

June 19, 1928.

1,673,832

N. LESTER

PNEUMATIC DIE CASTING MACHINE

Filed July 2, 1926

4 Sheets-Sheet 1

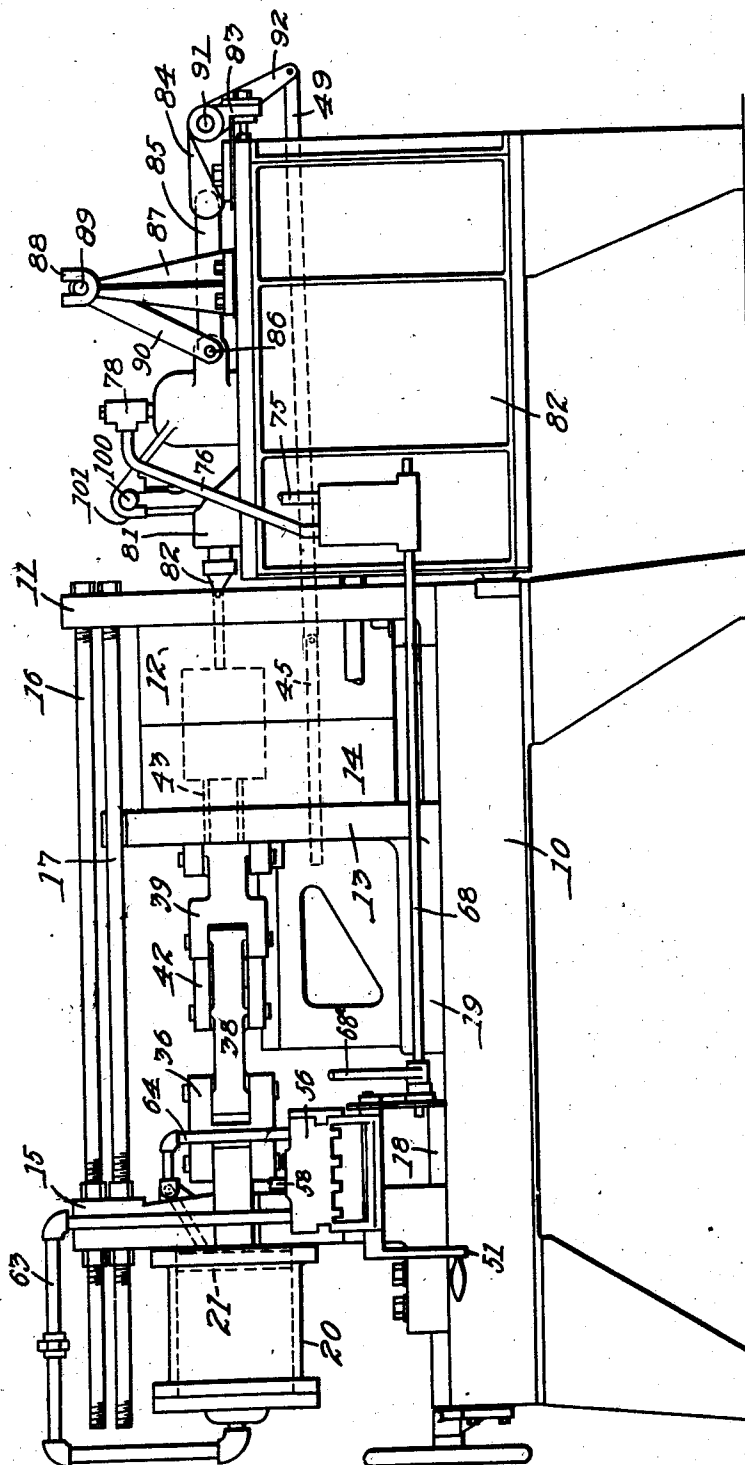


Fig. 1.

Inventor
Nelson Lester
By Attorney
Southgate
Fay & Stanley

June 19, 1928.

1,673,832

N. LESTER

PNEUMATIC DIE CASTING MACHINE

Filed July 2, 1926

4 Sheets-Sheet 2

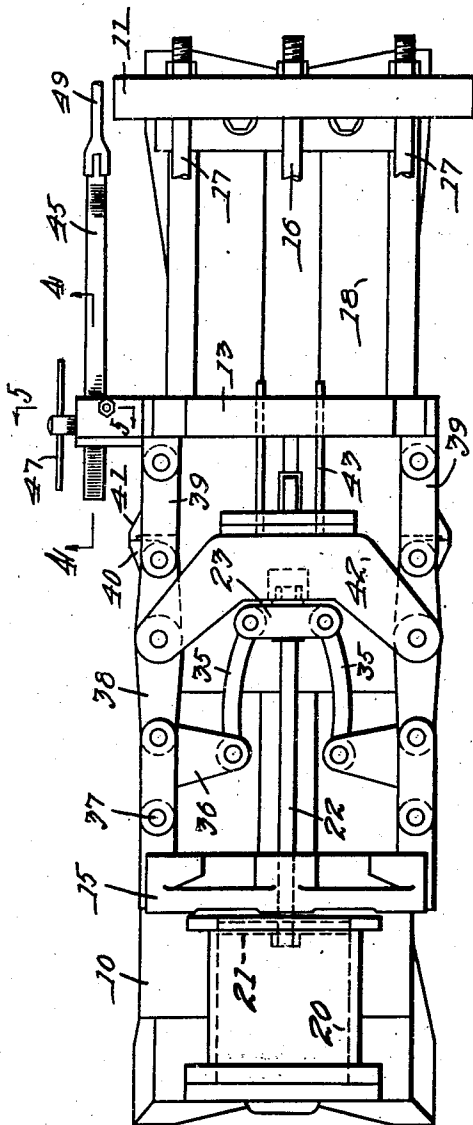


Fig. 2.

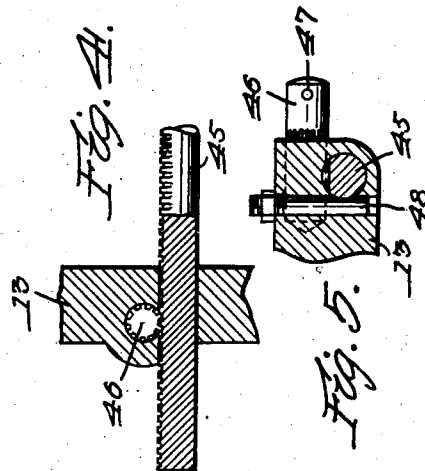
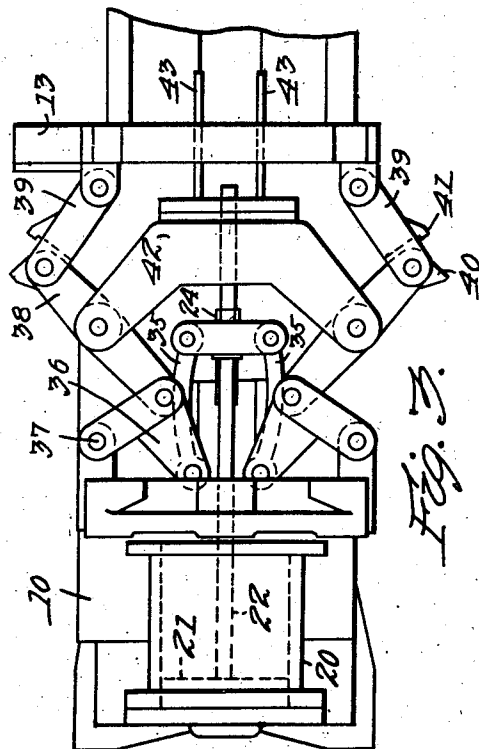


Fig. 3.

Inventor
Nelson Lester
By Attorneys
Southgate Fay & Hamby

June 19, 1928.

1,673,832

N. LESTER

PNEUMATIC DIE CASTING MACHINE

Filed July 2, 1926

4 Sheets-Sheet 3

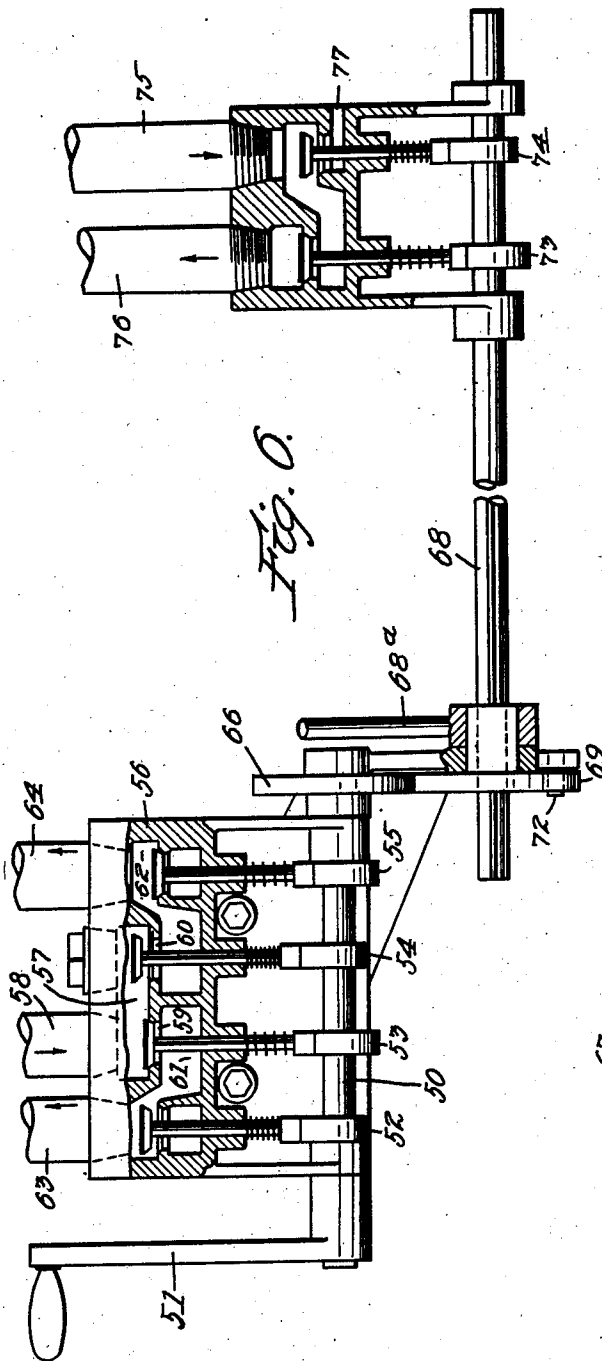


Fig. 0.

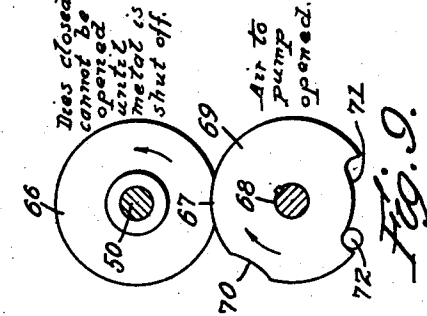


Fig. 9.

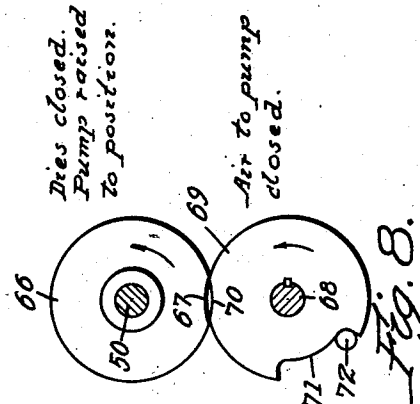


Fig. 8.

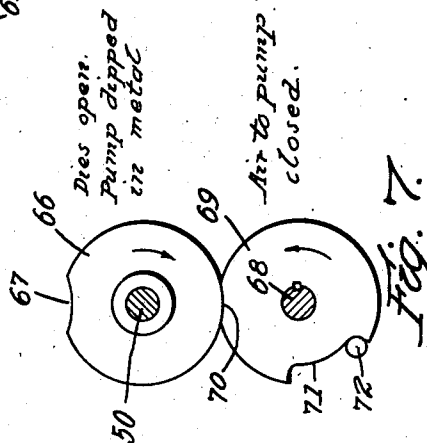


Fig. 7.

Inventor
Nathan Lester
By Attorneys
Southgate Fay & Hanley.

June 19, 1928.

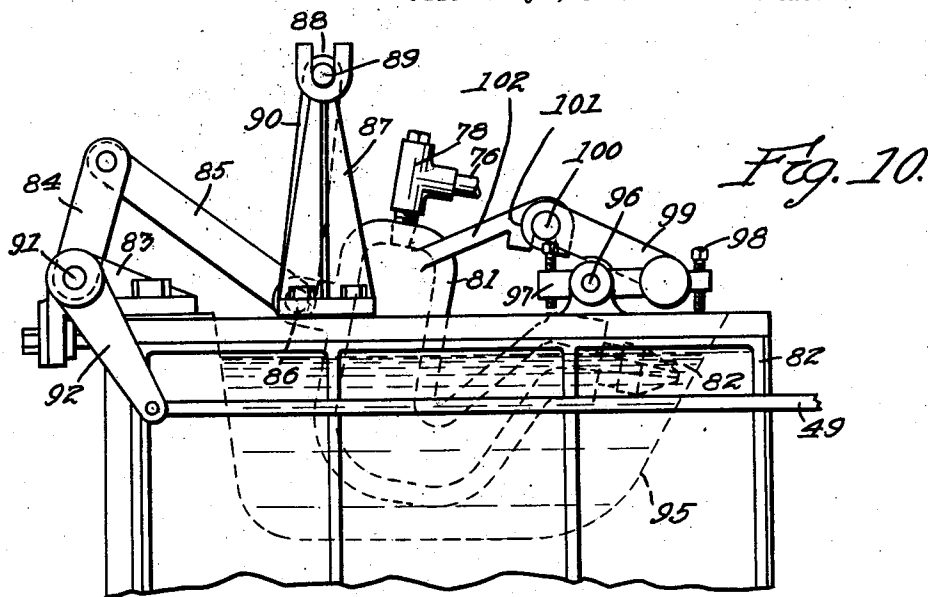
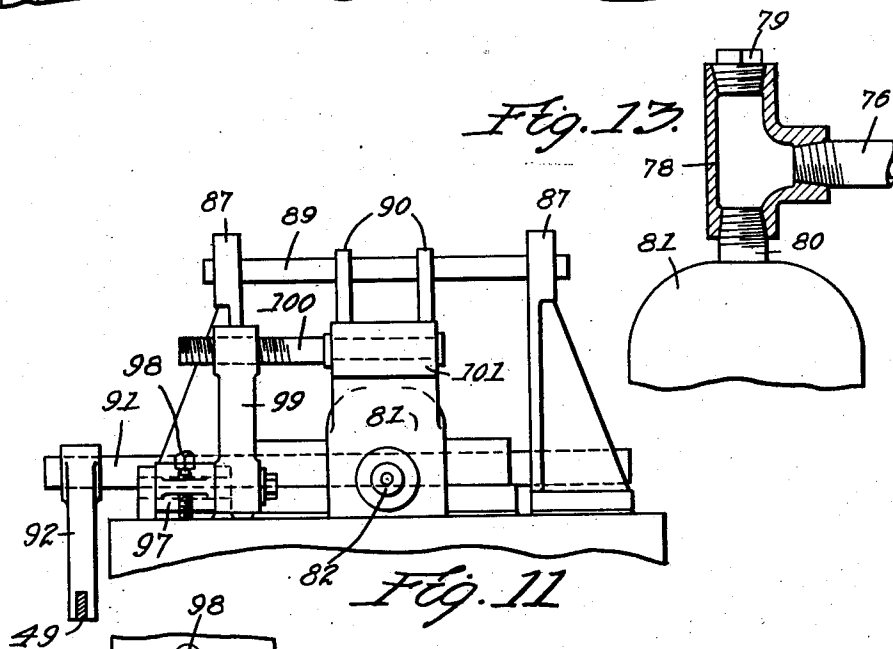
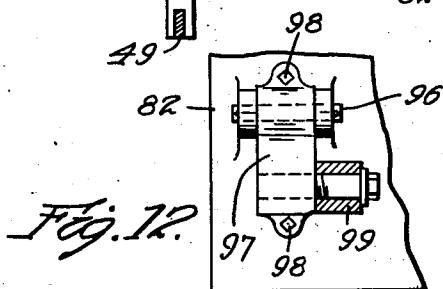
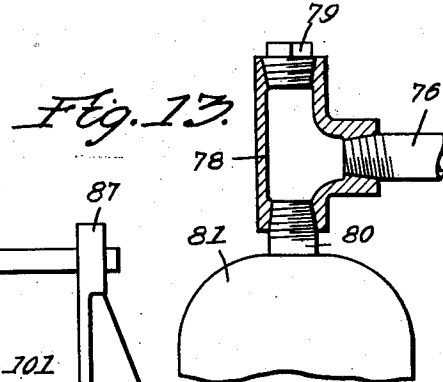
1,673,832

N. LESTER

PNEUMATIC DIE CASTING MACHINE

Filed July 2, 1926

4 Sheets-Sheet 4



Inventor
Nathan Lester
By Attorneys

Southgate Fay & Hawley

UNITED STATES PATENT OFFICE.

NATHAN LESTER, OF WORCESTER, MASSACHUSETTS.

PNEUMATIC DIE-CASTING MACHINE.

Application filed July 2, 1926. Serial No. 120,203.

This invention relates to a machine for casting metals and is particularly adapted for what is ordinarily known as "die" casting.

5 The principal objects of the invention are to provide a separable mold with means for closing it and opening it by air pressure and with means whereby when it is opened the casting will be ejected by the die operating means; to provide pneumatic arrangements with controlling means by which the proper sequence of operations is caused to take place necessarily and without any attention on the part of the operator except to turn a crank; to provide a casting pump in which the nozzle will enter the sprue in such a way as to prevent the formation of a projection thereon so that the casting can be removed; to provide a movable pump adapted to be submerged in the metal in the melting pot when not in casting position so as to keep it heated and filled with metal and adapted to be moved readily to casting position by the rotation of the same handle which has been mentioned above and at the proper time; and to provide other improvements in the various parts so as to get accurate adjustment and perfect timing of the various features of the device and to prevent any chance of the parts not working in their proper order.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings in which

Fig. 1 is a side view of a die casting machine constructed in accordance with this invention and shown in the position in which a casting is being made;

Fig. 2 is a plan of the operating means for the dies shown in position with the dies closed but omitting the dies themselves;

Fig. 3 is a similar view showing the position of the parts with the dies fully open;

Fig. 4 is a side view of a detail of an adjusting device with parts in section on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view on the line 5—5 of Fig. 2;

Fig. 6 is a longitudinal central sectional view of the controlling means for the inlet and exhaust of air under pressure for operating the machine;

Figs. 7, 8 and 9 are views of the cams which control the operation of the pump

shown in three different positions as indicated on the figures themselves;

Fig. 10 is a side view of the pump showing the opposite side from that illustrated in Fig. 1 and showing it in noncasting position;

Fig. 11 is an end view of the same but with the pump in the same position as shown in Fig. 1;

Fig. 12 is a plan, partly in section, of one of the pivot constructions; and

Fig. 13 is a sectional view of the arrangement at the top of the pump for preventing metal being drawn over into the air pipes.

Referring first to Fig. 1, the machine embodies a frame 10 on which are located a stationary plate 11 against which one of the dies 12 is adapted to bear and a slidable plate 13 carrying the other die 14. The frame is completed by an end piece 15 which is adjustable by means of bolts and is secured to the end piece 11 by threaded rods 16. Also secured to these end pieces are guide rods 17 for the plate 13. The frame 10 has ways 18 on which this plate 13 slides and the plate has a projection 19 extending to the rear, furnishing a solid base for it.

Supported by the end piece 15 is a cylinder 20 having therein a piston 21. Movable with the piston is a rod 22 which carries a head 23 fixed to it but adjustable by means of a screw collar 24. With this head I connect two links 35 on opposite sides which are pivoted to bell cranks 36. One end of each bell crank is pivoted at 37 to a stationary bracket or projection on the end piece 15. The third pivotal point of each bell crank 36 is connected with a lever 38. These levers are connected with two links 39 pivoted on the sliding plate 13.

It will be noticed that these levers 38 and links 39 are provided with projections 40 and 41 which, when the parts are in the extreme position shown in Fig. 2, abut against each other and prevent the link and lever constructions from passing beyond the dead center, thus limiting the action in that manner. The levers 38 are pivoted to the bell crank 36 and the link 39 at their extreme ends, but in the middle they are pivoted to a second head 42 which is centered on the piston rod 22, but slidable with respect to it. This head is provided with a plurality of ejectors 43 in the form of rods or plates. These normally, while in casting position,

project beyond the plate 13 into spaces in the die 14 and in fact clear to the adjacent surface of the mold cavity. From comparison of Figs. 2 and 3, the action of opening and closing the mold can be observed.

The plate 13 is provided with a perforation for a rod 45 extending longitudinally. This rod is provided with a series of teeth constituting a rack and on the plate 13 is provided a stud 46 having teeth all around it constituting a pinion for operating it and having an operating handle 47. This pinion is held in place by another stud 48 as shown in Fig. 5. In this way the rod 46 can be adjusted back and forth and it is provided with a link 49 connected with the pump for operating it as will appear.

For the purpose of operating and controlling the parts by compressed air, I provide a controlling shaft 50 with a crank 51 by which it can be rotated. This shaft is provided with a series of four cams 52, 53, 54 and 55. On each cam rests a spring compressed rod having a valve at the top. These valves control ports in a casing 56 above. This casing is provided with a space 57 for receiving air under pressure from an air inlet pipe 58 from any desired source. This space 57 is provided with two ports 59 and 60 adapted to be closed by the valves operated by two of the cams 53 and 54 to let the air down into either one of two spaces 61 and 62. From the space 61 the air is free to pass to a pipe 63 and into the outer end of the cylinder 20 for the purpose of forcing the piston forward and closing the dies. From the space 62, the air is free to pass through a pipe 64 to the other side of the cylinder 20 to open the dies. The two valves connected with the cams 52 and 55 open ports to exhaust the air from these two spaces 61 and 62 at the proper time.

On the controlling shaft 50 is another cam 66. This cam is of circular shape all around except for a notch 67 at one point. On a shaft 68 below there is another cam 69 which is of general circular form but also with a notch 70 of the same size and shape as the notch 67. Each of these notches, as will be observed from comparison of Figs. 7, 8 and 9, is of such shape that the other cam can rotate when in registration with that notch and not otherwise, that is, each notch is of the shape of an arc of the circle of the other cam. The shafts 50 and 68 have their axis at a distance apart less, by the width of one of the notches, than the sum of a radius of the two cams.

In the position shown in Fig. 8, either cam can be turned from its position, but in the positions shown in Figs. 7 and 9 only one cam can turn. The cam 69 also has another notch 71 which co-operates with a pin 72 to constitute a stop. This cam simply oscillates the length of this slot and cannot

move beyond it. The shaft 68 is oscillated by an arm 68^a projecting from it.

On the shaft 68 are a pair of cams 73 and 74 which operate valves above on spring-pressed stems as in the other case. These valves connect another air inlet 75 with a pipe 76 when the cam 74 closes its valve and the cam 73 opens the other. In the position shown in Fig. 6, the air cannot pass to the pipe 76 but only to the exhaust 77.

The pipe 76 passes either directly, or preferably through flexible hose, to a three-way chamber 78 which is of considerable importance. This comprises a straight passage which is closed by a plug 79 at the top and opens into a pipe 80 at the bottom which directs the air in the chamber 78 directly into a pneumatic pump 81. The pipe 76 enters the chamber 78 at one side and below the center. Therefore, when the compressed air has been flowing into the pump, which is provided with metal therein, and then is suddenly shut off and exhausted, the flux caused by the sudden reduction in pressure of the air above the metal may sometimes cause the metal to shoot up into the chamber 78. If it were not constructed in the way shown in Fig. 13, this metal might either flow or splash over into the pipe 76 and congeal therein, causing trouble or in some cases get into the inlet valve. But with the construction shown, if the metal shoots up it goes directly against the plug 79 and falls back again without having any chance to splash or flow into the pipe 76.

This pneumatic pump 81 comprises merely a casing with a nozzle 82. It is filled by dipping the nozzle down into the metal in the position shown in Fig. 10 and exhausting the air from the interior of the pump which will be replaced by metal. The metal is forced out of it into the mold in the position shown in Fig. 1. It is mounted to swing in the following way: The melting furnace 82 is provided with a bracket 83 on which is pivoted a link 84 connected by a link 85 with a pivot stud 86 on the pump itself. The furnace is provided with two brackets 87 which project upwardly and have open bearings 88 at the top in which is located a shaft 89. This shaft is provided with two links 90 pivoted freely thereon but supported thereby and extending down to the same stud 86 and supporting the pump 81 therefrom, but allowing it to swing. It will be understood that the arm 84 is fixed to a shaft 91 on which is fixed another arm 92 connected with the operating rod 49. This rod swings the pump 81 on the shaft 89 as a center from a position down in the melting pot 95 to casting position when the mold closes.

In order to guide this swinging exactly so that the nozzle 82 of the casting pump will register with the sprue hole in the plate

11, and its conical end fill the end of that hole to prevent the formation of a wider area on the sprue at the outer end than at any other part, the following mechanism is provided: On the furnace 82 is a shaft 96 mounted in suitable bearings and carrying a plate 97 which can be adjusted by screws 98 to have the proper angle so that an arm 99 thereon will be located in the proper position. This arm is provided with a transverse stud 100 which is adjustable longitudinally as indicated in Fig. 11 and which receives a downwardly opening rest or bearing 101 on a projection 102 fixed to, or cast integral with, the pneumatic pump 81. This arrangement of the parts 91, 89 and 100, together with the location of the end of the rod 49 with respect to the plate 13, allows of the proper operation of the pneumatic pump 81 from the filling position shown in Fig. 10 to casting position shown in Fig. 1 and back again.

The operation of the machine is as follows: With the mold open as shown in Fig. 3, and the pump in the position shown in Fig. 10, the crank 51 is turned a half revolution from the position in which the handle is vertically above the shaft 50 to its opposite position in which it is vertically below it. It will be noted that the valves are in the position shown in Fig. 6, the dies being open and being held open by the air in the pipe 64. Now the first effect of the turning of the handle in this position is to close the valve operated by the cam 54 and to open the valve operated by the cam 55 to release the air from in front of the piston 21. Then the valve controlled by the cam 52 is closed and the valve controlled by the valve 53 is opened to allow the air to be forced through the pipe 63 into the cylinder behind the piston. The result of this is to move the parts from the position shown in Fig. 3 to the position shown in Fig. 2. This forces forward the sliding plate 13, closes the dies, and withdraws the ejectors 43. The movement of the plate 13 forward actuates the rod 49 to swing the pump 81 upwardly. As it reaches the upward limit of its stroke, it also moves forwardly through the straightening out of the construction formed of the arm 84 and the link 85 and forces the nozzle 82 directly into the sprue opening in the plate 11. At the same time the crank 51, having now reached the bottom, the notch 67 will have come into register with the notch 70 from the position shown in Fig. 7 into that shown in Fig. 8. Now the handle on the shaft 68 which is pinned to the cam 69 is turned to bring this shaft and cam from the position shown in Fig. 8 around to that shown in Fig. 9. This admits air to the pneumatic pump 81 as will be obvious. Now the metal is forced into the mold by this air. The parts are left in this condi-

tion a very short period, just long enough for the casting to chill and retain its shape. Then the handle 68^a is turned back and the air released from the top of the metal in the pump and then exhausted at 77. Now if at this time the metal rushes up the pipe 80, it will be caught in the chamber 78 and drop back into the pump as stated above. This having been accomplished, the crank 51 is turned the rest of the way around the circle to its original position. This results in the opposite action, the closing the valve over the port 59 and the opening of the exhaust valve to the position shown in Fig. 6 so as to release the air from that side of the piston in the cylinder 20. Immediately the other two valves assume the positions shown in that figure and the compressed air is forced through the pipe 64 to draw back the piston. This restores the parts to the position shown in Fig. 3 and it will be seen that the ejectors 43, although drawn back slightly, are not drawn back as much as the plate 13. Therefore the casting in the mold is ejected by this action although the die 14 is attached to the plate 13 and drawn back with it.

It will be seen therefore that the dies are manipulated to open and close simply by the turning of the handle 51 around 360° and that the control of the air to the pump is also accomplished in a very simple way and controlled absolutely by the position of the handle 51. The pneumatic pump is moved bodily under the control of the handle 51 and the location of the several points of support and connections which have been shown. It is forced to assume the different positions in proper sequence without any attention on the part of the operator except to operate the handles 51 and 68^a. The casting is released from the mold on account of the arrangement of the nozzle of the pump and the ejecting devices which have been described in full, and this ejection is not left to chance but is made positive by the ejectors which will force it out, even though there might be something to cause it otherwise to stick. The whole operation is very simple and the machine itself is reduced to a small number of parts and yet has all the safety features which are necessary in these machines.

Although I have illustrated and described only a single form of the invention I am aware of the fact that modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of construction herein shown and described, but what I do claim is:—

1. In a die casting machine, the combination with a fixed plate and movable plate, of a mold formed of two dies, one connected with each of said plates, said mold having a

sprue hole through the back, means for moving the movable plate away from the fixed plate, an ejector projecting through the movable plate into one of the dies and to the edge of the mold cavity, and means whereby when the movable plate is drawn back, said ejector will be drawn back automatically and continuously but more slowly, whereby the ejector will project against the casting and eject it from that die.

2. The combination with a two die mold, a rod, and means for reciprocating said rod, of a head fixed on the rod, a pair of links connected with the head, a pair of bell cranks each having three pivotal points, one connected with one of said links and one with a stationary point, levers connected with the other point of each bell crank, a link pivoted to the other end of each lever and to one die, a second head freely slidable and having an ejector for ejecting a casting from the mold, said second head being pivoted to said levers, whereby when the rod is withdrawn the second head will be withdrawn but at a slower rate so that the ejector will project further and eject the casting.

3. The combination with means for supporting a two die mold, comprising a reciprocable plate, a rod, and means for reciprocating said rod, of a head fixed on the rod, a link connected with the head and extending backwardly therefrom, a lever, means for connecting the link with the lever for operating the latter, a link pivoted to the other end of the lever and to the reciprocable plate, a second head freely slidable on said rod and having an ejector thereon for ejecting a casting from the mold, said second head being pivoted to said lever, whereby when the rod is withdrawn the second head will be withdrawn but at a slower rate so that the ejector will project further through the sliding plate and eject the casting.

4. In a die casting machine, the combination with two stationary plates and a reciprocable plate arranged parallel with each other, dies carried by one of the stationary plates and the reciprocable plate and located between them, a cylinder carried by the other stationary plate having a piston therein and a rod, of ejectors extending into the reciprocable plate and into the mold cavity for stripping the castings therefrom when this plate is withdrawn, and a lever and link construction operated by the movement of said rod for projecting the ejectors into the dies as the reciprocable plate is withdrawn to separate the dies at a rate of speed different from that of the reciprocable plate.

5. In a die casting machine, the combination of a stationary plate and a reciprocable plate, dies carried by the plates and located between them, a cylinder, a piston therein, a piston rod, an ejector extending into the reciprocable plate and into the mold cavity

for stripping the casting therefrom when this plate is withdrawn, and means operated by the movement of said rod for projecting the ejector into the dies as the reciprocable plate is withdrawn to separate the dies at a rate of speed different from that of the reciprocable plate.

6. In a die casting machine, the combination of a pair of dies, a cylinder having a piston for opening and closing the dies, an operating shaft having means thereon for introducing fluid into the cylinder and opening and closing the dies as the shaft is rotated through a complete revolution, a cam on said shaft having a notch therein, a second shaft oscillatably mounted, a cam on the second shaft and having a notch therein, said notches being so related to each other that neither cam can turn except when in registration with the notch of the other cam, and means operated by the last named shaft for causing metal to be introduced into the mold.

7. In a die casting machine, the combination of a mold in two parts, means for opening and closing the mold, an operating shaft for controlling the operation of said means, a cam on said shaft having a notch therein, a second shaft having a handle thereon for swinging it, a cam on the second shaft having a notch therein, said notches being so related to each other that neither cam can turn except when in registration with the notch of the other cam, and means operated by the last named shaft for casting metal in the mold.

8. In a die casting machine, the combination with an operating shaft and a cam thereon of circular form and having an arcuate notch at one point, of a second shaft parallel therewith having a handle for oscillating it, a second circular cam on the second shaft having an arcuate notch therein, each notch being arranged to permit the other cam to rotate when in registration therewith and to prevent it at other times, the second cam having a limiting notch, and a stop pin in the limiting notch for controlling the oscillation of the shaft.

9. In a die casting machine, the combination with an operating shaft and a cam thereon of circular form and having a notch at one point, a second shaft having means for oscillating it, a second cam on the second shaft having a notch therein, each notch being arranged to permit the other cam to rotate when in registration therewith and to prevent it at other times, the second cam having a limiting notch, and a stop pin to control its oscillation, of a pair of cams on the second shaft, and valves operated by said cams for controlling the supply of compressed air to introduce metal into the mold when its cams are turned to the proper position.

10. In a die casting machine, the combination of a pneumatic pump for introducing metal into the mold or die, a controlling shaft having a handle thereon for oscillating it, a cam fixed on the shaft having a notch in its circumference, a stop pin co-operating with said notch for limiting the oscillation of the shaft, said cam having another notch therein, an operating shaft, a cam on the operating shaft having a notch of such a nature that neither cam can turn when its last named notch is in engagement with the circumference of the other cam, a compressed air supply, a pneumatic pump and means whereby the pump is prevented from discharging metal except when the second cam is in a predetermined position.

11. In a die casting machine, the combination of a pneumatic pump for introducing metal into the mold or die, a controlling shaft having a handle thereon for oscillating it, a cam fixed on the shaft having a notch in its circumference, an operating shaft having a cam with a notch, each notch fitting the circumference of the other cam and the shafts being at a distance apart less than the combined length of a radius of each cam so that neither cam can turn when its notch is in engagement with the circumference with the other cam, a compressed air supply, a pneumatic pump and means controlled by the first named shaft for regulating the admission of air from said pump and the exhaust therefrom so that the pump cannot discharge metal except when the second cam is in a predetermined position and the handle can be turned only at that time for operating the shaft.

12. In a die casting machine, the combination of a pneumatic pump for introducing metal into the mold or die, a controlling shaft having a handle thereon for oscillating it, a cam fixed on the shaft having a notch in its circumference, an operating shaft having a cam with a notch, each notch fitting the circumference of the other cam and the shafts being at a distance apart less than the combined length of a radius of each cam.

13. The combination with a pneumatic pump for the purpose described, of a pipe for introducing air under pressure therein, and a chamber above the pump and communicating therewith at the bottom of the chamber, said chamber having a boss into which the pipe extends, located materially below the top of the space in said chamber, whereby, when the air is cut off, the metal from the pump cannot be forced out of said pipe but can be forced up in said chamber only in a direction to fall back into the interior of the pump.

14. In a die casting machine, the combination with a movable die, of a rod connected

with said die to be moved therewith, a swinging support, an arm connected with said rod for turning the swinging support on that axis, a pneumatic pump pivoted on and supported by said swinging support, and means for guiding the pump to move the nozzle of the pump into casting position.

15. In a die casting machine, the combination of a two part mold, one part movable into closed position, a rod connected with said part to be moved therewith, a swinging support, means connected with said rod for turning the swinging support on that axis, a pneumatic pump pivoted on and supported by said swinging support at one end, and means for supporting and guiding the other end to move the nozzle of the pump into casting position when the mold closes.

16. The combination with a pneumatic pump for supplying metal to a mold, having a nozzle below the level of the metal for the purpose of filling the pump when it is vented, of a shaft, two arms projecting from said shaft, a rod connected with one of said arms and arranged to be moved when the mold is closed to move the shaft, a link connected to the other arms, a supporting link pivoted above and connected with the first named link and also connected with the pump for supporting it, and means for controlling the position of the pump and its nozzle.

17. The combination with a pneumatic pump provided with a nozzle movably located below the level of the metal in a melting pot to fill the pump when it is vented, of a shaft, two arms projecting from said shaft, a rod connected with one of said arm, means for moving the rod, a link connected to the other arms, a supporting link pivoted above and connected with the first named link and also pivoted to the pump for supporting it, said pump having a projection extending upwardly therefrom having an open bottom bearing, a stud located in said bearing, a pivoted arm on which the stud is mounted, and a pivoted plate adjustable about its pivot and connected with the last named arm for controlling the position of the pump and its nozzle.

18. The combination with a pneumatic pump provided with a nozzle, of a supporting link pivoted above and connected with the pump for supporting it, said pump having a projection extending upwardly therefrom having an open bottom bearing, a stud located in said bearing, a pivoted arm on which the stud is mounted, and a pivoted plate adjustable about its pivot and connected with the last named arm for controlling the position of the pump and its nozzle.

In testimony whereof I have hereunto affixed my signature.

NATHAN LESTER.