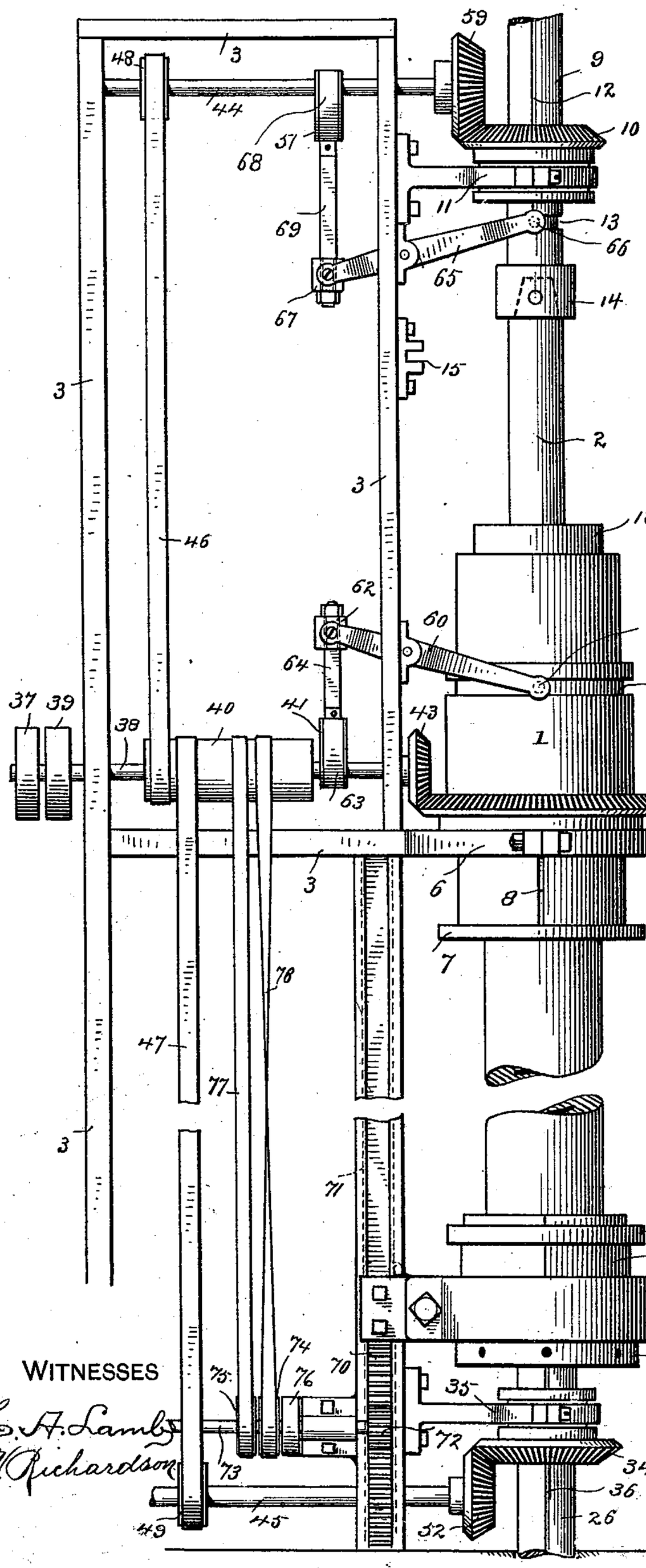
(No Model.) 3 Sheets—Sheet 1.

P. ARMAND & A. RAIS.

MACHINE FOR CASTING HOLLOW INGOTS.

No. 550,089. Patented Nov. 19, 1895.

Fig. 1.



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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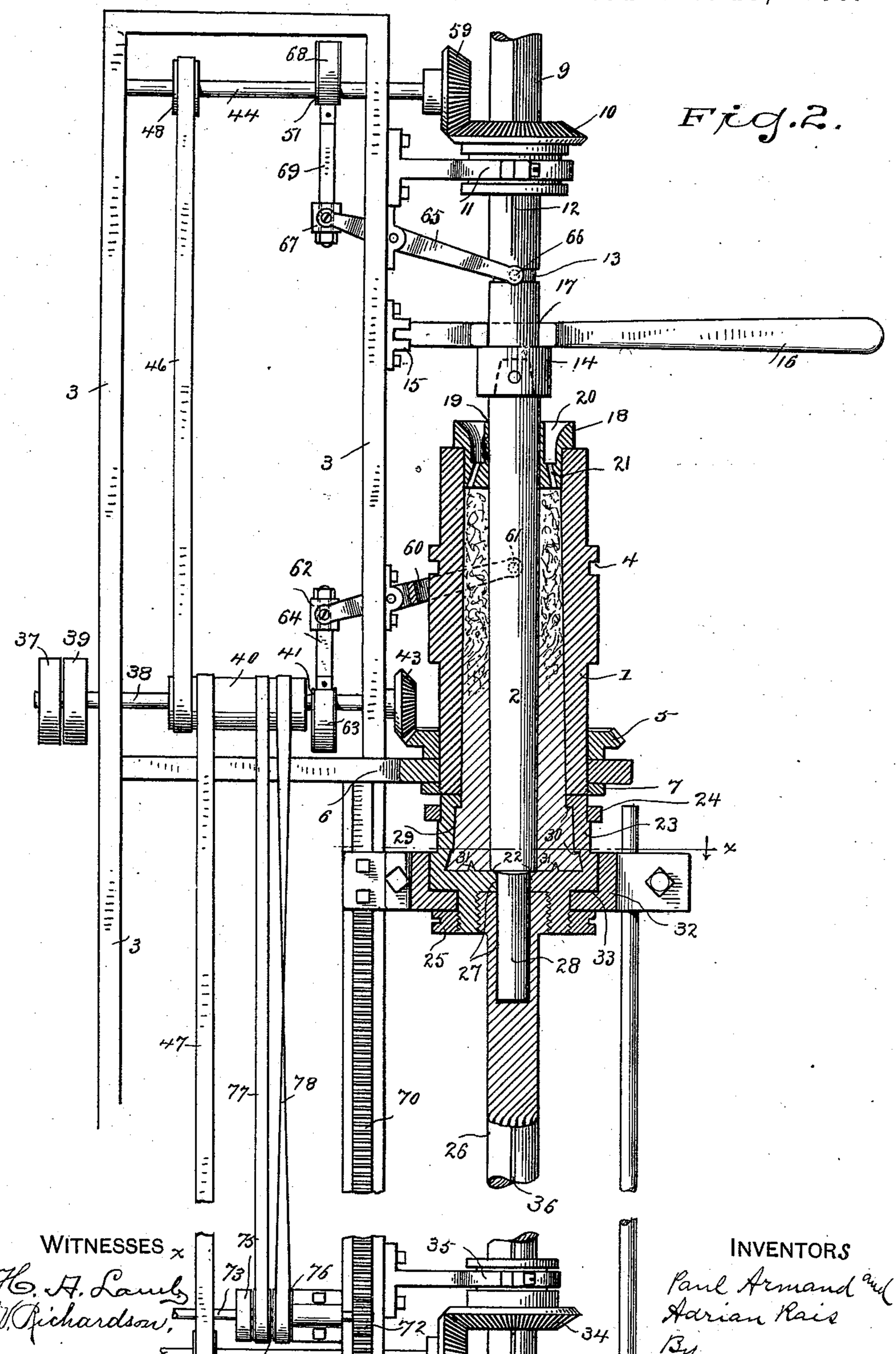

Fig. 2.

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Fig. 3.

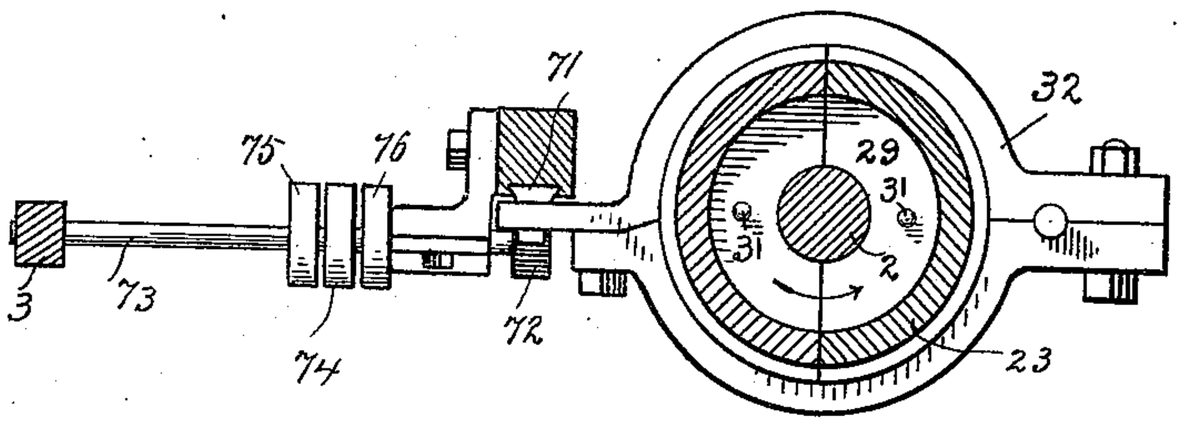


Fig. 4.

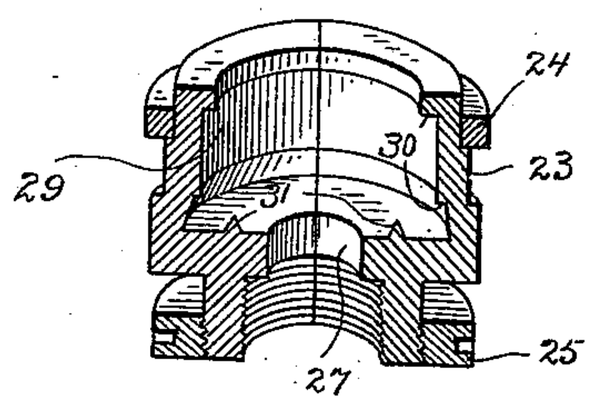
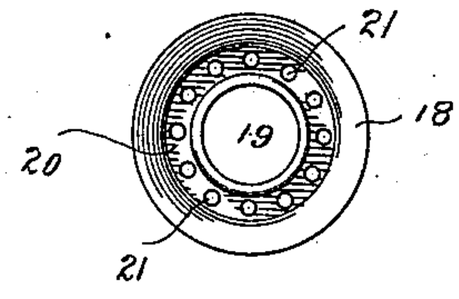


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

PAUL ARMAND, OF BRIDGEPORT, AND ADRIAN RAIS, OF WATERBURY, CONNECTICUT.

MACHINE FOR CASTING HOLLOW INGOTS.

SPECIFICATION forming part of Letters Patent No. 550,089, dated November 19, 1895.

Application filed August 1, 1895. Serial No. 557,863. (No model.)

To all whom it may concern:

Be it known that we, PAUL ARMAND, residing at Bridgeport, in the county of Fairfield, and ADRIAN RAIS, residing at Waterbury, in the county of New Haven, State of Connecticut, citizens of the United States, have invented certain new and useful Improvements in Machines for Casting Hollow Ingots; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention has for its object to produce a machine for casting hollow ingots or tubes of greater length than the mold and of greater length than it has heretofore been possible to produce them; and furthermore to provide a construction in which either the core or the mold or both may be reciprocated during the operation of casting, in which the lower bit may be moved away from the mold during the operation of casting, thereby drawing the partly-solidified casting from the mold, and in which, if desired, the mold, the core, or the lower bit may be rotated, during the operation of casting, either together or independently.

With these ends in view we have devised the novel machine of which the following description, in connection with the accompanying drawings, is a specification, numbers being used to designate the several parts.

Figure 1 is an elevation of our novel machine, showing the core in the raised position and the mold in the lowered position; Fig. 2, a similar view, partly in horizontal section, showing the model at the raised position, the core being lowered to the bottom of the mold, as at the commencement of the operation of casting; Fig. 3, a section on the line *x x* in Fig. 2, looking down; Fig. 4, a perspective section of the lower bit detached; and Fig. 5 is a plan view of the upper bit detached.

1 denotes the mold, 2 the core or mandrel, and 3 framework, which may be of any suitable or preferred construction.

As already stated, it is an essential feature of our invention that we provide means for reciprocating the core or mold or both during the operation of casting and for moving the lower bit away from the mold. These movements may be produced in any suitable manner, the special mechanism for producing said movements not being of the essence of our invention. Any desired style of hollow ingot or tube may be produced by giving to the internal diameter of the mold the desired shape in cross-section—that is, either polygonal, fluted, or channeled, or round. We have shown the mold as provided with a circumferential groove 4 and with a bevel gear-wheel 5, which is secured to the mold by a key, (not shown,) engaging a longitudinal groove 8 in the mold, so that the mold will be rotated by the gear-wheel, but will be free to reciprocate independently thereof. The hub of this gear-wheel rests upon a bearing 6, extending from the frame, in which the mold turns freely, the lower end of the mold being threaded and engaged by a threaded collar 7, which prevents the possibility of the mold being detached from the frame without removal of the collar. The core is detachably secured to a head 14 at the lower end of shaft 9. This shaft is provided with a circumferential groove 13 and carries a bevel gear-wheel 10, whose hub is journaled in a bearing 11, which extends from the frame, said gear-wheel being secured to the shaft by means of a key (not shown,) which engages a longitudinal groove 12 in said shaft, so that the shaft, and with it the core, will be rotated by the gear-wheel, leaving the shaft and core free to reciprocate independently of the gear-wheel.

15 denotes a projection from the frame, which serves as a fulcrum for a detachable lever 16. This lever is provided with a socket 17, which receives shaft 9, so that when the inner end of the lever is placed in engagement with the projection the walls of the socket will engage head 14 on the shaft and will enable the operator to press the core downward, so that a shoulder 22 at the lower end of the operative portion of the core will engage the lower bit, as clearly shown in Fig. 2.

18 denotes the upper bit, which is made of suitable refractory material, which engages the top of the mold and is provided with a central opening 19, through which the core

passes freely. The upper bit is provided with a funnel-shaped recess 20, into which the molten metal is poured, and with openings 21 in its bottom, which incline outward from the vertical plane, so that the molten metal as it passes into the mold will come first in contact with the inner periphery of the mold, instead of with the core.

23 denotes the lower bit, which is made in two parts, as clearly shown in Fig. 4, said parts being locked together by a ring 24 and a screw-ring 25. The bit in its assembled form is detachably secured at the upper end of a shaft 26, preferably by a threaded engagement, as shown in Fig. 2.

27 denotes an opening through the bottom of the lower bit and in the end of shaft 26, which receives the reduced lower end 28 of the core, whereby the core is centered and maintained in a central position during the operation of casting.

At the commencement of the operation of casting the mold rests upon the top of the lower bit, as shown in Fig. 2. In practice we ordinarily make the mold taper downward and outward slightly and the core to taper downward and inward slightly, although these are not essential features of construction. The lower bit is provided with a recess 29, which receives the first of the molten metal that is poured in at the upper bit. This recess is made to taper upward and inward or is provided with overhanging shoulders 30, so that the casting as it solidifies will be firmly held by the lower bit when the bit and mold separate, as will be more fully explained. Pins 31 extend upward from the bottom of the bit, so as to hold the casting solid with the bit should the latter be rotated.

32 denotes a cross-head which is adapted to move vertically on the framework and is provided with a bearing in which the lower bit may turn freely, the bit resting on a shoulder 33 in the bearing and screw-ring 25 engaging the bit below the bearing, so that the bit will move up and down with the cross-head wholly independently of the rotary movement which may or may not be imparted to the bit, as we shall presently describe.

Shaft 26 carries a bevel-gear 34, whose hub is journaled in a bearing 35, which extends from the frame, said gear-wheel being secured to the shaft by means of a key (not shown) which engages a longitudinal groove 36 in said shaft, so that the shaft, and with it the lower bit, will be rotated by the gear-wheel, leaving the shaft and bit free to be moved vertically independently of the gear-wheel.

Power may be applied to produce the movements we have described in any ordinary or preferred manner. In the present instance we have shown a construction in which power is applied by means of a belt (not shown) running over a belt-pulley 37 on a main shaft 38, which is journaled in the frame. This shaft also carries a loose pulley 39, a belt-drum (or series of pulleys, if preferred,) 40, an eccentric 41, and may or may not carry at its inner end a bevel-pinion 43, adapted to mesh with bevel-gear 5 on the mold, whereby the latter may be rotated. If it is not desired to rotate the mold, bevel-pinion 43 is removed from shaft 38, thus permitting the mold to reciprocate, as will presently be described, but without rotary movement. Loose pulley 39 is simply for the purpose of enabling the operator to shift the main belt (not shown) from pulley 37 when it is desired to stop the machine without stopping the power.

44 denotes a shaft journaled in the framework above the main shaft, and 45 a shaft journaled in the framework below the main shaft. These shafts are driven, respectively, by belts 46 and 47, extending over belt-drum 40 on the main shaft and belt-pulleys 48 and 49 on the upper and lower shafts. Shaft 44 carries, in addition to belt-pulley 48, an eccentric 51, and may or may not carry a bevel-pinion 59, adapted to mesh with bevel-gear 10 on shaft 9, whereby shaft 9 and the core may be rotated. If it is not desired to rotate the core, bevel-pinion 59 is removed, thus leaving shaft 9 and the core free to reciprocate, as will presently be described, but without rotary movement. Shaft 45 may or may not carry a bevel-pinion 52, adapted to mesh with bevel-gear 34 on shaft 26, which carries the lower bit, whereby the lower bit may be rotated. If it is not desired to rotate the lower bit, bevel-pinion 52 is removed, and shaft 45 may be thrown out of use, if preferred, by the removal of belt 47, thus leaving the lower bit free to be moved vertically, as will presently be described, but without rotation. Reciprocatory movement may be imparted to the mold and to the core in any ordinary or preferred manner. We have shown a construction in which reciprocatory movement is imparted to the mold by means of a lever 60, which is fulcrumed on the framework. One end of this lever is bifurcated, the branches partially inclosing the mold and carrying pins or rollers 61, (shown only in dotted lines,) which engage circumferential groove 4 in the mold. The other end of this lever is pivoted to a block 62.

63 denotes a strap inclosing eccentric 41, and 64 an eccentric-rod which is connected to the strap, and also by means of a suitable universal connection to block 62.

It will be obvious that rotation of shaft 38 and the eccentric will produce reciprocatory movement of the mold. The reciprocatory movement of the core is shown as produced in a similar manner.

65 denotes a lever which is fulcrumed on the framework. One end of said lever is bifurcated, the branches partially inclosing shaft 9 and carrying pins or rollers 66, (shown only in dotted lines,) which engage circumferential groove 13 in shaft 9. The other end of this lever is pivoted to a block 67.

68 denotes a strap inclosing eccentric 51, and 69 an eccentric-rod which is connected to the

strap, and also by means of a universal connection to block 67.

It will be obvious that rotation of shaft 44 and eccentric 51 will produce reciprocatory movement of shaft 9 and the core. Eccentrics 41 and 51 may be so adjusted on their respective shafts as to produce these movements simultaneously or alternately, as may be preferred. Should it not be required to reciprocate either the mold or the core the corresponding lever would be disconnected from the block to which it is attached in use.

The vertical movement of the cross-head which carries the lower bit may be produced in any ordinary or preferred manner. We contemplate applying hydraulic power for this purpose in practice, but for the purposes of this specification it is not deemed necessary to illustrate the application of hydraulic power, and we have shown a simple mechanical construction which we have found to operate perfectly in use.

70 denotes a rack which is rigidly secured to the cross-head and is adapted to reciprocate in a dovetail recess 71 in the frame. This rack is engaged by a pinion 72 on a shaft 73, journaled in the frame. This shaft also carries a fixed belt-pulley 74, and on opposite sides thereof loose pulleys 75 and 76.

77 denotes a straight belt and 78 a crossed belt extending from belt-drum 40 on shaft 38 to pulleys 74, 75, and 76 on shaft 73. It is obvious that when straight belt 77 is running over fixed belt-pulley 74 shaft 73 will be rotated thereby, the crossed belt being out of operation, as it will be running on loose pulley 76, and that when straight belt 77 has been shifted to loose belt-pulley 75, and crossed belt 78 has been shifted to the fixed belt-pulley, that shaft 73 will be rotated in the opposite direction, movement in one direction acting to move the rack and with it the cross-head and lower bit upward, and movement in the opposite direction acting to move the rack, cross-head, and lower bit, and with them the casting which is being drawn from the mold, downward. When both belts are shifted to loose pulleys, it is obvious that shaft 73 will not be rotated in either direction and that no movement will be imparted to the cross-head and lower bit. The shifting of the belts may be performed by hand or by any ordinary belt-shifter, which we have not shown, as specifically it forms no portion of our present invention.

The operation is as follows: In starting the parts are placed in the position shown in Fig. 2, the mold being in the raised position and resting upon the lower bit carried by the cross-head, which is also in the raised position. The core is pressed down in the mold until shoulder 22 rests upon the lower bit. In this position of the parts molten metal is poured into the upper bit and passes down through the mold and into the lower bit, which is filled with the molten metal before the mold begins to fill. As soon as the metal in the lower bit and in the lower part of the mold has become set sufficiently to be firm, this being a matter which can be timed accurately by an experienced workman, the belt (not shown in the drawings) by which the main shaft is driven is shifted from loose pulley 39 to fast pulley 37, and the reciprocation of the mold and core, either or both, commences. The effect of the reciprocatory movement of the mold and core is to prevent the casting from adhering to the core as the metal becomes solid. Simultaneously with the reciprocatory movement of the mold and core the mold, core, and the lower bit, either or all of them, as may be preferred, will commence to rotate. As soon as it is apparent that the metal in the lower part of the mold has become solidified, the operator shifts the proper belt to fixed belt-pulley 74 on shaft 73, and motion is imparted to said shaft and the pinion carried thereby, and the rack, cross-head, and lower bit are moved downward, and the solidified portion of the ingot is thus drawn from the mold, the operator continuing to pour molten metal into the upper bit until an ingot of the required length has been made or until the cross-head has been moved downward the full capacity of the framework and the mold is filled to the upper bit. The pouring then ceases, and the operator shifts the belt by which the main shaft is driven to loose pulley 39 and stops the movement of all the parts. The lower bit is so shaped as to keep firm hold upon the ingot, and the pins in the lower bit insure that when the lower bit is rotated the ingot will be rotated with it.

Having thus described our invention, we claim—

1. A machine for casting hollow ingots comprising in its construction a rotary and longitudinally movable mold and core, and a lower bit movable independently of the mold and core in a direction away therefrom, said bit being formed to positively engage or grasp the lower end of the casting, whereby movement of the bit away from the mold may elongate the casting.

2. In a machine of the character described the combination with a mold, a core, mechanism for imparting reciprocatory movement to one of said parts and mechanism for imparting rotary movement to one of said parts, of a lower bit, mechanism for moving said lower bit away from the mold and mechanism for imparting rotary movement to the lower bit and with it the casting independently of the vertical movement of the lower bit.

3. In a machine of the character described the combination with a mold and a core, of a lower bit made in two parts and provided with an overhang and rings 24 and 25 by which said parts are locked together.

4. In a machine of the character described the combination with a mold and a core having a reduced end 28, of a lower bit detachably secured to a shaft 26, said bit and said shaft having an opening 27 to receive the re-

duced end of the core whereby the latter is centered.

5. In a machine of the character described the combination with a mold, a core and mechanism for reciprocating one of said parts, of a lower bit formed to positively engage or grasp the lower end of the casting, a cross head in which the lower bit is detachably secured and mechanism for moving said cross head and with it the lower bit away from the mold.

6. In a machine of the character described the combination with a mold, a core and mechanism for reciprocating one of said parts, of a two part lower bit having an overhang and pins 31, a cross head in which the lower bit is detachably secured, mechanism for moving said cross head and with it the lower bit vertically away from the mold and mechanism for imparting rotary movement to the lower bit independently of the vertical movement so that the lower bit may be moved away from the mold drawing the casting with it and rotary movement may be imparted to both lower bit and casting.

7. In a machine of the character described the combination with a mold, a core and mechanism for imparting reciprocatory movement to one of said parts, of a lower bit adapted to register with the mold, mechanism for moving said lower bit away from the mold and an upper bit adapted to engage the top of the mold, both of said bits having openings through which the core passes freely.

8. In a machine of the character described the combination with a mold, a core and mechanism for imparting reciprocatory movement to one of said parts, of a lower bit adapted to register with the mold, mechanism for moving said lower bit away from the mold and an upper bit adapted to engage the top of the mold and provided with openings 21 which incline outward from the vertical plane so that molten metal as it passes into the mold will come first in contact with the mold instead of the core, both of said bits having openings through which the core passes freely.

9. In a machine of the character described the combination with a mold and a core, of an upper bit adapted to engage the top of the mold and having a central opening 19 through which the core passes freely, and an annular recess 20 surrounding the opening 19, said recess having a wall surrounding the opening 19 and being funnel-shaped in radial cross section and adapted to receive the molten metal, said bit being provided at the bottom of the recess with the openings 21 which incline outward from the vertical plane so that the molten metal as it passes into the mold will first come in contact with the mold instead of the core.

10. In a machine of the character described the combination with a mold and a core, of a lower bit made in two parts, a ring 24 and a screw ring 25 by which said parts are held together, said lower bit being provided with an opening 27 through which the core passes freely, a recess 29 which receives the first of the molten metal and overhanging shoulders 30 and pins 31 which are engaged by the metal as it solidifies so that the casting will be firmly held by the lower bit.

In testimony whereof we affix our signatures in presence of two witnesses.

PAUL ARMAND.
ADRIAN RAIS.

Witnesses:
FORTUNE GROS,
NELSON J. WELTON.