Jan 6, 1931. J. A. BYERS ET AL 1,787,567

CENTRIFUGAL CASTING MACHINE

Filed Dec. 31, 1928 4 Sheets-Sheet. 1

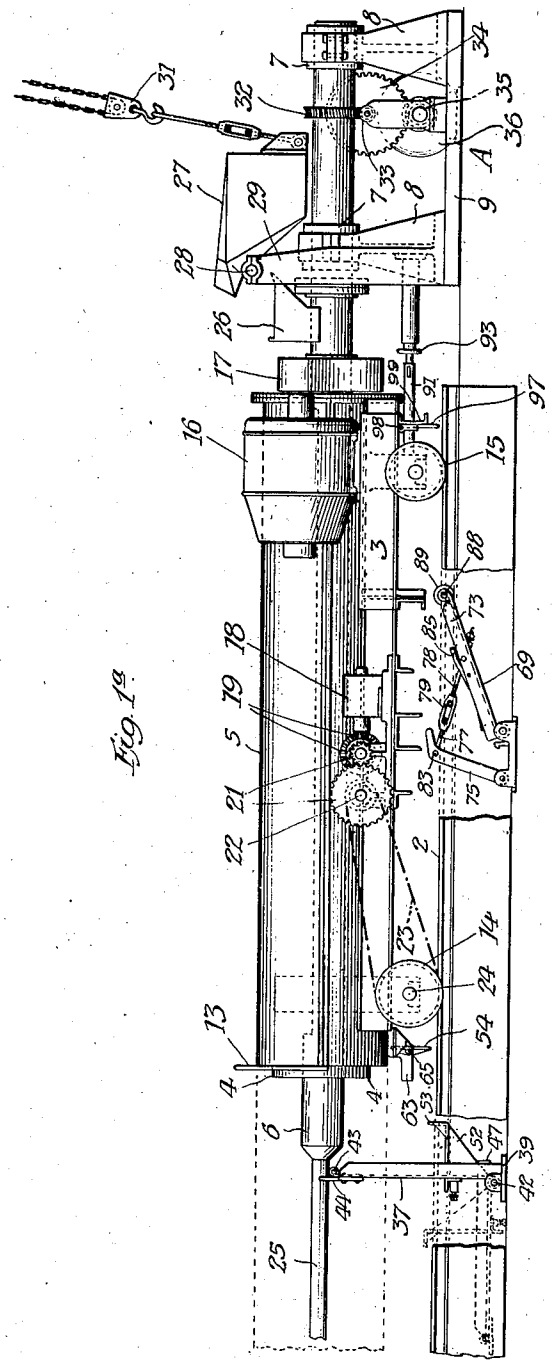


Fig. 1a

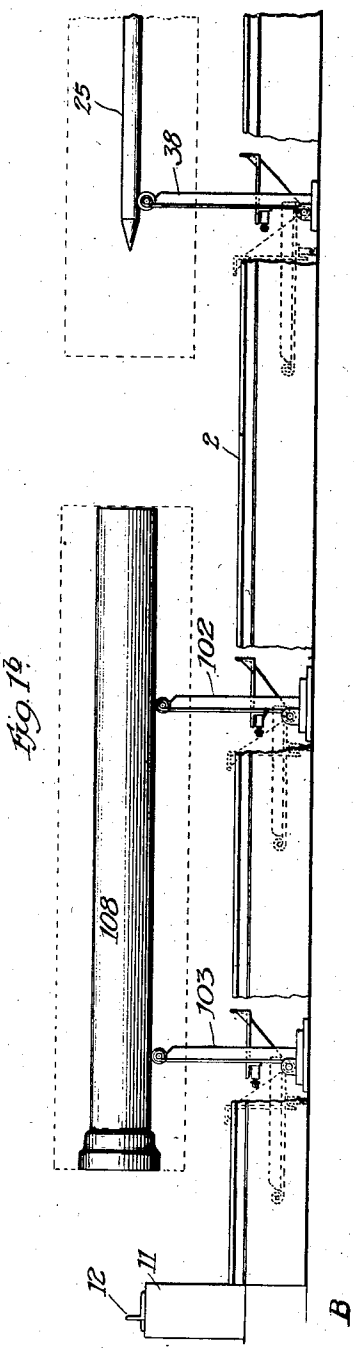


Fig. 1b

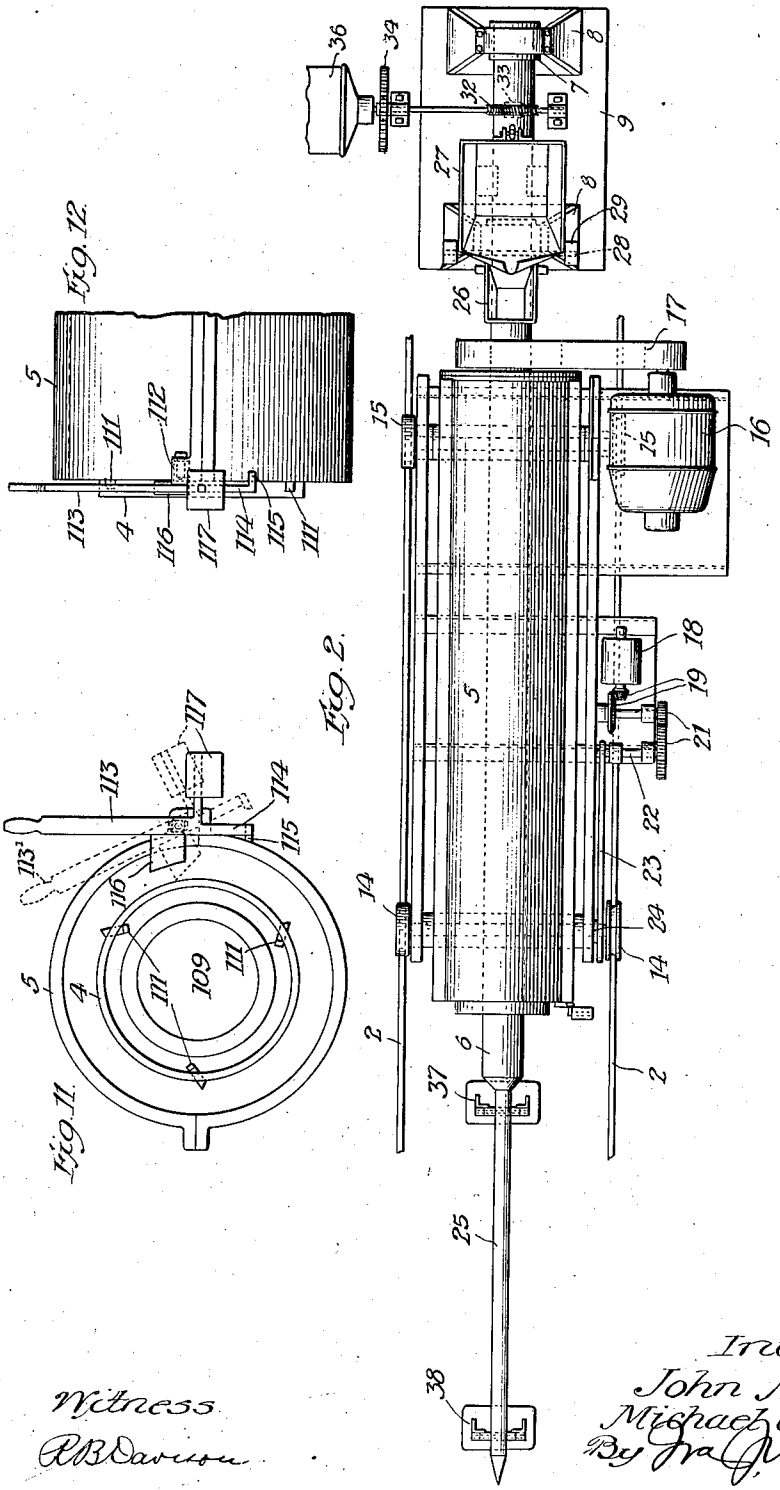
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CENTRIFUGAL CASTING MACHINE

Filed Dec. 31, 1928 4 Sheets-Sheet 2



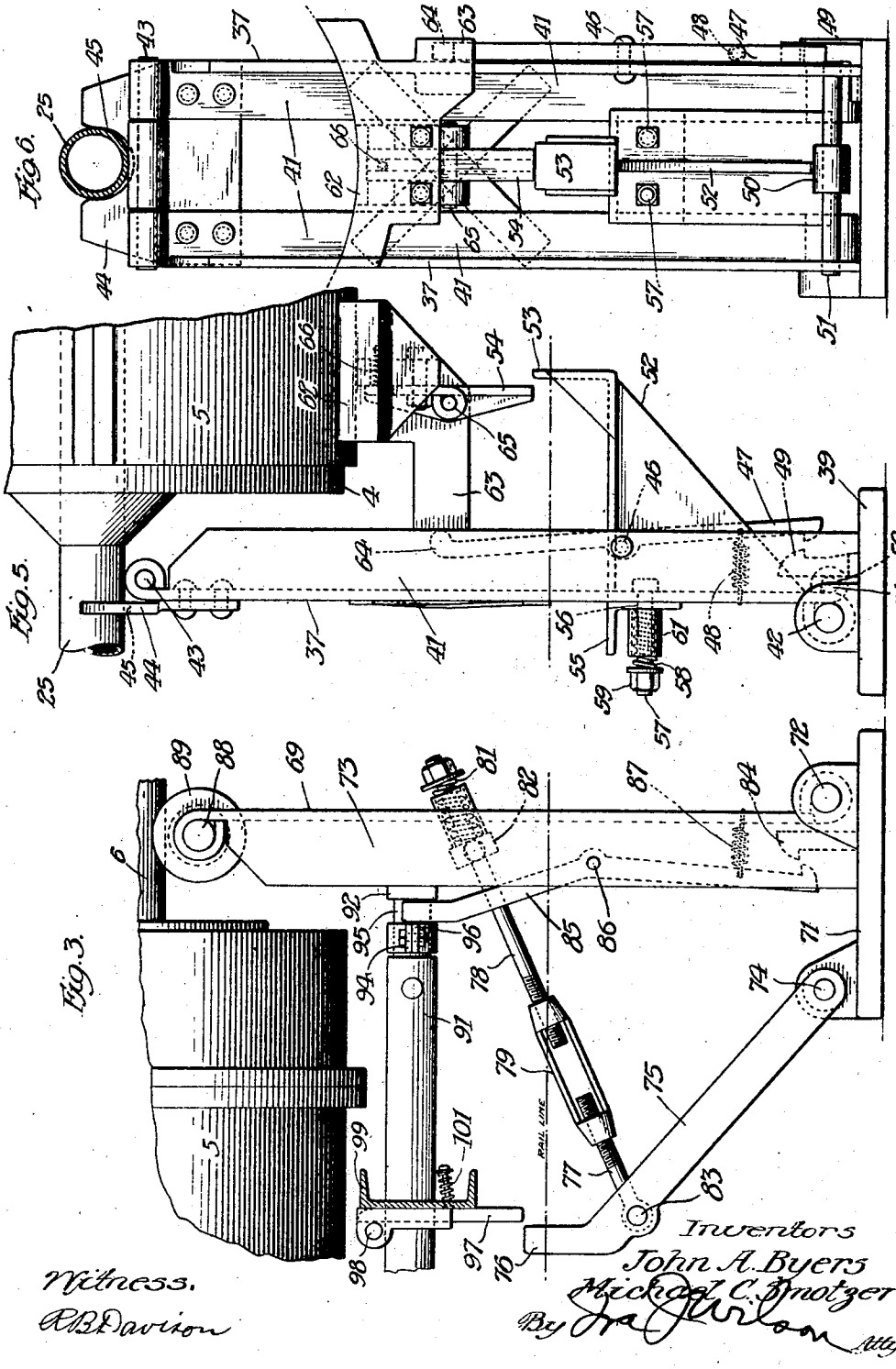
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CENTRIFUGAL CASTING MACHINE

Filed Dec. 31, 1928 4 Sheets-Sheet. 3



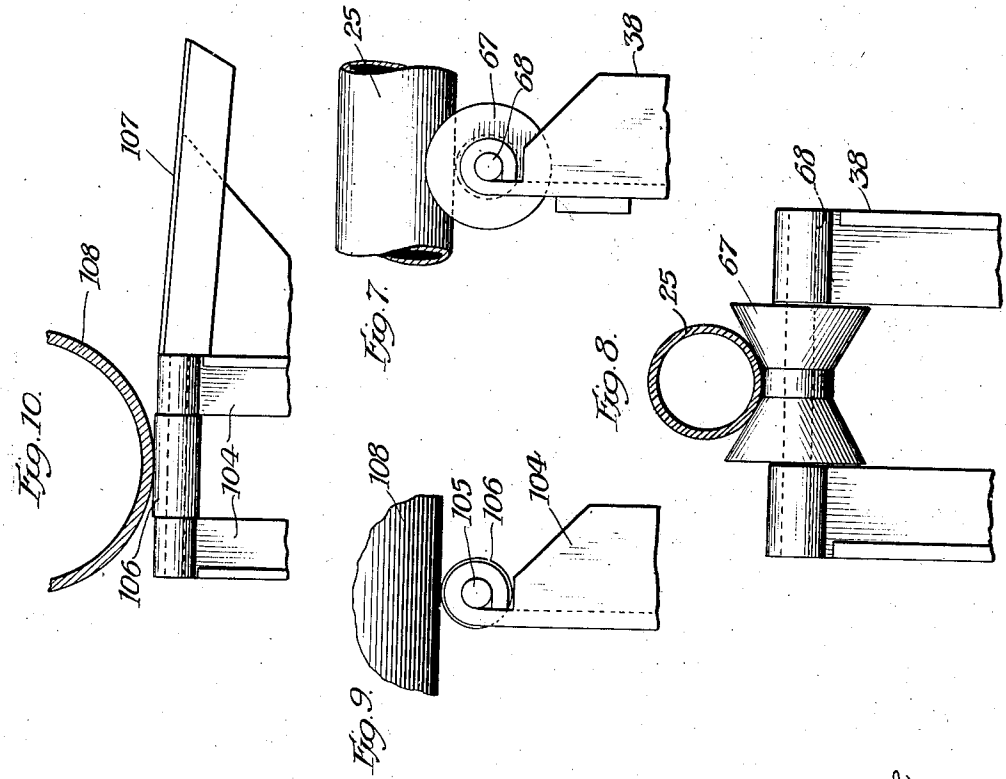
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CENTRIFUGAL CASTING MACHINE

Filed Dec. 31, 1928 4 Sheets-Sheet. 4



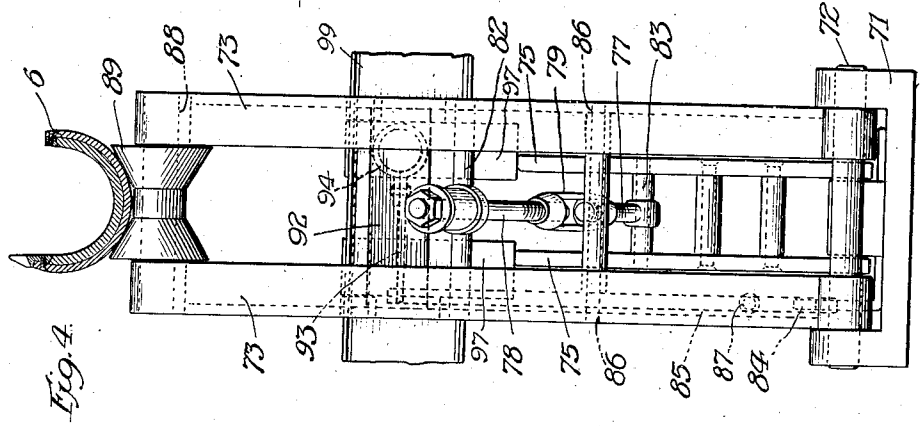


Fig. 4.

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1,787,567

UNITED STATES PATENT OFFICE

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CENTRIFUGAL CASTING MACHINE

Application filed December 31, 1928. Serial No. 329,357.

This invention pertains to centrifugal casting methods and apparatuses and more particularly to a simplified method of casting pipe and the like and a novel apparatus peculiarly adapted for carrying out the method and for speeding up the production of pipe and the like.

One of the primary objects of our invention is to facilitate the manufacture of centrifugally cast iron or other pipe and like structure by providing a novel and simplified method of procedure and a comparatively simple and inexpensive but effective casting machine or apparatus for carrying out the method, through the use of either or both of which production may be speeded up and the time ordinarily lost by the successive steps in the casting procedure minimized or eliminated.

Another important object is to provide a centrifugal casting machine or apparatus of the character employing a trough or distributor, with an arrangement for supporting the portion of the trough or distributor that is normally within the mold during the casting while such portion is within the mold and when the mold and trough are relatively moved to separated positions for removal of the casting.

Another object is to provide mechanism for supporting the cylindrical casting as and when it is removed or discharged from the mold and in such manner that neither the casting nor the mold will be damaged during the said step and so that the operations of the casting apparatus will not be impeded or delayed by jams, etc., that might occur were not the casting properly supported during its removal from the mold.

A further object is to provide mechanism of the character described that is entirely automatic in its operation, comparatively inexpensive to manufacture, repair or replace and requiring a minimum amount of attention by an operator whose time should be devoted to other matters.

Many further objects including the provisions of a novel type of pouring or distributing trough, a novel supporting mechanism for the pouring trough or distributor and for the casting as and when it is removed from the mold and mechanism for placing the supports in and out of operative position in their proper times and orders, as well as the functions, uses and advantages of the preferred form of the invention illustrated and described herein will be, or should become apparent after reading the following description and claims and after viewing the accompanying drawings in which:

Fig. 1[a] is a side elevational view of a centrifugal casting machine or apparatus embodying a preferred form of our invention, showing the pouring position.

Fig. 1[b] is a view similar to Fig. 1, being a continuation thereof, showing the pipe or casting in releasing or discharging position.

Fig. 2 is a top plan view of the casting machine or apparatus illustrated in Figs. 1[a] and 1[b], a portion of the apparatus of Fig. 1[b] being omitted.

Fig. 3 is a side elevational view of what may be termed the trough or distributor center support drawn to a larger scale than as illustrated in Fig. 1[a].

Fig. 4 is a front elevational view thereof, that is, looking from the right of Fig. 1[a].

Fig. 5 is a side elevational view of the inner collapsible support for the end of the trough or distributor to the scale of Fig. 3.

Fig. 6 is an end elevational view thereof looking from the right of Fig. 1[a].

Figs. 7 and 8 are, respectively, fragmentary views in side and front elevation of the top portion of the outer collapsible support for the end of the trough or distributor, the remainder of this support being identical in construction with the inner support of Figs. 5 and 6;

Figs. 9 and 10 are respectively side and front elevational views of the top portion of one of the two casting supports, both casting supports being identical in construction and similar except in so far as illustrated in Figs. 9 and 10 to the construction of the support illustrated in Figs. 5 and 6;

Fig. 11 is an end elevational view of the rotary mold and relatively stationary surrounding casing of the casting machine showing a wedge knocker applied thereto and,

Fig. 12 is a fragmentary side elevational view of the apparatus illustrated in Fig. 11.

The centrifugal pipe casting machine illustrated, comprises in general a suitable two rail track 2, upon which a car 3, carrying the centrifugal mold 4 and its enclosing casing 5, is mounted, a pouring trough or distributor 6 mounted at one end through suitable bearings 7 in supporting standards 8 rising from a fixed pedestal 9 at what may be termed the pouring position A, a pedestal 11, upon which a pipe pulling clamp 12 is secured, located at the opposite end of the track 2 at what may be termed the pipe pulling or discharging position B, a wedge knocking device, which is generally designated 13 mounted on the casing 5, and suitable supports etc. which will be described more particularly hereinafter. The car 3 is composed of any suitable structural members secured together in an approved manner and is provided with pairs of wheels 14 and 15 for running on the rails of the track 2 so that the car may be traversed by mechanism to be described, from the pouring position A to pipe discharging or removing position B.

The steel mold 4 is mounted in suitable bearings (not shown) within the casing 5 for rotation therein through the intermediary of an electric motor 16 mounted on the car and connected to it through a suitable belt or chain drive 17. A second motor 18 mounted on the car 3 is connected through gears 19 and gears 21 with a shaft 22 connected through a chain or belt drive 23 with the axle 24 upon which the wheels 14 are mounted and to which they are secured so that the car may be traversed back and forth as desired between the pouring and discharging positions A and B respectively. Control switches (not shown) control the current to the motors 16 and 18 so that the mold may be rotated and the car traversed as and when desired.

The pouring trough or distributor 6, is preferably of the construction and character illustrated in our prior Patent No. 1,684,419, dated September 18, 1928, except that it is modified to provide what may be termed a supporting spindle 25 at its outer end. At its inner end, that is the end supported in the bearings 7, it is provided with a metal receiving opening about which a hopper 26 is disposed. Molten metal is poured from a metal receiving ladle 27 trunnioned at 28 on a pedestal 29 rising from the pedestal 9 is arranged to be tilted through a suitable hoist 31 to pour metal into the hopper 26 when it is desired. Metal poured into the trough through the hopper 26 is poured from the trough or distributor into the mold by tilting the trough for which purpose a ring gear 32 is secured over and about the trough by the bearings 7 and is driven through suitable gearing 33, 34 and 35 with a third electric motor 36 or with any other suitable power device.

A desired quantity of metal is poured into the receiving ladle 27 at any time in the cycle of operations except when metal is actually being discharged from it. After the mold has been started in rotation and is being rotated at a predetermined rate of speed by the motor 16, the metal from ladle 5 is poured through hopper 26 into the pouring trough 6 and then from the pouring trough into the mold through the operation of motor 36. When the pipe has been cast the motor 18 is started to traverse the car and the mold to the pipe removing position B.

Though the pouring trough or distributor 6 is well supported in the bearings 7 at one end, nevertheless its opposite end may sag under its own weight and the weight of metal poured into it. This is particularly true where the trough is of any great length for casting pipe or similar articles of considerable length. In accordance with the preferred form of the invention the trough projects through the open ends of the mold 4 and at its end remote from the pouring position is provided with the supporting spindle 25 rigidly secured to it in any suitable manner. This spindle receives its support from one or more (preferably two) collapsible supports 37 and 38 which are substantially identical in construction except in so far as will be pointed out as this description proceeds.

Figs. 5 and 6 and 7 and 8 show, respectively, the detail construction of these two supports 37 and 38. The support 37 is mounted on a base 39 disposed intermediate the rails of the track 2 and includes a pair of standards 41 formed of angle irons which are rigidly braced and connected together in any suitable manner and pivoted at their lower ends on a hinge pin 42 for swinging movement to and from the position illustrated in Fig. 5 from and to a horizontal position to the left of the vertical position shown in Fig. 5. The tops of these standards 41 composing the primary portion of the support are preferably connected together by a pin 43, upon which a supporting roller may be mounted, and by a plate 44 which is provided with a groove 45 for receiving, guiding and supporting the spindle 25. Pivotally mounted on one of the standards 41 on a pivot 46 is a latch bar or pawl 47 which is normally urged in a clockwise direction about the pivot by a spring 48 secured between it and the standards 41. The pawl 47 when the standards are upright, is adapted to engage beneath a dog 49 fixedly secured to the base 39, and thereby hold the whole support in upright position, the bases of the standards 41, being cut square to prevent their moving beyond a vertical position in one direction.

A pivot or hinge pin 51 extends through and is preferably secured to the standards 41

adjacent their bases and mounted thereon on a pivot 50 for pivotal movement is what may be termed a pick-up pawl or reset lever generally designated 52. This pick-up pawl is provided with an upstanding tongue 53 adapted to engage and be engaged by a lever 54 carried by the mold casing 5 for purposes which will appear hereinafter. An abutment, in the form of the invention illustrated, an angle iron 55, is secured transversely across the backs of the standards 41 and is drilled in one, two or more places 56 for the reception of bolts 57 which also pass through corresponding holes drilled in side flanges of the pick-up pawl 52. Each bolt is surrounded by a coiled spring 58 which abuts at one end against the angle iron 55 and at the other against a flanged adjusting nut 59. A cylindrical limit washer and spring guard 61 is preferably placed about each spring. It will thus be apparent that the pick-up pawl 52 may be tilted in a clockwise direction, viewing Fig. 5, about its pivot 50, but cannot move in an anti-clockwise direction, viewing Fig. 5, being prevented from movement beyond its position illustrated by engagement with the angle iron 55.

The inclosing casing 5 or the car 3 is provided with a bumper block 62 which is rigidly secured to it. This mechanism includes a bumper or nose 63 adapted to engage the upper end 64 of the pawl 47 to release it from engagement with the dog 49. The lever 54 is pivotally mounted on the bumper block 62 on a pivot 65 and is arranged to rock about said pivot against the action of a spring 66 only in an anti-clockwise direction from its position illustrated in Fig. 5. The purpose of this construction will appear hereinafter.

The support 38 is preferably constructed in identically the same manner as the support 37 except that at its top end it is preferably provided with a double cone roller 67 rotatably mounted on a pin 68 secured through the tops of the standards. Both supports 37 and 38 are adapted to be collapsed or dropped down to substantially horizontal positions such as those illustrated in dotted lines in Figs. 1ª and 1ᵇ so that they will be out of the way during the passage of the car and mold from the pouring to the pipe discharging or removing positions. These two supports 37 and 38, while supporting the pouring trough during the time that the pipe is being cast, obviously cannot support the trough while the mold is on its way to or at the pipe discharging position, and unless it be supported its great weight, say when the pipe to be cast is of twelve feet or greater length, will cause it to sag to a considerable extent and interfere with proper functioning of the apparatus if it does not cause a break down. We have therefore devised a support adapted to be brought into an operative supporting position beneath the central portion of the trough after the support 37 has been collapsed, but before the support 38 has been knocked down.

This support which in Fig. 1ª is generally designated 69 is adapted to operate very similarly to supports 37 and 38, as will be more clearly noted from Figs. 3 and 4. A stationary base 71 is provided with a pivot pin 72 upon which a pair of standards 73 formed of angle iron and suitably interbraced are pivoted for swinging movements only in a clockwise direction from the position illustrated in Fig. 3. The down or collapsed position of this support 69 is shown in full lines in Fig. 1ª. Mounted on a pivot 74 secured to the base 71 are a pair of spaced pick-up pawls or reset levers 75 which are each provided with an upstanding tongue 76 at their upper ends and connected through rigid stays 77 and 78, a turn buckle 79 and a spring 81 with a cross bar 82 pivotally mounted at its ends in the standards 73 to prevent binding.

The construction of the spring tension arrangement including the spring 81 is very similar to that described as used in connection with the support 37. The stay 77 is pivotally mounted on a pivot 83 mounted between the lever 75. Also rigidly mounted on and secured to the base 71 is a dog 84 adapted to be engaged by a pawl 85 secured to a pivot rod 86 pivotally mounted on and between the standards 73; and the spring 87 normally tends to hold the pawl 85 in engagement with the dog 84.

The tops of the standards 73 comprising the supports 69 are joined by a pivot pin 88 upon which a double cone roller 89 is pivotally mounted, the roller being arranged to position and support a central portion of the pouring trough or distributor 6. The end of the car closest adjacent the pouring position is equipped with a bumper 91 not only adapted to engage a block 92 secured across the uprights or standards 73 to collapse the support, but to engage a bumper head 93 on the stationary base 9. A strap 94 is secured about a reduced portion 95 of the bumper 91 and is provided with a projecting arm 96 adapted to engage the upper end of the pawl 85 to effect its release from its dog 84 at the same time or shortly after the reduced end of the bumper 95 engages the block 92 collapsing the support 73. A resetting lever 97 is pivotally secured to the car or casing 5 on a pivot 98 arranged adjacent a suitable stop such as a cross frame member 99 of the car so that the lever can move in but one direction from its position illustrated in Fig. 3. A spring retracting device 101 serves to maintain the lever 97 in abutment against the frame member.

Located at suitable distances from the pipe pulling, discharging or removing position B

are spaced supports 102 and 103, both similar in construction, arrangement and operation to the supports 37 and 38, and for such reason their detail construction, except insofar as they differ from the supports 37 and 38, will not be described. Referring to Figs. 9 and 10, it will be observed that each of these supports 102 and 103 includes a pair of angle iron standards 104 suitably braced and connected together and provided with a connecting pivot pin 105 upon which a flat roller 106 is rotatably mounted. On the same side of each support 102 and 103, but on either side as preferred, is secured one or more inclined skids 107 in order that a pipe 108 after being withdrawn from the mold may be rolled off the supports to any place desired. The skids 107 being secured to the supports are arranged to be raised and lowered with them as will be appreciated.

Referring now to Figs. 11 and 12 in which only the left-hand end portion of the mold and its surrounding casing shown in Fig. 1[a] is illustrated, it will be seen that, as is more fully illustrated, described and claimed in our copending application Serial No. 319,803, filed November 16, 1928, the mold at the bell end is provided with a core 109 which is held in place by wedges 111. These wedges are driven through suitable apertures in the mold wall from the inside out and are so constructed and arranged that they may be knocked loose by driving them inwardly substantially radially of the mold. In order that the casting and pipe releasing operations may be facilitated we provide an arrangement whereby the wedges may be released or knocked out for removal of the core while the mold is still rotating at high speed. Pivotally mounted on the casing 5 by a pivot 112 is a hand lever 113 which at its lower end 114 is provided with a stop 115 adapted to engage the casing 5 and limit its movement in one direction. At the upper side of the pivot is a substantially heavy head 116 adapted to be brought into engagement with the wedges 111 as they rotate when the handle is moved to the position illustrated in dotted lines and designated 113′. A counterweight 117 is secured to the opposite side of the lever 113 below the pivot in order to maintain the lever and knocker in its position illustrated in full lines except when positively moved by the hand of the operator.

The operation

In operation, after the mold 4 has been started to rotate by the motor 16 and is rotating at constant speed, the molten metal from the trough or distributor 6 is poured or dumped into it. As soon as the casting operation is completed, the traversing motor 18 is started to translate or traverse the car and mold from pouring position to pipe discharging position, the mold still rotating at comparatively high speed. When the bumper 63 engages the head 64 of the pawl 47 it releases the pawl from the dog 49 and pushes the support over toward its position shown in dotted lines in Fig. 1[a], but before the support 37 has been pushed over any considerable distance the tongue 53 engages behind the resetting lever 54 which has been permitted to ride over it by reason of the pivot 65 and spring 66, and is thus lowered gently to a reclining position.

Before the bumper 63 engages and lowers the support 38 the resetting lever 97 engages the reset levers 75 and pulls the support 69 to an upright position underneath a central portion of the trough 6, the spring 81 of this support permitting the tongue 76 to depress sufficiently to permit the lever 97 to ride thereover as the car and mold progress toward pipe discharging position. Thereafter the supports 38, 102 and 103 are depressed or collapsed in the order named by the bumper 63 and after the manner in which the support 37 was lowered.

When the mold and car reach the pipe discharging position the traversing motor is stopped and the bumper 63, engages with the bumper block or any other suitable bumper mechanism. While the machine has been travelling, the motor 16 has been slowed down, and at command of the operator is stopped as the machine nears the bumper block. Just prior to the stopping rotation of the mold, the wedge knocker is operated to release the wedges for removal of the pipe, and as soon as the mold has ceased its rotation the operator, engaging a pipe puller behind the cleat 12, inserts it into the mold and clamps the pipe, whereupon the traversing motor 18 is reversed to start the car and mold back to pouring position. The pipe, of course, is removed as the mold returns to pouring position. As the car progresses back to pouring position A the support 103 is first raised by engagement of the lever 54 behind the tongue 53, pawl 47 engaging the dog 49 and locking the support in upright position beneath the pipe. The support 102 is next raised in the same manner and together with the support 103 and the pipe puller maintain the pipe in proper alignment with the mold so that the pipe cannot bind in the mold as it is being removed.

When the machine reaches the second dotted position in Fig. 1[b], a socket core is placed in the mold.

The spindle 25, being of comparatively small diameter compared to the diameter of the trough 6, which must of necessity be of only slightly less diameter than the openings in the ends of the mold, is enabled to pass through the openings in the mold and core even though the trough may have sagged a considerable amount, but as soon as the mold has reached a position, on its return toward

position A, where the lever 54 will engage the tongue 53 of the support 38, the support 38 is raised and raises the spindle and trough 6 sufficiently to permit the trough to pass through the left-hand end opening in the mold, viewing Fig. 1ª. Shortly after the support 38 is raised the support 69 is lowered by engagement of the bumper 95 and arm 96 with the pawls 85 and bumper block 92, the tongue 76 of the reset lever or pawl 75 engaging behind the lever 97 which has been permitted to ride thereover by reason of the pivot 98 and spring 101. Next, the support 37 is raised and the machine is in position and condition for the next casting operation.

While we have illustrated and described a preferred embodiment of the invention, it will be appreciated that many changes of structure, arrangement and function may be made therein without departing from the spirit of the invention and the scope of the appended claims.

We claim:

1. In a centrifugal casting apparatus in combination, a rotatable mold, a pouring trough supported at one end portion and projecting into said mold, means for translating said mold endwise away from said supported end portion of said trough, and means movable into operative engagement with a portion of said trough spaced from said supported end portion after said mold has been translated a predetermined distance, for supporting said trough at said portion spaced from said end portion.

2. In a centrifugal casting apparatus in combination, a rotatable mold, a pouring trough supported at one end portion and projecting into said mold, means for translating said mold endwise away from said supported end portion of said trough, and means rendered operative upon a predetermined translational movement of said mold for supporting said trough at a place spaced from said end portion.

3. In a centrifugal casting apparatus in combination, a rotatable mold, a pouring trough supported at one end portion and projecting into said mold, means for translating said mold endwise away from said supported end portion of said trough, and means operatively engageable with said trough at a place normally within said mold, after predetermined translational movement of said mold away from said supported end portion, for supplementing the support of said trough.

4. In a centrifugal casting apparatus in combination, a rotatable mold, a pouring trough supported at one end portion and projecting into said mold, means for translating said mold endwise away from said supported end portion of said trough, and means rendered operative by said mold upon translational movement thereof, for supporting a portion of said trough normally within said mold.

5. In a centrifugal casting apparatus in combination, a hollow, substantially cylindrical mold, a trough for pouring into said mold, said trough when in normal pouring position having a portion extending within and longitudinally of said mold, means for moving said mold to uncover said trough portion, and means for supporting said trough portion when it is uncovered.

6. In a centrifugal casting apparatus, a substantially cylindrical mold, a pouring trough adapted to enter an open end of said mold, means for moving said mold and trough relatively for removing said trough from within said mold, and means for supporting said trough at a place normally within said mold during pouring after said mold and trough have been moved relatively from one another.

7. In a centrifugal casting apparatus in combination, a rotatable mold, a pouring trough supported at one portion adjacent one end of said mold and projecting into the mold, and means for supporting said trough at a plurality of spaced places adjacent the other end of said mold.

8. In a centrifugal casting apparatus in combination, a hollow substantially cylindrical mold, a trough for pouring into said mold, said trough when in normal pouring position with respect to said mold having a portion extending within and longitudinally of the mold, means for moving said mold and trough relatively for uncovering the portion of the trough within the mold, means for substantially permanently supporting an end portion of said trough outside said mold, means independent of the first said supporting means for supporting the first said portion of said trough when the first said trough portion is uncovered, and means independent of the first and second said supporting means for supporting a third portion of said trough spaced from the first and second said portions.

9. In a centrifugal pipe casting machine in combination, a hollow open ended mold, means for moving said mold from pouring position to pipe discharging position, a pouring trough anchored against longitudinal movement at one end only and projecting through said mold when the latter is in pouring position, means secured to said trough at its unanchored end, a collapsible support normally engaging said means secured to said trough for supporting said trough when the mold is in pouring position, a collapsible casting support adjacent said discharging position for supporting a casting removed from said mold, and means operative upon movement of said mold from pouring position to discharging position for collapsing said supports.

10. In a centrifugal pipe casting machine in combination, a hollow open ended mold, means for moving said mold from a pouring position to a pipe discharging position and back again, a pouring trough anchored adjacent said pouring position only and projecting through said mold when the latter is in pouring position, means secured to said trough at its unanchored end, a collapsible support normally engaging said secured means for supporting said trough when the mold is in pouring position, a collapsible casting support adjacent said discharging position for supporting a casting removed from said mold, and means operative upon movement of said mold from pouring position to discharging position for collapsing said supports in the order named and operative upon reverse movement of said mold for raising said casting support and then the first said support.

11. In a centrifugal casting apparatus, a substantially cylindrical mold, means for moving said mold from a pouring position to a casting discharging position, a pouring trough at said pouring position and projecting into said mold when the mold is in pouring position, means for substantially permanently supporting one end of said trough, a collapsible support for supporting said trough intermediate its ends when said mold is moved to casting discharging position, a collapsible casting support adjacent said discharging position for supporting a casting removed from said mold, means operative upon movement of said mold from pouring to discharging position for raising the first said collapsible support into trough supporting position, and means operative during a reverse movement of said mold for raising the second said collapsible support into casting supporting position.

12. In a centrifugal casting machine, a cylindrical mold longitudinally traversable from a pouring position to a casting discharging position, a pouring trough having an end adapted to be projected into one end of said mold when the mold is traversed to pouring position, means for traversing said mold, normally fixed means for supporting the opposite end of said trough, and collapsible means for supporting a portion of said trough remote from the said opposite end thereof when the mold is in either of said positions.

13. In a centrifugal casting machine, a cylindrical mold longitudinally traversable from a pouring position to a casting discharging position, a pouring trough having an end adapted to be projected into one end of said mold when the mold is traversed to pouring position, means for traversing said mold, normally fixed means for supporting the opposite end of said trough, a collapsible support for supporting a portion of said trough remote from the said opposite end thereof when the mold is in one of said positions, and a second collapsible support for supporting a portion of said trough remote from the said opposite end thereof when the trough is in the other of said positions.

14. In a centrifugal casting machine, a cylindrical mold longitudinally traversable from a pouring position to a casting discharging position, a pouring trough having an end adapted to be projected into one end of said mold when the mold is traversed to pouring position, means for traversing said mold, normally fixed means for supporting the opposite end of said trough, a collapsible support for supporting a portion of said trough remote from the said opposite end thereof when the mold is in one of said positions, a second collapsible support for supporting a portion of said trough remote from the said opposite end thereof when the trough is in the other of said positions, and means movable with the mold for raising one end collapsing the other of said collapsible supports upon traversing movement of the mold from one toward the other of said positions.

15. In a machine for casting metal centrifugally, a horizontal rotatable mold, a trough for pouring molten metal into the mold permanently supported at one end, means for longitudinally traversing the mold and trough relative to each other so that the trough is moved into the mold for pouring and out of the mold when the casting is to be removed, and auxiliary means for supporting the trough beyond its permanent support in all of its positions relative to the mold.

16. In a machine for casting metal centrifugally, a horizontal rotatable mold, a trough for pouring molten metal into the mold permanently supported at one end, means for longitudinally traversing the mold and trough relative to each other so that the trough is moved into the mold for pouring and out of the mold when the casting is to be removed, a support for the outer end of the trough during pouring, and a support intermediate the ends of the trough in use when the trough is out of the mold, one of said supports being always in operative position.

17. In a machine for casting metal centrifugally, a horizontal rotatable mold, a trough for pouring molten metal into the mold permanently supported at one end, means for longitudinally traversing the mold and trough relative to each other so that the trough is moved into the mold for pouring and out of the mold when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible support intermediate the ends of the trough in use when the trough is out of the mold, one of said collapsible supports being always in operative position, and means operated by the

relative movement of the mold and trough for moving the supports into and out of supporting position.

18. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, and a collapsible intermediate support for the trough when the mold is moved to uncover the trough.

19. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, and means carried by the mold for moving the collapsible trough supports into and out of operative position.

20. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, actuating means for moving the intermediate support into operative position as the mold is moved away from the trough, means for thereafter moving the end support out of operative position, means for restoring the end support to operative position as the mold is returned to cover the trough, and means for thereafter moving the intermediate support into inoperative position, all of said actuating means being carried by the mold.

21. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, and a collapsible casting support for supporting the casting when the mold is returned to cover the trough.

22. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, collapsible casting supports for supporting the casting when the mold is returned to cover the trough, means carried by the mold for moving the collapsible casting supports into inoperative position as the mold is moved outward into position for removing the casting, means for holding the casting as the mold is returned thereby stripping the mold, and means carried by the mold for moving the casting supports into operative position to receive the casting as the mold is returned to pouring position.

23. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, collapsible casting supports for supporting the casting when the mold is returned to cover the trough, actuating means carried by the mold for moving the collapsible supports into and out of operative position, the same means actuating the outer trough support and the casting supports.

24. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a fixed trough for pouring molten metal into the mold, a permanent support for the end of the trough remote from the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for the outer end of the trough during pouring, a collapsible intermediate support for the trough when the mold is moved to uncover the trough, collapsible casting supports for supporting the casting when the mold is returned to cover the trough, actuating means carried by the mold for moving the collapsible support into and out of operative position, a latch for holding each collapsible sup-

port normally upright designed to be opened by the actuating member on the mold, and a laterally extending reset lever on each support designed to be moved into the path of the actuating mold member as the latter swings the support into inoperative position whereby on the return of the mold the support is restored to operative position.

25. In a machine for casting metal centrifugally, a horizontal rotatable, longitudinally movable mold, a trough for pouring molten metal into the mold, means for longitudinally traversing the mold to cover the trough during pouring and uncover it when the casting is to be removed, a collapsible support for supporting the casting when the mold is returned to cover the trough, actuating means carried by the mold for moving the collapsible support into and out of operative position, a latch for holding the collapsible support normally upright designed to be opened by the actuating member on the mold, and a laterally extending reset lever on the support designed to be moved into the path of the actuating mold member as the latter swings the support into the inoperative position whereby on the return of the mold the support is restored to operative position.

In witness of the foregoing we affix our signatures.

JOHN A. BYERS.
MICHAEL C. SMOTZER.