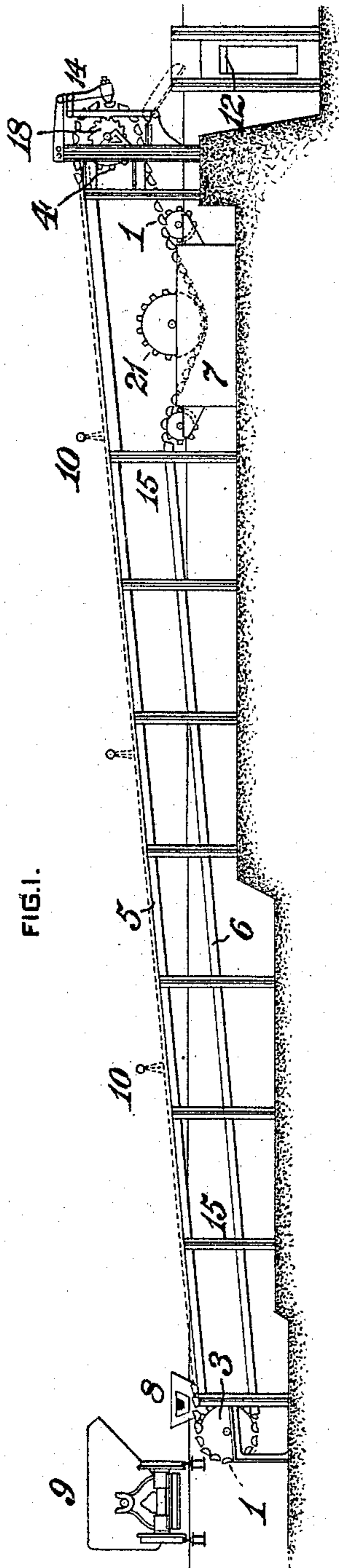


FIG. 1.

WITNESSES:

T. J. Hogan.
S. R. Bell.

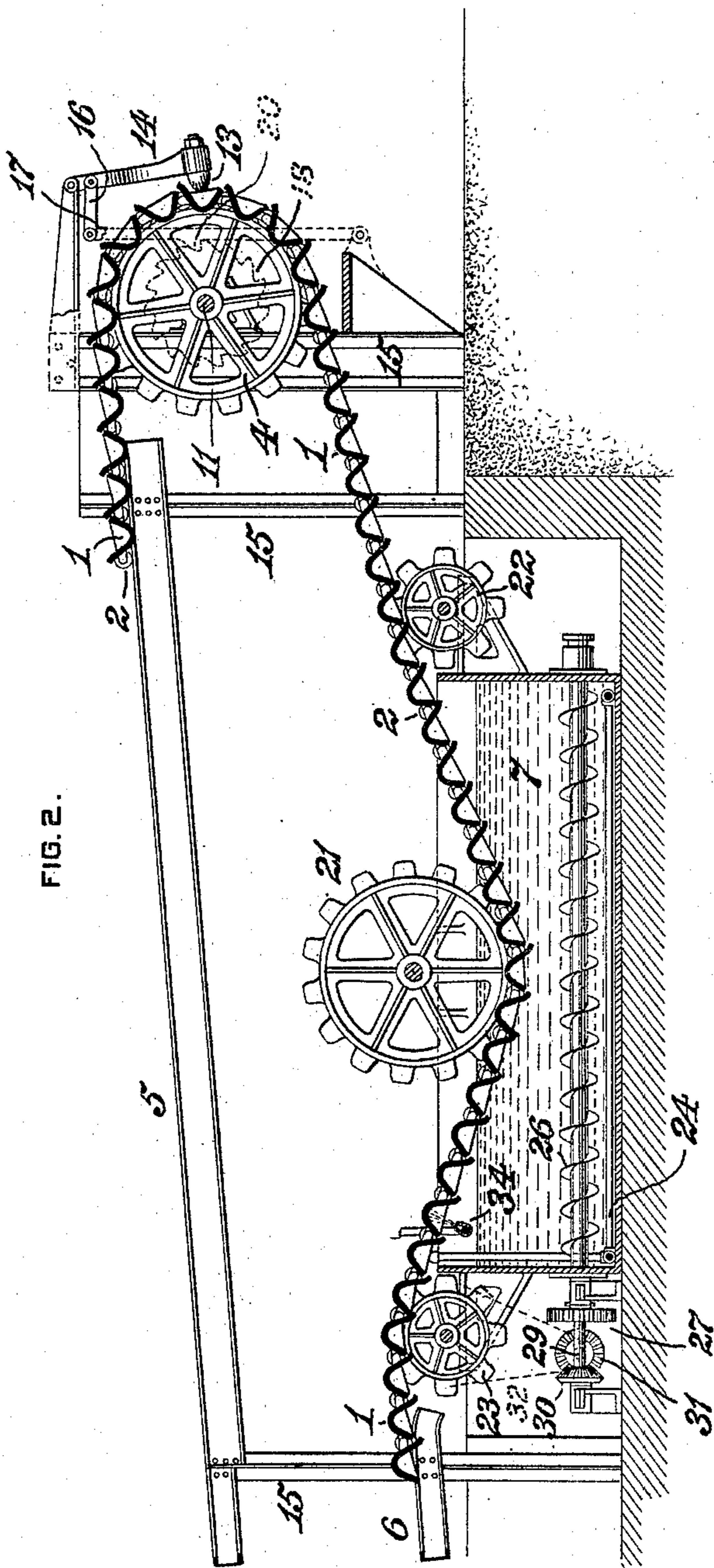


FIG. 2.

INVENTOR.

James S. Laughlin,
by S. R. Bell,
Att'y.

(No Model.)

2 Sheets—Sheet 2.

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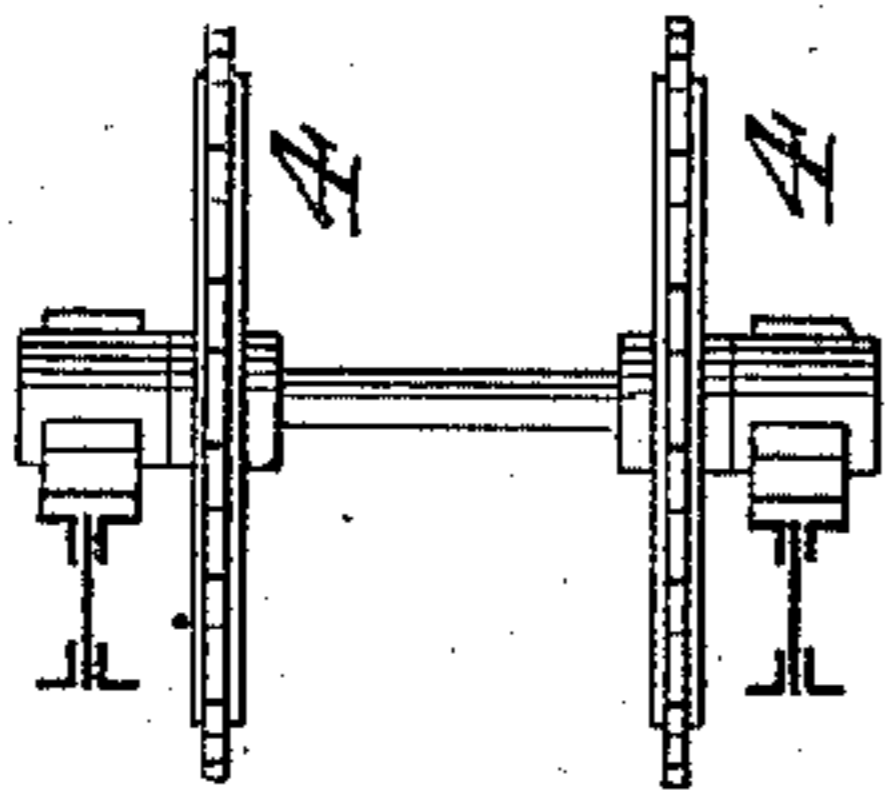


FIG. 3.

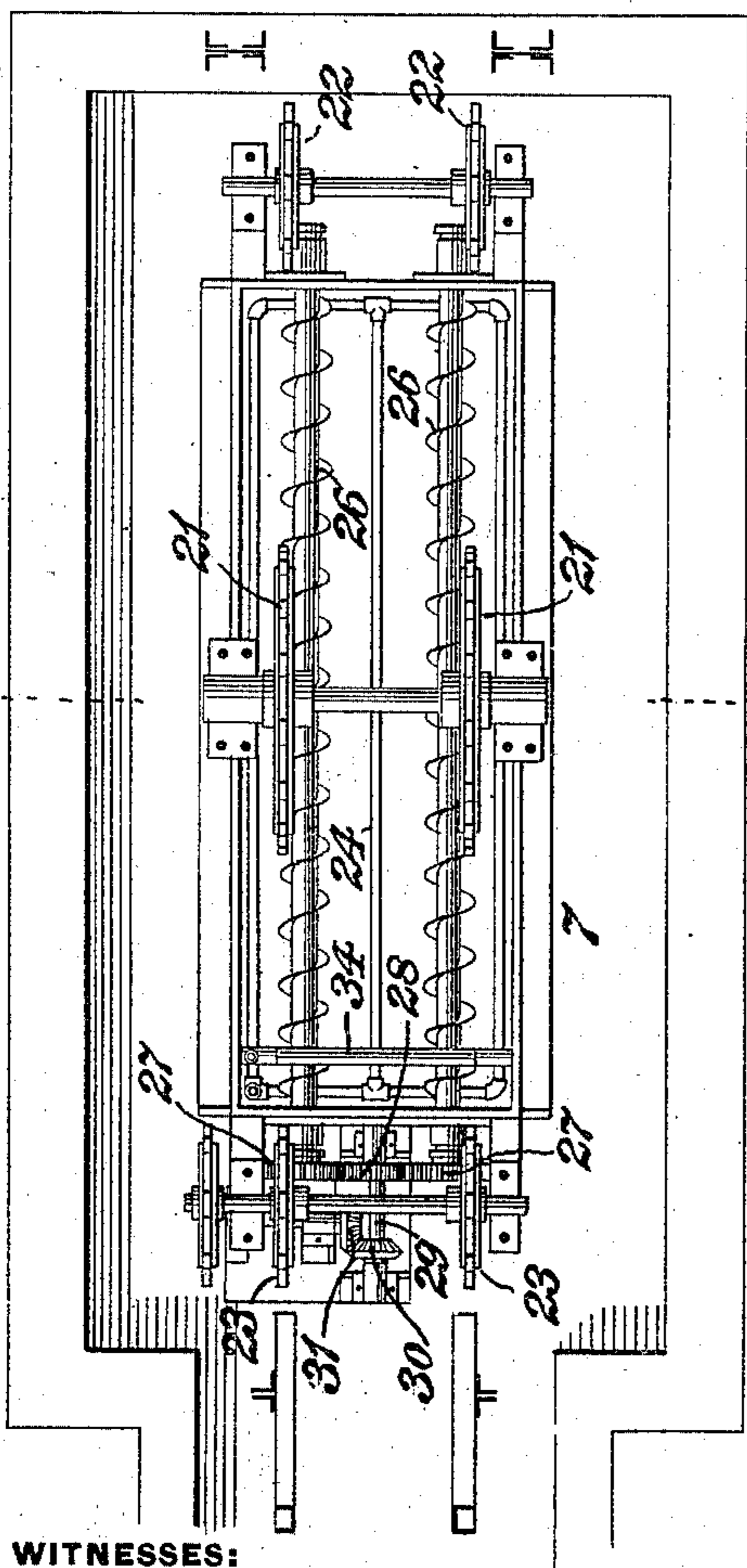
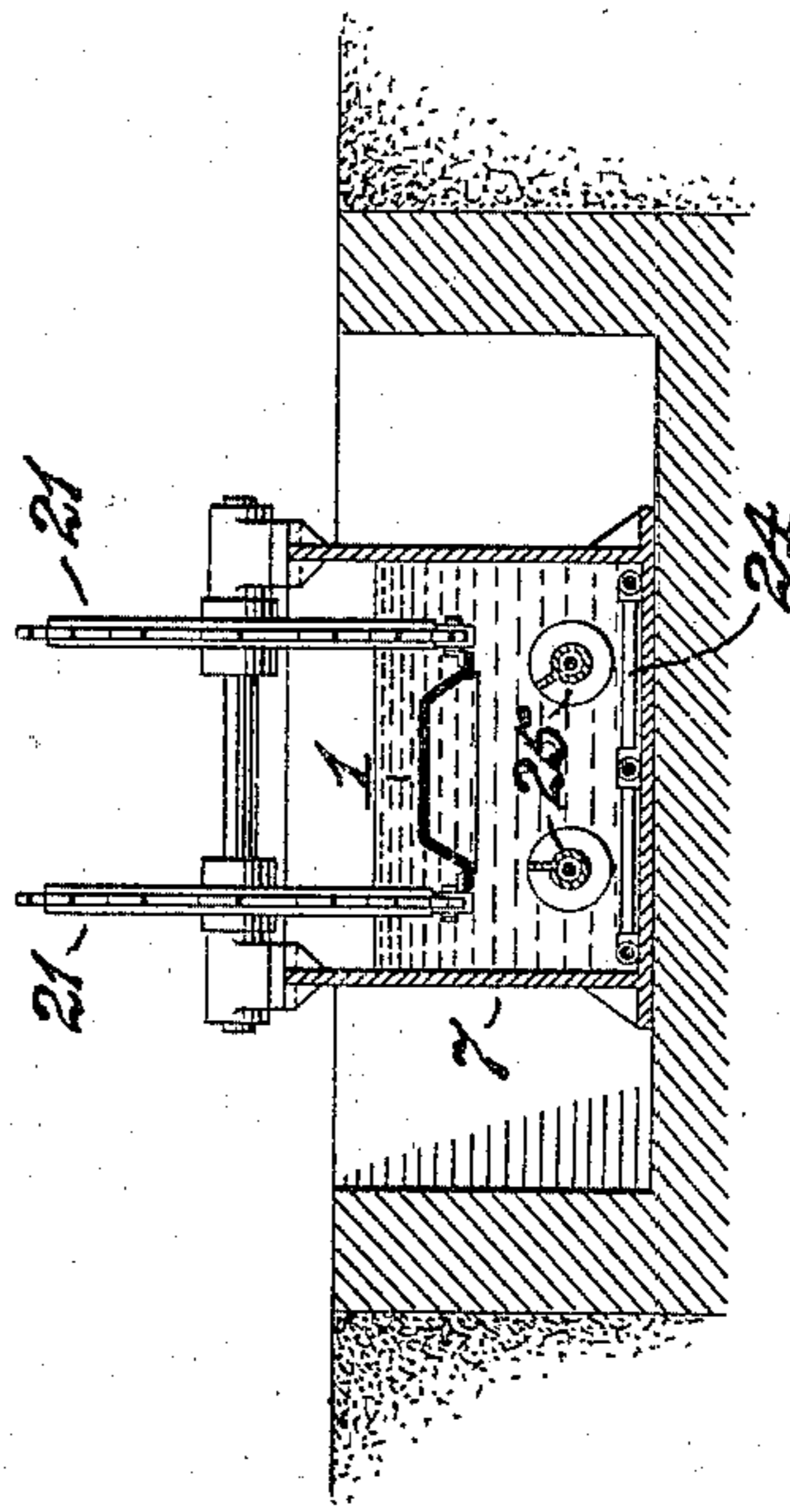


FIG. 4.



WITNESSES:

T. J. Hogan.
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UNITED STATES PATENT OFFICE.

JAMES B. LAUGHLIN, OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR CASTING METAL.

SPECIFICATION forming part of Letters Patent No. 584,691, dated June 15, 1897.

Application filed April 24, 1897. Serial No. 633,726. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. LAUGHLIN, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Apparatus for Casting Metal, of which improvement the following is a specification.

My invention relates to the casting of metal from blast or cupola furnaces or from a reservoir supplied therefrom into a connected series of traveling molds, within which the metal is solidified during the traverse of the series and carried to a suitable point of discharge, at which it is delivered in the desired solid form, the emptied molds thence returning to the point of supply and being successively refilled with molten metal, which is similarly solidified, conveyed, and discharged. Such operation and apparatus by which it is practiced have long been known in the art, and the object of my invention is to enable the advantages of casting metal in this manner to be more fully attained than under the applications of the system heretofore practiced or proposed by further economizing labor in the operation, increasing the durability of the molds, and providing an apparatus which shall be specially and desirably adapted to use in the production of pig-iron upon an extensive scale.

To this end my invention, generally stated, consists in a novel apparatus for supplying molten metal to a connected series of traveling molds, solidifying the metal in and by the traverse of the series to a point of discharge, passing the molds, while traversing toward the point of supply, after the discharge of the solidified metal, through a bath of liquid refractory material, removing the surplus refractory material from the molds, and returning the molds so coated with refractory material to the point of supply; also in the combination of a molten-metal-supply spout, a connected series of traveling molds, a mold-coating tank adjacent to the point of discharge of the series of molds, means for traversing the molds through said tank during the passage toward the supply-spout, and means for removing surplus coating material from the molds; also in the combination of a molten-metal-supply spout, a connected series of traveling molds, and means for promoting

the detachment and delivery of the cast metal from the molds.

The improvement claimed is hereinafter fully set forth.

In the practice of my invention I provide a series of metal-molds which are of form and dimensions proper for the formation of the castings desired and are coupled one to the other, so as to form an endless chain, which in the manufacture of pig-iron should be of considerable length, as, say, one hundred feet or thereabout. The molds are provided with wheels or rollers upon their ends, which traverse upon longitudinal ways or rails and engage with the teeth of pairs of carrying-wheels at the extremities of the endless chain of molds. Longitudinal movement is imparted to the molds, to effect their continuous traverse, at a determined and comparatively slow speed, past a superposed spout or channel for the supply of molten metal, located adjacent to one end of the chain, by power applied to rotate either pair of carrying-wheels or a special pair of toothed driving-wheels which engage successively the rollers of the molds. The supply-spout is located in suitable position to receive the molten metal, either directly from a blast or other furnace or from a portable reservoir or car supplied from said furnace, and the molten metal is delivered successively to the molds by the spout as they pass below it. In the traverse of the molds from the supply-spout to the farthestmost pair of carrying-wheels the metal supplied to the molds becomes solidified therein, the operation being promoted by the application of jets of water after solidification has commenced, and the metal is discharged in solid form by the action of gravity at the farther or outer end of the chain of molds, from which the molds return to and past the supply-spout to similarly receive and deliver new charges of metal.

In order to counteract the tendency of the solidified metal to adhere to the molds and permit its free delivery therefrom to be effected by the action of gravity as the molds successively pass below the axis of the carrying-wheels at the discharge end of the apparatus, mechanism is provided by which a blow is struck upon the metal in each mold as the same approaches its position of dis-

charge, thereby detaching the pig or other casting and allowing it to drop out of the mold.

The action of the hot metal upon the molds, if unopposed, effects their rapid deterioration and destruction, and to counteract this injurious tendency, as well as to prevent the adhesion of the molten metal to the molds, the molds are coated with a suitable clay-wash or other liquid refractory material by immersing them successively in a bath of such material during their traverse toward the supply-spout and as soon as practicable after the discharge of the castings. The refractory material is kept at a high temperature by steam heating-pipes or other suitable means and is also preferably mechanically agitated, so as to prevent the subsidence of solid matter.

The immersion of the molds in the bath may be effected by providing a sufficient amount of slack on the lower side of the endless chain of molds to allow the molds to drop below the surface of the refractory material in the vat or tank, but the molds are preferably carried down to the requisite level by means of toothed guide-wheels journaled above and below the lower side of the endless chain of molds and engaging the rollers of the molds. After the molds pass out of the refractory coating material in the vat or tank the surplus coating material is removed, preferably by a blast of steam or air, and the coated molds are, in their further traverse, dried and presented to the supply-spout in proper condition for receiving new charges of molten metal therefrom.

In the accompanying drawings, Figure 1 is a diagrammatic side view of an apparatus for casting metal, illustrating an application of my invention; Fig. 2, a vertical longitudinal section, on an enlarged scale, through a portion of the same at and near its discharge end; Fig. 3, a plan or top view of the coating-tank and adjacent members, the molds being removed; and Fig. 4, a transverse section at the line *x x* of Fig. 3.

In the practice of my invention I provide a connected series of molds 1, each of shape and dimensions proper to form a pig or other desired casting and having wheels or rollers 2 journaled on its ends, the molds being linked or coupled one to another, so as to form an endless chain, which passes around pairs of toothed guide-wheels 3 and 4, journaled in bearings adjacent to the receiving and delivery ends of the chain, respectively, and engaging the end rollers 2 of the molds. The rollers traverse and are supported intermediately of the guide-wheels upon upper and lower pairs of rails or ways 5 and 6, supported upon posts or standards 15, the lower rails 6 terminating at a sufficient distance from the discharge or delivery end of the chain of molds to permit of the same being carried down into a coating vat or tank 7, to be presently described. A supply spout or channel 8 is located above the chain of molds adjacent to

the receiving end thereof and projects over the molds in position to successively deliver charges of molten metal to the several molds as they pass beneath it in the longitudinal traverse of the chain. The supply-spout 8 may either be supplied with molten metal directly from a blast or other furnace or receive the same from a portable reservoir or car 9, by which the metal is transported from the furnace or furnaces, the latter being the preferable mode of supply, as it enables the casting apparatus to be located in any desired relation to the furnace as well as to serve for casting metal from one or more of a plurality of furnaces.

The connected series or chain of molds should be of sufficient length—as, say, one hundred feet, or thereabout, between the axes of the guide-wheels at its ends, in blast-furnace practice—to allow the molten metal to solidify by exposure to the atmosphere in the comparatively slow longitudinal traverse of the molds from the supply-spout to the discharge or delivery end of the apparatus, the solidification of the metal being accelerated by the application of jets of water from overhead sprinkler-pipes 10. The traverse of the molds is effected by the rotation at proper and determined speed, by a steam-engine or other suitable motor, of either of the toothed guide-wheels 3 and 4, in this instance the shaft 11 of the guide-wheel 4 being the driving-shaft to which rotative power is applied. The detailed features of construction and connection of the molds are not claimed as of my present invention, and being in and of themselves well known in the art need not be herein at length set forth.

The solidified metal drops from the molds by the action of gravity as they successively pass below the axis of the guide-wheels 4 at the discharge end of the apparatus, and the castings may be received upon an endless-belt conveyer 12, by which they are transported to a desired location of storage or shipment, or they may drop into cars running upon a track extending transversely to the apparatus adjacent to its discharge end. In order to promote and insure the unobstructed delivery of the cast metal from the molds by counteracting its tendency to adhere thereto, mechanism is provided for rapping or striking the metal in each mold shortly before the mold arrives at the point of discharge. In the instance shown the operation is effected by a hammer 13, fixed upon and weighting the lower end of an arm 14, which is pivoted at its upper end to the supporting-posts at the discharge end of the apparatus. The arm 14 is coupled by a link 16 to the upper end of a vibratable arm 17, the lower end of which is pivoted to a bracket on one of the supporting-posts 15. A wheel 18, having teeth of ratchet form, is secured upon the shaft 11 of the guide-wheels 4 at the discharge end of the machine, the teeth of said wheel successively engaging a cam projection 20 on the arm 17 and thereby

vibrating said arm and the connected hammer-arm 14 in a vertical plane. As said arms are swung to the right by the action of a tooth of the wheel 18 the hammer 13 is brought into position to deliver a blow upon the casting of the next approaching mold, which blow is struck by the gravity of the hammer upon the release of the cam projection 20 from contact with the tooth. It will be seen that the action of the hammer is effected automatically and in proper relation to the progressive movement of the molds around the guide-wheels 4, so as to insure the delivery of each blow fairly upon the metal in the mold which is presented to it.

I do not desire to limit myself to the specific detaching mechanism herein set forth, as it will be obvious that modifications thereof will readily suggest themselves to a mechanic skilled in the art without departure from my invention, the leading and essential feature of which in this particular consists of a striking mechanism which is automatically operated coincidently with and proportionately to the rotation of the guide or carrying wheels at the discharge end of the endless chain of molds.

In apparatus of the type to which my invention relates the molds have heretofore been coated with clay-wash or other suitable liquid refractory material, to prevent the molten metal from adhering to them and to increase their durability, either by means of brushes, by removing them from the carrier, lowering them into a vat of clay-water, and replacing them in operative position, or by spraying or injecting the liquid material by means of a pump. Each of these expedients is subject to greater or less objection, and under my invention I effect a further economization of time and labor and a thorough and effective application of the coating material to the interior surfaces of the molds by immersing them, while in transit toward the supply-spout and as early as practicable after the delivery of the castings, in a vat or tank of liquid refractory material which is maintained at a comparatively high temperature and removing the surplus coating material by an air or steam blast as or shortly after the molds emerge from the liquid. To this end the chain of molds is made of such length as will provide an amount of slack sufficient to enable its lower side to dip into and traverse longitudinally below the level of the liquid in a coating vat or tank 7, which is located below and in line with the endless chain of molds, as closely as may be to the discharge end of the apparatus, and is supplied with clay-water or other suitable liquid refractory material. To effect the proper immersion of the molds and prevent their contact with the ends of the vat, the molds are caused to pass under a pair of toothed guide-wheels 21, journaled in bearings above the coating-tank and engaging the rollers 2 of the molds, and to pass above pairs of toothed guide-wheels 22

23, journaled in bearings at the ends of the coating-tank. The lower rails 6, upon which the rollers on the lower side of the endless chain of molds traverse in the direction of the pouring-spout, terminate, as before stated, at a sufficient distance from the discharge end of the apparatus to admit of the introduction of the coating-tank, and the rollers of the molds pass to and traverse on said rails after leaving the guide-wheels 23.

The liquid in the coating-tank is maintained at as high a temperature as is conveniently practicable by any suitable means for applying a heating medium, as, for example, coils or return-bends of steam heating-pipe 24, disposed adjacent to the bottom of the tank, and in order to prevent the subsidence or settling of the solid matter in the solution it is preferably kept in a state of agitation, for which purpose shafts 25, carrying helical blades or threads 26, may be journaled in bearings near the bottom of the tank, said shafts carrying spur-gears 27, engaging a similar gear 28 on a shaft 29. The shaft 29 carries a bevel-gear 30, which engages a similar gear 31 on a horizontal shaft rotated by a belt 32 from the shaft of the guide-wheels 23.

The surplus coating material is removed from the molds as they successively emerge from the liquid in the tank 7 by a blast of steam or air supplied through a pipe 34, which extends across the tank, near the end thereof from which the molds pass out, and is provided with an opening or series of jets throughout its length, so as to direct the blast upon the entire length of the molds. The surplus liquid which is removed by the blast falls back into the tank and the coated molds pass onward to the supply-spout, being dried in transit by exposure to the atmosphere and to the heat of the charged molds on the upper side of the endless chain and in proper condition to receive fresh charges of molten metal.

I claim as my invention and desire to secure by Letters Patent—

1. In an apparatus for casting metal, the combination, substantially as set forth, of a molten-metal-supply spout, a connected series of traveling molds, a mold-coating tank adjacent to the point of discharge of the series of molds, means for passing the molds through said tank during their traverse toward the supply-spout, and means for removing surplus coating material from the molds.

2. In an apparatus for casting metal, the combination, substantially as set forth, of a molten-metal-supply spout, a series of molds connected to form an endless chain, toothed guide-wheels engaging the chain of molds adjacent to the supply-spout and to a desired point of discharge at the opposite extremity of the chain, mechanism for traversing the members of the chain of molds from the supply-spout to the point of discharge and thence back to the supply-spout, a coating-tank located below the chain of molds and adjacent to the discharge extremity thereof, and toothed

guide-wheels engaging the chain of molds within and at opposite ends of the coating-tank.

3. In an apparatus for casting metal, the combination, substantially as set forth, of a molten-metal-supply spout, a series of molds connected to form an endless chain, toothed guide-wheels engaging the chain of molds adjacent to the supply-spout and to a desired point of discharge at the opposite extremity of the chain, mechanism for traversing the members of the chain of molds from the supply-spout to the point of discharge and thence back to the supply-spout, a coating-tank located adjacent to the discharge extremity of the chain of molds and receiving successively the molds thereof during their traverse to the supply-spout, and a pipe for delivering a blast of fluid under pressure to the molds after their immersion in liquid refractory material contained in the coating-tank.

4. In an apparatus for casting metal, the combination, substantially as set forth, of a molten-metal-supply spout, a series of molds connected to form an endless chain, toothed guide-wheels engaging the chain of molds adjacent to the supply-spout and to a desired point of discharge at the opposite extremity of the chain, mechanism for traversing the members of the chain of molds from the supply-spout to the point of discharge and thence back to the supply-spout, a coating-tank located adjacent to the discharge extremity of the chain of molds and receiving successively the molds thereof during their traverse to the supply-spout, and means for applying a heating medium to liquid refractory material contained in the coating-tank.

5. In an apparatus for casting metal, the combination, substantially as set forth, of a

molten-metal-supply spout, a series of molds connected to form an endless chain, toothed guide-wheels engaging the chain of molds adjacent to the supply-spout and to a desired point of discharge at the opposite extremity of the chain, mechanism for traversing the members of the chain of molds from the supply-spout to the point of discharge and thence back to the supply-spout, a coating-tank located adjacent to the discharge extremity of the chain of molds and receiving successively the molds thereof during their traverse to the supply-spout, and mechanism, actuated through connection with the chain of molds, for agitating liquid refractory material contained in the coating-tank.

6. In an apparatus for casting metal, the combination, substantially as set forth, of a molten-metal-supply spout, a series of molds connected to form an endless chain, toothed guide-wheels engaging the chain of molds adjacent to the supply-spout and to a desired point of discharge at the opposite extremity of the chain, mechanism for traversing the members of the chain of molds from the supply-spout to the point of discharge and thence back to the supply-spout, a hammer fixed on an arm which is journaled to vibrate in a vertical plane adjacent to the molds in their passage around the guide-wheel at the discharge extremity of the chain of molds, a ratchet-wheel fixed on the shaft of said guide-wheel, a pivoted arm having a cam projection engaging the teeth of the ratchet-wheel, and a link coupling said arm to the hammer-arm.

JAMES B. LAUGHLIN.

Witnesses:

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B. F. JONES, Jr.