June 28, 1938. D. J. CAMPBELL 2,122,022

MOLDING APPARATUS

Filed Oct. 21, 1935 4 Sheets-Sheet 1

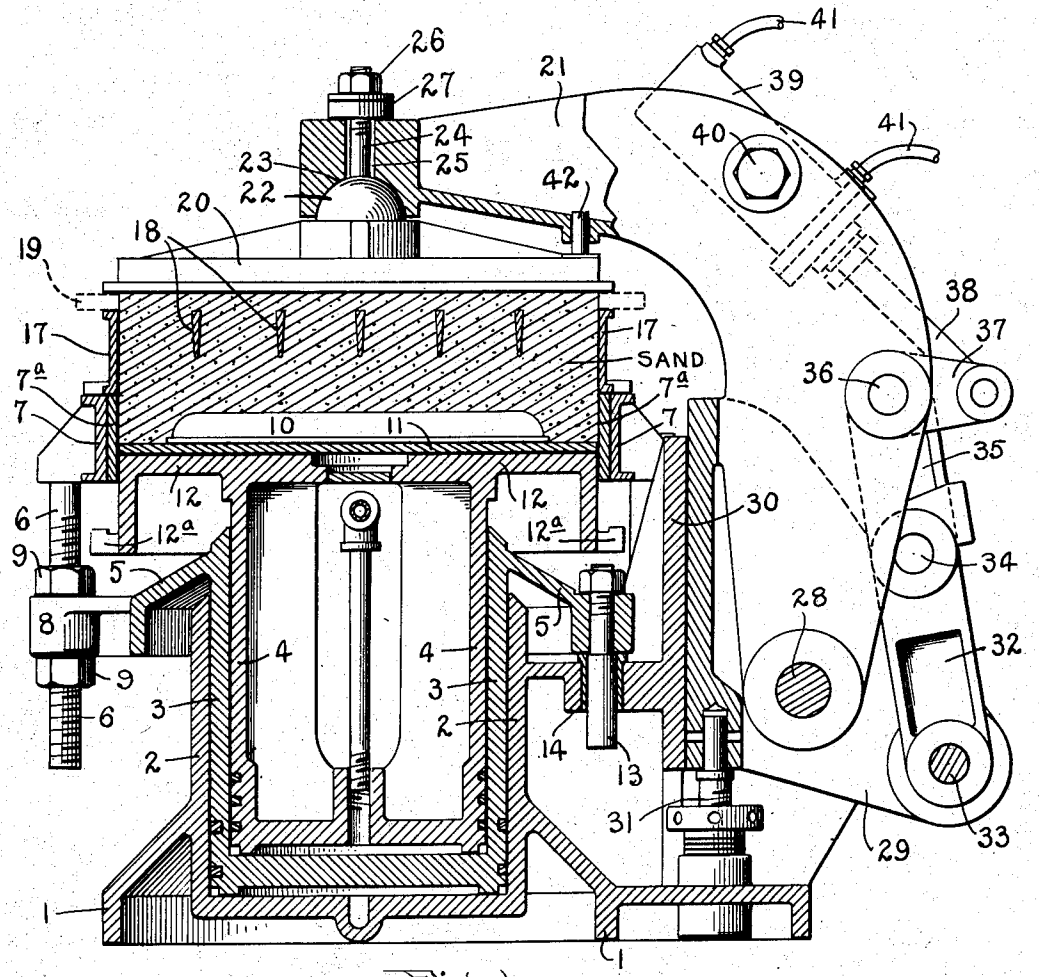


Fig. 1.

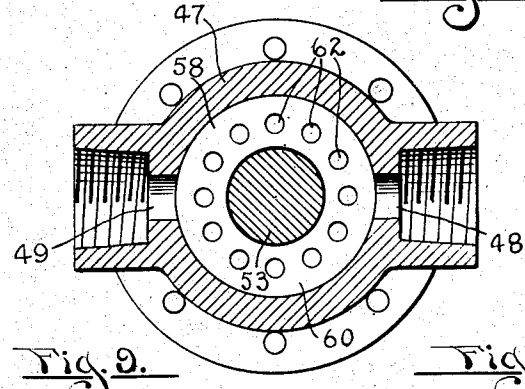


Fig. 9.

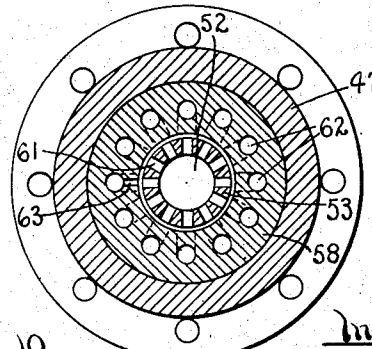


Fig. 10.

Inventor
Donald J. Campbell
By Livingston & Van Antwerp
Attorneys

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MOLDING APPARATUS

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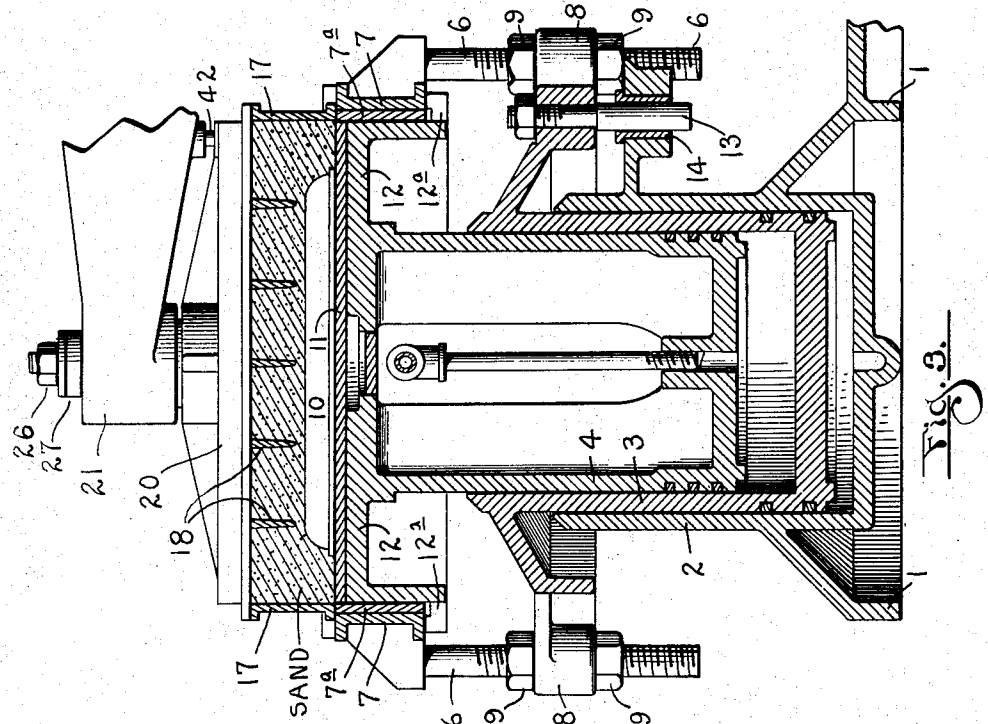


Fig. 3.

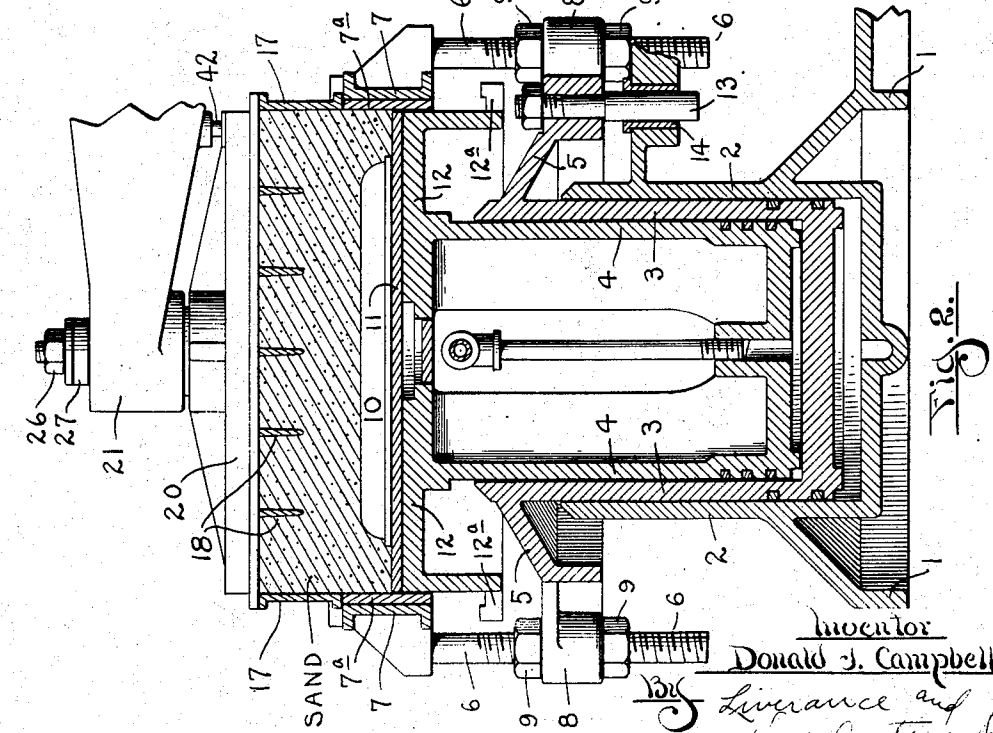


Fig. 2.

Inventor
Donald J. Campbell
By Livingston and Van Santvoord
Attorneys

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MOLDING APPARATUS

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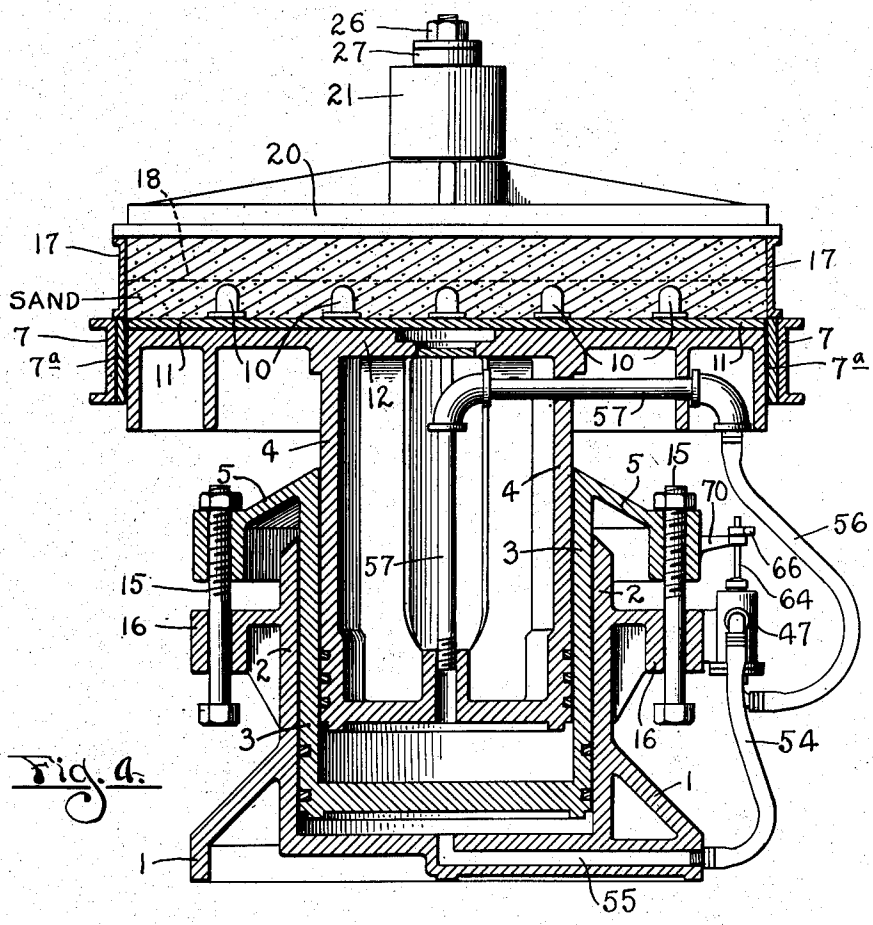


Fig. 4.

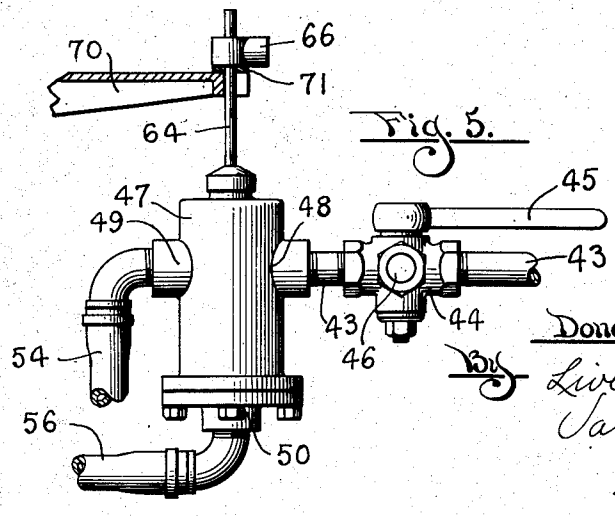


Fig. 5.

Inventor
Donald J. Campbell
By Liverance and Van Antwerp
Attorneys

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MOLDING APPARATUS

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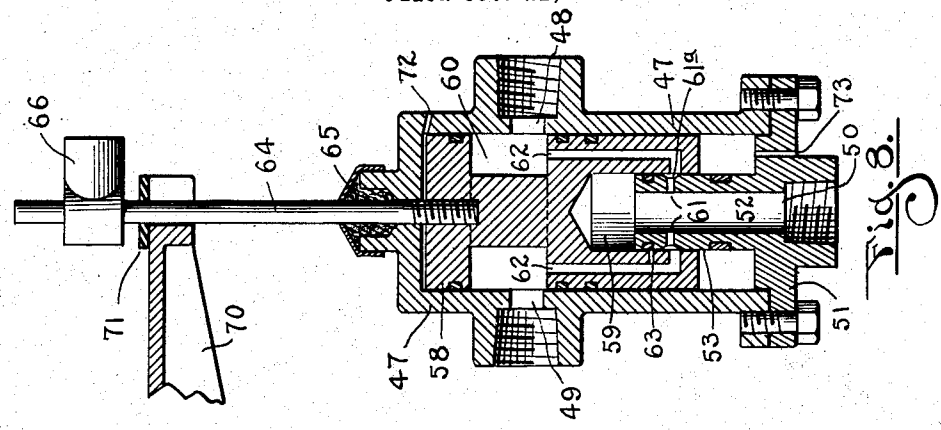


Fig. 8.

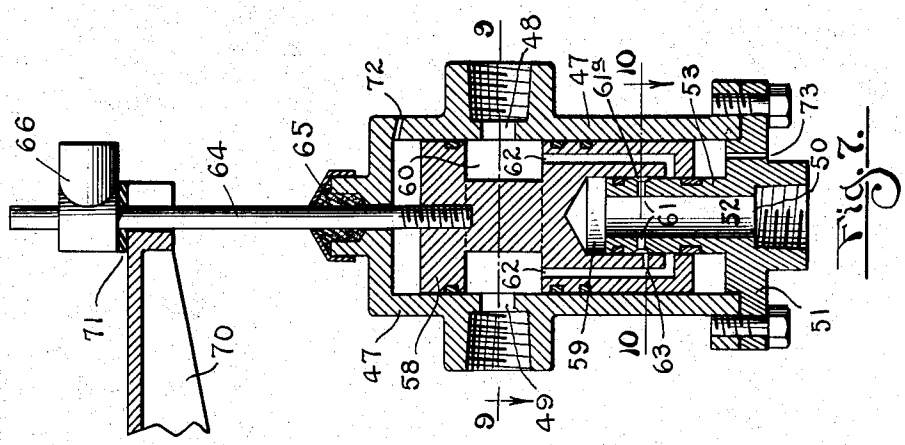


Fig. 7.

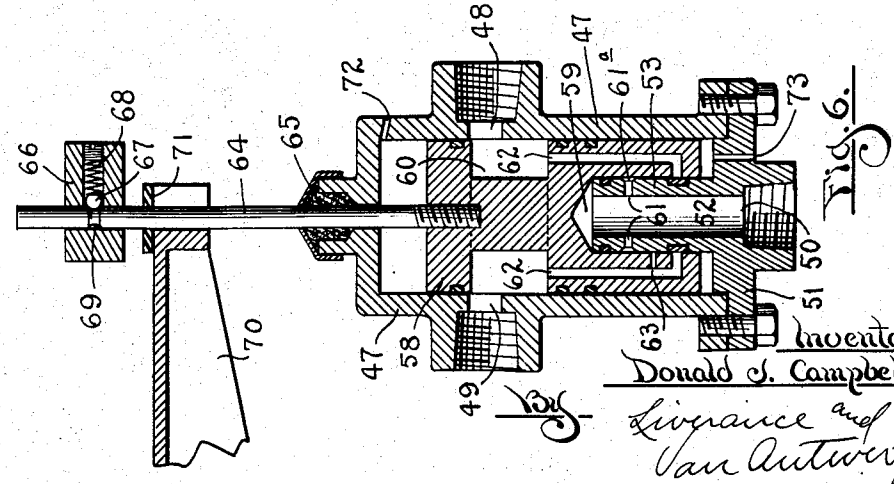


Fig. 6.

Inventor
Donald J. Campbell
By Livingston and Van Antwerp
Attorneys

Patented June 28, 1938 2,122,022

UNITED STATES PATENT OFFICE

2,122,022

MOLDING APPARATUS

Donald J. Campbell, Spring Lake Township, Ottawa County, Mich., assignor to Campbell, Wyant & Cannon Foundry Company, Muskegon Heights, Mich., a corporation of Michigan

Application October 21, 1935, Serial No. 45,907

18 Claims. (Cl. 22—25)

This invention relates to molding machines and particularly to molding machines of the type used in foundries for producing sand molds from a pattern of the metal castings to be made.

Foundry sand molds are customarily contained in foundry flasks which are in the nature of several-sided frames having open tops and bottoms and a portion of the pattern is customarily attached to a follow board laid in one of the open sides of the flask cope or drag, after which the sand is placed within the flask against the pattern and tamped or rammed from the opposite side compressing it within the flask and around the pattern. This method of forming a mold resulted in the sand being packed more tightly at the opposite side of the flask than at the surface surrounding the pattern, especially when flasks having so-called flask bars are used, which bars extend at spaced intervals across the flask near its upper side and resist and interfere with movement of the sand toward the pattern in the flask. It is necessary to pack the sand uniformly throughout the mold and especially around the pattern in order to obtain true-to-pattern casting and it is the object of the present invention to provide means for squeezing the sand in the mold from opposite directions whereby its compactness will be substantially uniform throughout the whole mold and whereby the sand will be uniformly compressed against the pattern.

Another object of the invention is to provide a power operated mechanism for expeditiously and efficiently performing the molding operation.

A further object of the invention is to provide means for automatically controlling the operation of the mechanism.

This invention provides various other novel features of construction and arrangement as hereinafter more fully described and particularly pointed out in the claims and reference to the accompanying drawings in which:—

Fig. 1 is a transverse sectional elevation of a molding machine embodying this invention showing a flask, pattern and sand in position to commence the squeezing operation.

Fig. 2 is the same as Fig. 1 with parts broken away and showing the first step of the squeezing operation in which the sand is compressed in the upper portion of the mold.

Fig. 3 is the same as Fig. 2 showing the completion of the squeezing operation in which the sand is compressed in the lower portion of the mold.

Fig. 4 is a sectional elevation at right angles to Fig. 3 showing the parts in the same position as Fig. 3.

Fig. 5 is a fragmentary elevation, partially in section, of the automatic control valve and associated parts.

Figs. 6, 7 and 8 are enlarged sectional elevations of the automatic control valve shown in three different positions.

Fig. 9 is an enlarged sectional plan of the control valve on the line 9—9 of Fig. 7, and

Fig. 10 is an enlarged sectional plan of the automatic control valve on the line 10—10 of Fig. 7.

Like numbers refer to like parts in all of the figures.

The machine has a base 1 upon which is formed a vertical cylinder 2. The cylinder 2 is provided with a hollow piston 3, the interior of which forms a cylinder for the inner piston 4. Each of the pistons 3 and 4 projects from the upper end of its respective cylinder.

The outer piston 3 has an outwardly extending apron 5 which serves as a guard to prevent sand and other foreign matter from entering the upper end of the cylinder 2 and the apron 5 also serves as a support for the threaded adjustable bars 6 which extend upwardly and carry at their upper ends a supporting frame 7. The members 6 are in the nature of screw threaded bars and extend through lugs 8 and are locked relative therewith by nuts 9 above and below each lug and whereby they may be longitudinally adjusted. The bars 6 are preferably four in number arranged in spaced relation with each other at the sides of the supporting frame 7.

The pattern 10, which is to form the mold cavity, is usually mounted on a pattern plate 11 and the pattern plate is supported on a table 12 which is fixed to the upper end of the inner piston 4 and in the structure shown is integrally formed therewith. The table 12 is approximately the same shape and size as the inside of the supporting frame 7 and is arranged to slide vertically therein, the supporting frame 7 being preferably provided with a removable lining 7a which may be readily replaced when worn. Stops 12a extend from the table 12 to engage the underside of the supporting frame 7 to limit the upward movement of the pattern and pattern plate. The outer piston 3 has a guide pin 13 attached to its apron 5 which extends downwardly through a guide bushing 14 mounted in a fixed member of the machine and prevents rotation of the outer piston as it reciprocates.

The said apron 5 is also provided with adjust-

able stop bolts 15 which likewise extend downwardly through bracket 16 on a fixed portion of the machine. The stop bolts 15 are screw threaded into the apron and have heads at their lower ends, which heads engage the lugs 16 to limit the upward movement of the outer piston 3 and the extent of such upward movement may be adjusted by the screw thread attachment of the bolts in the apron 5.

The mold flask 17 is the same size interiorly as the supporting frame 7 and is removably supported on the upper side of said supporting frame. The flask 17 may be provided with the conventional flask bars 18 which extend across the flask. The purpose of these flask bars is to tie the sand into the flask and to reinforce the completed mold so that it may be handled without detriment. A dummy frame 19, shown in dotted lines in Fig. 1, is provided to be placed upon the upper surface of the flask and is used when filling the flask with sand as hereafter described.

A pressure head 20 is arranged to be located over the flask and is mounted on a pivoted arm 21. The head is provided with a hemi-spherical bearing member 22 on its upper surface, which bearing member fits into a socket 23 on the end of the arm 21 and a bolt 24 passes loosely through an opening 25 in the arm and is provided with a nut 26 at its upper end, which nut bears against a washer and a flexible disk 27 to provide a slight self-alining movement of the head relative to the arm.

The arm 21 is pivoted at 28 to a bracket 29 which bracket is attached for vertical adjustment on a vertical frame member 30 forming a part of the base 1. A jackscrew 31 supports the bracket 29 in adjusted position. Power means for swinging the pivoted arm 21 is provided and consists of a toggle lever having a lower link 32 pivoted at 33 to the bracket 29 and pivoted at its upper end at 34 to the lower end of the upper link 35 which upper link is pivoted at 36 to the arm 21 at a point in spaced relation to the pivot 28 of the arm 21.

The upper link 35 is in the nature of a bell crank, it having an arm 37 to which is connected a piston rod 38 which piston rod is connected to a piston which operates in a conventional type of cylinder 39. The cylinder 39 is mounted on a trunnion 40 on the arm 21 and is provided with conduits 41 at its respective ends through which fluid under pressure may be introduced to operate the piston in the cylinder. The details of construction of the cylinder 39 and its piston are not shown inasmuch as they are of a conventional and well-known nature and form no specific part of this invention. A guide pin 42 extends upwardly from the pressure head 20 at a distance from its connection with the arm and slidably extends through a portion of the arm to prevent rotation of the head relative to the arm but with sufficient clearance to permit a limited self-alining movement thereof.

The pistons 3 and 4 are adapted to be operated in their respective cylinders by fluid pressure, preferably compressed air, and a valve is provided to control and direct the flow of the compressed fluid to actuate the pistons in proper sequence and in the desired manner. A manually operated valve is also provided in the air supply conduit to commence the operation of the pistons and to cut off the air pressure and permit the pistons to return to normal position.

The main compressed fluid supply conduit 43 leads from a convenient source of supply; a manually operable fluid control valve 44 is located in the conduit 43. The valve 44 is of conventional cock type having a hand lever 45 and is so constructed that when the hand lever is turned to one position a free passage is provided through the valve and when the lever is turned to another position the passage is closed at the inlet side of the valve and another passage is opened leading from the outlet side of the valve to an exhaust port 46 in the valve housing. This provides means whereby the compressed fluid may be permitted to pass through the valve to the operating valve beyond or cut off and exhausted through the port 46.

The operating valve mechanism comprises a piston valve, a vertical cylinder 47 having an inlet port 48 and two outlet ports 49 and 50 respectively. The inlet port 48 and the outlet port 49 are located near the upper end of the cylinder 47 in substantially the same plane and may be diametrically opposite each other as shown. The outlet port 50 is located at the lower end of the cylinder in the cylinder head 51 and communicates with a passage 52 extending upwardly through an axially located post 53 which post is fixed to the cylinder head 51, being preferably formed integral therewith. The fluid pressure supply conduit 43 communicates with the inlet port 48 and the outlet ports 49 and 50 communicate with the outer and inner cylinders 2 and 3 respectively.

A conduit 54 serves as the communication between the outlet port 49 and a passage 55 in the base of the machine which passage enters the lower end of the outer cylinder 2. A flexible conduit 56 extends from the outlet port 50 to a pipe 57 mounted on the inner piston 4 which pipe communicates with a passage through the lower head of said piston thereby directing the fluid into the inner cylinder 3. It will be remembered that the cylinder 3 is in the nature of a hollow piston serving as a piston in the outer cylinder 2 and also as a cylinder for the inner piston 4.

The cylinder 47 is provided with a valve 58 which piston valve has an axial opening 59 in its lower end to slidably receive the vertical post 53, said opening and post acting as a piston valve. The valve 58 is provided near its upper end with an annular space 60 which registers with both the ports 48 and 49 in any of its positions thereby insuring an open passage or communication between said ports at all times. The passage 52 in the post 53 extends upwardly through the upper end of the post and in which lateral ports 61 are provided extending from the passage 52 through the wall of the post to the exterior thereof.

Ports 62 extend from the opening 59 of the piston valve 58 to the annular groove 60, their lower ends communicating with the axial opening 59 near the bottom of the valve. When the valve 58 is in lower position the passages 62 are closed at their lower ends by the outer surface of the post 53 but when the valve is raised the lower ends of the passages 62 communicate with the openings 61 in the post and thus provide air passages from either of the ports 48 and 49 through the annular space 60, through the body of the valve and into the passage 52 communicating with the outlet port 50. An annular groove 61a is preferably provided on the outer side of the post 53 communicating with the opening 61 to insure communication between the passages 62 and the opening 61 regardless of the rotary position of the valve.

A restricted opening 63 extends from at least

one of the ports 62 to the axial opening 59 at a point somewhat above the openings of the passages 62 into said axial opening 59. This restricted passage is out of communication with the openings 61 when the piston is in lowered position but communicates with said openings 61 when the piston is partly raised.

A valve stem 64 is attached to the valve 58 and extends through a stuffing box 65 in the head of the cylinder 47 and is provided near its free end with a yieldable stop 66. The stop 66 has a ball 67 pressed inwardly by spring 68 and normally engages a notch or annular groove 69 provided near the end of the valve stem 64. The ball 67 by engaging the groove forms a yieldable stop for the stem 64. The operating valve is mounted on some fixed portion of the machine such as the bracket 16 and an arm 70 extends from some portion of the outer piston 3 such as the apron 5 thereof and the outer end of the arm is adjacent the valve stem 64 and is preferably forked to embrace the stem. A cushion washer 71 is preferably laid on top of the outer end of the arm 70 and upward movement of the outer piston 3 carries the arm 70 upward and engages the washer 71 with the collar 66 to raise the valve 58 of the operating valve. The spring pressed ball 67 will yield under abnormal pressure and permit the stop 66 to slide on the stem 64 to prevent breakage.

Various sealing rings to prevent leakage of compression in the several cylinders are illustrated in the several pistons and valve of the machine but have not been specifically referred to as their use is common practice. Relief openings 72 and 73 are provided at the respective upper and lower ends of the cylinder 47 above and below the valve 58 to insure free movement of the piston in the cylinder.

Operation

When a proper pattern, as 10, and pattern plate 11 are mounted on the table 12 and the machine has been properly adjusted for operation, the arm 21 carrying the pressure head 20 is swung upwardly and rearwardly by action of the fluid pressure against the piston in the cylinder 39 acting upon the toggle links 32 and 35. The hand lever 45 of the valve 44 is turned to shut-off position and the pistons 3 and 4 are in lowered position. In this position the pattern and pattern plate 10 and 11 will be lowered into the supporting frame 7 as shown in Fig. 1. The flask 17 is then placed on the supporting frame 7 and the dummy frame 19 is placed on the upper edge of the flask 17. The operator then deposits sand above the pattern and pattern plate in sufficient quantity to fill the supporting frame 7 above the pattern plate and to completely fill the flask 17 and dummy frame 19. He then strikes off the surplus sand flush with the upper surface of the dummy frame 19 and removes the dummy frame thereby leaving a quantity of sand projecting above the upper edge of the flask 17. The arm 21 and pressure head 20 are then swung forwardly and downwardly by action of the piston in the cylinder 39 and coacting parts above referred to, the parts being so arranged and adjusted that this forward and downward movement will stop with the lower surface of the pressure head 20 in engagement with the surface of the sand in the flask.

It is advisable to first perform the "top squeeze", that is, to compress or squeeze the sand above the upper portion of the flask left by the removal of the dummy frame into the flask, which action is accomplished by upward movement of the outer piston 3 forcing the flask against the pressure head 20 and corresponding lower squeeze is then made by the upward movement of the inner piston 4 which carries the table 12 and pattern plate 11. In other words all of the supporting members, move upwardly, carrying the pattern with the pattern plate, the flask and the sand contained therein as a body, forcing the sand that was in the dummy frame against the pressure head 20 which compresses it into the upper portion of the flask and around the flask bars 18.

The next step of the operation is to retain the flask and supporting frame in its raised position and to move the pattern and pattern plate upwardly within the frame 7 to perform the "bottom squeeze", that is, to compress the sand in the lower portion of the flask and around the pattern. This action is accomplished by movement of the inner piston 4 within the outer piston 3 as the outer piston is held in raised position.

The pistons are actuated as above described by means of compressed air or other pressure fluid admitted to the respective cylinders in the proper sequence by actuation of the manual valve and the operating valve. To start the operation the lever 45 is turned to open position of the valve. The fluid passage through the valve 44 is then opened and admits pressure fluid into the port 48 from where it passes around the annular groove 60 and out through the port 49, through the conductor 54, the passage 55 and into the lower end of the cylinder 2.

The position of the operating valve at the beginning of the operation is shown in Fig. 6. As the fluid enters the cylinder 2 it raises the outer piston 3, and also the inner piston 4 which is supported within it, thus carrying all of the supporting members upwardly as above described and compressing the sand against the pressure head 20. This movement requires that heavy pressure be exerted to sufficiently compress the sand. As the parts, including piston 3, move upwardly, the arm 70 mounted on the apron 5 of the outer piston 3 rises and when the stroke has been completed the arm engages the collar 66 and carries the valve 58 upwardly.

As the piston is moved upwardly the restricted passage 63 registers with an opening 61 and admits a restricted flow of compressed fluid through a passage 62, the opening 61, and through the various passages and conductors 52, 50, 56 and 57 into the inner cylinder 3. Admitting fluid pressure in a restricted quantity in this manner slowly builds up a pressure in the inner cylinder below the piston 4 during the time that the several supporting parts are being moved upwardly by pressure in the outer cylinder below the piston 3 until eventually such pressure is accumulated that will raise the piston 4 and in so doing raise valve 58 to the top of its upward travel.

This is accomplished by virtue of the fact that the fluid pressure within the passages leading to the inner cylinder below the piston 4 also acts directly upon the upper end of the opening 59 in the valve and when such pressure is great enough the valve will be lifted to the top of its travel. The intermediate position of the valve 58 is shown in Fig. 7 wherein the arm 70 has raised the valve 58 to register the restricted passage 63 with an opening 61.

The final position of the valve 58 is shown in Fig. 8 wherein the valve 58 has been raised by fluid pressure to the top of its travel. In the final

position of the valve all of the passages 62 register with the openings 61 which affords a relatively free passage of fluid pressure through these ports and openings and through said passages and conductors 50, 52, 56 and 57 to the interior of the inner cylinder which causes the inner piston 4 to rise relative to the outer piston and accomplishes the bottom squeeze by raising the pattern and pattern plate within the supporting frame 7. In this latter movement the pressure to raise the inner piston 4 is also acting oppositely against the lower end of the outer piston 3 but it will be noted that the area of the end of the piston 3 exposed to the same pressure is greater than that of the inner piston 4 and therefore the outer piston will remain raised.

The upward movement of the pattern and pattern plate and the table 12 on which they are supported is limited by engagement of the stop 12a with the under side of the supporting frame 7. In this position the top of the pattern plate is substantially flush with the lower edge of the flask. The upward movement of the outer piston 3 is stopped by engagement of the heads of the stop bolts 15 with the bosses 16. These stop bolts are adjusted to stop the movement with the upper edge of the flask 17 in engagement with the lower surface of the pressure head 20.

After the sand has thus been squeezed both top and bottom it is desirable to return the parts to normal position and at the same time perform the so-called stripping action, that is, to withdraw the pattern from the mold. The reverse operation is effected by manual operation of the valve 44, turning the lever 45 to shut off the supply of fluid pressure and at the same time opens the exhaust passage which permits pressure to flow backwardly through the valve and through the exhaust port 46. When the valve has been so turned air in both the inner and outer cylinders will escape through the conduits and passages to the operating valve which is then in the position shown in Fig. 8 and affords a free outlet from the ports 49 and 50 to the port 48 from where it escapes through the valve 44.

As the pressure fluid escapes from the cylinders the respective pistons therein will lower and carry the flask containing the mold away from the pressure head 20 and at the same time lowering the pattern plate and pattern within the supporting frame 7 and away from the mold which is held supported in the flask on top of the supporting frame.

During the return movement, pressure fluid escapes from both cylinders 2 and 3 simultaneously, the pressure fluid from the outer cylinder 2 escapes through the port 49 and the annular groove 60 and the port 48 while pressure fluid from the inner cylinder 3 escapes through the port 50 and the passages 52, 61 and 62 into said annular groove 60 and out of the port 48. Both pistons 4 and 3 will lower in their respective cylinders simultaneously until each has reached the bottom of its stroke and during this operation the valve 58 is held in raised position by pressure of the escaping air against the upper end of the axial opening 59 therein in which position the openings 61 register with the passages 62 to permit a substantially unobstructed flow of pressure fluid.

After the pressure fluid ceases to flow from the cylinders 2 and 3, and particularly from the cylinder 3, the pressure against the upper end of the axial opening 59 ceases whereupon the valve 58 will lower to its original or normal position shown in Fig. 6, the small amount of pressure fluid necessarily displaced from the upper end of the axial opening 59 to permit this movement being passed off by ordinary leakage. It will be understood that the arm 70 has been lowered with the cylinder 3 to which it is attached which will permit the valve 58 to lower.

After the parts have returned to their lowered or normal position they will again be in the position shown in Fig. 1 excepting that the sand will be compressed in the mold and the pressure head 20 may then be swung upwardly and rearwardly out of the way to permit removal of the flask with the mold. In these relative positions the completed mold with the sand squeezed therein will be supported within its flask 17 upon the upper edge of the supporting frame 7 and the pattern 10 will be withdrawn from the mold and will be located in a position below it and thus the completed mold may be readily lifted out of the machine after which another flask is placed in position on the supporting plate, filled with sand as heretofore described and the operation of producing another mold repeated.

I claim:

1. A molding machine comprising, means for supporting a flask to contain sand for a mold, a pattern associated therewith, means for supporting said pattern, a pressure head above said flask, means for moving said flask upwardly toward said pressure head for the purpose of compressing sand into the top side of said flask into said flask from adjacent the top of said flask, means for maintaining the flask in its upper position, and means for raising said pattern plate and pattern while the flask is in its upper position for the purpose of compressing sand from the lower side of the flask into said flask and against the pattern.

2. A molding machine comprising, means for supporting a pattern, means for supporting a flask elevated above said pattern, said flask being adapted to contain sand deposited therein around said pattern, a pressure head above said flask, means for raising said flask and pattern toward said pressure head, means for holding the flask in its raised position and means for raising said pattern relative to said flask and pressure head.

3. A molding machine comprising, a supporting frame, a flask located above said supporting frame, a pattern supported for vertical movement in said supporting frame and adapted to be lowered below said flask, said flask having open upper and lower sides and said supporting frame having an open upper side and said flask and supporting frame being adapted to receive sand above said pattern, a pressure head located above said flask and means for raising said flask, supporting frame and pattern toward said pressure head for the purpose of compressing the sand in the flask and around the pattern from both the upper and lower sides thereof, said raising means functioning in immediate sequence upon the frame and pattern.

4. A molding machine comprising, a supporting frame, a flask located above said supporting frame, a pattern supported for vertical movement in said supporting frame and adapted to be lowered below said flask, said flask having open upper and lower sides and said supporting frame having an open upper side and said flask and supporting frame being adapted to receive sand above said pattern, a pressure head located above said flask, means for raising the supporting

frame, flask and pattern simultaneously toward said pressure head and means for raising the pattern within the said supporting frame toward said flask and pressure head.

5. A molding machine comprising, a supporting frame, a vertically movable member within said supporting frame serving as a movable bottom therefor, a pattern mounted on said vertically movable member, a flask mounted above said supporting frame, said flask having open upper and lower sides and said supporting frame having an open upper side and said flask and supporting frame being adapted to receive sand above said vertically movable member and pattern thereon, a pressure head located above said flask, means for simultaneously raising said supporting frame, flask, vertically movable member and pattern toward said pressure head, and means for raising the vertically movable member and pattern within the supporting frame and relative to said flask and pressure head.

6. A molding machine comprising, means for supporting a flask, means for supporting a pattern associated with said flask, said flask being adapted to contain sand around said pattern, a pressure head above said flask, fluid pressure actuated means for simultaneously raising said flask and pattern toward said pressure head, fluid pressure actuated means for raising said pattern relative to said flask and pressure head and automatic means for controlling the fluid pressure for actuation of both of said fluid pressure actuated means.

7. A molding machine comprising, means for supporting a flask, means for supporting a pattern associated with said flask, said flask being adapted to contain sand around said pattern, a pressure head above said flask, fluid pressure actuated means for raising said flask toward said pressure head, fluid pressure actuated means for raising said pattern relative to said flask and pressure head and automatic means to control the fluid pressure for operation of both of said pressure actuated means.

8. A molding machine comprising, means for supporting a flask to receive sand around a pattern associated therewith, means for supporting said pattern, a pressure head above said flask, means for moving said flask upwardly toward said pressure head for the purpose of compressing sand from the upper side in said flask, means for raising said pattern for the purpose of compressing sand from the lower side around said pattern in said flask, and automatic means for controlling the movements of both of said flask moving means and said pattern moving means.

9. A molding machine comprising, means for supporting a flask to receive sand around the pattern associated therewith, means for supporting said pattern, a pressure head above said flask, means for simultaneously moving said flask and pattern upwardly toward the pressure head, means for raising said pattern relative to said flask and pressure head and automatic means for controlling the movements of both of said flask moving means and said pattern moving means.

10. A molding machine comprising, a fixed vertical cylinder, a combined piston and cylinder therein, a supporting frame carried by said combined piston and cylinder, a flask supported by said supporting frame, said flask having open upper and lower sides and said supporting frame having an open upper side, an inner piston in said combined piston and cylinder, a pattern plate and pattern located in said supporting frame and carried by said inner piston, a pressure head located above said flask and means for injecting compressed fluid into said fixed cylinder, means for maintaining it therein, and additional means for injecting fluid into said combined piston and cylinder to elevate the respective pistons therein.

11. A molding machine comprising, a fixed vertical cylinder, a combined piston and cylinder therein, a supporting frame carried by said combined piston and cylinder, a flask supported by said supporting frame, said flask having open upper and lower sides and said supporting frame having an open upper side, an inner piston in said combined piston and cylinder, a pattern plate and pattern located in said supporting frame and carried by said inner piston, a pressure head located above said flask, means for injecting fluid into said fixed cylinder and said combined piston and cylinder to elevate the respective pistons therein, and means for limiting the upward movement of the inner piston relative to the combined piston and cylinder.

12. A molding machine comprising, a fixed vertical cylinder, a combined piston and cylinder therein, a supporting frame carried by said combined piston and cylinder, a flask supported by said supporting frame, said flask having open upper and lower sides and said supporting frame having an open upper side, an inner piston in said combined piston and cylinder, a pattern plate and pattern located in said supporting frame and carried by said inner piston, a pressure head located above said flask, means for injecting fluid into said fixed cylinder, then into both the fixed cylinder and said combined piston and cylinder and then into said combined piston and cylinder to elevate the respective pistons in sequence, means for limiting the upward movement of said combined piston and cylinder relative to said fixed cylinder, and means for limiting the movement of the inner piston relative to the combined piston and cylinder.

13. A molding machine comprising, a fixed vertical cylinder, a combined piston and cylinder therein, a supporting frame mounted on said combined piston and cylinder, a flask mounted on said supporting frame, a pressure head over said flask, an inner piston in said combined piston and cylinder, a pattern and pattern plate located within said supporting frame and mounted on said inner piston, and an automatic fluid control valve connected with a source of fluid pressure and also connected with said fixed cylinder and said combined piston and cylinder and provided with means for first directing fluid to said fixed cylinder and then for directing fluid to said combined piston and cylinder.

14. A molding machine comprising a fixed vertical cylinder, a combined piston and cylinder therein, a supporting frame mounted on said combined piston and cylinder, a pressure head over said frame, an inner piston slidable in said combined piston and cylinder, a pattern located within said supporting frame and mounted on said inner piston, an automatic fluid control valve connected with a source of fluid pressure and also connected with said fixed cylinder and said combined piston and cylinder and provided with means for directing the fluid to said fixed cylinder and additional means for directing the fluid to said combined piston and cylinder and means for operating said additional means, said operating means being operated by movement of

the combined piston and cylinder to a predetermined position.

15. A molding machine as set forth in claim 14 in which a reservoir of predetermined size is provided between the inner piston and the combined piston and cylinder and means for causing a flow of pressure fluid therebetween simultaneously with the concluding movement of the pressure flow to the fixed vertical cylinder.

16. A combination of elements as set forth in claim 14 in which the automatic fluid control valve is actuated by a vertically movable member, said vertical movable member being rigidly attached to the outer piston, said automatic fluid control valve having means therewithin for providing a restricted flow due to the actuation by said extension and also having means for providing full and complete flow of pressure fluid to the space between the inner piston and the combined piston cylinder in which it is mounted.

17. A molding machine of the class described comprising, a base, a cylinder rigidly formed therewith, a combined piston and cylinder slidably mounted in the said cylinder, an extension extending outwardly from the top of the combined piston and cylinder, a table, means for mounting the table on said extensions, a mold receivable upon said table, a piston slidably mounted within the combined piston and cylinder, a pattern mounted upon the top of said piston and means for introducing fluid pressure between the cylinder and the combined piston and cylinder and also between the combined piston and cylinder and the piston located within the same.

18. A molding machine as set forth in claim 14 in which additional extensions are formed on the combined piston and cylinder, and lost motion means are associated therewith and with the said base whereby the upward movement of the mold is limited.

DONALD J. CAMPBELL.