Aug. 27, 1935. C. ROEHRI 2,012,548

DIE CASTING MACHINE

Original Filed March 5, 1932 4 Sheets-Sheet 1

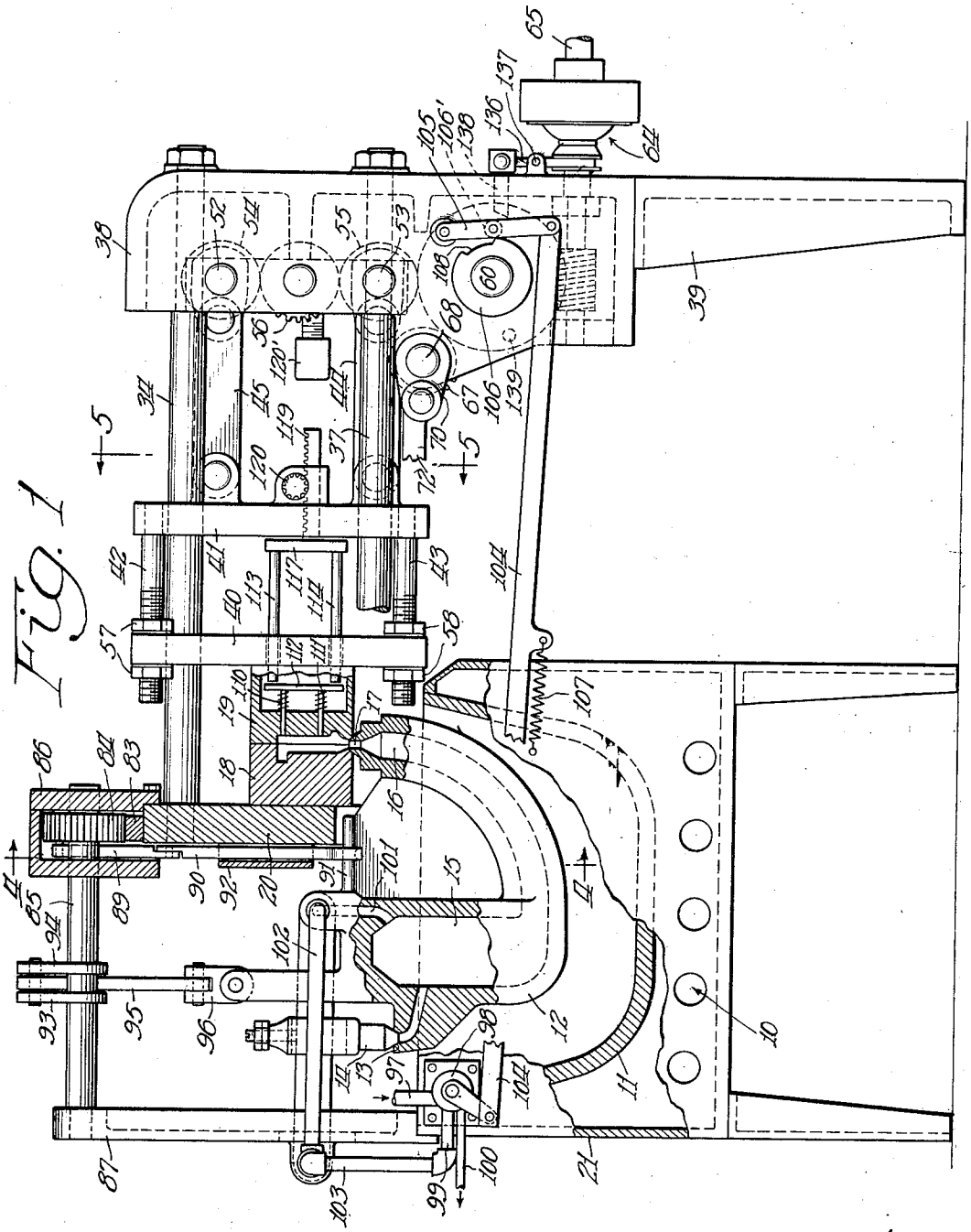

Fig. 1

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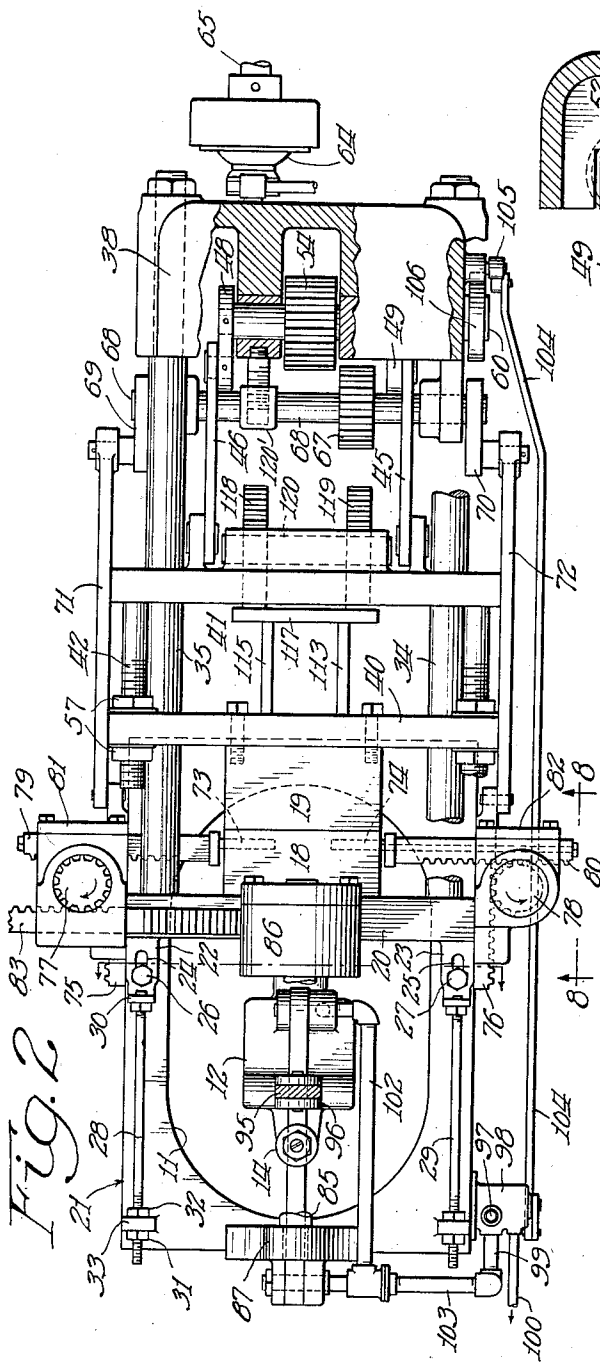

Fig. 2

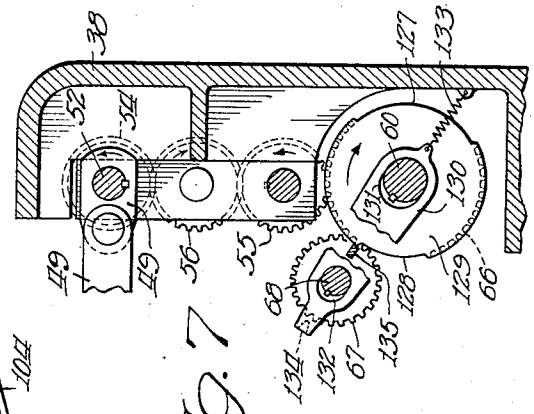

Fig. 7

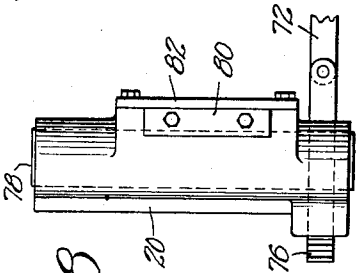

Fig. 8

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DIE CASTING MACHINE

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Fig. 3

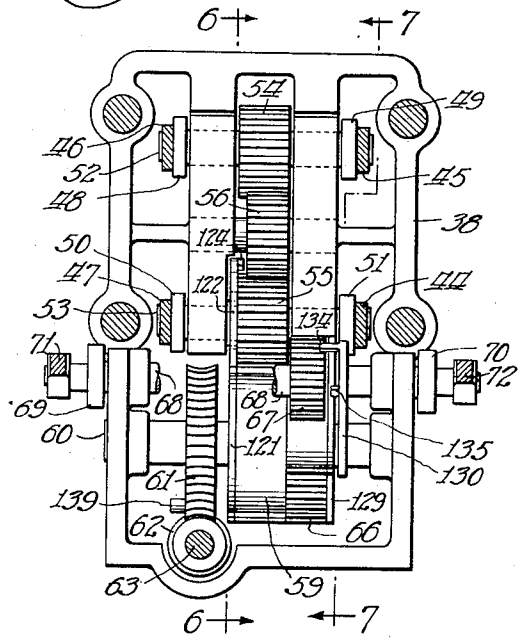


Fig. 5

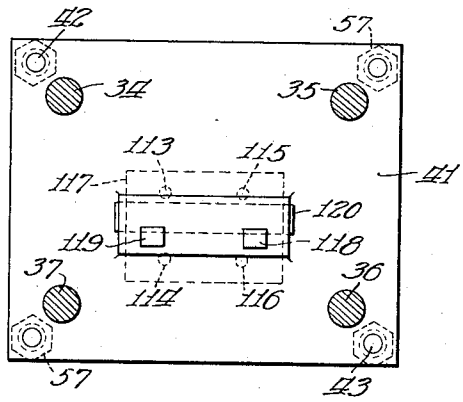


Fig. 6

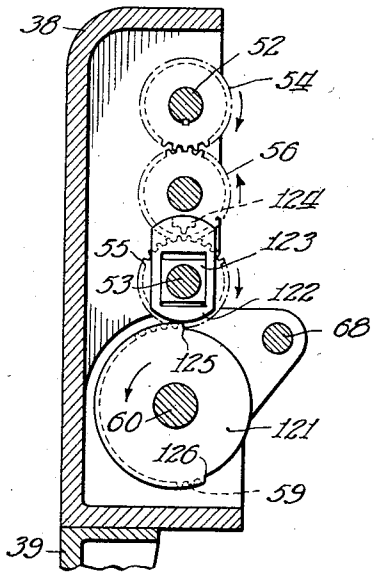
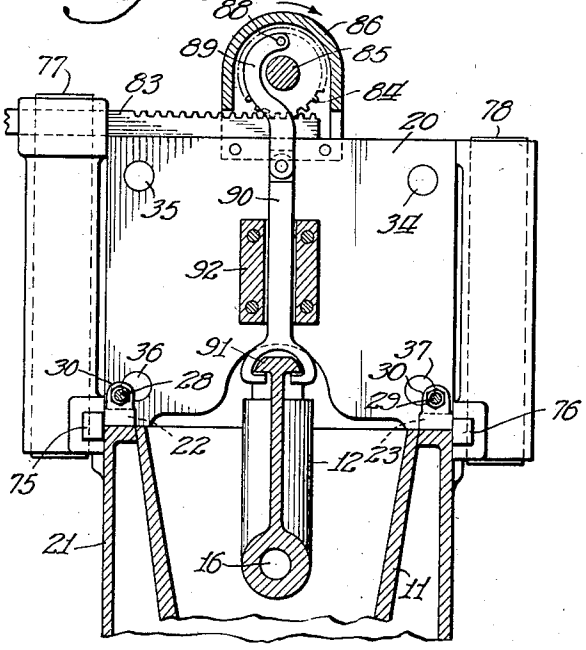


Fig. 4



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DIE CASTING MACHINE

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Fig. 10

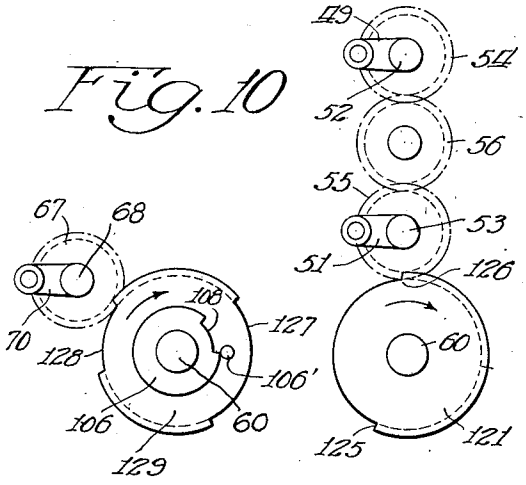


Fig. 12

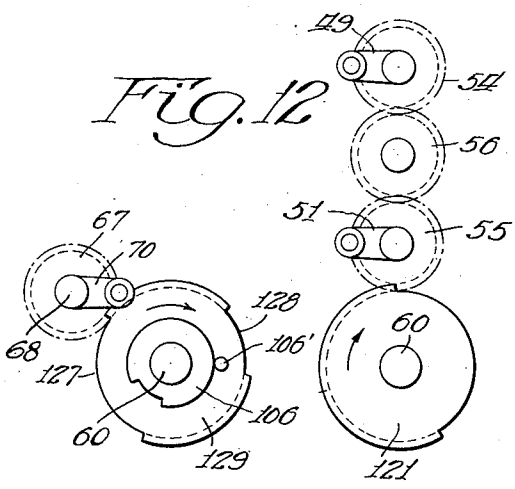


Fig. 11

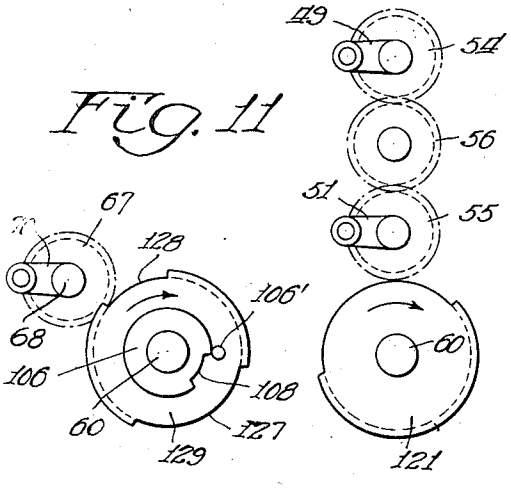
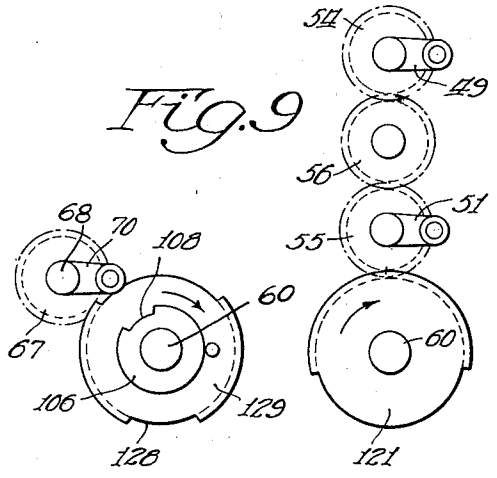


Fig. 9



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UNITED STATES PATENT OFFICE

2,012,548

DIE CASTING MACHINE

Carl Roehri, Chicago, Ill.

Application March 5, 1932, Serial No. 596,919
Renewed March 15, 1935

5 Claims. (Cl. 22—93)

My invention relates to die casting machines.

The principal purpose of my invention is to provide a machine of this character wherein the action of the die closing mechanism is so timed as to close the dies with a relatively small amount of strain upon any portion of the mechanism thus enabling it to be made of much lighter weight than has heretofore been possible.

It is also the purpose of this invention to provide in a machine of this character a novel means for operating the receiver for the molten material which fills the die.

A further object of the invention is to provide a novel timing mechanism whereby the movable section of the die and the core parts of the die are moved into position and retracted and the material which is being cast is supplied in a definite timed sequence that may be varied over a wide range to adapt the device to different kinds of castings.

Another object of the invention is to provide a novel stop mechanism whereby to bring all of the moving parts to definite stops in the proper positions during the cycle of operation.

Other objects and advantages of this invention will appear as the description proceeds in connection with the accompanying drawings wherein the preferred form of the invention is shown. It is to be understood, however, that the description and drawings are illustrative only and are not to be taken as limiting the invention except in so far as it is limited by the claims.

In the drawings—

Fig. 1 is a side view partly in section of a die casting machine;

Fig. 2 is a plan view partly in section of the machine;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a section on the line 5—5 of Fig. 1;

Fig. 6 is a section on the line 6—6 of Fig. 3;

Fig. 7 is a section on the line 7—7 of Fig. 3;

Fig. 8 is a side view of a portion of the core operating mechanism, this view being taken substantially in the direction indicated at 8—8 on Fig. 2; and

Figs. 9, 10, 11, and 12 are diagrammatic views illustrating the various positions of the timing mechanism during a cycle of operation.

Referring now in detail to the drawings, the machine includes heating means indicated generally at 10 beneath a vat or receptacle 11 which contains the material to be used in casting, this receptacle 11 being normally kept substantially filled with the molten material. The receiver 12 extends down into the receptacle 11 and has an inlet at 13 closed by the stopper 14 when the receiver is in uppermost position and open when the receiver is lowered into the receptacle to permit the material to flow into the chamber 15 of the receiver. The outlet from the receiver to the dies consists of a passage 16 starting from the bottom of the chamber 15 and curving upwardly to a nozzle at 17 which nozzle, when the receiver is raised, is positioned as shown in Fig. 1 to discharge the material between the dies 18 and 19. By a suitable mechanism to be hereinafter described, the nozzle 17 is always held above the level of the liquid in the receptacle 11.

The die 18 is the stationary die and forms a part of a second section of the machine. This section consists of the frame member 20 which as shown more clearly in Fig. 2, is connected to the casing 21 housing the receptacle 11 and its heating means 10. This member 20 has the extensions 22 and 23 which are slotted as indicated at 24 and 25 so as to slide on the bolts 26 and 27 so that the member 20 may be adjusted endwise along the top of the casing 21. The moving mechanism for adjusting the member 20 consists of the rods 28 and 29 each rod being screwthreaded into a suitable lug 30 such as shown on the member 22. The rod 28 is adjusted by screwing the two nuts 31 and 32 on opposite sides of the lug 33 at the back end of the casing 21, the rod projecting through this lug as indicated in Fig. 2. The member 20 is connected by four rods 34, 35, 36, and 37 to the gear housing 38 wherein the timing and driving gears are mounted. This housing is supported by a leg 39.

The section of the machine just described includes substantially all of the mechanism whereby the movable die 19 is caused to move into and out of closed position and whereby the core members are inserted and withdrawn. The movable die 19 is supported on a frame piece 40 which is connected with another frame piece 41 by means of the bolts such as 42 and 43 and this entire framework is linked by means of the four connecting rods such as 44, 45, 46, and 47 to the cranks 48, 49, 50, and 51, these cranks being mounted upon the shafts 52 and 53 which shafts are in turn driven by the gears 54 and 55. These gears are connected by the idle gear 56 so that they turn in the same direction at the same rate of speed thus moving all four of the links 44 to 47 together to move the framework 40 to thus advance and retract the die 19. The bolts 42 and 43, in connection with the nuts such as indicated at 57 and 58, provide means for ample adjustment of

the frame piece 40 to take care of larger or smaller dies 19. The gear 55 is driven from a main drive gear 59 which drive gear is mounted on the drive shaft 60.

The shaft 60 is driven by means of the worm gear 61 meshing with the worm 62 on the power shaft 63. This power shaft is connected by a suitable clutch mechanism such as indicated at 64 to a drive shaft 65 that may be driven from any suitable source of power such for example as an electric motor. The shaft 60 has gears 59 and 61 thereon and also a third gear 66 which third gear meshes with a small spur gear 67 mounted on the shaft 68 which shaft is journalled in the frame 38 and has at its outer ends the two cranks 69 and 70. (See Fig. 2.)

The shaft 68 through the cranks 69 and 70 and the links 71 and 72 operates the mechanism for pushing in and retracting the core rods shown at 73 and 74 in Fig. 2. Through the links 71 and 72, this shaft also operates the mechanism for lowering and raising the receiver 12 as will be hereinafter more clearly described.

Links 71 and 72 are connected to the racks 75 and 76 at opposite sides of the member 20, and these racks in turn mesh with the pinions on the lower ends of the members 77 and 78 so that as the racks are moved the two members 77 and 78 are caused to turn in opposite directions as indicated by the arrows in Fig. 2. These members 77 and 78 have gears meshing with the racks 79 and 80 which are suitably guided by means of the plates 81 and 82 and which carry the core pins 73 and 74 at their inner ends. Members 77 and 78 are merely elongated gears. The top of the member 77 engages another rack 83 which rides on top of the member 20 (see particularly Fig. 4) and meshes with the gear 84 on the shaft 85 which shaft is mounted at one end in the housing 86 carried by the member 20 and at the other end in the standard 87 rising from the receptacle 21. Gear 84 has a pin at 88 on which the curved link 89 is secured, this link being connected to another link 90 that carries the forward end of the receptacle 12, the link 90 being engaged with the web 91 as shown most clearly in Figs. 1 and 4. A suitable guide 92 is mounted on the member 20 for guiding the link 90. The back end of the receptacle 12 is moved up and down by the shaft 85 through the medium of the crank arms 93 and 94, the link 95, and the link 96.

Attention is directed at this time to the fact that arms 93 and 94 are considerably longer than the distance between the center of the shaft 85 and the pin 88 on the gear 84. The reason for this difference is to provide means whereby the back end of the receptacle 12 may be lowered well below the forward end so that the inlet 13 may be submerged within the metal in the vat 11 while the nozzle 17 is retained above the level of the molten metal.

The metal from the chamber 15 is forced into the die by fluid pressure from some exterior force entering into the valve from the conduit 97. The valve 98 is an ordinary three-way valve which in the position shown in Fig. 1 connects the pipe 99 with the exhaust pipe 100 so that any air in chamber 15 may escape by passing out through the passage 101, movable conduit 102, conduit 103, pipe 99, and the valve to the exhaust pipe 100. However, when the link 104 connected to the valve is moved to the left from the position shown in Fig. 1, it shifts the valve so as to connect pipes 97 and 99 together and thus pass the air under pressure through pipes 103 and 102 and passage 101 into the chamber 15. Link 104 is controlled by means of the link 105, cam 106 on shaft 60, and spring 107. That is to say, normally the cam 106 holds the valve in the position shown in Fig. 1 against the tension of the spring 107. When, however, the roller on the link 105 drops into the recess 108 of the cam, spring 107 shifts link 104 to the left to direct the air into the chamber 15 and forces the metal down in this chamber and up through the passage 16 into the dies.

A distinct feature of this device lies in the fact that the arrangement of the receiver 12 and the outlet passage 16 in combination with the inlet 13 and the air inlet 101 always causes the molten material to enter at the back and top of the chamber 15 while the material entering the die is forced from the bottom of the chamber 15 up through the passage 16 thus any dross or light impurities which may be on the metal and which may get into the chamber 15 cannot find its way into the casting. The material for the casting is always drawn from the bottom of the chamber 15 while the lighter dross is always near the top of the chamber.

Referring now particularly to Figs. 1 and 2, I provide means for knocking the casting out of the die 19 at the end of the opening stroke thereof. This means consists of the pins 110 and 111 which pins are connected by the plate 112 and normally held back in the position shown in Fig. 1 by suitable springs about the pin or by the pressure of the air or fluid material within the casting chamber. A set of pins 113, 114, 115, and 116 are carried upon a back plate 117 to which are connected the racks 118 and 119 which racks engage a common gear 120 carried on the back of the frame member 41. One of these racks is adapted at the end of the retractile motion of the frame carrying the die 19 to engage a stop 120' and thus force the racks forward to in turn force the pins 110 and 111 against the casting and knock it out of the die.

In order to insure the proper stopping of the core pins and the die moving mechanism in proper positions at all times, I employ cams and lock mechanisms in connection with the gears 55 and 59 and the gears 66 and 67. This mechanism is brought out more clearly in Figs. 3, 6, and 7.

Referring now to Figs. 3 and 6, the gear 59 has a cam 121 fixed on the face thereof and a lock member 122 mounted upon a block as 123 that surrounds the shaft 53 upon which the gear 55 is keyed. Block 123, however, is fixed against rotation by being formed on the bearing for the shaft 53 so that the action of the cam is merely to raise or lower the member 122. The member 122 carries on the side next to the gear 55 a locking pin 124 which, when the cam 121 permits the member 122 to drop, engages in the teeth of the gear 55 and securely locks this gear against further rotation until the gear 59 shall have rotated sufficiently far enough to again bring the teeth on this gear into engagement with the teeth of gear 55. It is to be noted at this time that gear 59 is cut away between the points 125 and 126 as shown clearly in Fig. 6.

Referring now to Figs. 3 and 7 and gears 66 and 67, the gear 66 is cut away in two portions—namely, the portion 127 and the portion 128 and the cam 129 thereon is similarly cut away. This cam-like member 121 is a separate cam secured on the gear so as to rotate therewith. The locking mechanism consists of the member 130 which

member is apertured at 131 with a slightly oblong aperture to receive the shaft 60 and is apertured at 132 with another oblong aperture to receive the shaft 68 upon which the gear 67 is fixed. A spring 133 normally tends to pull the member 130 down so as to bring the locking pin 134 into engagement with the teeth of the gear 67. A lug 135 on the member 130, however, rides on the cam 129 and prevents this engagement except when this lug can drop into the cut-away portions 127 and 128 of the cam. When the lug 135 drops into one of these cut-away portions, it is clear that the pin 134 will drop into engagement with the gear 67 and lock this gear against further motion until it is released. In this way gears 65 and 67 are prevented from rotating in any direction during the time that the smooth portions of the gears 59 and 66 are passing by their teeth.

I have also provided mechanism for stopping the machine at the end of every cycle. This mechanism consists of the lever arm 136 operating the clutch member 64 and pivoted at 137 onto the frame 38. This lever arm carries at its upper end an inwardly extending pin 138 which pin is adapted to be pressed outwardly so as to release the clutch 64 by another pin 139 carried on the worm gear 61. This pin is so related to the other mechanism that at the end of the retractile movement of the frame carrying the die 19, pin 139 forces pin 138 out to release the clutch 64 and then, owing to the momentum of the machine, passes slightly beyond this pin so as to permit the clutch to be again closed.

Referring now particularly to Figs. 9 to 12, I have shown here the various cams and their associated gearing in several positions which they take during the cycle of operations that involves the closing of the dies and the raising of the receiver nozzle, the opening of the valve, the subsequent withdrawal of the core pins, and then the opening of the die and the kicking out of the completed casting.

As shown in Fig. 9, the cam 121 has the cut-away portion substantially directly opposite the gear 55. This is at the starting or stopping point as indicated by the positions of crank arms 49 and 51 which control the withdrawal of the die 19 and the crank arm 70 which controls the withdrawal of the core pins and the lowering and raising of the metal at the receiver 12. The direction of rotation of the shaft 60 and the respective cams is indicated in all figures by the arrows.

As the rotation begins, cam 129 has just released its lock for the gear 67 and the action taking place during the first part of the revolution of shaft 60 is to simultaneously swing the cranks 49, 51, and 70 so as to advance the movable die 19 and at the same time by advancing the links 71 and 72 to advance the core pins 73 and 74. During this period, the gear 77 is moving the rack 83 to turn shaft 85 in a clockwise direction as indicated by the arrow in Fig. 4, thus raising the receiver 12 out of the receptacle 11. The back end of the receiver was lowered farther than the front end owing to the difference in the length of the cranks to which the links 90 and 95 are connected. As the shaft 60 continues to rotate, it ultimately brings the section 128 of cam 129 and the associated bare section of the gear to which this cam is attached into engagement with the gear 67. This causes the lock pin 134 to drop into engagement with the gear 67 and thus stop the gear 67 with the mechanism in the position shown in Fig. 1, that is with the receiver raised, the die closed, and the core pins moved into place. Thus all of the closing action preparatory to forcing the molten material into the die is accomplished at once. The gears 55 and 54 are also locked at this time due to the fact that the locking device 122 has dropped down off the cam at the point 126. Shaft 60 continues to rotate, and at this time the cam 106 allows the pin on the lever 105 to drop into the slotted section 108 thus operating the valve 98 to force air into the chamber 15 and force the material into the die. During the period required for this action which is indicated at the period expiring between the position shown in Fig. 10 and that shown in Fig. 11, the die is filled, and then the valve is closed, the other parts remaining locked stationary.

The next action taking place is to pull out the cores and drop the receiver back into the receptacle 11. This is done by the cam 129 arriving at the position shown in Fig. 11 which releases gear 67 from its lock and again rotates this gear to pull the links 71 and 72 back and thereby reversing the rotation of shaft 65 and also reversing the movement of the racks 79 and 80 to withdraw the cores. During all of this time, however, the die remains closed owing to the fact that gear 55 is still riding, as shown by Fig. 11, on a bare section of the gear to which cam 121 is attached. The shaft 60 continues to move thereafter until the cores are completely withdrawn at which time the gear 67 is again locked by the locking mechanism associated with cam 129. Cam 121 releases the gear 55 and it again engages teeth on gear 59 to continue the rotation of gears 54 and 55 and thus withdraw the die 19 by means of the links 44, 45, etc. Gear 67 at this time has been locked against rotation so the receiver 15 is stationary in its lowered position, and the cores are stationary in their withdrawn position while the die is being opened. Further rotation of shaft 60 opens the die and brings the rack 118 against the stop 120 to thus knock the casting out of the die 19, and simultaneously therewith the pin 139 on the worm wheel 61 engages with pin 138 to throw out the clutch and to stop the machine bringing all of the parts back to the position represented in Fig. 9.

As an example of the angular movements of the shaft 60 during this cycle, the first movement as shown consists of an angular movement of 103° to close the die and move the cores into position as well as to raise the receiver up to the position where it may fill the dies. The valve is then opened and closed during the next 51 degrees of rotation of the shaft 60. The core opens, and the receiver goes down during the next 103° of rotation of the shaft, and then the final 103° of rotation opens the die and stops the machine. There is considerable range of movement possible with the same mechanism just by changing the time gears and cams. I find that I may vary the closing between 80° and 118° angular movement for the drive shaft 60. I can vary the valve opening and closing between 120° and 6°, and the core opening and die opening movements may each be varied between 80° and 118°. This gives a sufficiently wide range of adjustment to enable the machine to be adapted to any type of die casting.

A brief analysis of the mechanisms used, it is believed, will show the extreme simplicity and

lightness of the structure without the sacrifice of any needed strength.

The pressure on the material within the die is always under control regardless of the size of casting made as this pressure depends wholly upon the pressure supplied behind the molten material in the chamber 15. The dies are closed and locked in closed position before the material is allowed to enter them. Moreover, they are retained in this locked position during the removal of the core pins so that no difficulty can be encountered at this point. The receiver 12 is submerged during all of the cycle except that at which it must be raised in position to fill the die and this is only a short portion of the cycle. This in itself aids in preventing the light impurities in the molten material from getting into the chamber 15 in excess quantities as they have a chance to adjust themselves while the inlet 13 is submerged and thus escape from the chamber 15 or at least permit sufficient good material to reach the bottom of the chamber 15 to supply the necessary amount for each casting.

From the above description, it is believed that the construction and operation of this device will be clear to those skilled in this art and the advantages thereof readily apparent.

Having thus described one specific form of my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a die casting machine having in combination a stationary die, a movable die, a core pin movable into and out of the dies, a crank and means connecting it to said movable die to advance and retract it, a second crank and means connecting it to the core pin to move the core pin in and out, separate gears driving said cranks, a drive shaft, and means connecting both said gears to said shaft at the same time to cause closing of the dies and insertion of the core pin, and successively connecting said gears to said shaft to cause withdrawal of the core pin and opening of the dies.

2. In a die casting machine having in combination a stationary die, a movable die, a core pin movable into and out of the dies, a crank and means connecting it to said movable die to advance and retract it, a second crank and means connecting it to the core pin to move the core pin in and out, a shaft for each crank, a drive shaft, means connecting each crank shaft with the drive shaft transmitting power to each crank shaft during a portion of each rotation of the drive shaft and releasing the crank shafts from the drive shaft during other portions of each rotation of the drive shaft, and locking means holding said crank shafts stationary while they are released from the drive shaft.

3. In a die casting machine having in combination a stationary die, a movable die, a core pin movable into and out of the dies, a crank and means connecting it to said movable die to advance and retract it, a second crank and means connecting it to the core pin to move the core pin in and out, a shaft for each crank, a drive shaft, means connecting each crank shaft with the drive shaft transmitting power to each crank shaft during a portion of each rotation of the drive shaft and releasing the crank shafts from the drive shaft during other portions of each rotation of the drive shaft, and locking means holding said crank shafts stationary while they are released from the drive shaft, said connecting means comprising gears on the crank shafts and mutilated gears on the drive shaft.

4. In a die casting machine having in combination a stationary die, a movable die, a core pin movable into and out of the dies, a crank and means connecting it to said movable die to advance and retract it, a second crank and means connecting it to the core pin to move the core pin in and out, a shaft for each crank, a drive shaft, means connecting each crank shaft with the drive shaft transmitting power to each crank shaft during a portion of each rotation of the drive shaft and releasing the crank shafts from the drive shaft during other portions of each rotation of the drive shaft, and locking means holding said crank shafts stationary while they are released from the drive shaft, said drive shaft having control cams thereon for actuating said locking means.

5. In a die casting machine having in combination a stationary die, a movable die, a core pin movable into and out of the dies, a crank and means connecting it to said movable die to advance and retract it, a second crank and means connecting it to the core pin to move the core pin in and out, separate gears driving said cranks, a drive shaft, and means connecting both said gears to said shaft at the same time to cause closing of the dies and insertion of the core pin and successively connecting said gears to said shaft to cause withdrawal of the core pin and opening of the dies, said last named means comprising mutilated gears on the drive shaft.

CARL ROEHRI.