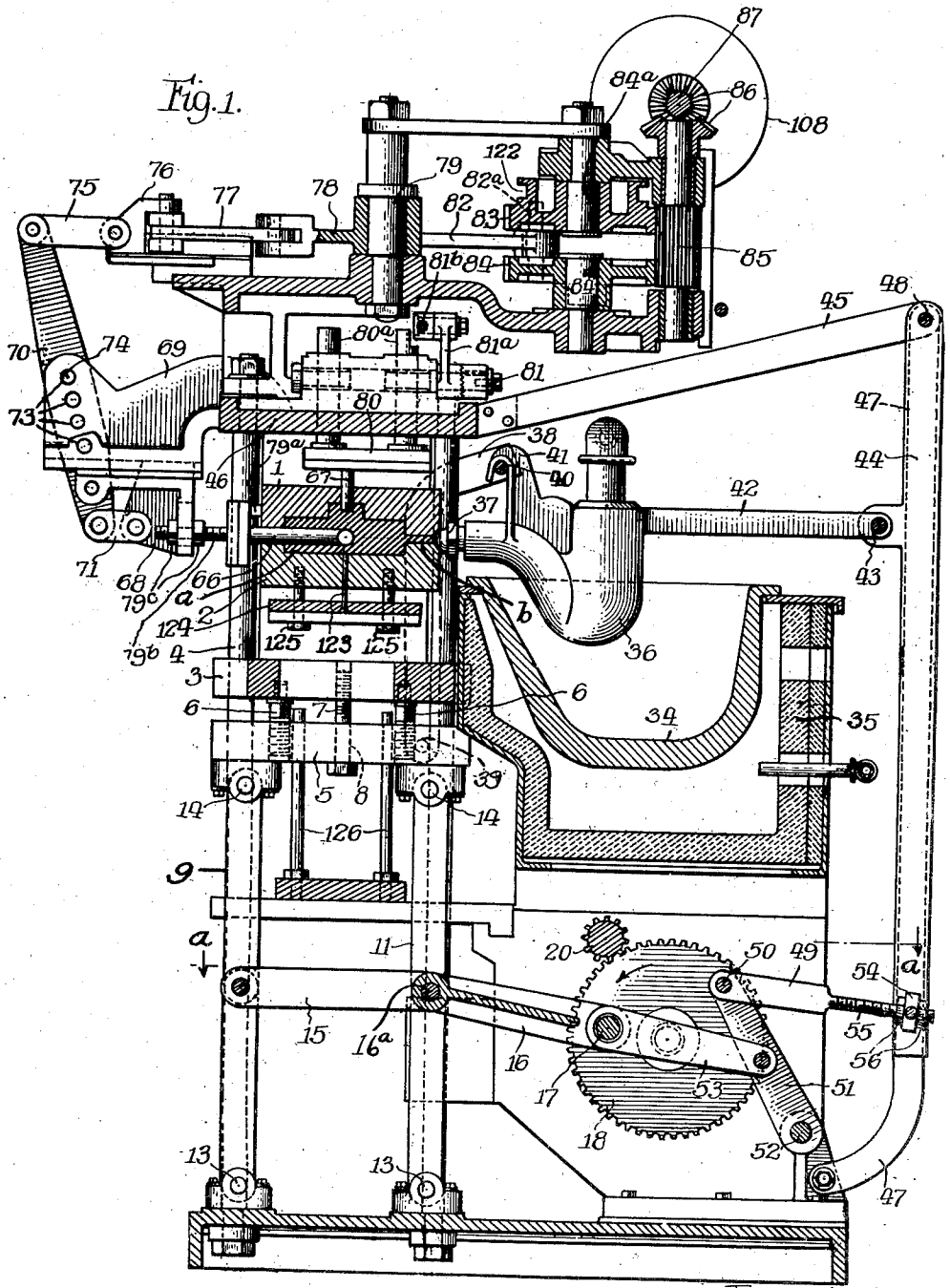
Sept. 25, 1934. F. LANNERT 1,974,822

DIE CASTING MACHINE

Filed Aug. 25, 1930 5 Sheets-Sheet 1

Fig. 1.



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Sept. 25, 1934. F. LANNERT 1,974,822

DIE CASTING MACHINE

Filed Aug. 25, 1930 5 Sheets-Sheet 2

Fig. 2.

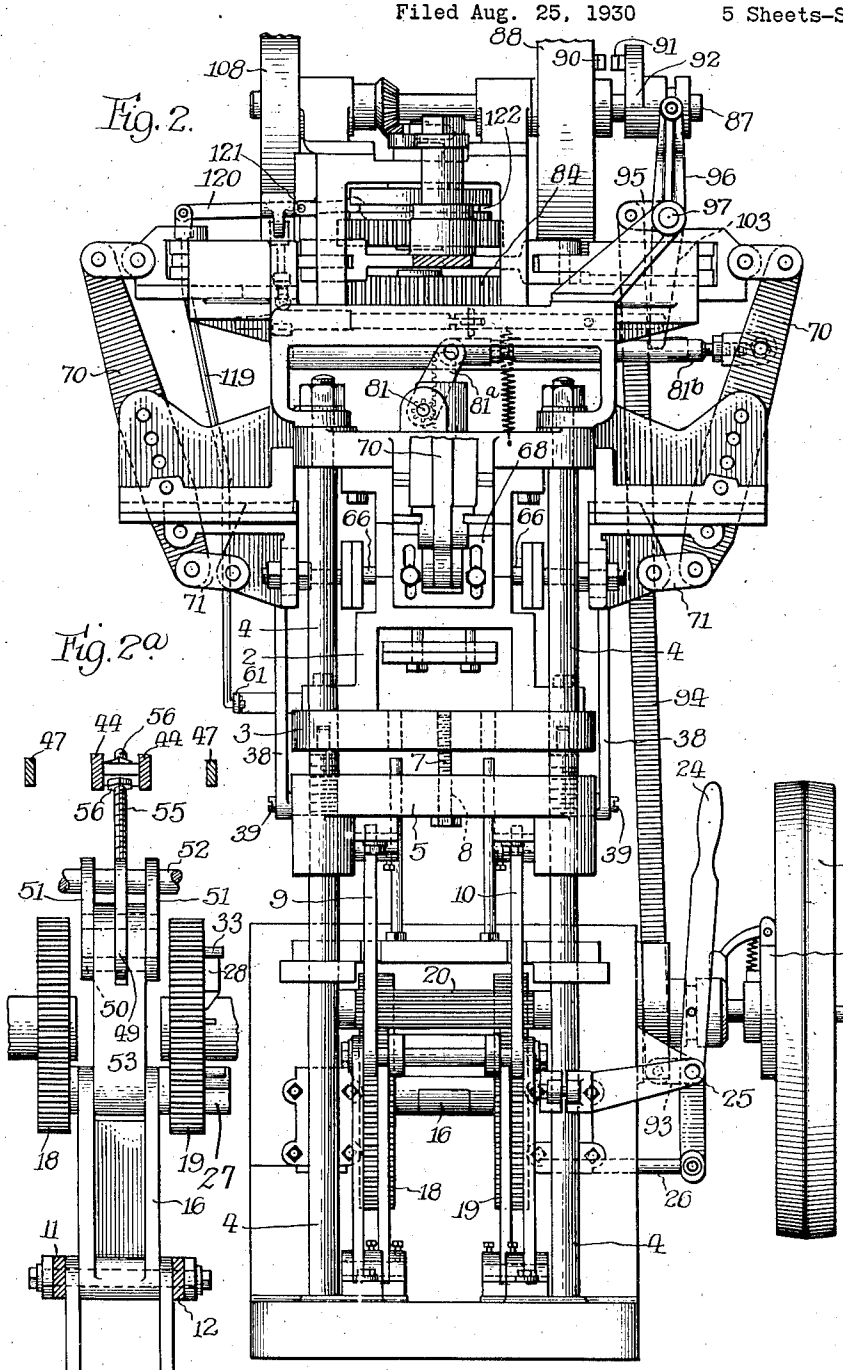


Fig. 2a

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Sept. 25, 1934. F. LANNERT 1,974,822

DIE CASTING MACHINE

Filed Aug. 25, 1930 5 Sheets-Sheet 3

Fig. 3.

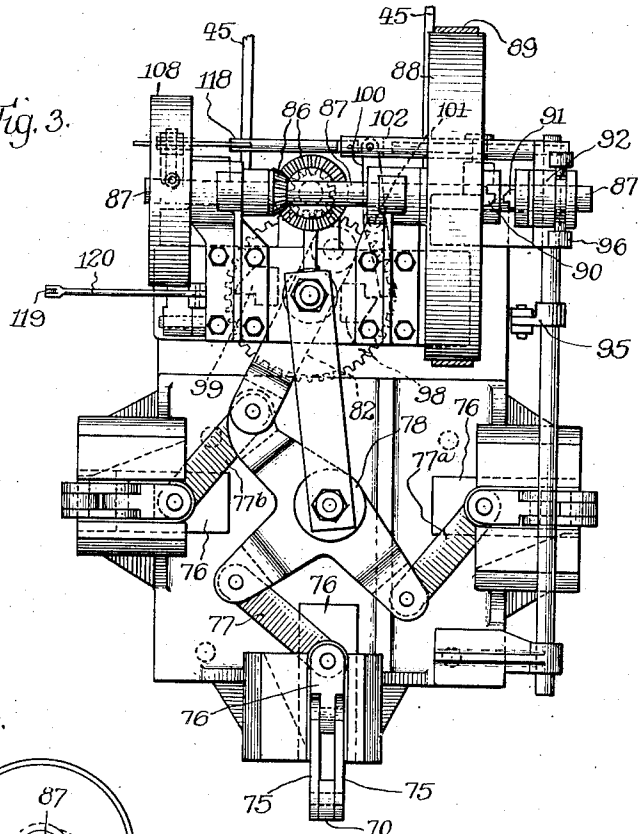
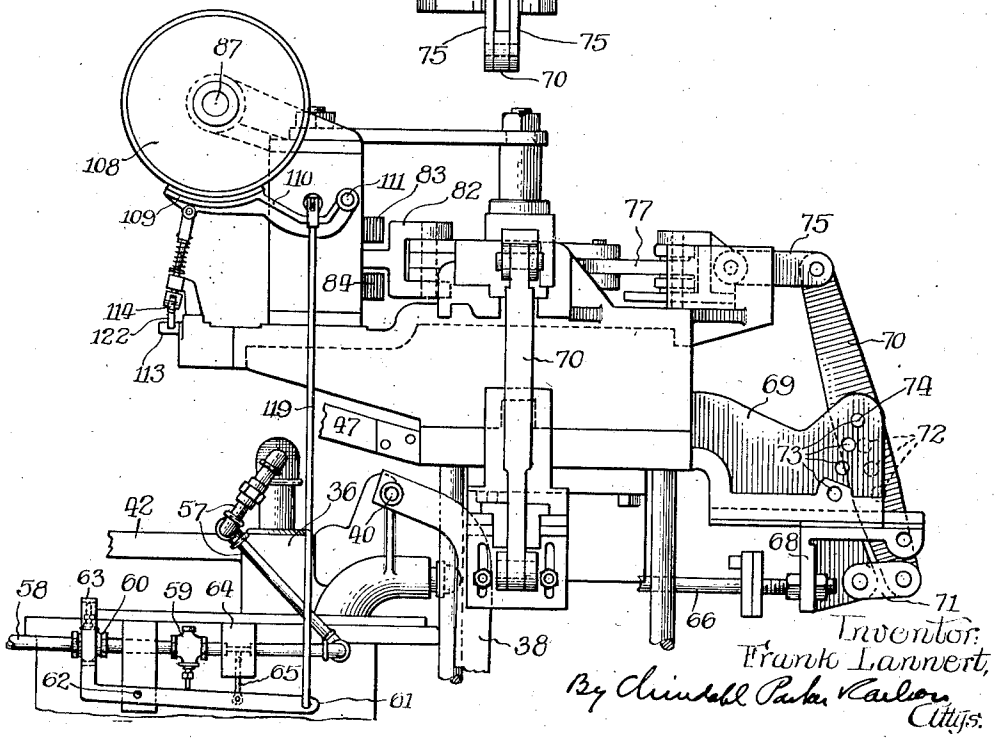


Fig. 4.



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Sept. 25, 1934. F. LANNERT 1,974,822

DIE CASTING MACHINE

Filed Aug. 25, 1930 5 Sheets-Sheet 4

Fig. 5.

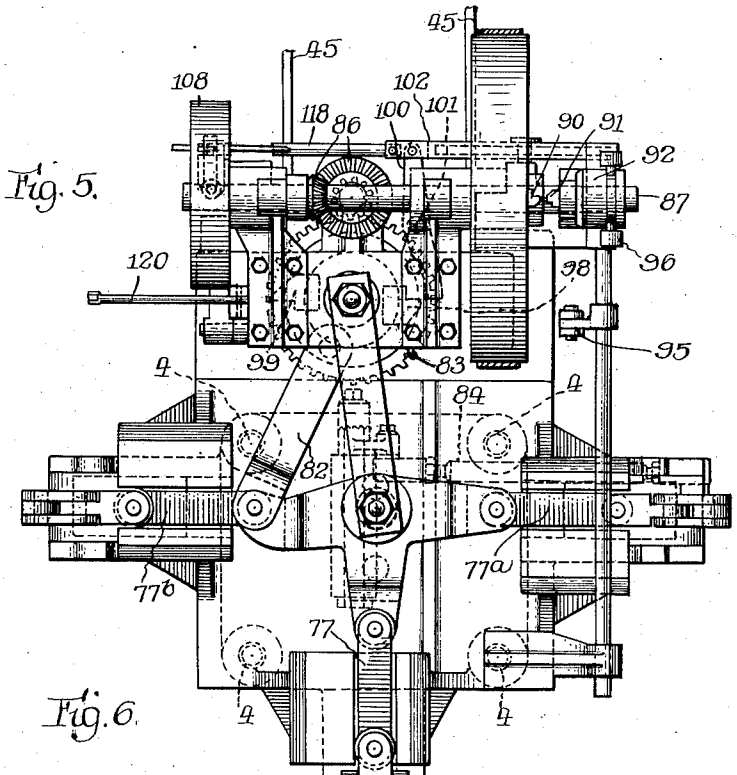
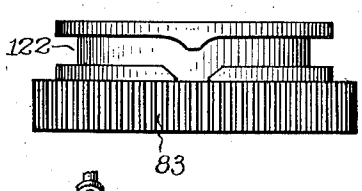


Fig. 6.



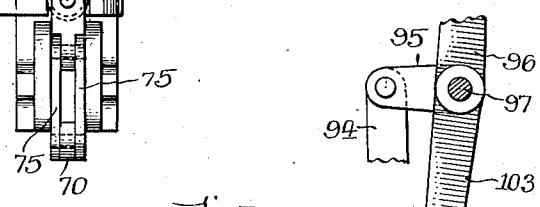


Fig. 7.

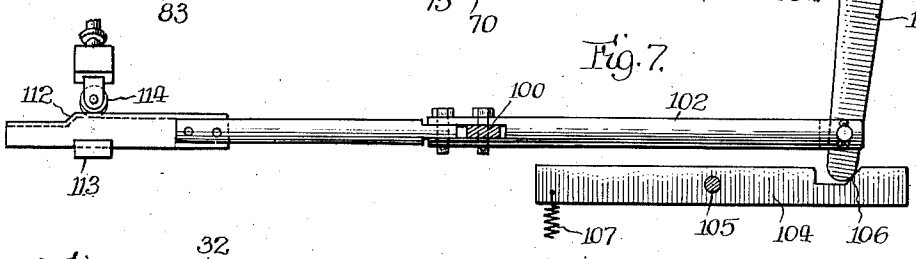


Fig. 8.

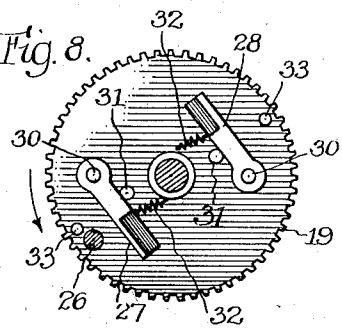


Fig. 9.

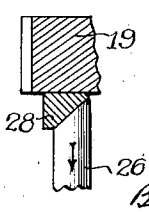
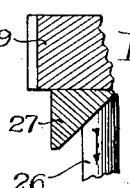


Fig. 10.



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Sept. 25, 1934. F. LANNERT 1,974,822

DIE CASTING MACHINE

Filed Aug. 25, 1930 5 Sheets-Sheet 5

Fig. 11.

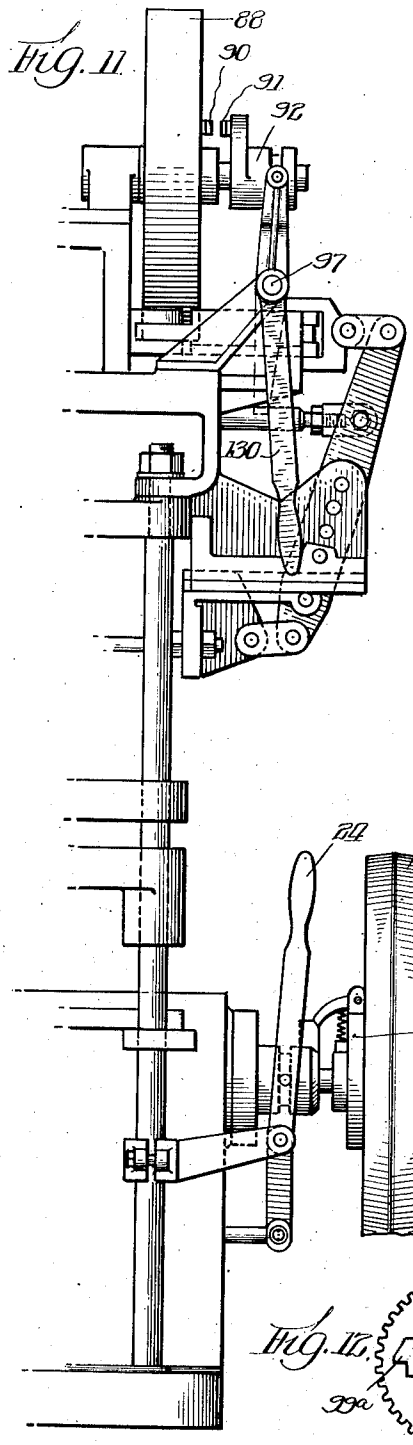


Fig. 15.

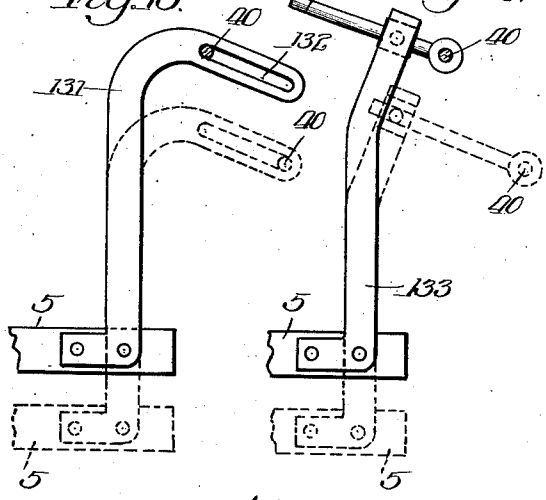


Fig. 16.

Fig. 17.

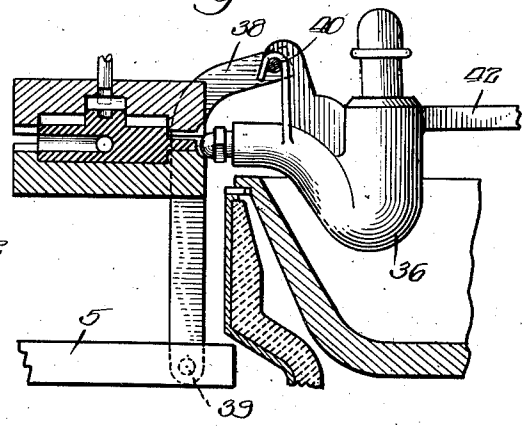


Fig. 13.

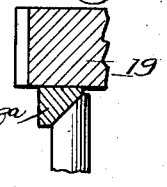


Fig. 14.

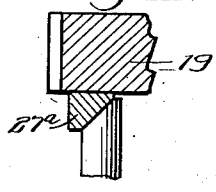
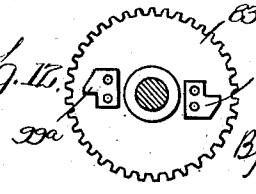


Fig. 12.



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Patented Sept. 25, 1934

1,974,822

UNITED STATES PATENT OFFICE

1,974,822

DIE-CASTING MACHINE

Frank Lannert, Chicago, Ill., assignor to Paragon Die Casting Company, Chicago, Ill., a corporation of Illinois

Application August 25, 1930, Serial No. 477,503

15 Claims. (Cl. 22—69)

The object of this invention is to produce an improved die-casting machine in which the die-opening and closing means, the metal-injecting means, the pressure-controlling means, the core-inserting and withdrawing means and the ejecting means shall be properly coordinated so as to operate in correct time relation, with provision for a pause of variable length to permit the metal to set, the various mechanisms being readily adjustable in accordance with the particular form of casting to be produced.

In the accompanying drawings:

Figure 1 is a vertical sectional view of a die-casting machine embodying the features of my invention.

Fig. 2 is a fragmental elevation looking from the left-hand side of Fig. 1.

Fig. 2ª is a fragmental horizontal sectional view on line *a*—*a* of Fig. 1.

Fig. 3 is a fragmental plan view showing the position assumed by the actuating mechanism when the cores are in withdrawn position.

Fig. 4 is a fragmental side elevation looking from the left-hand side of Fig. 2. The core actuating mechanism is here shown in core retracted position.

Fig. 5 is similar to Fig. 3, but shows the position occupied when the cores are in inserted position.

Fig. 6 is a detail view of one of the gears and cams.

Fig. 7 illustrates the means for operating the brake and the means for insuring complete separation of the clutch elements 90 and 91.

Figs. 8, 9 and 10 are views of certain devices for operating the clutches.

Fig. 11 is a fragmental view of a modified construction.

Figs. 12, 13 and 14 illustrate modifications of the cams to correspond with the modification illustrated in Fig. 11.

Figs. 15 and 16 illustrate modifications of the gooseneck-operating means.

Fig. 17 shows the operation of withdrawing the gooseneck.

In the embodiment herein shown of the invention, the dies consist of a stationary upper part 1 and a vertically movable lower part 2. It will be understood that the shape and dimensions of the dies 1 and 2 will vary in accordance with the work in hand. The die 2 is secured to a table 3 which is vertically movable upon guide rods 4 which constitute part of the machine frame. The table 3 is adjustably secured to a head 5 so that the normal elevation of the table 3 may be varied in accordance with the dimensions of the die. In this instance, the connection between the table 3 and the head 5 consists of vertical studs 6 having a screw-thread connection with the head 5 so that they may be adjusted up and down. The table 3 rests upon these studs and is held in contact with them by means of a screw 7 which extends through an opening 8 in the head 5 and engages the table 3.

The head 5 is moved up and down by means comprising four toggles 9, 10, 11 and 12 (Figs. 1, 2 and 2ª), the lower ends of which are pivoted in the machine frame at 13 and the upper ends of which are pivoted to the head 5 at 14. The middle points of the toggles 9 and 10 are connected to the middle points of the toggles 11 and 12, respectively, by means of links 15. The adjustable connection between the table 3 and the head 5 permits of adjusting the die 2 into close contact with the die 1 when the toggles are on dead center. The toggles are operated by means of a member 16 which is virtually a connecting rod, said member being pivotally connected to the middle points of the toggles 11 and 12 at 16ª and to a crank pin 17 extending between two spur gear wheels 18 and 19. These gear wheels are journaled in bearings in the machine frame and are arranged to be rotated in unison by means of an elongated pinion 20 fixed upon the drive shaft 21. A drive pulley 22 rotatably mounted on said shaft is arranged to be connected thereto by means of a clutch 23 which is operable by a hand starting lever 24 pivoted in the machine frame at 25. The lower arm of the hand lever 24 is connected by means of a pin-and-slot to a rod 26 which is supported in the machine frame for horizontal reciprocation. The inner end of said rod is beveled, as shown in Figs. 9 and 10. On the adjacent side of the gear wheel 19 are two dogs 27 and 28, said dogs being pivoted at 30 to diametrically opposite points on the gear wheel and being normally held against stop pins 31 by means of springs 32. Stop pins 33 limit outward pivotal movement of the dogs. Said dogs have beveled surfaces adapted to engage the correspondingly beveled inner end of the rod 26. In the rotation of the gear wheel 19, one of the dogs will engage the end of the rod 26 and push said rod outwardly, thereby throwing out the clutch 23 and thus stopping the mechanisms driven by said clutch at the end of a half-revolution of the gear wheel. The beveled surface on the dog 27 is adapted to impart a longer movement to the rod 26 than the dog 28, for a reason to appear hereinafter.

It will be seen that by reference to Figs. 1 and 2ª that the toggles 9—10 and 11—12 are operated

by another toggle formed of the connecting rod 16 and the lever arm constituted by that portion of the wheels 18 and 19 between the crank pin 17 and the axis of said wheels. The die 2 is pressed against the die 1 before the point 16^a reaches dead center position, the last few degrees of movement of the point 16^a serving merely to lock the die 2 in position against the die 1. As the point 17 approaches its dead center position it imparts very little movement to the point 16^a. Hence it will be seen that the point 17 moves a substantial distance (approximately ten degrees) after the die 2 has been pressed against the die 1, and that the point 17 moves a similar distance beyond its dead center position before the die 2 is withdrawn from the die 1.

34 and 35 (Fig. 1) denote a pot and a furnace, respectively, which may be of any preferred character. The means for transferring metal from the pot to the dies 1 and 2 comprises a ladle or gooseneck 36 having a nozzle 37 adapted to engage the inlet opening of the dies. One end of the gooseneck 36 is supported by means of two adjustable arms 38 (Figs. 1 and 2), the lower ends of said arms being pivoted to the head 5 at 39 and their upper ends being attached to a cross-bar 40. The gooseneck 36 is provided with a hook 41 that engages the cross bar 40. It will be seen that as the head 5 is raised and lowered the adjacent end of the gooseneck also will rise and fall. In order that the gooseneck may at the same time be moved toward and away from the dies, the outer end of the gooseneck is provided with a rigid arm 42 which is pivoted at 43 to two levers 44 (Figs. 1 and 2^a). These levers are pivoted in the machine frame in any preferred manner. Herein I have shown two brackets 45 (Fig. 3) which are fixed to a head 46 which in turn is fixed to the upper ends of the guide rods 4. The outer ends of the brackets 45 are supported from the base of the machine by means of two braces 47 (Figs. 1 and 2^a). The levers 44 are pivoted to the brackets 45 at 48. The lower ends of the levers 44 are adjustably connected to a link 49 which is pivoted at 50 to two arms 51 (Fig. 2^a) which are pivoted in the framework of the machine at 52. Intermediate their ends the arms 51 are connected to one end of the member 16 by means of a pivoted link 53.

Referring to Fig. 1, it will be seen that as the gear wheels 18 and 19 revolve in the direction indicated by the arrow, the die 2 will be lowered in order to permit of the withdrawal of the casting *a*, and that the gooseneck 36 will be simultaneously withdrawn from the dies and lowered into the pot to take up another charge of molten metal. These movements will be completed in a half-revolution of said gears. In the succeeding half-revolution of the gears the die 2 will be returned into engagement with the die 1 and the gooseneck 36 will be lifted out of the pot 34 and placed in engagement with the dies. As illustrated in Fig. 17, the means for operating the gooseneck 36 is arranged to lower the gooseneck in proper timed relation to the lowering of the die 2 so that the gate *b*, that is to say, the metal extending between the nozzle 37 and the body of the casting, shall not be subjected to lifting or bending stresses, thus preventing damage to the casting.

In order that the gooseneck may be pressed against the inlet opening of the dies with the proper degree of force, the levers 44 are adjustably connected to the link 49 as before stated. While this connection may be of any preferred character, I have herein shown a crosshead 54 which is pivoted in the levers 44. The link 49 has a screw-threaded portion 55 which extends slidably through an opening in said cross-head. Nuts 56 on the threaded portion 55 on opposite sides of the crosshead provide for adjustment of the link 49 with relation to the levers 44. The parts are so adjusted that the gooseneck is pressed firmly against the dies while the point 17 (Fig. 1) still has a substantial distance (approximately ten degrees) to move before reaching dead center position, and remains pressed against the dies until the point 17 has moved approximately ten degrees beyond its dead center point.

Molten metal is forced from the gooseneck 36 into the dies 1 and 2 by means of pressure fluid, as for example, compressed air. The pressure fluid is suplied to the gooseneck through joined piping 57 (Fig. 4). Said piping communicates with piping 58 stationarily mounted upon the side of the machine. In the piping 58 are two valves 59 and 60 which may be of ordinary construction, the stems of which valves are arranged to be operated to open the valves by means including a lever 61. The lever 61 is pivoted in the machine frame at 62 intermediate the two valves. The stem of the valve 59 extends downwardly into position to be lifted by one arm of the lever 61, whereas the stem of the other valve extends upwardly into position to be depressed by an angular portion 63 of said lever. It will be seen that when the right-hand arm of the lever 61 is raised, as viewed in Fig. 4, both of the valves will be positively opened. When the lever 61 is swung in the opposite direction either or both of the valves will be automatically closed. The use of two valves reduces the danger that the supply of compressed air to the gooseneck will not be shut off because of sticking or other defective operation of one of the valves.

After the valves 59 and 60 have been closed and before the gooseneck is withdrawn from the dies, it is desirable to relieve the air pressure in the piping between the valve 59 and the gooseneck in order that metal shall not be forced out of the gooseneck when the latter is moved away from the dies. I therefore provide a relief valve 64 (Fig. 4) comprising a valve casing interposed in the piping between the valve 59 and the gooseneck. Said casing has an outlet which is arranged to be blanked by a plunger 65 connected to the lever 61. Immediately after the valves 59 and 60 have closed and before the gooseneck is removed from the dies, the plunger 65 opens the outlet of the valve casing 64 and thus allows the residual air pressure upon the metal in the gooseneck to escape to the atmosphere. Before the valves 59 and 60 are again opened, said outlet is closed. The means for operating the lever 61 will be presently described.

Means has been provided for automatically inserting cores into the cavity formed between the dies and for automatically withdrawing the cores. In the present instance, means has been provided for thus operating four cores, but it will be understood that the precise number is not of the essence of the invention.

In the construction shown in the drawings three cores are arranged to extend horizontally into the die cavity, one core being inserted vertically into the cavity from above. Referring now to Figs. 1 and 2, the horizontally extending cores are numbered 66 and the vertically extending core is numbered 67. The means for operating the three horizontally extending cores are sub-

stantially similar and therefore a description of one will suffice.

As shown in Fig. 1, the core 66 therein illustrated is adjustably secured to a slide 68 which is guided for horizontal reciprocation toward and away from the dies by means of a bracket 69 rigid with the head 46. A lever 70 pivoted to the bracket 69 is connected by means of parallel links 71 to the slide 68. In order that the range of movement of the lower arm of the lever 70 may be varied in accordance with the length of the core and still have the outward movement of the slide terminate always at the same point, the lever 70 is provided with a series of openings 72 (Fig. 4) and the bracket 69 is formed with a similar series of openings 73 (Figs. 1 and 4), so that a pivot pin 74 may be adjustable into any desired pair of openings in the lever and the bracket. The upper arm of the lever 70 is connected by means of parallel links 75 (Fig. 3) to a slide 76 which in turn is connected to a link 77 that is pivoted to one arm of a three-arm lever 78. The lever 78 is pivotally mounted upon a stud 79 fixed in the machine frame. The devices for operating the other two horizontally extending cores are connected to the lever 78 by means of links 77^a and 77^b. It will be seen that the link 77 and the arm of the lever 78 to which it is pivoted constitute a toggle, the same being of course true of the links 77^a and 77^b and the corresponding lever arms.

As shown in Fig. 1, a stop 79^a rigidly connected to the core is arranged to abut against the die 1. The screw-threaded stem 79^b and nuts 79^c serve to connect the core to the slide 68. In setting up the machine, when the lever 78 is in the core-inserting position, the nuts 79^c are adjusted so as to take up all play in the linkage and press the stop 79^a firmly against the die 1 with the pressure required to resist the force of the metal against the core.

The vertically extending core 67 (Fig. 1) is secured to a head 80 which is secured to two vertically extending stems 80^a. These stems have rack teeth milled therein to mesh with pinion teeth formed in a shaft 81. The shaft 81 is herein shown as driven by means including a crank arm 81^a fixed to said shaft and connected by means of an adjustable link 81^b to the lever 70 that operates one of the cores 66.

The means for pivotally moving the lever 78 consists of a pitman 82 which is connected to a crank pin 82^a that extends between and is carried by two spur gears 83 and 84. The pitman 82 and the gears 83 and 84 constitute a toggle for actuating the toggles 77, 77^a and 77^b. The gears 83 and 84 are mounted upon alined studs 84^a fixed in the machine frame. Said gears mesh with a pinion 85 which is arranged to be driven through bevel gears 86 from a shaft 87.

Means of any preferred character may be provided for driving the shaft 87. Herein I have shown a fly wheel or drive pulley 88 rotatably mounted upon the shaft 87 and continuously driven from any preferred source of power, as, by means of a belt 89 (Fig. 3). When the shaft 87 is to be driven, the pulley 88 is connected to said shaft by means of a clutch consisting, in this instance, of a lug 90 on the pulley 88 arranged to engage a lug 91 on a clutch collar 92 which is splined to the shaft 87.

While the means for operating the clutch collar 92 may partake of various forms, I have herein shown it as under a dual control. As illustrated in Fig. 2, the hand lever 24 is rigid with a short crank arm 93 which is connected by means of a link 94 to a crank arm 95 that is rigid with an arm 96 which is pivoted in the machine frame at 97. The upper end of the arm 96 is in the form of a yoke carrying pins that extend into a peripheral groove in the clutch collar 92. It will be seen that when the hand lever 24 is swung to the left (Fig. 2) the clutch collar 92 will be moved in the direction to place the lug 91 in the path of the constantly revolving lug 90 and thus cause the shaft 87 to be driven.

The other means for operating the clutch collar 92 consists of two cams 98 and 99 (Fig. 3) secured to the lower side of the gear wheel 82 at diametrically opposite points. These cams are arranged to engage one arm of a lever 100 (Fig. 5) which is pivoted at 101 in the machine frame, the other arm of said lever being connected to a link 102 (Fig. 7) which in turn is pivoted to an arm 103 which is rigid with the arm 96. Engagement of one of the cams 98 and 99 with the lever 100 causes the clutch collar 92 to be moved away from the drive pulley 88. In order to insure that the lug 91 shall be moved far enough away from the lug 90 so that there shall be no danger of clashing, I provide means such as a lever 104 (Fig. 7) pivoted at 105 in the machine frame and having a beveled surface 106 which is arranged to bear against the lower edge of the arm 103. A spring 107 tends to move the lever 104 in the direction to cause the beveled surface 106 to move the arm 103 and thus the clutch collar 92 a slight distance in addition to the movement caused by the cam on the gear wheel 82.

The cam 99 is somewhat longer than the cam 98 and is thus able, through the intervening system of levers and links, to move the hand lever 24 from its leftward position through its middle or neutral position, to its right-hand position to engage the clutch 23.

In order that the mechanism driven by the shaft 87 shall stop promptly upon disengagement of the clutch collar 92, I have provided means which, in the present embodiment of the invention, comprises a brake drum 108 fixed upon said shaft and arranged to be engaged by a brake shoe 109 (Fig. 4) carried by an arm 110 that is pivoted at 111. The brake shoe 109 is arranged to be moved by means of a cam bar 112 which is mounted for horizontal movement in a guide 113. One end of said cam bar is connected to the link 102 and consequently to the lever 100. A roller 114 bears against the cam bar 112 and is yieldingly connected to the lever 110. When either of the cams 98 and 99 operates the lever 100 the brake shoe 109 is pressed against the brake drum 108.

Reverting to Fig. 4, the means for operating the valves 59, 60 and 64 comprises a link 119 which is pivoted to one arm of a lever 120 (Fig. 2) pivoted at 121 in the machine frame. The other arm of the lever 120 carries a roller stud that lies in a cam groove 122 (Fig. 6) formed in a collar on the gear wheel 83.

The means for ejecting or freeing the casting from the lower die 2 is herein shown as consisting of a suitable number of pins 123 (Fig. 1) fixed to a head 124 which is vertically movable upon a plurality of guide studs 125 secured to and extending downwardly from the lower die 2. The pin or pins 123 extend vertically through an opening or openings in the lower die. When the dies are closed the head 124 is in its lower position, and the upper end of the ejecting pin is flush with the inner wall of the die 2. When

the die 2 is lowered the head 124 strikes the upper ends of four pins 126 which are fixed in the machine frame and extend upwardly through openings in the head 5 and the table 3. After the descent of the head 124 has been stopped by engagement with the pins 126 the continuing descent of the die 2 causes the ejector pin or pins 123 to free the casting from said die.

Assuming that the dies 1 and 2 are open and empty and the machine is standing idle, the operation is as follows: The operator starts the machine by swinging the hand lever 24 (Fig. 2) to the right, thereby throwing in the clutch 23. The ensuing movement of the main shaft 21 causes the die 2 to be raised into engagement with the stationary die 1 and also causes the gooseneck 36 to be pressed against the inlet of the dies. These operations take place during a half-revolution of the gears 18 and 19. As the half-revolution is being completed, the long dog 27 engages the rod 26 and thus causes the hand lever 24 to be swung from its right-hand position to its left-hand position. The clutch 23 is thus thrown out and the clutch collar 92 moved into engagement with the driving lug 90. The main shaft 21 which operated the lower die and the gooseneck is thus thrown out of operation, and the shaft 87 which actuates the core mechanism and operates the valves is driven. Thereupon the cores 66 and 67 are inserted into the cavity of the dies. As the gear wheels 83 and 84 complete a half-revolution, the valves 59 and 60 are opened to place the metal in the gooseneck under pressure whereby the molten metal is forced from the gooseneck into the dies, and the short cam 98 throws out the clutch collar 92, places the hand lever 24 in its middle or neutral position, and applies the brake shoe 109. The entire machine is then at rest. The operator permits the machine to stand idle long enough to allow the metal in the dies to solidify, whereupon he swings the lever 24 to the left (Fig. 2), thereby again throwing in the clutch collar 92 and withdrawing the brake shoe. At the beginning of the ensuing half-revolution of the gear wheels 83 and 84 the valves 59 and 60 are closed and the relief valve 64 opened. As the gear wheels 83 and 84 continue to revolve the cores are pulled out of the casting. As the gear wheels 83 and 84 complete a half-revolution the long cam 99 throws out the clutch collar 92, applies the brake shoe 109 and throws in the clutch 23. The main shaft 21 is thereby driven to cause the lower die 2 to descend and the gooseneck 36 to withdraw from the dies. As the die 2 descends, the ejector head 124 comes into engagement with the pins 126 and thus frees the casting from the die 2. As the gear wheels 18 and 19 complete a half-revolution the short dog 28 engages the rod 26 and moves the hand lever 24 into the neutral position, thus throwing out the clutch 23 and causing the machine to come to rest. The casting having been removed, the cycle of operations described is repeated.

If the casting being produced is of such character that no extended pause is required after the dies have been filled, the short cam 98 may be removed, thus enabling the machine to perform a complete cycle of operations and come to rest with the dies separated.

The cores are usually slightly tapered, the taper being too slight to be illustrated in the drawings. In spite of such taper a great deal of power is required to withdraw the cores, as the metal clings to them, and in the case of some alloys the metal contracts so as to grip the cores. The continuously driven fly wheel 88 provides the power necessary for the withdrawal of the cores. It will be seen that the power is exerted through a power-multiplying gear train and through a system of toggles. These toggles at the commencement of their operation exert a powerful and slow pull on the cores. A slow pull at first is highly desirable to avoid cracking the casting. The means whereby ample power is available for the withdrawal of the cores is one of the important features of my invention.

It will be noted that the die-operating mechanism and the gooseneck-operating mechanism are driven from one source of power, namely, the pulley 22, and that the core-operating mechanism is driven through a separate source of power, i. e., the fly wheel 88. The provision of two drives as compared with a single drive actuating all the mechanisms through a cam or set of cams, is highly advantageous since it makes possible the application of more power and permits of varying the timing of the core-pulling mechanism with relation to the operation of the die mechanism and gooseneck mechanism. When castings are to be produced which require no cores, the core-pulling mechanism may be permitted to remain idle, whereas with a unitary drive the core-pulling mechanism must always operate, thus causing unnecessary wear.

The machine hereinbefore described may be modified in various ways without departing from the spirit and scope of the invention. For example, if the casting to be made has thin walls so that the metal will solidify rapidly, it is practicable to have the machine go through its cycle of operations without a pause. This result may be effected by omitting the dog 98 (Fig. 3). As hereinbefore explained, the toggles that operate the die 2 are actuated by a toggle formed of the member 16 and the wheels 18 and 19. Hence a substantial amount of movement of the point 17 as it approaches and leaves its dead center position produces a relatively slight movement of the die 2 and the gooseneck. Similarly the toggles 77, 77^a and 77^b are actuated by the toggle 82. The cores are pressed into operative position while the point 82^a still has a substantial distance to move before reaching dead center position; and the cores remain in operative position while the point 82^a is moving a substantial distance beyond its dead center position. The total movement of the gear wheels 83 between the point where the cores are pressed into position and the point where they are withdrawn approximates twenty degrees and is sufficient for the cam 122 to operate the air supply and relief valves when the casting is of such character that the metal solidifies quickly. Hence the dog 98 may be removed, and the machine caused to go through its complete cycle automatically.

Another modification is illustrated in Fig. 11. The link 94 may be omitted and a hand lever 130 may be secured to the shaft 97 so as to permit of manually operating the clutch 90, 91 wholly independently of the clutch 23. With such a modification, the two dogs on the gear wheel 19 would be of the same height as indicated at 27^a and 28^a in Figs. 13 and 14, and the two cams on the gear wheel 83 also would be of the same throw as shown at 98^a and 99^a in Fig. 12.

The cam 122 also may be omitted and the air valves operated manually, thus permitting of the application of air pressure only as long as desired, instead of as long as the machine is at rest, as in the construction first described.

The means for operating the gooseneck may partake of various forms. For example, in lieu of the pivoted arms 38 I may employ brackets 131 (Fig. 15) rigidly secured to the head 5, said brackets having a cam slot 132 therein in which the crossbar 40 is slidable. It will be seen that as the head 5 is lowered and the levers 44 are swung outwardly, the rod 40 will slide down the cam slots 132, thus withdrawing the gooseneck from the dies, and that as the head 5 and levers 44 are moved in the opposite direction the gooseneck will be moved into operative engagement with the die.

Fig. 16 illustrates a further modification of the gooseneck-operating means wherein brackets 133 are fixed to the head 5, said brackets having guide bearings within which guide rods 134 are slidable. The guide rods 134 support the crossbar 40. It will be seen that the movement imparted to the gooseneck by means of the construction shown in Fig. 16 will be the same as in the case of the modification illustrated in Fig. 15.

Various other alternative constructions are embraced within the scope of the appended claims.

While I have shown a machine of the vertical type, it will be understood that the invention may be embodied in a horizontal machine.

I claim as my invention:

1. A die-casting machine comprising, in combination, a stationary die section, a coacting die section, toggle means for moving the second-mentioned die-section, two coaxial spur gears having crank pins on their adjacent faces, a member connecting the toggle means to said crank pins, a gooseneck, one end of which is arranged to be moved by said toggle means, mechanism actuated by said member for modifying the movement of the gooseneck produced by said toggle means, a drive for said gears, a clutch controlling said drive, a dog on one of said gears, and means actuated by said dog for throwing out the clutch.

2. A die-casting machine comprising, in combination, a stationary die-section, a coacting die-section, a table supporting the second-mentioned die-section, means for moving the table toward and away from the stationary die-section, a gooseneck, an arm pivoted at one end to the table and at its other end to one end of the gooseneck, and means connected to the other end of the gooseneck for moving the gooseneck toward and away from the die-sections as the table is reciprocated.

3. A die-casting machine having, in combination, dies, means for operating the dies, a core, means for operating the core, and means for operating said dies and core in timed relation to one another, comprising a drive for the dies, a drive for the core-operating means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, a part rotated by the first-mentioned drive and carrying a dog for throwing out the first mentioned clutch and throwing in the second-mentioned clutch, a member rotated by the second-mentioned drive, two diametrically opposite cams on said member, one of said cams being arranged to throw out the second clutch, and the other cam being arranged to throw out the second clutch and throw in the first clutch after the operator has thrown in the second clutch, and means carried by said part for throwing out the first-mentioned clutch.

4. A die-casting machine having, in combination, dies, means for operating the dies, a core, means for operating the core, and means for operating said dies and core in timed relation to one another, comprising a drive for the dies, a drive for the core-operating means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, means actuated by the first-mentioned drive for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, means actuated by the second-mentioned drive for throwing out the second clutch and then throwing out the second clutch and throwing in the first clutch after the operator has thrown in the second clutch, and means actuated by the first drive for throwing out the first-mentioned clutch.

5. A die-casting machine having, in combination, dies, means for operating the dies, cores, means for operating the cores, means for controlling the injection of metal into the dies, and means for operating said dies, cores, and controlling means in timed relation to one another, comprising a drive for the dies, a drive for the core-operating means and controlling means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, a part rotated by the first-mentioned drive and carrying a dog for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, means operated by the second-mentioned drive for throwing out the second clutch, means actuated by the second-mentioned drive for throwing out the second clutch and throwing in the first clutch after the operator has thrown in the second clutch, and a dog carried by said part diametrically opposite the first dog for throwing out the first-mentioned clutch.

6. A die-casting machine having, in combination, dies, means for operating the dies, cores, means for operating the cores, a gooseneck for injecting metal into the dies, valve means for controlling the ejection of metal from the gooseneck, and means for operating said dies, cores, gooseneck and valve means in timed relation to one another, comprising a drive for the dies and the gooseneck, a drive for the core-operating means and valve means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, means actuated by the first-mentioned drive for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, means operated by the second-mentioned drive for throwing out the second clutch, means actuated by the second-mentioned drive for throwing out the second clutch and throwing in the first clutch after the operator has thrown in the second clutch, and means operated by the first-mentioned drive for thereafter throwing out the first-mentioned clutch.

7. A die-casting machine having, in combination, dies, means for operating the dies, a core, means for operating the core, means for controlling the injection of metal into the dies, and means for operating said dies, core and controlling means in timed relation to one another, comprising a drive for the dies, a drive for the core-

operating means and controlling means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, a part rotated by the first-mentioned drive and carrying a dog for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, a member rotated by the second-mentioned drive, two diametrically opposite cams on said member, one of said cams being arranged to throw out the second clutch, and the other cam being arranged to throw out the second clutch and throw in the first clutch after the operator has thrown in the second clutch, and a dog carried by said part diametrically opposite the first dog for throwing out the first-mentioned clutch, and a brake for the second-mentioned drive arranged to be actuated by each of said cams.

8. A die-casting machine having, in combination, dies, means for operating the dies, a core, means for operating the core, means for controlling the injection of metal into the dies, and means for operating said dies, core, and controlling means in timed relation to one another, comprising a drive for the dies, a drive for the core-operating means and controlling means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, a part rotated by the first-mentioned drive and carrying a dog for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, a member rotated by the second-mentioned drive, two diametrically opposite cams on said member, one of said cams being arranged to throw out the second clutch, and the other cam being arranged to throw out the second clutch and throw in the first clutch after the operator has thrown in the second clutch, and a dog carried by said part diametrically opposite the first dog for throwing out the first-mentioned clutch.

9. A die-casting machine having, in combination, dies, means for operating the dies, a core, means for operating the core, and means for operating said dies and core in timed relation to one another, comprising a drive for the dies, a drive for the core-operating means, a clutch for the first-mentioned drive, a clutch for the second-mentioned drive, manual means for throwing in the first-mentioned clutch, a connection between said manual means and the second-mentioned clutch, means actuated by the first-mentioned drive for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, means actuated by the second-mentioned drive for throwing out the second clutch and throwing in the first clutch, and means actuated by the first drive for throwing out the first-mentioned clutch.

10. A die-casting machine having, in combination, a gooseneck, piping to supply pressure fluid to the gooseneck, two shut-off valves in said piping, one of said valves having an upwardly extending operating stem and the other a downwardly extending operating stem, a lever pivoted at a point between the valves, one arm of said lever being arranged to operate one stem and the other arm the other stem, and means for actuating the lever.

11. A die-casting machine having, in combination, dies, means to operate the dies, a gooseneck, means to apply the gooseneck to and withdraw it from the dies, a core, means to insert the core into and withdraw it from the dies, a drive for the die-operating means and the gooseneck-operating means, and a wholly independent source of power for driving the core-operating means.

12. A die-casting machine having, in combination, dies, a core, a toggle for inserting the core into and withdrawing it from the dies, and a second toggle for actuating the first toggle, the core being in its operative position while the second toggle still has a substantial distance to move before reaching its dead center position.

13. A die-casting machine comprising, in combination, dies and a gooseneck, means for operating the dies and the gooseneck, a clutch through which said means is driven, a core, means for inserting the core into the dies and withdrawing it therefrom, a clutch through which the core-operating means is driven independently of the die operating means, means actuated in timed relation to the die and gooseneck-operating means for throwing out the first-mentioned clutch and throwing in the second-mentioned clutch, and means actuated in timed relation to the core-operating means for throwing out the second-mentioned clutch and throwing in the first-mentioned clutch.

14. A die-casting machine comprising, in combination, dies and a gooseneck, means for operating the dies and the gooseneck, a clutch through which said means is driven, a core, means for inserting the core into the dies and withdrawing it therefrom, a clutch through which the core-operating means is driven independently of the die operating means, means actuated in timed relation to the die and gooseneck-operating means for throwing in the second-mentioned clutch, and means actuated in timed relation to the core-operating means for throwing out the second-mentioned clutch and throwing in the first-mentioned clutch, the third mentioned means being arranged to throw out the first-mentioned clutch after said clutch has been thrown in by the fourth mentioned means.

15. A die-casting machine having, in combination, a frame, dies supported by said frame, a plurality of cores, and means for inserting and withdrawing the cores from the dies comprising a slide for each core supported by said frame, a lever pivoted intermediate its ends on said frame and connected at one end to said slide, and a second slide on said frame to which the other end of said lever is linked, an actuating lever pivoted in said frame and having a plurality of arms each linked to one of the last mentioned slides, and means for oscillating the plural-armed lever to reciprocate the cores.

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