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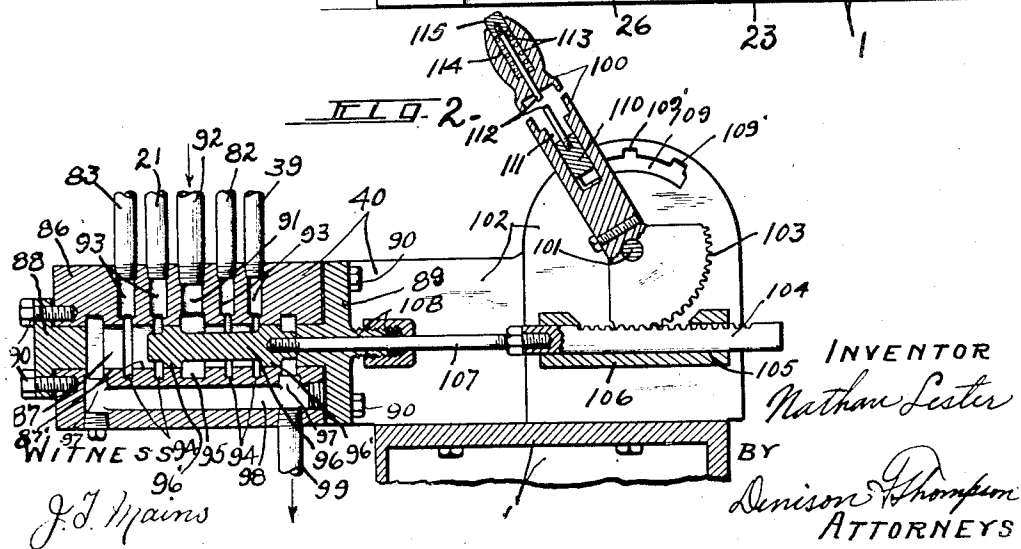
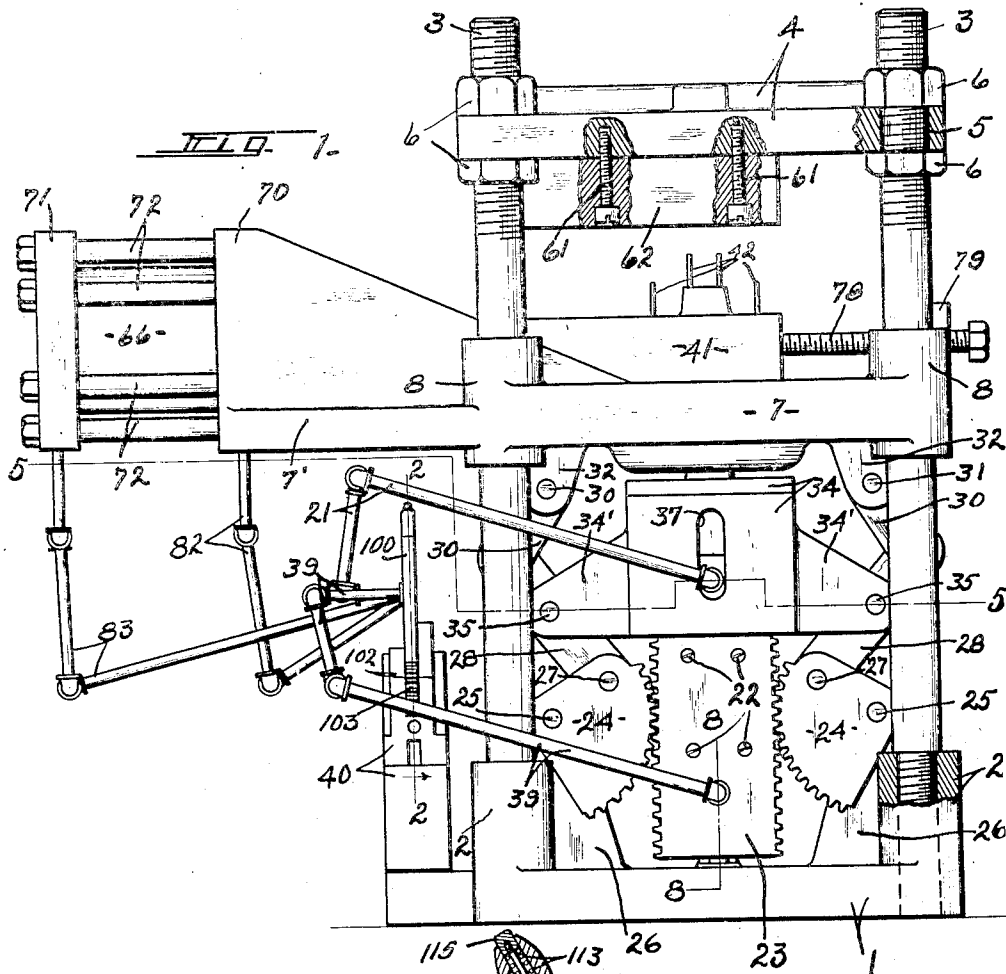
N. LESTER

1,891,894

DIE CASTING MACHINE

Filed Jan. 19, 1931

3 Sheets-Sheet 1



INVENTOR
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BY
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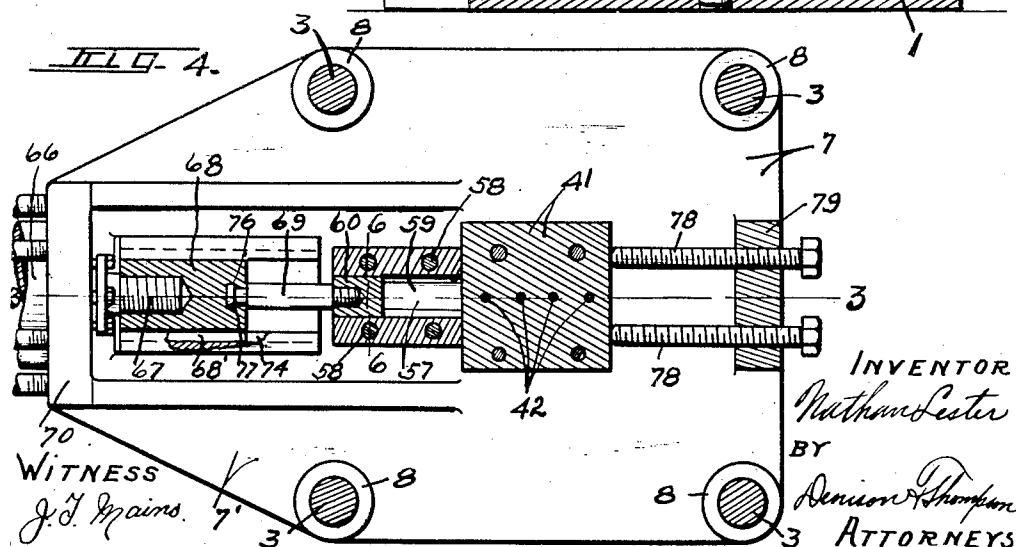
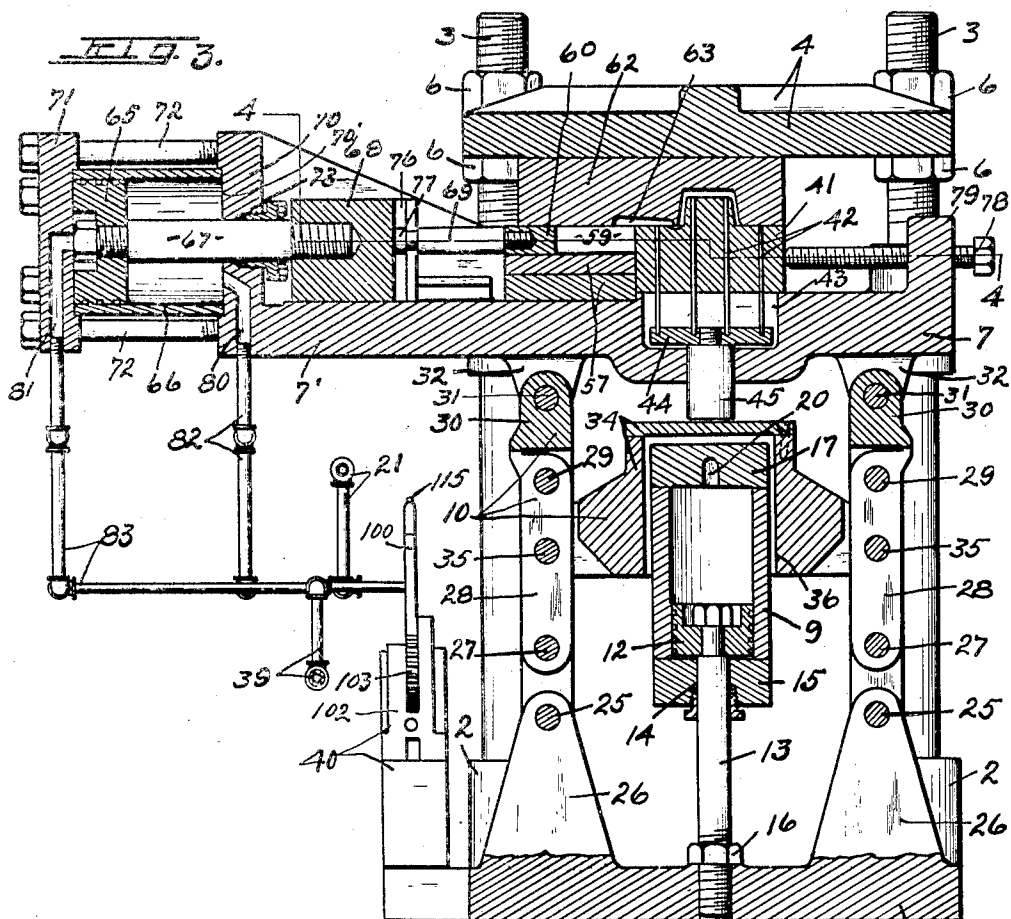
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3 Sheets-Sheet 2



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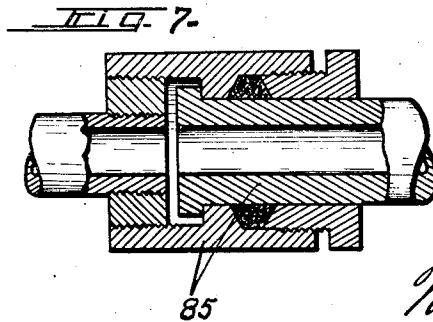
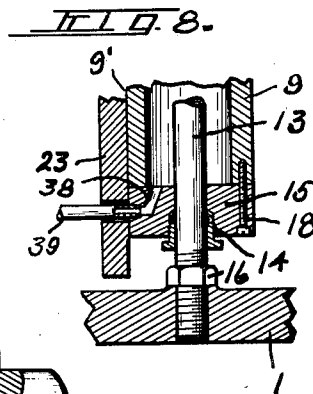
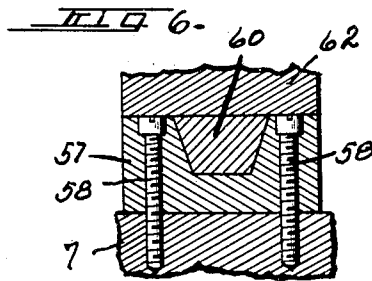
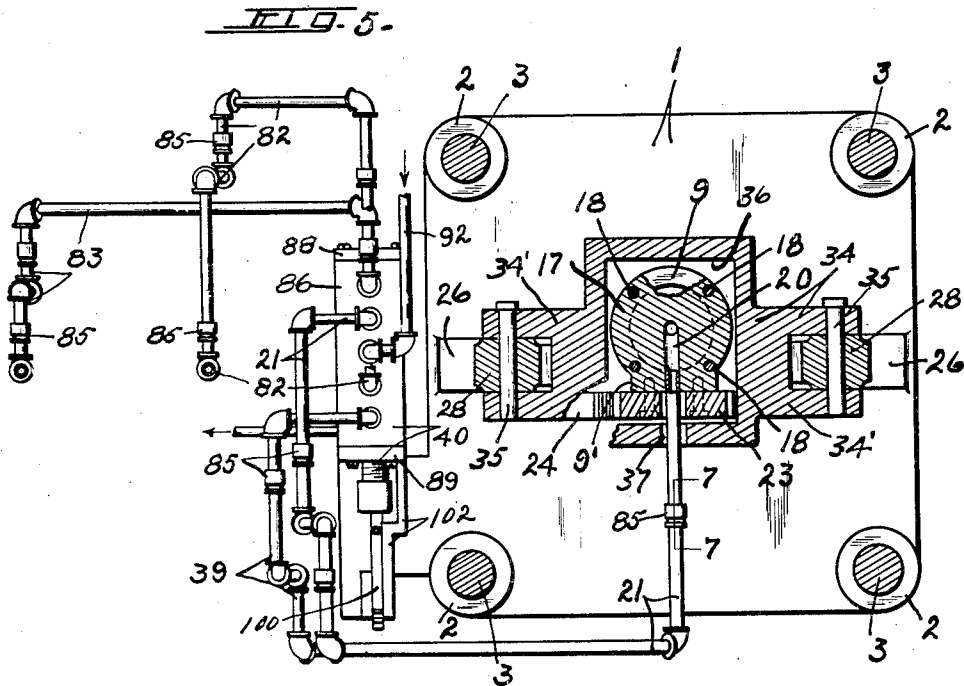
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DIE CASTING MACHINE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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DIE-CASTING MACHINE

Application filed January 19, 1931. Serial No. 509,746.

This invention relates to die-casting machines in which a delivery pot operates in conjunction with a movable die section and wherein the delivery pot and movable die section are moved into and out of casting relation with a fixed die section by fluid pressure.

One of the objects of this invention is to provide a casting machine with an improved means for supplying molten metal to the die cavity.

Another object is to provide a novel and improved means for ejecting castings from the die. A further object is to provide an efficacious means for operating and controlling the various moving parts of the machine.

Other objects and advantages relating to the particular form, relation and operation of the various parts of the device, will more fully appear from the following description, taken in connection with the accompanying drawings, in which:—

Figure 1 is a front elevation, partly in section, of a die-casting machine embodying the various features of this invention, the machine being illustrated in the inoperative or casting ejecting position.

Figure 2 is an enlarged longitudinal vertical sectional view taken on line 2—2, Figure 1, and illustrating the construction of a suitable fluid control valve for this machine.

Figure 3 is a transverse vertical sectional view taken substantially in the plane of the line 3—3, Figure 4, with the machine illustrated in the operative position ready to form a casting.

Figure 4 is a detail transverse horizontal sectional view taken on line 4—4, Figure 3.

Figure 5 is a transverse horizontal sectional view taken on line 5—5, Figure 1.

Figure 6 is an enlarged detail transverse vertical sectional view through the delivery pot taken in the plane of the line 6—6, Figure 4.

Figure 7 is an enlarged longitudinal sectional view of one of the swivel joints taken on line 7—7, Figure 5.

Figure 8 is a detail vertical sectional view taken on line 8—8, Figure 1.

The apparatus, as illustrated in the draw-

ings, consists of a base —1— substantially square in plan view, and having each corner thereof provided with an upwardly extending hollow boss —2— adapted to receive therein one end of a vertically disposed tie rod —3—. The tie rods —3— extend upwardly some distance above the base —1— and have secured to the upper ends thereof a fixed die-supporting plate —4—. The plate —4— is substantially square in plan view similar to the base —1— and is provided at each corner thereof with an opening —5— adapted to receive a respective tie rod —3— therethrough.

The plate —4— is adjustably secured to the tie rods —3— by means of nuts —6— screw-threaded on the upper ends of said rods and positioned one at the upper and lower sides of said plate. Positioned intermediate the base —1— and the fixed die-supporting plate —4— is a movable die-supporting plate —7—. This plate —7— is made similar in plan view to the base —1— and has each corner thereof provided with a hollow boss —8— for receiving a respective tie rod —3— therethrough so that the plate —7— will be guided by said rods as it is moved vertically towards and away from the fixed die-supporting plate —4—.

This vertical movement of the plate —7— is effected, in this instance, by means of fluid under pressure actuating a cylinder —9— which, in turn, is operably connected with the plate —7— through the medium of a toggle link mechanism —10—. Within the cylinder —9— is positioned a piston —12— which is connected with one end of a piston rod —13— which extends downwardly through a suitable opening —14— provided in the lower head plate —15— for the cylinder —9— and has the lower end thereof secured to the base —1—.

The rod —13— is adjustably secured to the base —1— to permit the proper positioning of the cylinder —9— respective to the plate —7—, and for this purpose, the lower end of the rod —13— is screw-threaded in the base —1— and may be permanently maintained at a predetermined position by means of a lock

nut —16— screw-threaded on the rod —13— in contacting relation with the base —1—.

The cylinder —9— is also provided with a second head plate —17— similar to the plate —15— and which is positioned at the upper end of said cylinder. The cylinder —9— and the head plates —15— and —17— are secured together by bolts —18— or their equivalent, which pass through suitable openings in the head plates —15— and —17— and are screw-threaded in the adjacent end of the cylinder wall. The head plate —17— is provided with a port —20— in communication with the interior of the cylinder —9—. Said port is also connected by means of a conduit —21— to a suitable fluid control valve —40— which will be hereinafter more fully described.

One side of the cylinder —9— is made to extend outwardly to form a substantially flat vertical surface —9'— to which is secured by screws —22— a double-faced rack —23—, the opposite vertical side edges of the rack —23— being provided with gear teeth which are in meshing engagement with respective segmental gears —24—.

Each of the gears —24— are pivotally connected at —25— to an upwardly extending boss or arm —26— secured to or made integral with the upper face of the base —1—, the teeth of these gears —24— being made concentric with the pivots —25— so as to always remain in meshing engagement with the rack —23— throughout the entire rocking movement of said gears.

Pivotally connected to the upper outer edge of each of the gears —24— as at —27— is one end of a rock arm —28— which has the other end thereof pivotally connected at —29— to a link —30— which, in turn, is pivotally connected at —31— to a downwardly extending lug —32— secured to or made integral with the lower face of the movable die-supporting plate —7—.

A cross head —34— is positioned intermediate the arms —28— and has the opposite vertical side walls thereof provided with outwardly extending arms —34'—, each of which is pivotally connected at —35— to a respective rock arm —28— intermediate the ends thereof. The cross head —34—, in this instance, is provided with a recess —36— which extends upwardly from the lower edge thereof and is adapted to receive therein the upper portion of the cylinder —9— so as to permit the free operation of the cylinder —9— and to conserve space.

The conduit —21— secured to the cover plate —17— of the cylinder —9— extends outwardly from said head plate through a suitable elongated slot —37— provided in one face of the cross head —34— which permits the free movement of the cylinder —9— in said recess —36—, as will hereinafter be more fully described.

The lower head plate —15— of the cyl-

inder —9— is also provided with a port —38— which is in communication with the interior of the cylinder and also connected by a conduit as —39— which has one end thereof extending through a suitable opening in the rack —23— and screw-threaded in the port —38— while the other end of said conduit is connected with the hereinbefore mentioned control valve —40—.

It is now evident that any vertical movement of the cylinder —9— will cause a corresponding movement of the rack —23— which in turn will cause a rocking movement of the gear segments —24— and as the gears —24— are rocked, the arms —28— will be rocked about the pivotal pins —35— which will cause the folding or the extension of the toggle mechanism —10— for moving the die plate —7— vertically along the tie rods —3—.

Secured to the upper face of the die plate —7— is a suitable die section —41— which has suitable vertical openings therethrough for receiving ejector pins —42—, and for this reason, the die —41— will hereinafter be called the ejector die section. The ejector pins —42— extend downwardly from the die —41— into a suitable recess —43— formed in the upper face of the movable die-supporting plate —7— beneath the ejector die —41—.

The lower ends of the pins —42— are secured to a suitable ejector plate —44— positioned in the recess —43— and which, in turn, is secured to a suitable ejector plunger —45— slidably mounted in an aperture provided in the plate —7— beneath the recess —43—. The ejector plunger —45— extends downwardly below the plate —7— with the lower end thereof adapted to contact with the upper end of the cross head —34— in such a manner that when the toggle mechanism —10— is in the extended position, the upper ends of the ejector pins —42— will be in registration with the adjacent wall of the die cavity to form a smooth continuous surface of the die cavity.

Also secured to the upper face of the movable die supporting plate —7— is a delivery pot —57—. The delivery pot —57— may be secured in any suitable manner to the plate —7— as by screws —58—, said pot being provided with a pressure chamber —59— which, in this instance, is a groove or slot formed in the upper face of the pressure pot —57— to extend longitudinally thereof. The pressure chamber —59—, in this instance, has the vertical longitudinal side walls thereof tapered outwardly for receiving a similarly constructed plunger —60—.

The delivery pot —57— is so mounted on the plate —7— that the inner end of the chamber —59— will be closed by the ejector die section —41— while the plunger —60— is normally maintained at the other or outer end of the chamber —59— to form a closure for that end of said chamber.

To the under face of the fixed die supporting plate —4— is secured by any suitable means, as screws —61—, a die section —62— which, in this instance, is provided in its lower surface with a suitable gate or sprue-forming passage —63— and, therefore, this section of the die will hereinafter be termed the sprue die section. The sprue die section —62— is so constructed that one side thereof will extend outwardly over the delivery pot —57— to form a closure for the pressure chamber —59— when the ejector die —41— is in casting relation with the sprue die —62— as illustrated in Figure 3.

The plunger —60— is formed to have a close sliding fit in the chamber —59— and between the lower wall of the chamber and the lower face of the sprue die section —62— when the die sections —41— and —62— are in casting relation for the purpose of ejecting molten metal which may be contained in the chamber —59— from said chamber through the gate —63— into the die cavity.

The longitudinal reciprocative movement of the plunger —60— in the chamber —59— may be produced by any suitable means such as fluid as oil under pressure, operating upon a piston —65— mounted for longitudinal reciprocative movement in a cylinder —66— and which is connected with the plunger —60— by means of a piston rod —67—, a slide —68— and a connecting rod —69—, all of which may be mounted in any suitable manner so as to move vertically with the delivery pot —57— and, for this purpose, one side of the die supporting plate —7— is projected outwardly to form a supporting plate or extension —7'—.

The outer end of the supporting plate extension —7'— is provided with an upwardly extending vertically disposed flange —70— which has the outer vertical face thereof provided with a recess —70'— for receiving one end of the cylinder —66— and forming an end plate therefor.

Positioned adjacent the outer end of the cylinder —66— is a second cover plate —71—, the cylinder —66— and plate —71— being secured together and to the plate —70— by means of a plurality of, in this instance six, screws or bolts —72— which pass through suitable openings in the end plate —71— and are screw-threaded in the plates —70—.

The piston rod —67— extends outwardly through a suitable opening —73— provided in the end plate —70— concentric with the cylinder —66— and is screw-threaded in the slide —68—. The slide —68—, in this instance, has the outer lower longitudinal edges thereof provided with outwardly extending flanges —68'— adapted to travel in a corresponding groove —74— formed in the inner faces of a pair of upwardly extending spaced longitudinal flanges —75— formed integral with or secured to the upper face of the extension —7'— for guiding the slide —68— in the longitudinal reciprocative movement produced by the piston —65—.

The inner vertical end face of the slide —68— is provided with a vertically disposed T-slot —76— for receiving the similarly constructed T-head —77— of the connecting rod —69— which secures said rod to the slide —68— while the other end of the rod —69— is screw-threaded in the plunger —60—.

The delivery pot —57— may be formed with the chamber —59— adapted to contain more or less molten metal depending upon the size of the die cavity which will, of course, necessitate the forming of different sizes of plungers —60— to conform to the size of the chamber —59— and, for this reason, the T-slot —76— formed in the slide —68— is of sufficient length to permit the necessary positioning of the rod —69— caused by the different sized plungers used, without the necessity of providing separate means for securing the rod —69— to the slide —68—.

It is evident that during the forcing of the metal from the chamber —59— into the die cavity that a considerable side thrust will be produced upon the die section —41— due to said die forming a closure for the inner end of the chamber —59—, and for the purpose of maintaining the die —41— in contact with the inner end of the delivery pot —57— under all pressure conditions, a pair of stay bolts —78— are screw-threaded in an upwardly extending flange —79— formed at the opposite side of the plate —7— to that at which the extension —7'— is provided, said bolts being so constructed that the inner ends thereof will engage the adjacent face of the die section —41—.

Each of the cover plates —70— and —71— for the cylinder —66— is provided with a respective inlet port —80— and —81— in communication with the interior of the cylinder —66—. The inlet port —80— is connected by a suitable conduit —82— to the hereinbefore mentioned control valve —40— while the port —81— is connected by a similar conduit —83— to said control valve.

It is evident that as the cylinder —9— is moved vertically for transmitting a similar movement to the die plate —7— to bring the ejector die section —41— and the delivery pot —57— into and out of casting relation with the sprue die section —62— that some suitable means must be employed in the conduits —21—, —39—, —82— and —83— for permitting this movement, and for this purpose, each of said conduits is provided with a sufficient number of suitable swivel joints as —85— which will permit the required relative movement of certain portions of respective conduits relative to the remaining portion thereof and, at the same time, prevent any leakage or escapement of the fluid used for producing these movements.

The hereinbefore mentioned control valve —40— may be of any suitable construction for controlling the fluid passing to the cylinders —9— and —66— for producing the re-
 5 quired movements of the respective units actuated thereby. In Figure 2 more particularly is shown a simple valve which may be utilized for this purpose and which consists of a body portion —86— substantially
 10 rectangular in cross section and having a longitudinal bore —87— extending there-through substantially midway between the upper and lower faces of the body.

The ends of the bore —87— are closed by
 15 suitable end plates —88— and —89— which are secured to the respective ends of the body —86— by screws —90—. The valve —40— is also provided with an inlet
 20 port —91— which, in this instance, is located in the upper portion of the body —86— substantially midway between the ends thereof and is connected by a suitable conduit as
 —92— to any convenient means for supplying fluid under pressure, such as a pressure
 25 tank or pump not shown.

The valve —40— is also provided with a plurality of, in this instance four, control
 ports —93—, two of which are located at the left hand side of the inlet port —91— and
 30 two at the right hand side of said port. These control ports —93— are spaced substantially equal distances apart and from the inlet port —91— and are each connected with
 the piston chamber —97— of the valve by
 35 means of annular recesses —94— formed in the wall of the chamber —87—.

The inlet port —91— is likewise provided
 with an annular recess —95— which also connects said port with the chamber —87—.
 40 The recesses —94— and —95— are constructed of such a width that the distance between the adjacent walls thereof will be substantially equal, thereby forming annular flanges
 —87'— surrounding the chamber —87—, all
 45 of which will be of substantially the same width.

A piston —96— is mounted for longitudinal reciprocative movement in the chamber —87—.
 50 The major portion of the piston —96— is made substantially smaller in diameter than the chamber —87— and is provided near each end thereof with an outwardly
 extending annular flange —96'— which are of substantially the same diameter as the
 55 chamber —87— and have the same width as the flanges —87'—.

The piston flanges —96'— are spaced apart a distance substantially equal to the distance
 between the outer wall of one of the outer
 60 positioned recesses —94— and the opposite wall of the intake recess —95—, as clearly shown in Figure 2.

Each of the outer ends of the chamber —87—, in this instance, is connected by re-
 65 spective ports —97— to a common outlet

chamber —98— which extends longitudinally through the body —86— below the chamber —87—. The outlet chamber —98— is
 connected by a suitable conduit —99— with
 the source of fluid supply for returning the
 70 fluid thereto.

Each of the conduits —21—, —39—, —82— and —83— is connected with a respective
 control port —93— in such a manner that the
 operation of the movable units of the die-
 casting machine may be progressively controlled
 75 by moving the piston —96— from one end of the chamber —87— to the other. This
 movement of the piston —96— may be effected by any suitable means such as a lever
 80 —100— which, in this instance, is pivotally mounted at —101— to a bracket —102— secured to or made integral with the body
 —86— of the valve —40—, or as illustrated
 85 in this instance, may be made integral with the end plate —89— for said valve.

The lower end of the lever —100— extends
 below the pivot —101— and is made concentric with said pivot and provided with gear
 90 teeth —103— formed in the lower peripheral wall thereof for engaging a suitable rack
 member —104— which is slidably mounted in a bore —105— formed in an outwardly
 projecting flange —106— secured to or made
 95 integral with the bracket —102—.

This rack —104— in turn is connected with
 the piston —96— by means of a piston rod
 —107— which has one end thereof secured to the piston —96— and extends outwardly
 100 through a suitable opening —108— provided in the end plate —89— and has the outer
 end thereof adjustably secured to the rack —104—.

The piston —96— may be releasably maintained in any one of a plurality of, in this
 105 instance three, positions in the chamber —87— for maintaining the fluid pressure in the desired end of the cylinders —9— and
 —66—, and for this purpose, the bracket —102— is provided with a slot —109— positioned
 110 above the pivot —101— and made concentric therewith for receiving a pawl
 —110— which is slidably mounted in a suitable groove —111— formed in the lever
 115 —100—, said pawl having a laterally extending arm adapted to travel in the slot —109— and in any one of a plurality of, in this
 instance three, radial slots —109'— formed in the upper surface of the slot —109—.

The pawl —110— may be yieldingly maintained in engagement with the radial slots
 —109'— by means of a rod —112— and
 120 spring —113—, said rod having one end thereof connected with the pawl —110— and the outer end positioned in a suitable recess
 125 —114— formed in the outer end of the lever —100—.

The spring —113— is positioned in the recess —114— between the lower or inner end
 of said recess and a suitable nut —115— 130

screw-threaded on the outer end of the rod —112—, said nut —115— being so arranged as to normally extend above the outer end of the lever —100— so that the pawl —110— may be readily moved downwardly against the action of the spring —113— by a slight pressure upon the nut —115—.

Operation

Assuming now, that the control valve —40— is connected with a source of fluid supply adapted to supply fluid under very high pressure and that the piston —96— is positioned at the extreme right hand end of the chamber —87—, as illustrated in Figure 2, this will cause the lower end of the cylinder —9— to be connected through the conduit —39— and chamber —87— with the inlet port —91— of the valve —40—, which will position the cylinder —9— in its lowermost position, and therefore cause the movable die-supporting plate —7— to be in its lowermost position, as illustrated in Figure 1.

The inner or rod end of the cylinder —66— will also be connected with a source of fluid pressure which will maintain the plunger —60— in its outermost position with the pressure chamber —59— in position to receive a charge of molten metal. The pressure chamber —59— may now be filled with molten metal after which the piston —96— may be moved inwardly toward the left hand end of the chamber —87— to bring the conduit —39— into communication with the outlet —97— and the conduit —21— into communication with the inlet port —91—. This will permit the fluid, under pressure, to flow through the port —20— into the upper end of the cylinder —9—, which will cause said cylinder to move upwardly due to the piston —12— being fixedly supported by the base —1—.

The upward movement of the cylinder —9— will cause the rack —23— secured thereto to rock the gear segments —24— about their respective pivots —25— and thereby cause the toggle mechanism —10— to assume the extended position and move the die-supporting plate —7— upwardly to bring the ejector die section —41— and the pressure pot —57— into casting relation with the sprue die section —62—. This upward movement of the plate —7— will, of course, carry the cylinder —66— upwardly and position the pressure chamber —59— with the inner end thereof in communication with the gate —63— of the sprue die section —62—.

Now, by moving the piston —96— of the valve —40— to the extreme left hand position in the chamber —87—, the inner end of the cylinder —66— will be cut off from the source of fluid supply and connected with the exhaust conduit —99—, while the outer end of said cylinder will be connected with the source of fluid supply. This will cause

the piston —65— to move inwardly and thereby force the molten metal from the pressure chamber —59— by the inward movement of the plunger —60— into the die cavity.

It is evident that any excess metal remaining in the pressure pot after the die cavity has been filled, will be positioned at the forward or inner end of the pressure chamber —59— in contact with the sprue formed in the gate or passage —63—.

As the quantity of the excess metal in the pressure pot —59— will be comparatively small, the metal will very quickly solidify so that upon the plunger —60— being returned to the normal outer position by the proper manipulation of the piston —96—, said excess material will remain in connection with the sprue.

As the piston —96— is moved towards the right hand end of the chamber —87— to its original position, the plunger —60— will first be returned to its normal outer position due to the inner or rod end of the cylinder —66— being connected with the source of fluid supply, and as the piston —96— continues the return movement, the lower end of the cylinder —9— will be connected with the source of fluid supply which will cause said cylinder to move to its lowermost position which will cause the rack —23— to rotate the gears —24— and move the toggle mechanism to the folded position, which will cause the movable die supporting plate —7— to return to its lowermost position, as illustrated in Figure 1.

It is now evident that as the cross head —34— is carried by the arms —28—, that said cross head will travel a less distance than the die supporting plate —7— which will cause the plate —7— to approach the upper end of the cross head —34— as the plate —7— approaches its lowermost position. This will cause the ejector plunger —45— to be engaged by the cross head —34— and move it upwardly through the die supporting plate —7—.

This upward movement of the ejector plunger —45— will, of course, cause a corresponding upward movement of the ejector pins —42— through the ejector die section —41— and thereby discharge the casting from the die section —41— after which the casting may be readily removed by the operator.

This completes one cycle of operation of the machine, and it is evident that the cycle may be repeated as many times as desired.

Although I have shown and described the preferred form of this invention, I do not wish to be limited to the exact construction shown, as various changes both in the form and the relation of the parts thereof may readily be made without departing from the spirit of this invention as set forth in the appended claim.

I claim:

A die-casting machine comprising in combination a pair of die sections, a fixed die-supporting plate for one of the die sections,
5 a movable die-supporting plate for the other die section, a delivery pot secured to the movable die-supporting plate for movement therewith, a plunger mounted for reciprocative movement in said pot, actuating means
10 connected with the plunger for operating said plunger and secured to the movable plate for movement therewith, and separate operating means for moving the movable plate and associated parts towards and from
15 the fixed plate.

In witness whereof I have hereunto set my hand this 18th day of December, 1930.

NATHAN LESTER.

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