May 26, 1925. 1,539,110

E. CARLSON

DIE CASTING MACHINE

Filed Sept. 11, 1922 5 Sheets-Sheet 1

Fig. 1.

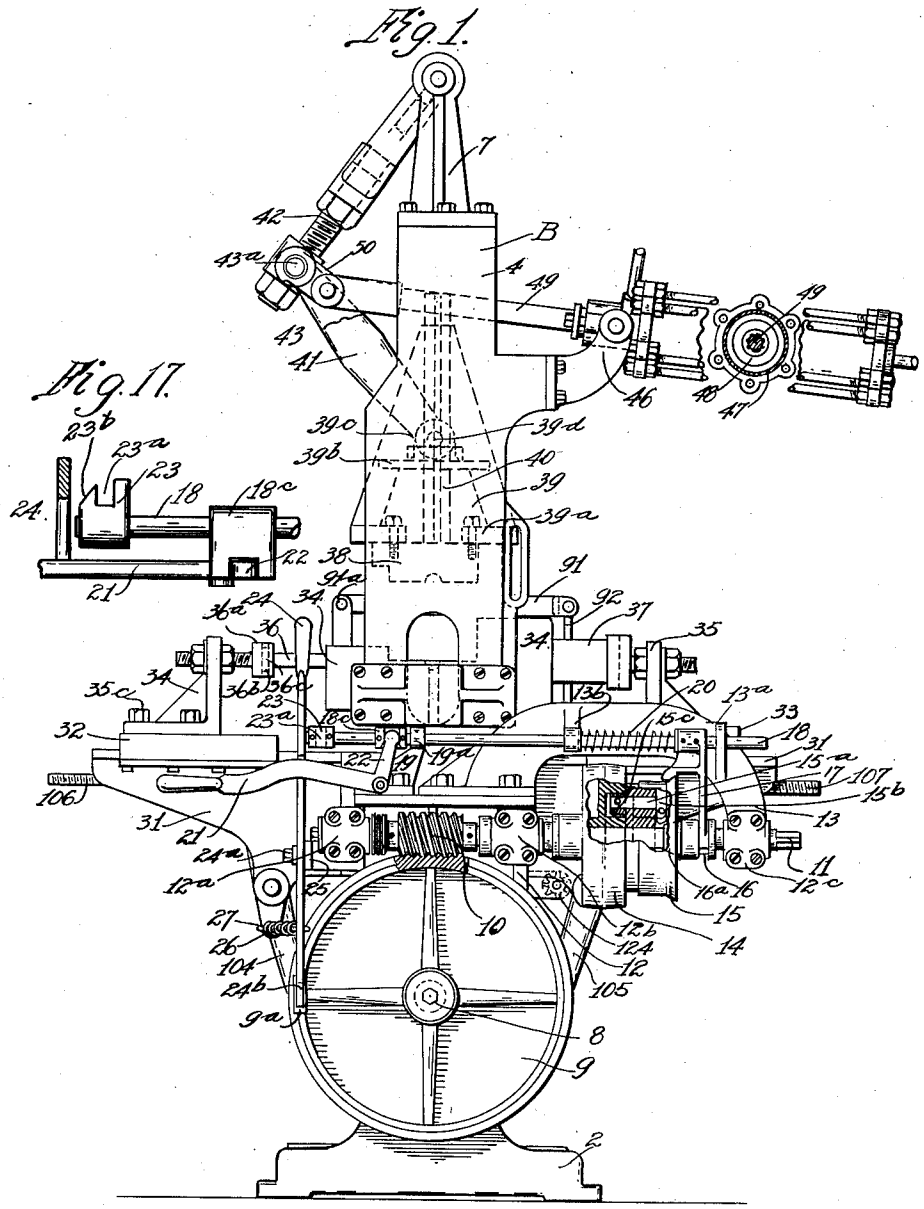


Fig. 17.

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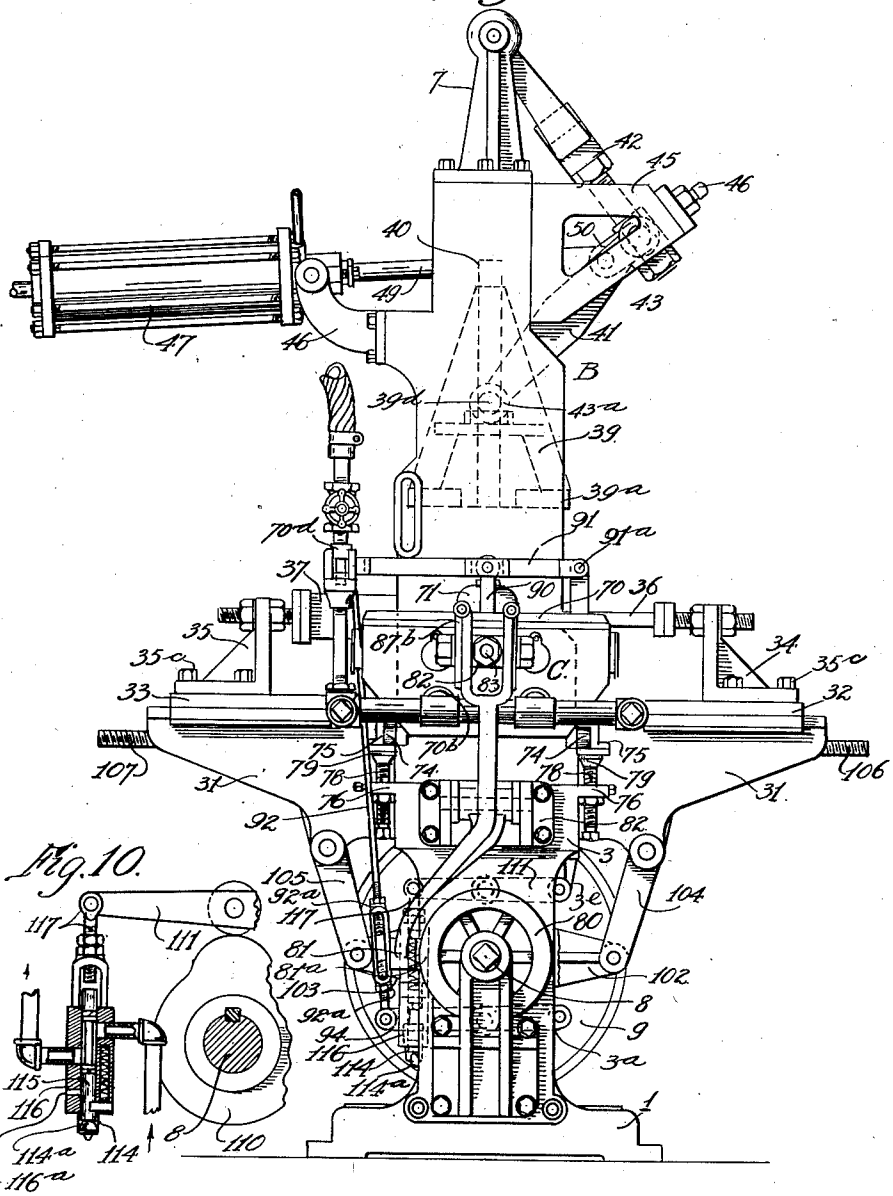
May 26, 1925. 1,539,110

E. CARLSON

DIE CASTING MACHINE

Filed Sept. 11, 1922 5 Sheets-Sheet 2

Fig. 2.



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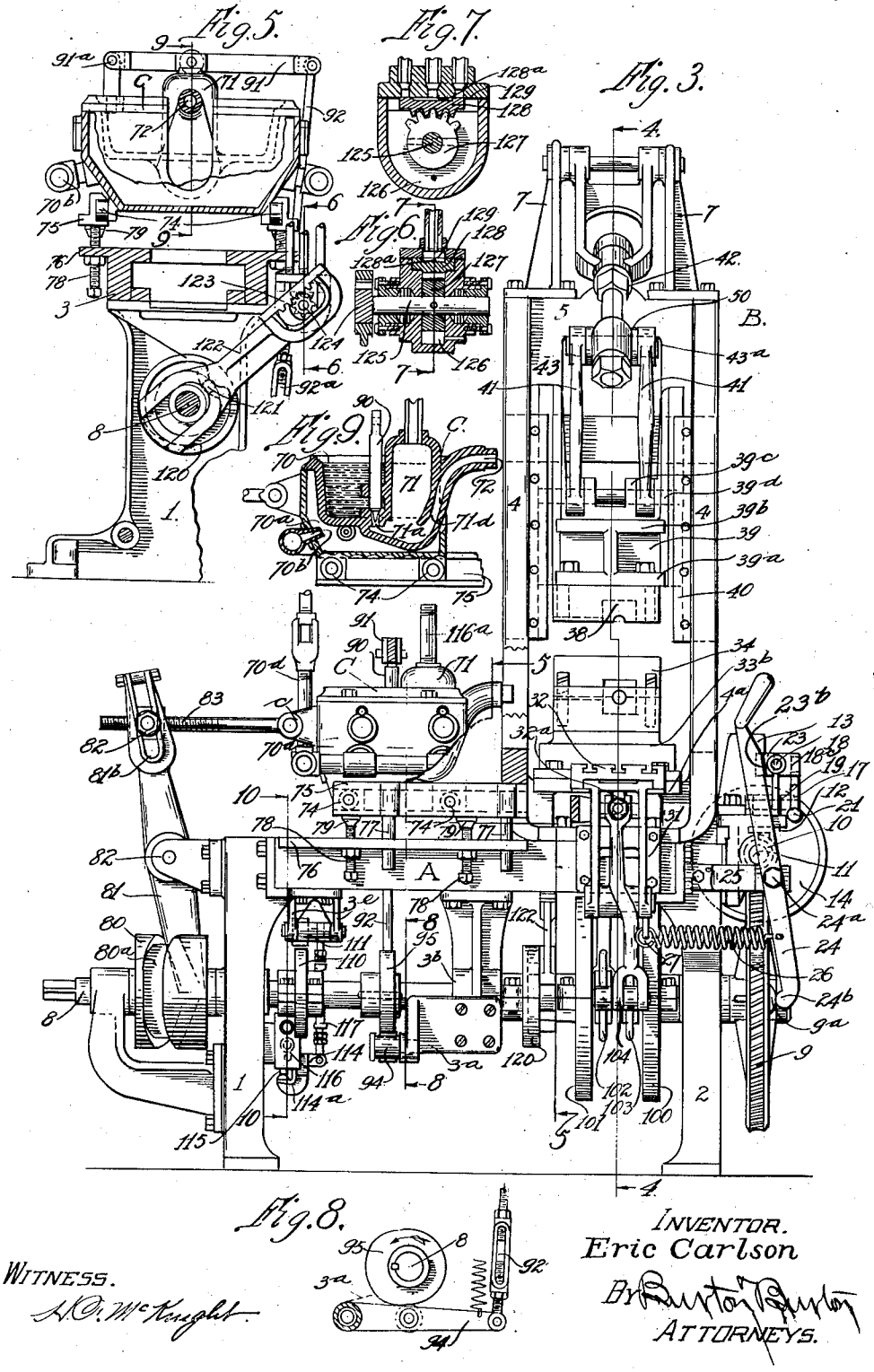
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May 26, 1925. 1,539,110

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DIE CASTING MACHINE

Filed Sept. 11, 1922 5 Sheets-Sheet 3



WITNESS.
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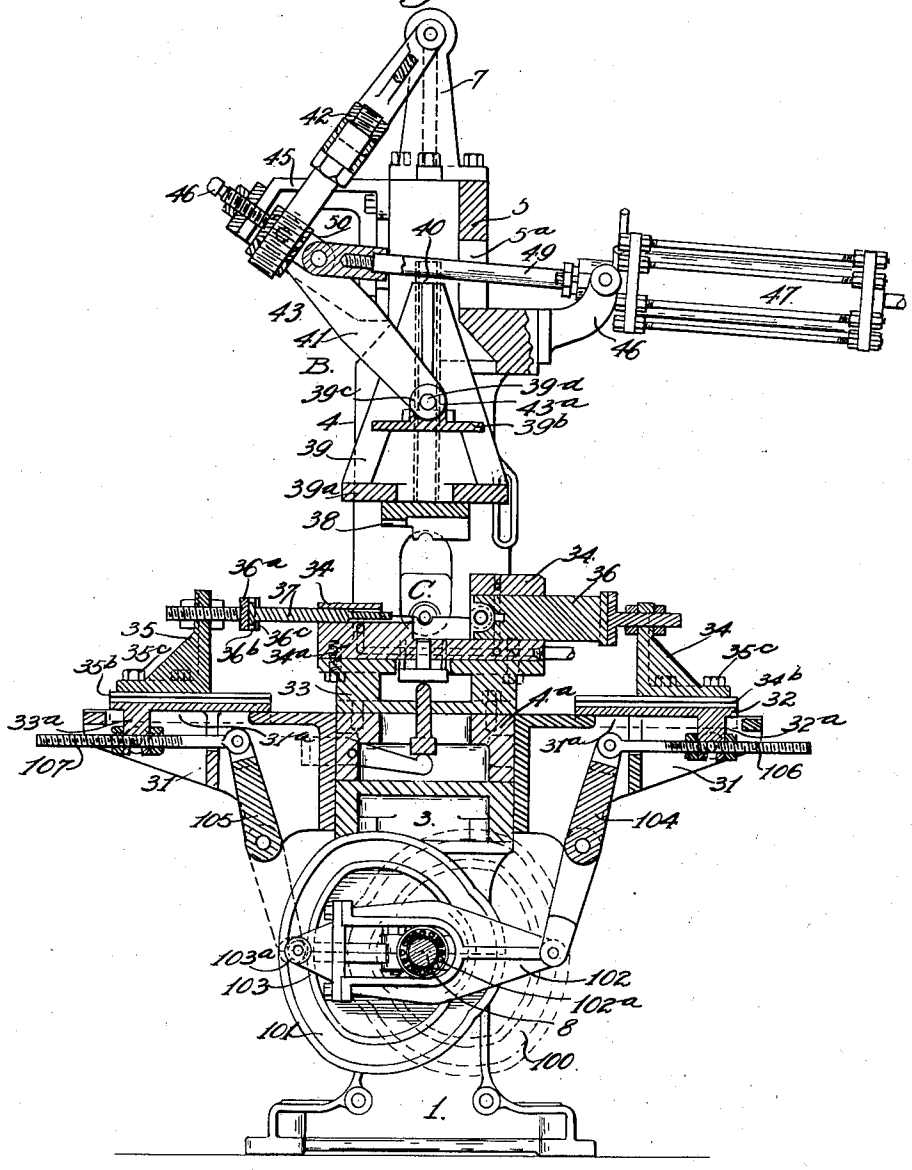
May 26, 1925. 1,539,110

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DIE CASTING MACHINE

Filed Sept. 11, 1922 5 Sheets-Sheet 4

Fig. 4.



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May 26, 1925. 1,539,110

E. CARLSON

DIE CASTING MACHINE

Filed Sept. 11, 1922 5 Sheets-Sheet 5

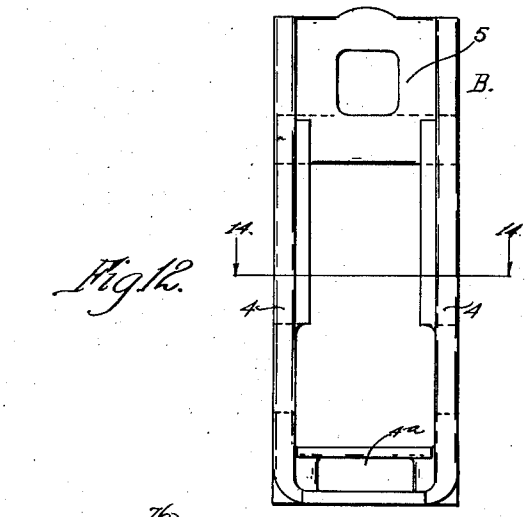


Fig. 12.

Fig. 11.

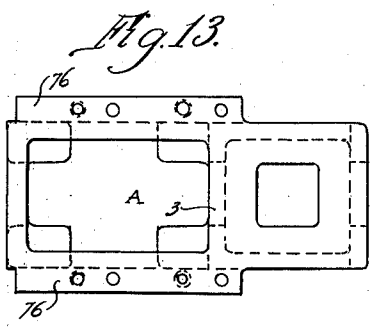


Fig. 13.

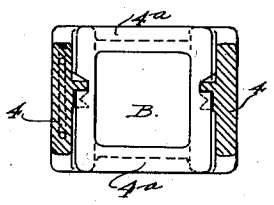
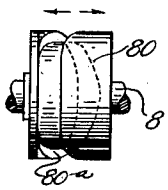
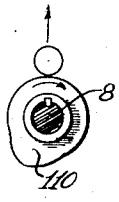
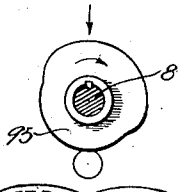


Fig. 14.







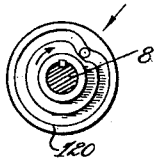


Fig. 15.

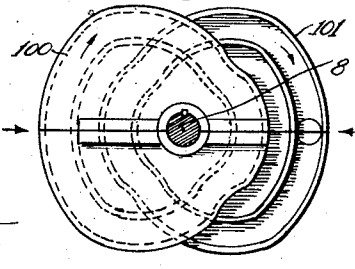


Fig. 16.

WITNESS.
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Patented May 26, 1925. 1,539,110

UNITED STATES PATENT OFFICE.

ERIC CARLSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO STEWART MANUFACTURING CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

DIE-CASTING MACHINE.

Application filed September 11, 1922. Serial No. 587,263.

To all whom it may concern:

Be it known that I, ERIC CARLSON, a citizen of the United States, residing in the city of Chicago, in the county of Cook and the State of Illinois, have invented certain new and useful Improvements in Die-Casting Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved construction of die-casting machine particularly adapted for relatively heavy die-casting and more compact and reliable in operation than any previous constructions for this purpose. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:—

Figure 1 is a front end elevation of the machine embodying this invention.

Figure 2 is a rear end elevation of the same.

Figure 3 is a left hand side elevation with certain parts omitted or in part broken away to disclose parts otherwise hidden.

Figure 4 is a section at the line 4—4 on Figure 3.

Figure 5 is a section at the line 5—5 on Figure 3.

Figure 6 is a section at the line 6—6 on Figure 5.

Figure 7 is a section at the line 7—7 on Figure 6.

Figure 8 is a section at the line 8—8 on Figure 3.

Figure 9 is a section at the line 9—9 on Figure 5.

Figure 10 is a section at the line 10—10 on Figure 3.

Figure 11 is a left hand side elevation of the base frame stripped of mechanism.

Figure 12 is a similar view of the upright frame member, same shown in its proper position relative to the base frame in Figure 11 except that it is uplifted therefrom.

Figure 13 is a top plan view of the bed member of the base frame.

Figure 14 is a section at the line 14—14 on Figure 13.

Figure 15 is a side elevation of the several cams on the power shaft except the core-operating cams arranged side by side in one plane for showing the time relation of their respective actions.

Figure 16 shows a core-operating cam in the same relative position for showing time relation and its action to those of the other cams.

Fig. 17 represents in part the clutch mechanism for connecting the operating parts of the machine to the driving pulley.

The structure shown in the drawings comprises a rigid frame which consists of a base, A, having two end standards, 1 and 2, joined by a bed member, 3. Upon the base frame there is erected an upright frame member, B, comprising standards, 4, 4, formed integrally with a cross bar 4^a, and joined at the upper end by a transversely extending web member, 5. Upon the bed, 3, there is mounted the metal pot, C, hereinafter more particularly described. In the end standards, 1 and 2, of the base member there is journaled a main cam shaft, 8, having at the right hand end a worm wheel, 9, driven by a worm, 10, on the power shaft, 11, which is journaled transversely of the cam shaft in bearings, 12^a and 12^b, provided upon a bracket, 12, mounted upon the forward end standard, 2. A third journal bearing, 12^c, is provided for this shaft in an overhung bracket, 13, mounted upon the bracket, 12, and extending toward the right hand side of the frame structure for carrying the journal bearing, 12^c, for the right hand end of the shaft, 11. Intermediate the two bearings, 12^b and 12^c, under the curved and overhanging bracket arm, 13, there is loose upon the shaft, 11, a pulley or belt driven power wheel, 14, outside of which,—that is between the same and the bearing, 12^c,—there is also loose on the shaft a clutch carrying wheel, 15, having a clutching device hereinafter described for clutching to the power wheel, 14. Outside said clutch wheel there is feathered on the shaft for rotating therewith and sliding thereon a collar, 16, having a conically tapered end for entering the recessed center of the clutch wheel to operate the clutch. Said clutching device consists of a dog in the form of a rock shaft, 15^a, journaled on the inner side of the rim of the clutch wheel and having two lever arms, 15^b and 15^c, the first of which extends across the lateral central aperture or recess in the

clutch wheel in position to be encountered by the tapered end of the collar, 16, and swung aside, rocking the dog and carrying the lever arm, 15^b, thereof, into contact with the interior of the flange 14^a, of the power wheel, 14, said lever arm of the dog being of such length as to encounter the flange at an effective driving angle thereto,—slightly divergent from radial direction. The clutch collar has an annular groove, 16^b, which is engaged by a forked shipping arm, 17, which is mounted on the shaft, 18, for which slide bearings are provided in lugs, 13^a and 13^b, which project from the overhanging bracket arm, 13, and also in a lug, 19^a, on a bracket, 19, which is also mounted upon the upper side of the bracket, 12, at the left hand end of the bearing bracket, 13. A spring, 20, coiled about the shipping arm slide shaft, 18, reacts against the bearing, 13^b, and the hub or secured end of the shipping lever, 17, for thrusting the shaft, 18, and thereby the shipping lever, to the right for carrying and holding the cone clutch, 16, out of engagement with the pulley, 14. Fulcrumed on the bracket, 19, is a hand lever, 21, of bell-crank form having its short arm, 22, engaged in the notch or fork of a forked collar, 18^c, which is fast on the shaft, 18, so that the depression of the free end of the hand lever, 21, operates to retract the shaft, 18, against the resistance of the spring, 20, for bringing the clutch cone, 16, into operative engagement with the pulley, 14. On the left hand end of the shaft, 18, there is a second collar, 23, having a rearwardly projecting lug provided with a notch, 23^a, and slope at 23^b, at the left hand side. Fulcrumed at 24^a, on a bracket, 25, which projects from the standard, 2, there is a lever, 24, which extends up past and inside of, that is rearwardly of, the lever, 21, and behind the shaft, 18, in position to engage the notch, 23^a, of the collar, 23, when the shaft, 18, is retracted as described for driving engagement of the clutch cone with the pulley, 14. A spring, 26, connected at one end to the lever 24, below its fulcrum and at the other end to an eye, 27, on the bracket, 31, hereinafter mentioned mounted on the standard, 2, tending to retract the lower end of the lever, 24, which operates to hold the upper end into position for encounter with the sloping edge, 23^b, of the notched lug of the collar, 23, so that when the shaft, 18, is retracted the lever, 24, is crowded back along the slope, 23^b, and snapped into the notch, 23^a, and thereby locks the shaft, 18, at position for holding the clutch cone in driving engagement with the pulley. The worm gear, 9, has upon its forward face at one point in its circumference an abutment, 9^a, in whose path the lower end of the lever, 24, stands, said lever being provided with a rearwardly protruding nose, 24^a, for encounter with said abutment, 9^a. The height of the abutment is such that when it encounters the nose, 24^a, of the lever, the lever is rocked about its fulcrum sufficiently to disengage it from the notch, 23^a, releasing the shaft, 18, which is thereupon subject to the thrust of the spring, 20, which operates to disengage the clutch cone, 16, from the pulley, 14, and thereby halt the operation of the machine. From the foregoing description it will be understood that the machine having been started at any time by the operator pressing the lever, 21, for throwing the clutch cone into engagement with the pulley, 14, the machine will perform one complete cycle of its operation, comprising one revolution only of the gear, 9, and cam shaft, 8, and will come to rest at the end of one complete revolution by the encounter of the abutment, 9^a, with the lever, 24.

The operation of all the parts of the casting machine is controlled and the several movements timed by cams on the shaft, 8. These several operations comprise the following: (1) closing together of the mold members consisting of a fixed member carried on the bed, a reciprocating cover member carried in the upright frame (2) the in-thrust of core members carried by operating parts on the frame structure; (3) shutting-off the molten metal charge chamber from the metal source; (4) advancing the metal pot (charge chamber) into registration with the die; (5) admitting fluid pressure to the charge chamber for discharging the metal into the die; (6) shutting off the fluid pressure; (7) retracting the movable members of the die for opening the same; (8) opening the shut-off between the metal source and the charge chamber.

The machine having come to rest after this complete cycle of movement, the casting is dislodged from the die by a manually-operated "knock-out", as hereinafter described.

The several parts concerned in the operation above outlined will now be identified, and the mechanism for operating them will be described.

The carrier or holder for the fixed die member is seen at 33 being mounted upon the lower cross bar, 4^a, of the upright frame, B. The fixed die member, 34, of whatever form, according to the casting to be used, is provided with suitable means for bolting it rigidly to the die-carrying member, 33, as indicated by the bolts, 34^a. In the upright frame, B, there is mounted for sliding in vertical guideways, 40, a carrier, 39, for the reciprocating cover member of the die which is shown at 38, bolted to the lower transverse web, 39^a, of said reciprocating carrier, 39. For operating this reciprocating carrier, 39, there is provided a pair of toggle levers, 42 and 43, the upper lever, 42, being pivoted at its upper end upon brackets, 7, 7,

mounted upon the top of the upright frame, the lower toggle lever, 43, which comprises two parallel arms, 41, extending from the opposite ends of the pivot bolt, 43a, (which connects the two toggle levers pivoted at the lower ends of said arms, 41, 41,) to the carrier, 39, which for that purpose has its side bars connected by a cross bar, 39b, which has lugs, 39c, for the pivot pin, 39d, which connects said arms, 41, 41, to said carrier, 39. The toggle levers are operated by fluid pressure for which purpose there is provided a cylinder, 47, pivotally mounted upon a bracket arm, 46, which projects off from the left hand side of the upright frame, B, at the lower end of the transverse web, 5, see Figure 4. The piston, 48, in said cylinder has its stem, 49, extending through an aperture, 5a, in the web, 5, and pivotally connected to the toggle, the connection being shown as made to a lug, 50, which projects off from the lower end of the upper toggle lever, 42. This particular connection is a matter of convenience only, the effect being substantially as if the connection were made at the toggle pivot. Fluid pressure connections to the cylinder are made and controlled as hereinafter described. For checking the folding movement of the toggle which produces the retraction of the carrier, 39, there is provided a bracket, 45, mounted upon the web, 5, of the upright frame and having an arm extending to overhang the toggle joint and provided with a screw, 46, which may be adjusted to limit the outward folding of the toggle in the retracting movement.

For carrying and operating the cores there are mounted upon opposite sides of the base frame embracing the bed member, 3, and the lower end of the upright frame, B, brackets, 31, 31, which extend off equally to the right and left hand of the base frame as seen clearly in Figures 1, 4 and 5. The upper surface of each of these brackets is flush with the bottom of the carrier, 33, for the fixed die member; that is, with the top surface of the transverse web, 5a, of the upright frame member, B, as seen in Figure 4. Upon this upper surface of the horizontal arms of each of the brackets, 31, there is mounted slide members, which for convenience are distinguished as the right and left hand slides, 32 and 33. These slides have lugs, 32a and 33a, which project down through slots, 31a, in the webs of the horizontal arms of the brackets, 31, and below said webs these lugs are connected to threaded links, 106 and 107, respectively, which extend from the upper ends of levers, 104 and 105, which are fulcrumed on the brackets, 31, and at their ends are connected to operating arms, 102 and 103, respectively, which are forked for striding and obtaining guidance upon the shaft, 8, which may be provided with a ball bearing casing collar as seen at 102a, (Figure 4) for relieving friction of sliding the said arms on the shaft. At the pivot connection of each of the levers, 104 and 105, with the arms, 102 and 103, respectively, there is provided a stud-and-roll, 103a, for engagement with the cam slots of two cams respectively, 100 and 101, which are mounted for rotation with the shaft, 8, these cams being reciprocal or reversed in form for rocking the two levers similarly in opposite directions. The purpose of threading the links, 106 and 107, is to permit proper adjustment of the slides, 32 and 33, for the stroke which they are to give to the cores which are to be carried by them, which vary in different dies which may be operated in the machine. For carrying these cores there are mounted upon the upper sides of the slides, 32 and 33, brackets, 34 and 35, which are adjustable along the slides and guided in such adjustment by the tongue-and-channel engagement which is seen at 34b and 35b, bolts, 35c, being provided to secure the brackets in adjusted position on the slides. The cores carried by the two slides respectively are seen at 36 and 37, being merely conventional forms which may be taken as representing any form of core adapted to be thrust into the fixed die member and retracted therefrom. For engagement of the core with the carrier the latter has a coupling member, 36a, consisting of a head having an undercut vertical slot, 36b, and a threaded stem which extends through the upright arm of the bracket and provided with securing nuts at both sides of the latter. And the cores have their stems provided with cross heads, 35c, adapted to engage the undercut slots, 36b.

The metal pot, C, as shown comprises a reservoir, 70, which constitutes a source of molten metal, and the charge chamber, 71, from which the metal is discharged by fluid pressure. Necessarily the communication between the reservoir and the charge chamber is cut off before the fluid pressure is admitted for discharge in the mold. The metal pot including both reservoir and charge chamber is enclosed in a jacket, 70a, within which are located gas burners, 70b, for heating and maintaining temperature of the metal. 70d represents the gas supply pipe connected with the burners. The reservoir, 70, communicates with the charge chamber, 71, through a port, 71a, at the lower part which opens into the two chambers respectively near the bottom of each; and the charge chamber has for its discharge a duct, 71d, leading from the bottom upward to the discharge nipple, 72, at the high liquid level of the reservoir; that is, the highest level to which that reservoir is at any time to be filled. For shutting off the communication between the reservoir and the charge chamber there is provided

a valve, 90, which is connected to an operating lever, 91, fulcrumed on the top of the pot as seen at 91ª, and connected by a downwardly extending link, 92, with a second lever, 94, fulcrumed on a bracket, 3ª, which depends from the bed member, 3, (and may carry a bearing, 3ᵇ, for the shaft, 8).

For admitting fluid pressure to the cylinder, 47, for operating the toggle to close the valve by depressing the cover member, the shaft, 8, has a face cam, 120, whose cam groove engages a stud-and-roll abutment, 121, on a slide bar, 122, which is guided on the bed, 3, and has a rack, 123, engaging a pinion, 124, on a short shaft, 125, journaled in a valve casing, 126, mounted on the bed, 3, and having within the casing a pinion, 127, which engages rack teeth on a slide valve, 128, sliding upon a seat, 129, having three ports within the range of its sliding movement, said ports being connected,—the middle one to a source of fluid pressure, and the extreme ones to opposite ends of the cylinder, 47. The valve has on its seating face a recess, 128ª, long enough in the direction of the sliding movement of the valve to lap the middle port and either of the extreme ports, according to the position of the valve. It will be understood that when the valve is at one limit of the stroke which the cam, 120, is calculated to give it, it connects the middle port with one end of the cylinder, and when it is at the other limit, it connects the middle port with the opposite end of the cylinder, and that at either position the port leading to the cylinder-end which is not connected by the valve with the middle port and thereby with the source of fluid pressure, is uncovered for exhaust of the fluid pressure from that end of the cylinder.

A turn-buckle, 92ª, in the link, 92, serves to adjust it to insure the accurate seating of the valve, 90, for shut-off during the dwell of the cam, which as may be seen from Figure 14 covers the period during which the charge chamber is exposed to the fluid pressure for discharge to the die. For controlling the admission and shut-off of fluid pressure to the charge chamber, the valve chamber, 116, is connected with a source of fluid pressure as indicated by the pipe, 116ª; and a valve, 114, reciprocating in said chamber for controlling the ports thereof is actuated by a cam, 110, on the shaft, 8, acting against the lever, 111, which is fulcrumed between lugs, 3ᵉ, 3ᵉ, depending from the bed, 3, said lever having connected to it a link, 117, which extends down past the shaft, 8, and is connected to a slide block, 114, mounted on the valve casing, 116, and having a finger, 114ª, projecting for encounter with the protruding end of the stem of the valve, 115. The valve is held at one limit of its throw by a spring, 115ª. The cam, 110, holds the valve open for a very short time indicated by the dwell, 115ᵉ, immediately following the closing of the die and introducing of the cores as may be understood by comparison of the cams in Figure 14.

The metal pot is provided with rollers or wheels, 74, 74, for which there are provided tracks, 75, 75, mounted adjustably as to height, upon flanges, 76, 76, projecting from opposite sides of the bed member, 3, the tracks having spindles or stems, 77, 77, which extend vertically through apertures in the flanges, 76, and the tracks being upheld upon the upper ends of supporting screws, 78, which are screwed through the flanges, 76, and provided with jam nuts below the latter, the upper ends of the screws having swiveled flat heads, 79, upon which the brackets, 75, seat.

For advancing and retracting the metal pot to register the nipple, 72, of the charge chamber with the die and to withdraw it therefrom, the shaft, has a cylindrical cam, 80, whose peripheral groove, 80ª, engages a stud-and-roll, 81ª, on a lever, 81, which is fulcrumed between brackets, 82, which are bolted to the outer side of the standard, 1, the upper end of said lever, 81, being forked for holding a nut, 82, pivotally mounted in the fork, 81ᵇ, and screwed onto the threaded end of the link, 83, which is pivotally connected to the metal pot at lugs, *c*, thereon. It will be understood that the rotation of the cylindrical cam oscillates the lever, 81, for reciprocating the pot and that the lateral deflections of the cam groove are circumferentially positioned to time the movements of the pot as desired and necessary with relation to the other movements.

Of the movements above described which are controlled by the cams, the resulting order of operations will be understood from inspection of Figure 14, showing the relative circumferential positions of the operating features of the several cams, to be as follows:

Upon the operator starting the machine by depressing the handle of the lever, 21, the cam, 120, operates the valve, 128, for admitting fluid pressure to the inner end of the cylinder, 47, causing the piston to be retracted and straightening the toggle, depressing the cover member of the die for closing the die. Simultaneously with this action or immediately succeeding it, the cams, 100 and 101, operate the levers, 104 and 105, respectively, for thrusting inward the core carriers to properly intrude the cores into the molds. During these mold-closing movements the cam, 95, operates by the connections described for shutting off the reservoir, 70, from the charge chamber, 71. Next the cam, 80, operates as described for advancing the pot, C, to register

the nipple, 72, with the die. Upon the completion of this movement the cam, 110, operates the valve, 115, for admitting fluid pressure to the charge chamber, 71, and the metal is thereby discharged into the mold. The dwell of the several cams causes the parts to remain for a very brief period in the position described,—that is, the mold being closed and the nipple, 72, registered therewith; but almost immediately the rotation of the shaft causes the valve, 110, to shut off the fluid pressure from the charge chamber and immediately thereafter the cam, 180, retracts the pot from the die; and upon the completion of this movement the dwell of the cam, 120, having passed the stud-and-roll abutment of the lever, 122, the valve, 128, is reversed shifting the fluid pressure to the outer end of the cylinder, 47, causing the folding of the toggle joint and retraction of the upper die member; and simultaneously the cams, 100 and 101, retract the core carriers, and the cam, 95, reopens the communication between the reservoir, 70, and the charge chamber, 71, permitting the latter to be refilled for the next charge, and the mechanism comes to rest by the encounter of the abutment, 9^a, with the terminal nose, 24^a, of the lever, 24, releasing the lever, 21, so that the spring, 20, retracts the clutch collar, 16, from its engagement with the power pulley, 14. To insure that upon disengagement of the clutch collar the shaft, 11, shall not continue to revolve by momentum of the fly wheel, the shipping lever, 17, has a friction finger, 17^a, which overhangs a beveled flange, 14^a, on the pulley, 14, and which is held in firm engagement with that flange by the pressure of the spring, 20, when the clutch collar is retracted from its engagement.

I claim:—

1. In a die casting machine in combination a power shaft; a continuously revolving power wheel loose on the shaft; clutch means for engaging the shaft with the wheel for rotation of the shaft by the wheel; a rotated element driven by the power shaft and making a single revolution in the complete cycle of the machine; manually operable means for operating the clutch to engage the power shaft with the wheel; automatic locking means for said manual means to maintain the parts clutched, and means carried by the rotated element for releasing said locking means at the completion of the cycle.

2. In the construction defined in claim 1, foregoing, the locking means being manually operable for releasing the clutch holding means at any point in the cycle of the machine.

3. In a die casting machine in combination with fixed movable mold member means for closing and opening the mold, a pot for the molten metal mounted for movement toward and from the mold entrance; compressed air means for expelling the metal from the pot into the mold and valve means for controlling the metal-expelling action; a rotating shaft carrying operating means for the several movements of the several parts mentioned, whereby said movements are all performed in a single revolution of said shaft, said shaft having its length in the direction of the movement of the pot to and from the mold; an inleading power shaft transverse to the first mentioned shaft and power-communicating connections between the two shafts comprising a disengageable clutch device and means for operating the clutch for engagement of the parts.

4. In a die casting machine in combination a power shaft; a continuously revolving power wheel loose on the shaft; a rotatable member loose on the shaft adjacent to the power wheel; a clutch dog carried by said adjacent member adapted to be moved at its mounting in said member for clutching the power wheel; a collar slidably engaged with the shaft for rotation therewith, having means encountering the clutch dog in said sliding movement for forcing the dog into clutch engagement with the power wheel, and means for sliding the collar on the shaft.

5. In a die casting machine which comprises fixed and movable mold members and means for moving the movable member for opening and closing the mold; a metal pot for supplying metal to the mold mounted for movement toward and from the mold entrance; a main shaft carrying operating means for all the movements of mold members and pot, the movable mold member being positioned for up and down opening and closing movement, the pot being mounted for horizontal movement to and from the mold, and the main shaft being horizontal and extended in the direction of said movement of the pot.

6. In a die casting machine which comprises fixed and movable mold members and means for moving the movable member for opening and closing the mold, a metal pot for supplying metal to the mold mounted for movement toward and from the mold entrance, a main shaft carrying operating means for all the movements of the mold member and pot, the mold member being positioned for vertical opening and closing movement, the pot being mounted for horizontal movement to and from the mold, in combination with core-carrying members for co-operating with the fixed and movable mold members, said core-carrying member being mounted for horizontal movement transversely to the movement of the metal pot.

7. In a die casting machine in combination with a fixed mold member, a movable

member; a supporting frame structure in which the movable member is mounted above the fixed member and guarded for up and down opening and closing movement, the means for operating said member for opening and closing, comprising a pair of toggle levers fulcrumed for swinging in a vertical plane, the link connected near the pivot for folding and straightening movement of the toggle lever; a cylinder carried in substantially horizontal plane by said frame structure and the piston in said cylinder connected with said link.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 7th day of Sept., 1922.

ERIC CARLSON.