

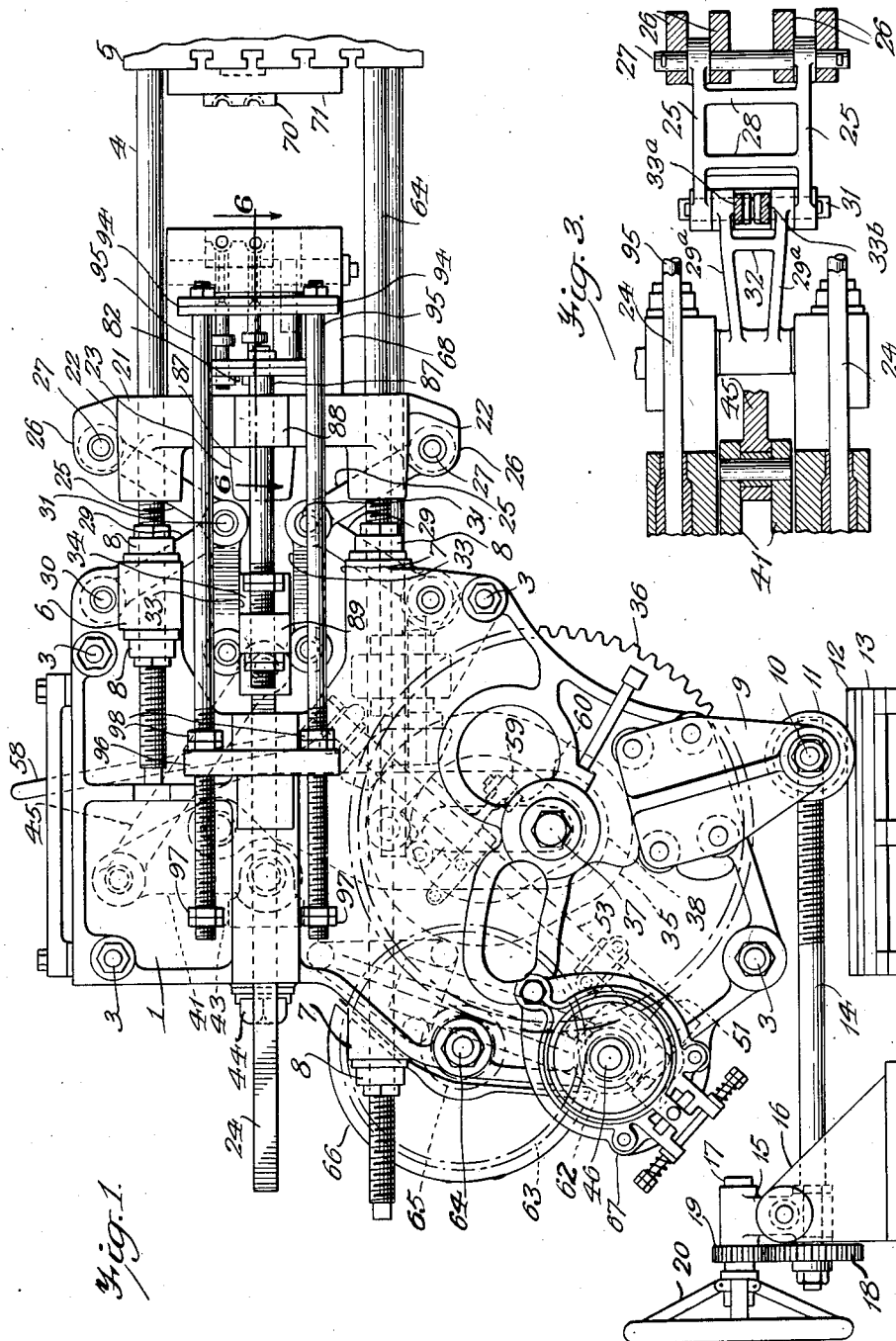
Jan. 2, 1934.

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1,941,811

CORE PULLING AND EJECTING MECHANISM

Original Filed Feb. 6, 1931 3 Sheets-Sheet 1



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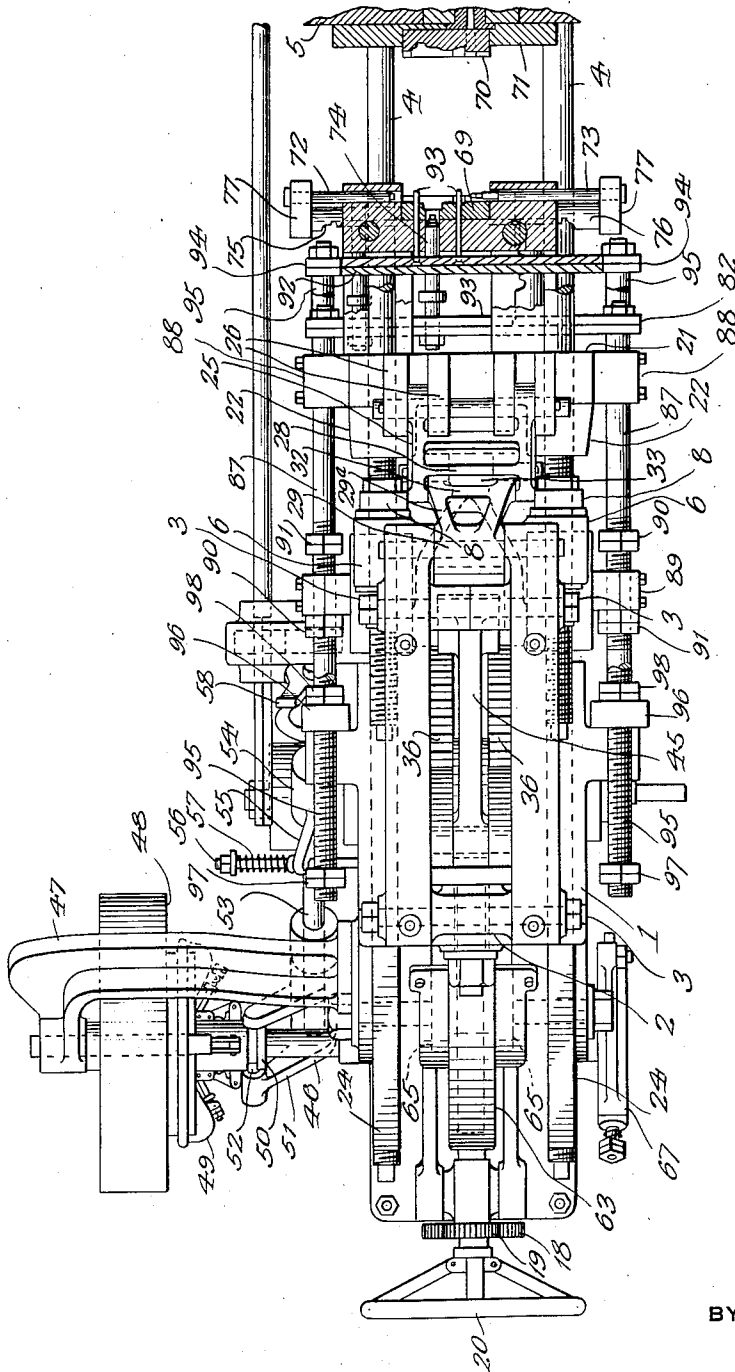
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3 Sheets-Sheet 2



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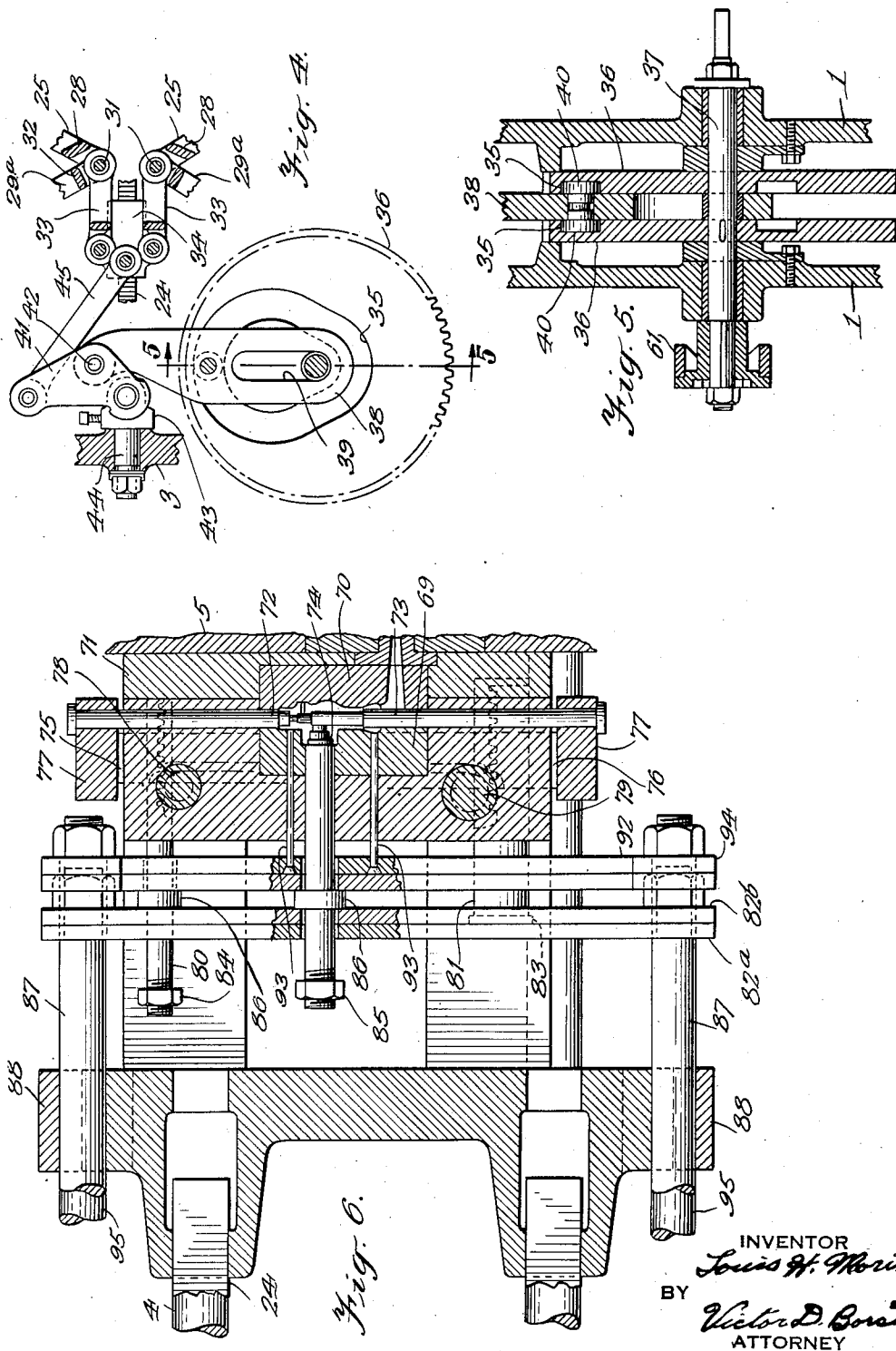
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CORE PULLING AND EJECTING MECHANISM

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3 Sheets-Sheet 3



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1,941,811

CORE PULLING AND EJECTING MECHANISM

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Original application February 6, 1931, Serial No.
513,803. Divided and this application April 8,
1931. Serial No. 528,571

4 Claims. (Cl. 22—93)

My invention relates to die-casting machines in which metal is forced under pressure into a permanent mold or die. In particular, the invention relates to core pulling and ejecting mechanism for such machines.

Die-casting machines, in general, comprise a stationary die plate and a movable die plate to which die-parts are secured, the die-parts carried by the plates constituting a complete die. The movable die plate is movable with respect to the stationary die plate to move the die-part carried thereby into and out of operative relation with the die-part secured to the stationary die plate. The mold cavities of the die-parts are so formed that the metal forced into the mold cavity of the die, when the die-parts are in operative relation, remains in the die-part secured to the movable die plate when the plate is moved to separate the die-parts. The cast metal so remaining in the cavity of the movable die-part must be ejected therefrom so that when the die-parts are again brought together they will be in condition to receive another charge of molten metal. Where core pins are used to form openings in the castings produced, these pins must be withdrawn from the mold cavity of the die before the casting is ejected.

In accordance with my invention, the core pins are withdrawn from the mold cavity of the die, and the casting is ejected automatically. The core pulling and ejecting mechanism are positive in their operation, and are effective by virtue of relative movement with respect to the movable die plate.

An advantage of my invention is the fact that core pins at an angle to the line of movement of the movable die plate may be withdrawn and inserted by the core pulling mechanism.

Specifically, I provide a stationary die plate which is secured to the pressure end of the machine. This stationary die plate is adapted to carry a die-part in operative relation with the pressure pot of the die-casting machine. Slidably supported on rods extending from the pressure end of the machine there is a movable die plate. This movable die plate carries an ejector box in which there are two plates, an ejector plate and a core plate. The ejector box also carries a die-part which is, by virtue of the movement of the die plate, carried into and out of operative relation with the die-part secured to the stationary die plate. The ejector plate and core plate are slidably mounted in the ejector box and extend through the sides thereof. The ends of the ejector plate extend through the sides

of the ejector box and are connected by means of rods to the frame of the machine. The rods are slidably mounted in lugs formed on the frame of the machine and are adapted to carry adjustable abutments which, on movement of the die plate, abut against the lugs on the frame and hold the ejector plate stationary with respect to the frame. On each of the rods connected to the ends of the ejector plate, there is an abutment on either side of the lug on the frame of the machine through which the rod passes. As the die plate moves in a direction to separate the die-parts, one of these abutments engages the lug on the frame, and holds the ejector plates stationary so that ejector pins, which are aligned with openings in the ejector box and the die-part carried thereby, extend into the mold cavity of the die-part upon relative movement of the die plate and the ejector plate. As the die plate moves to close the dies, the abutment on the opposite side of the lug through which the rod passes engages the lug and holds the ejector plate stationary so that relative movement of the die-part in this direction causes the ejector pins to be withdrawn from the mold cavity.

The movable die plate is actuated by a toggle mechanism. The ends of the core plate extending through the ejector box carried by the movable die plate are connected to the toggle mechanism for operating the die plate. The plate is connected to the toggle mechanism so that when the toggle mechanism is operated to move the die plate, the core plate is moved in the same direction as the die plate but relative thereto. The relative movement of the core plate serves to withdraw and insert the cores depending upon the direction of movement of the die plate.

If the casting to be produced requires core pins at an angle to the direction of movement of the movable core plate, these angular core pins are secured to a rack which engages a pinion rotatably mounted in the ejector box. Additional racks actuated by the core plate also engage the pinion so that movement of the core plate operates the pinions which in turn operate upon the racks to which the core pins are secured to withdraw and insert the angular core pins.

A clearer understanding of my invention will be had from the following particular description of one embodiment thereof which is shown in the accompanying drawings in which:

Fig. 1 is a side elevation of the operating mechanism of a machine constructed in accordance with my invention;

Fig. 2 is a plan of the same;

Fig. 3 is a fragmentary sectional plan showing the toggle mechanism for operating the movable die plate;

Fig. 4 is a fragmentary sectional elevation of the operating mechanism of the machine;

Fig. 5 is a fragmentary transverse, sectional elevation taken on the line 5—5 of Fig. 4; and

Fig. 6 is an enlarged fragmentary sectional plan of the ejector box taken on the line 6—6 of Fig. 1 and showing the die plate in the closed position of the die-parts.

In the drawings, I have illustrated only the operating mechanism of a die-casting machine.

A complete die-casting machine is shown in my copending application Serial No. 513,803, filed February 6, 1931, of which this application is a division. The mechanism illustrated may be used with any of the well known pressure ends of die-casting machines, and for this reason and for the purpose of simplifying the drawings, the pressure end of the machine, which is well known to those skilled in the art, has been omitted.

The operating end of the machine which is shown in the drawings is mounted in a frame which includes parallel side frame members 1 and a transverse frame member 2. The side frame members 1 are rigidly secured together in spaced relation by a series of transverse tie rods 3, and the frame is rigidly secured in place with respect to the pressure end of the machine by four parallel frame rods 4 which are arranged in two parallel planes. These frame rods are firmly secured to the pressure end of the machine, indicated by the member 5, in which the pressure pot of the machine is located. The frame rods extend perpendicular from the member 5 and through the side frame members 1, the two upper frame rods extending through hub shaped projections 6 formed on the sides of the frame members in which they are slidably mounted, and the two lower frame rods extend through the frame members 1 which have hub shaped portions 7 at each end through which the rods extend and in which they are slidably mounted. The portion of each of the frame rods which extends through the frame members 1 are threaded to receive nut 8 by means of which they are rigidly secured to the frame members, there being a nut on each side of the hubs through which the frame rods extend. These frame rods are slidably mounted in the frame members so that the frame may be adjusted with respect to the pressure end of the machine in order to accommodate different sized dies.

To permit adjustment of the frame, with respect to the pressure end of the machine, the frame is supported through brackets 9 which extend downwardly from, and forwardly of, the side frame members 1 to which they are rigidly secured. A shaft 10 extends between the brackets 9 and through aligned openings provided therefor in the brackets. Adjacent each bracket, there is rotatably mounted on the shaft 10 a flanged wheel 11 which rests upon a track 12 supported by a base 13. When the nuts 8, on the frame rods 4, are loosened the frame may be moved on the flanged wheels 11 along the tracks 12 to the desired position, in which position the frame may be locked by the nuts 8. For moving the frame along the tracks 12, there is provided an adjusting screw 14 which extends through the shaft 10 in threaded engagement therewith. The end of the adjusting screw opposite to the shaft 10 is rotatably mounted in a frame 15

which is pivoted between the arms of a bifurcated bracket 16. The frame 15 is pivoted to the bracket 16 between its ends, and on the side of the pivot opposite to that through which the adjusting screw 14 extends, it is provided with a hub in which a stub shaft 17 is rotatably mounted. The end of the adjusting screw extending through the frame 15 carries a spur gear 18 which is secured thereto and which meshes with the spur gear 19 secured to the shaft 17. The end of the shaft 17 is provided with a hand wheel 20 which is secured thereto and by means of which the shaft 17, and consequently, the adjusting screw 14 may be rotated to move the frame of the machine along the tracks 12.

Slidably mounted on the frame rods 4, there is a die plate 21 which is provided with hub shaped portions 22 through which the frame rods extend. The die plate is also provided with hub shaped portions 23 into which guide rods 24 extend, the guide rods extending from the die plate perpendicular thereto and through the frame of the machine. These guide rods are substantially square in cross section and extend through openings in the frame members which are complementary in shape. The die plate 21 is moved along the frame rods by a toggle mechanism. The toggle mechanism includes two pairs of links, one pair at the top of the machine and the other pair midway of the machine and at the bottom of the die plate. Each pair of links includes a link connected at one end to the frame of the machine, and a link pivotally connected at one end to the die plate, the opposite ends of the links being pivotally connected together. The link which is pivotally connected to the die plate has two parallel arms 25 the ends of which extend between brackets 26 formed on the die plate and extending perpendicular therefrom, the arms of the link being pivotally connected to the brackets on the die plate by a pivot pin 27. The two arms constituting the link are secured together and reinforced by cross members 28 which are formed integral therewith. The link 29 of each pair which is connected to the frame of the machine is pivotally mounted between the side frame members 1 on a pivot pin 30 extending from the frame members. This link 29 is bifurcated at the end opposite to that secured to the frame members and the arms 29a of the bifurcated portion of the link are pivotally secured to the arms 25 of the other link of the pair by a pivot pin 31. The arms of the bifurcated portion of the link 29 are strengthened by an integral cross piece 32. Between the arms 29a of the bifurcated link 29 there is mounted on the pivot pin 31 one end of a link 33. At the end opposite to that mounted on the pivot pin 31, the link 33 is also bifurcated. Each arm 33a and 33b of the bifurcated portion of the link 33 is secured to a member 34 which is slidably mounted on one of the guide rods 24 of the die plate, there being two such members 34 which are connected together and constitute a cross head.

The toggle mechanism is actuated through the cross head comprising the members 34 which is operated by cams 35 formed by recessing the sides of a pair of gears 36, the cross head being operated by these cams through a system of links and levers. The gears are mounted upon a shaft 37 which extends between and through the two side frame members 1, the shaft being rotatably mounted in openings in the frame members. The contour of the cams formed by recessing the

opposed faces of the gears 36, as shown in Fig. 4, is such as to reciprocate a link 38 mounted between the gears and provided with a slot 39 through which the shaft 37 extends. The link 38 is provided with a pair of cam followers 40 which are rotatably mounted therein and extend into the cam recesses in the gears 36. The link 38 extends above the gears 36 and at the upper end is pivotally secured to a link 41 which link 41 consists of two parallel members spaced apart. The upper end of the link 38 extends between these members and is secured thereto by a pivot pin 42 extending between the members. The link 41 is fulcrumed, at one end, on a bracket 43 which extends between the members of the link and which is secured to the transverse frame member 3 by means of a bolt 44. The opposite end of the link 41 is pivotally connected to a link 45 which extends between the link 41 and the cross head members 34 to which it is also pivotally secured. Thus, as the gears 36 are rotated the link 38 is reciprocated in a vertical plane and the movement of the link 38 is translated into reciprocating movement of the cross head members 34 in a horizontal plane.

The gears 36 are operated through a drive shaft 46 through a train of reducing gears. The drive shaft is journaled in the side frame members and a bracket 47 extending from and secured to one of the frame members. Between the bracket 47 and the frame member to which it is secured there is a drive pulley 48 rotatably mounted on the shaft 46. This drive pulley is connected to and disconnected from the shaft 46 by a clutch mechanism 49. The clutch mechanism may be any of the well known types. The mechanism illustrated is such that it is operated by sliding a collar 50 along the shaft 46, and for this purpose, there is provided a bracket 51 having lugs 52 extending into a circular groove formed on the collar 50. The bracket 51 is secured to a shaft 53 which extends along the side of the machine and is journaled in hubs formed on the side of the machine. Intermediate of the ends of the shaft 53 there is a bracket 54 having an arm 55 extending radially therefrom. Through this arm 55, a bolt 56 extends which is secured in the side of the frame member. A convolute spring 57, surrounding the bolt, acts between a nut on the end of the bolt and the arm 55, and the action of the spring is such as to move the shaft 53 in a direction to operate the clutch mechanism to disengage the drive pulley 48 from the shaft 46. For operating the clutch to connect the drive shaft 46 to the pulley 48 there is provided a handle 58 which is secured to the end of the shaft 53. The bracket 54 is also provided with an arm 59 which carries a cam follower 60 in operative relation to a cam 61 secured on the end of the shaft 37. The cam 61 is such, having one V-shaped groove, that when the handle 58 is moved to cause the clutch 49 to connect the drive pulley 48 to the drive shaft 46, the cam engaging the cam follower 60 on the bracket arm 59 will hold the clutch in the operative position while the shaft 37 makes one complete revolution.

On the drive shaft 46 there is mounted a pinion 62 which meshes with a gear 63 that is rotatably mounted on a shaft 64 extending between the side frame members 1. On either side of the gear 63 there is a pinion 65 secured thereto, the pinions meshing with the gears 36. All of the gears are enclosed by a gear cover 66. On the drive shaft 6, there is also mounted a brake mechanism 67 which is adapted to take up back-lash in the

train of gears just described and to prevent over-travel of the toggle mechanism.

From the above description of the mechanism for operating the movable die plate, it will be apparent that when the clutch is thrown in, the die plate will be reciprocated once. The position of the V-shaped notch in the cam 61 is such that the clutch is thrown out when the die plate is in operative position, that is, when the die-parts are together and in position to receive a charge of molten metal. On operation of the clutch mechanism, therefore, the movable die plate will be moved to open and close the die.

The movable die plate carries an ejector box 68 which is secured thereto. The ejector box carries a die-part 69 which is adapted to cooperate with the die-part 70 carried by the stationary die plate 71 which is secured to the member 5. The mold cavities of the die-parts are so formed that the metal cast in the die remains in the mold cavity of the die-part secured to the ejector box when the die-parts are separated. The die illustrated in the drawings is provided with three core pins, two lateral core pins 72 and 73, and a longitudinal core pin 74. The ends of the lateral core pins which extend through openings in the ejector box are secured to lateral racks 75 and 76 by lugs 77. The lateral racks 75 and 76 engage pinions 78 and 79 respectively which are rotatably mounted in the ejector box. The pinions 78 and 79 are also engaged by longitudinal racks 80 and 81 respectively. The die shown, for the purposes of illustration, requires lateral core pins of different lengths which requires that the core pins be moved through different distances to insert or pull the cores. The longitudinal core pin likewise must be moved through a distance differing from the distance which either of the lateral core pins must be moved. The longitudinal rack 81 which operates the longer of the two lateral core pins is secured in a core plate. The core plate consists of two plates 82a and 82b which are secured together. The plate 82b is provided with a recess and an opening, the recess being at the base of the opening and adapted to receive a flange 83 formed on the end of the rack 81. Thus, when the two plates are secured together, the end of the rack is firmly secured to the core plate. The longitudinal rack 80 extends through the core plate which is provided with an opening therefor. The end of the longitudinal rack 80 is threaded to receive a nut 84 which is of greater diameter than the opening in the core plate through which the rack extends and which is adapted to engage the core plate when the core plate is moved in the direction of the nut. The longitudinal core pin 74 also extends through the core plate, and the end of the core pin is threaded to receive a nut 85 which is adapted to engage the core plate. It will be seen, therefore, that as the core plate moves relative to the die plate, in a direction away from the die plate it will move the longitudinal racks, either by virtue of the fact that the rack is secured therein, or by engaging the nut on the end of the rack. The racks, upon being moved by the core plate, will rotate the pinions 78 and 79, which will move the racks 75 and 76 to move the core pins 72 and 73. The longitudinal core pin will, of course, be drawn by the engagement of the core plate and the nut 85. On the return movement of the core plate, the racks and the longitudinal core pin are moved in the opposite direction by the engagement of the core plate with collars 86 secured on the rack and the core pin. It will be apparent that the distances the core

pins are moved depends upon the character of their engagement with the core plate.

The ends of the core plate extend through openings in the sides of the ejector box, the core plate 5 being slidably mounted in the ejector box. To each of the extended ends of the core plate, an operating rod 87 is secured and extends perpendicularly to the core plate along the side of the machine, the rods extending through projections 88 10 formed on the sides of the die plate and being supported thereby. The operating rods 87 also extend through openings in projections 89 formed on the members 34 which constitute the cross-head of the toggle mechanism. These rods are 15 slidably mounted in the projections 88 and 89. The portions of the rods 87 which extend through the projections 89 on the cross-head members 34 are threaded to receive nuts 90 and 91 and 90' and 91' on opposite sides of the projections 89 which 20 are adapted to engage the ends of the projections. By the engagement of the projections and the nuts, the core plate is moved relative to the die plate and in the same direction as the direction of movement of the die plate as the cross-head mem- 25 bers move a greater distance and at a greater speed than the die plate. Thus, as the cross-head moves in a direction to separate the die-parts, the core plate will be moved relative to the die plate so as to withdraw the core pins, and as 30 the die plate is moved in a direction to close the die-parts, the core plate will be moved in a direction to insert the core pins.

Within the ejector box, there is also an ejector plate 92. Like the core plate, the ejector plate 35 is composed of two plates secured together. The plate towards the die is provided with a plurality of openings ending in conical recesses. Through these openings a plurality of ejector pins 93 extend, the ejector pins having conical heads which 40 are received in the conical recesses of the openings through the plate and are firmly secured between the plates. When the dies are closed, in the position shown in Fig. 6, the ejector pins extend through aligned openings in the ejector box and 45 the die-part carried thereby, the ends of the ejector pins being flush with the surface of the mold cavity of the die-part. The ends of the ejector plate also extend through the sides of the ejector box, and the ejector plate is slidably 50 mounted in the ejector box. Each end of the ejector plate has a pair of lugs 94 formed thereon through which operating rods 95 extend, the ends of the rods being secured to the plate. The operating rods 95 extend perpendicularly to the ejector 55 plate along the sides of the frame and extend through openings in plates 96 which are secured to the side frame members 1. These operating rods are threaded throughout the portion which extends through the openings in the plates and are 60 slidably mounted in the openings. The rods are provided with nuts 97 and 98 located on opposite side of the plates. As the die plate moves to open the dies, to the position shown in Figs. 1 and 2, the nuts 98 engage the plates 96 after the 65 die plate has moved a certain distance, depending upon the position of the nuts 98, and hold the ejector plate stationary with respect to the die plate so that as the die plate continues to move, the ejector pins are inserted in the mold cavity of the die-part carried by the movable die to eject 70 the casting therefrom. As the die plate is returned to the position in which the dies are closed, as shown in Fig. 6, the ejector plate moves with the die plate until the nuts 97 on the ends of the oper- 75 ating rods 95 engage the plate 96 and hold the

ejector plate from further movement. Further movement of the die plate is then relative to the core plate and causes the ejector pins to be withdrawn from the mold cavity of the die-part carried by the movable die plate. 80

The operation of the machine is as follows: When the mold cavity of the die has been charged with metal, the operator actuates the handle 58 to cause the clutch mechanism to connect the drive pulley 48 to the drive shaft 46. As the shaft 85 46 is rotated, the shaft 37 is also rotated through the train of gears hereinbefore described and the cam 61 is rotated to engage the cam follower on the bracket 54 to hold the clutch in the operative position against the action of the spring 57. Rotation of the gears 36, which are secured to the shaft 37, causes the link 38 to be reciprocated, 90 which, through the links 41 and 45, causes reciprocation of the cross-head members 34 on the guide rods 24. When the machine is in the position shown in Fig. 6, the toggle mechanism locks the movable die plate. As the link 38 is lifted by the cams in the gears 36, the cross-head members 34 are moved to break the toggle and move the die plate 21 in a direction to separate the die-parts. 100 It will be obvious that the cross-head members 34 move at a greater speed than the movable die plate and, as hereinbefore described, the core plate, through the operating rods 87, will be moved relative to the die plate in the same direction of 105 movement of the die plate, thereby withdrawing the cores. The core plate will move with the die plate until the nuts 98 engage the plates 96 when further movement of the ejector plate will be restrained and the continued movement of the 110 die plate will cause the ejector pins to extend into the mold cavity of the die-part carried thereby. As the link 38 is moved downwardly towards its initial position, the reverse of the above operation will take place and the ejector pins will be 115 withdrawn, the core pins inserted, the die plate moved to close the dies and locked in that position by the toggle mechanism. When the die plate has reached the closed position, the V notch in the cam 61 on the shaft 37 will have reached 120 the cam follower on the bracket 54. The spring 57 will then actuate the shaft 53 to cause the clutching mechanism to break the connection between the drive pulley and the drive shaft. The machine is then in position to repeat the 125 cycle just described.

It will be apparent that when the machine is started, further operation is automatic including the withdrawing of the core pins and the ejecting of the casting until the machine is re- 130 turned to the position in which it is adapted to receive a charge of molten metal.

It is obvious that various changes may be made in the details of the embodiment disclosed in the drawings and above particularly described by 135 those skilled in the art within the principle and scope of my invention as expressed in the appended claims.

I claim:

1. In a die casting machine, a stationary frame, 140 a die plate stationary with respect to the frame, a die-part carried by the stationary die plate, a movable die plate carried by the frame, an ejector box carried by the movable die plate, and having openings therethrough substantially 145 perpendicular to the die plate, a die-part secured to the ejector box and having a mold cavity therein and openings therethrough in alignment with the openings in the ejector box and communicating with the mold cavity, means for 150

moving the movable die plate to carry the die-part thereon into and out of operative relation with the die-part secured to said stationary die plate, an ejector plate slidably mounted within the ejector box and having the ends thereof extending through the sides of the ejector box, ejector pins secured to the ejector plate and extending into the aligned openings in the die-part and the ejector box, rods secured to the ends of the ejector plate and extending along the sides of the frame, lugs on the frame in which the rods are slidably mounted, adjustable abutments on the rods adapted to abut against said lugs to hold the ejector plate stationary with respect to the movable die plate.

2. In a die-casting machine, in combination a stationary die plate, adapted to hold a die-part, a movable die plate, an ejector box carried by the movable die plate, and adapted to carry a die-part, a toggle joint through which the movable die plate is actuated to move a die-part carried by the ejector box into and out of operative relation with a die-part held by said stationary die plate, a slidably mounted member connected to said toggle joint, said slidably mounted member being movable in the direction of movement of said movable die plate and adapted to move the die plate through the toggle mechanism, a core plate in the ejector box having its ends extending through the slides of the ejector box and being slidably mounted therein, a lost motion connection between the slidable member for operating the toggle mechanism and the core plate, and means for moving the slidable member.

3. In a die-casting machine, in combination a stationary die plate, adapted to hold a die-part, a movable die plate, an ejector box carried by the movable die plate and adapted to carry a die-part, a toggle joint through which the movable die plate is actuated to move a die-part carried by the ejector box into and out of oper-

ative relation with a die-part held by said stationary die plate, a slidably mounted member connected to said toggle joint, said slidably mounted member being movable in the direction of movement of said movable die plate and adapted to move the die plate through the toggle mechanism, a core plate in the ejector box having its ends extending through the sides of the ejector box and being slidably mounted therein, a rod extending from said core plate and slidably mounted in said slidable member, adjustable abutments on the rod adapted to engage said slidable member, and means for moving the slidable member.

4. In a die-casting machine, in combination a stationary die plate, adapted to hold a die-part, a movable die plate, an ejector box carried by the movable die plate and adapted to carry a die-part, a toggle joint through which the movable die plate is actuated to move a die-part carried by the ejector box into and out of operative relation with a die-part held by said stationary die plate, a slidably mounted member connected to said toggle joint, said slidably mounted member being movable in the direction of movement of said movable die plate and adapted to move the die plate through the toggle mechanism, a core plate in the ejector box having its ends extending through the sides of the ejector box and being slidably mounted therein, core pins parallel to the core plate, and operatively related thereto, additional core pins angularly disposed with respect to the core plate and operatively related thereto, a rod extending from said core plate and slidably mounted in said slidable member, adjustable abutments on the rod adapted to engage said slidable member, means for moving the slidable member, and means for translating relative movement between the core plate and the movable die plate into longitudinal movement of the core pins.

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