Oct. 27, 1942. F. N. GILLILAND 2,300,148

MOLD AND CORE BLOWING MACHINE

Filed July 27, 1940 5 Sheets-Sheet 1

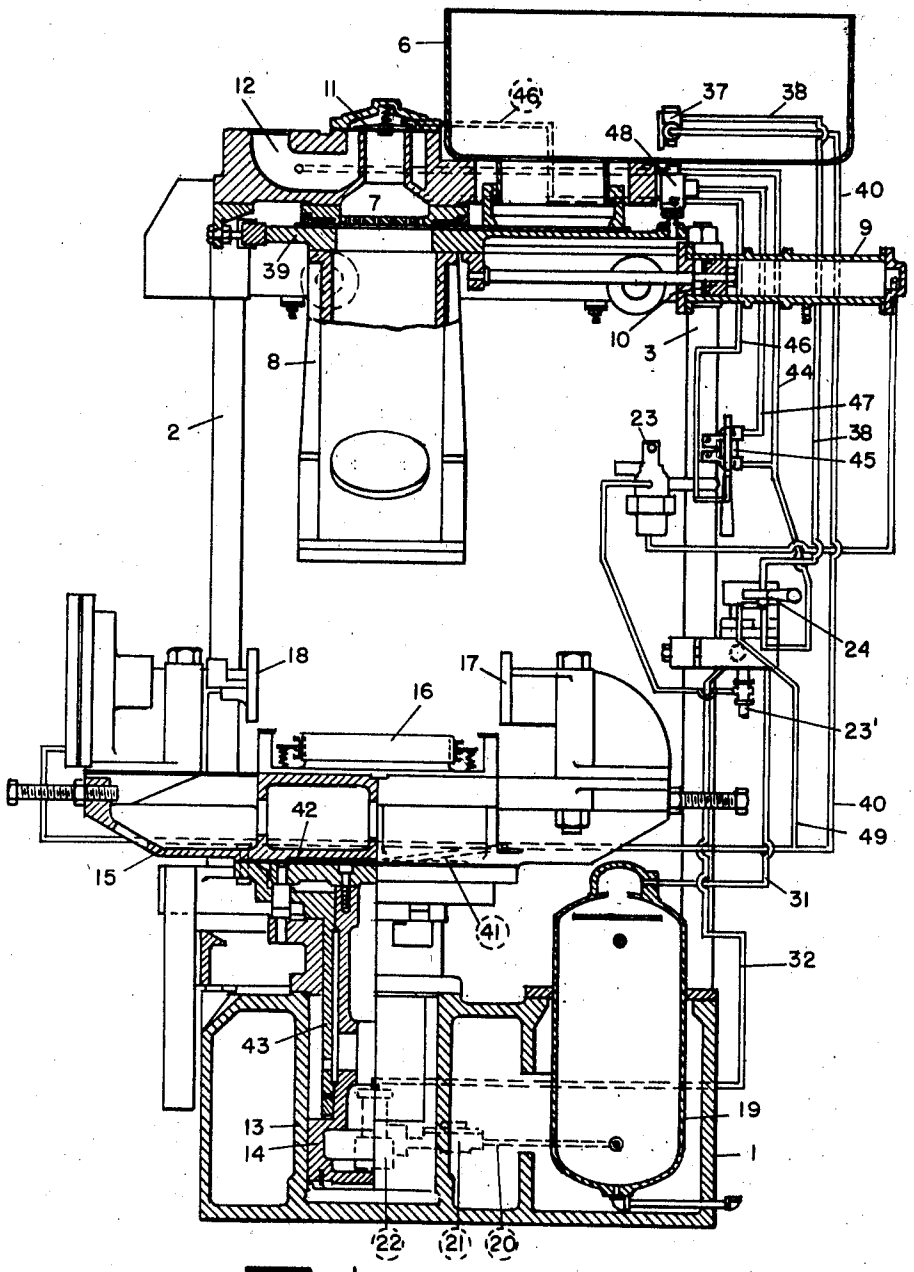


FIG. 1

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MOLD AND CORE BLOWING MACHINE

Filed July 27, 1940 5 Sheets-Sheet 2

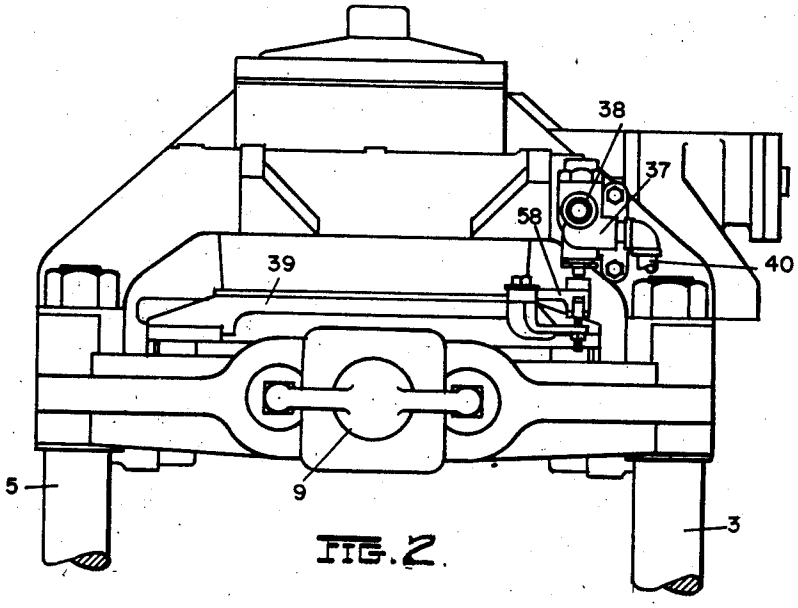


FIG. 2.

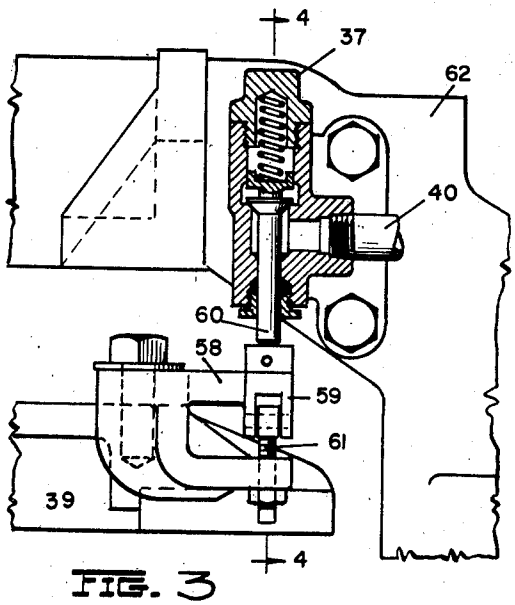


FIG. 3

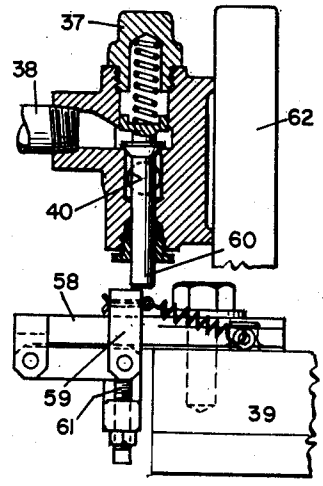


FIG. 4.

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MOLD AND CORE BLOWING MACHINE

Filed July 27, 1940 5 Sheets-Sheet 3

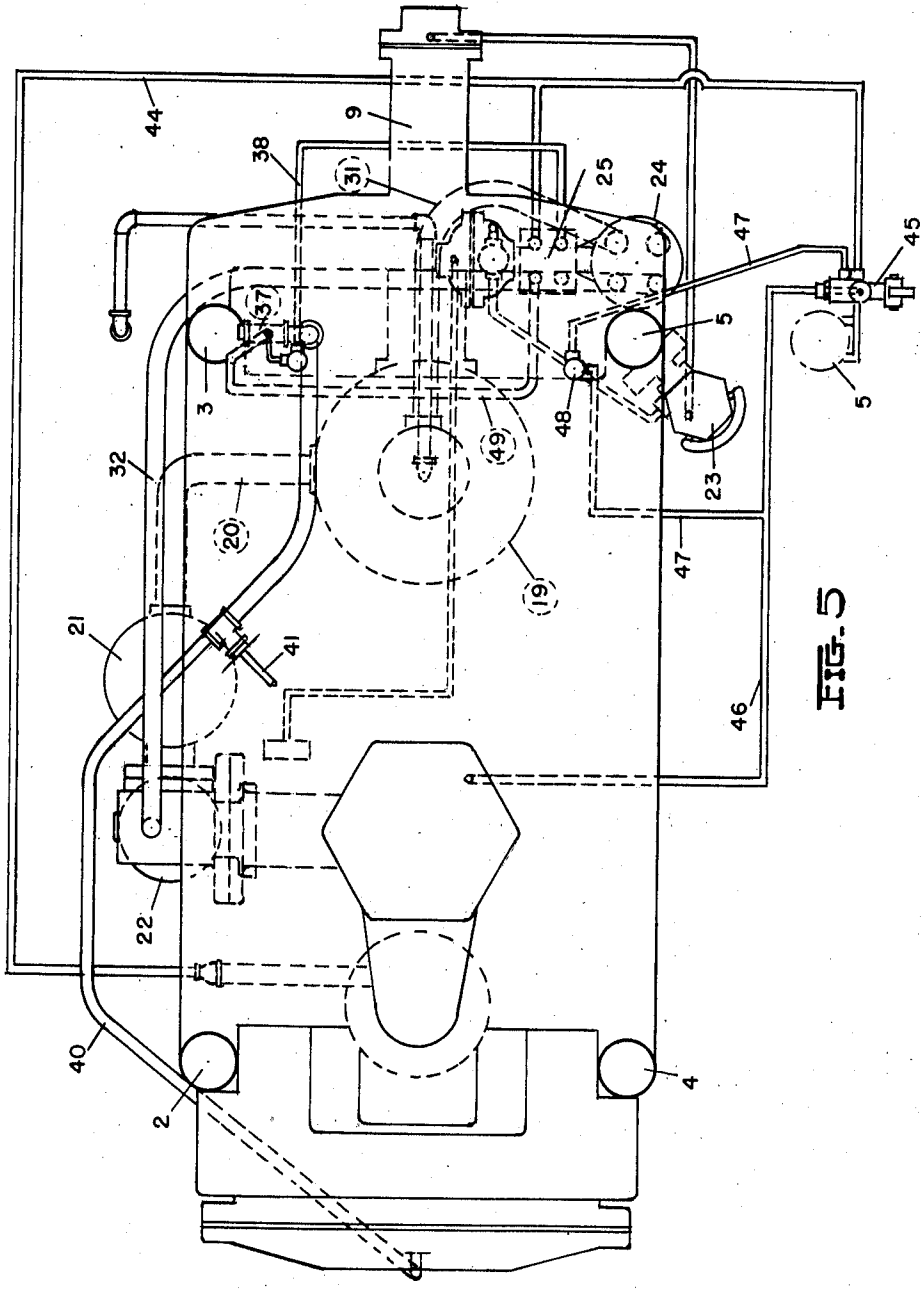


FIG. 5

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MOLD AND CORE BLOWING MACHINE

Filed July 27, 1940 5 Sheets-Sheet 4

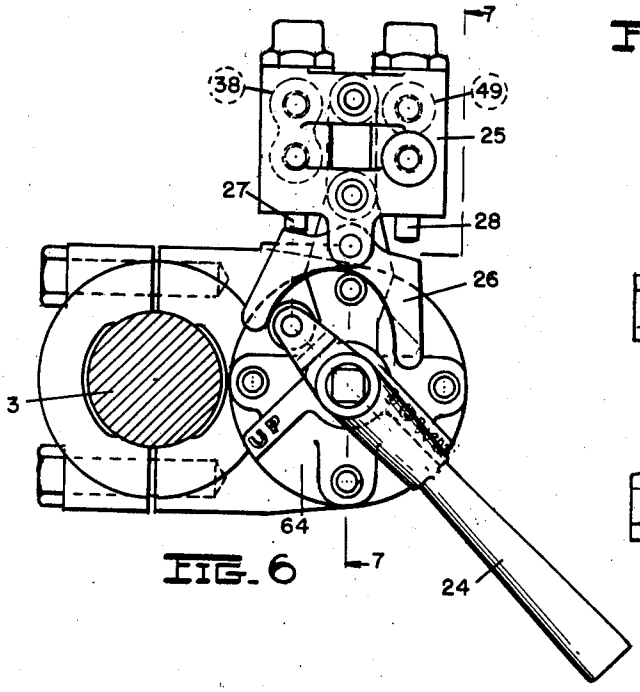


FIG. 6

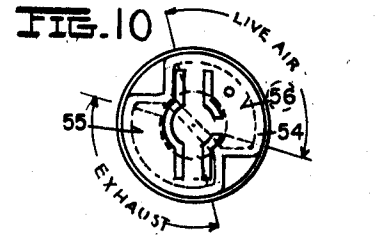


FIG. 10

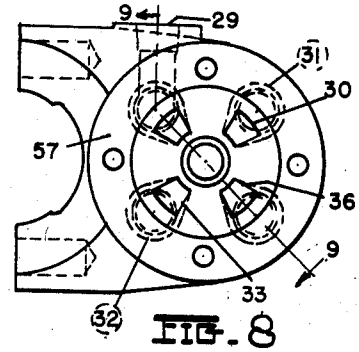


FIG. 8

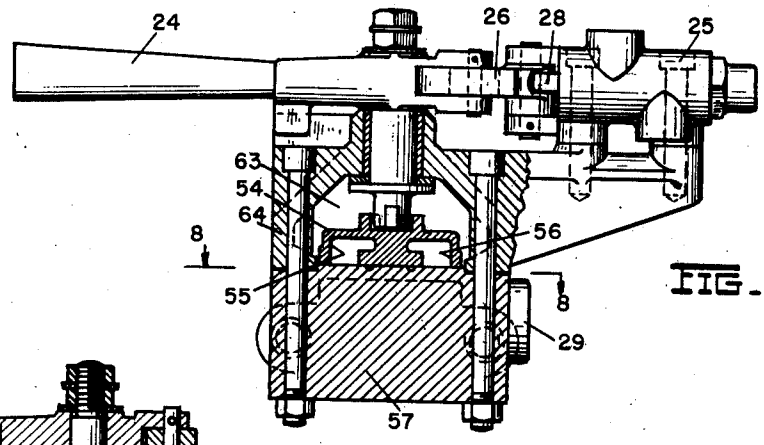


FIG. 7

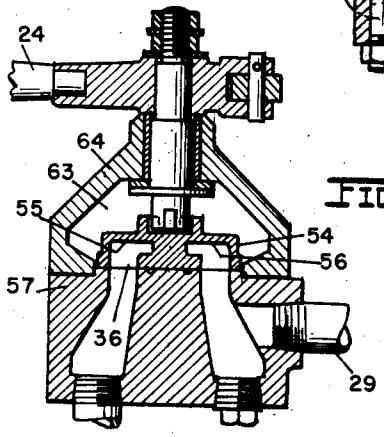


FIG. 9

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MOLD AND CORE BLOWING MACHINE

Filed July 27, 1940 5 Sheets-Sheet 5

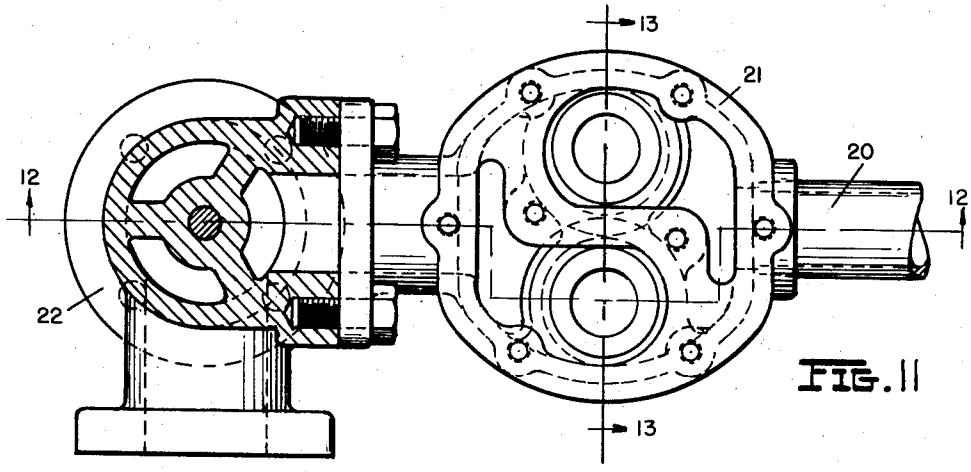


FIG. 11

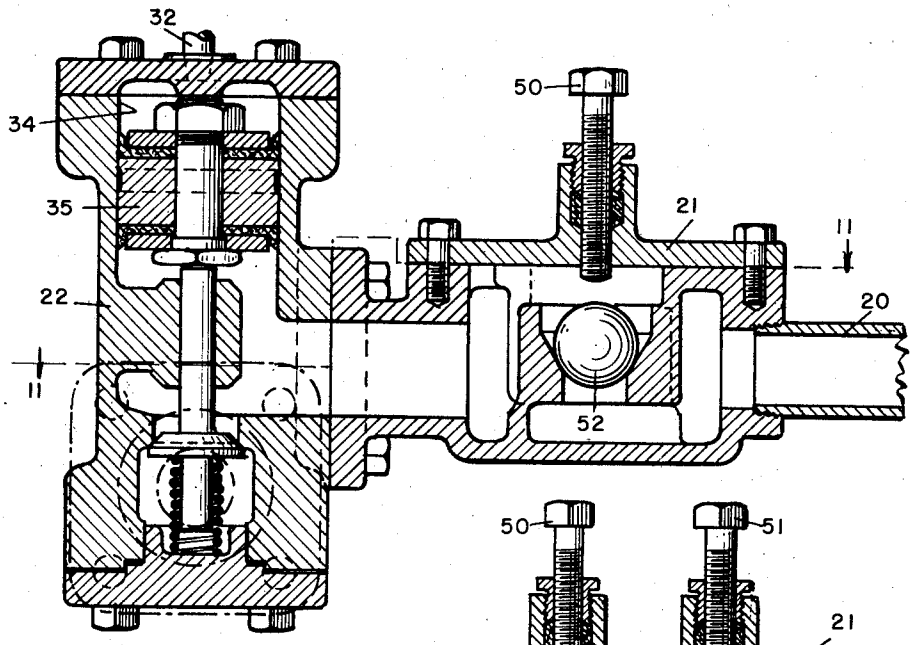


FIG. 12

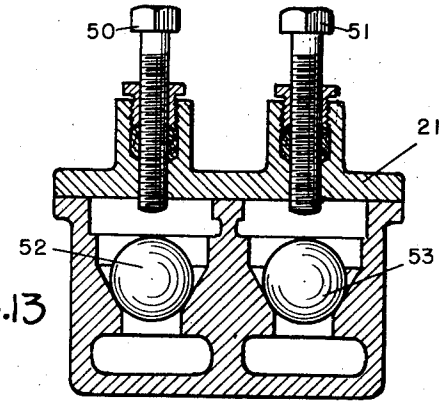


FIG. 13

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Patented Oct. 27, 1942

2,300,148

UNITED STATES PATENT OFFICE

2,300,148

MOLD AND CORE BLOWING MACHINE

Francis N. Gilliland, Shaker Heights, Ohio, assignor to The Osborn Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application July 27, 1940, Serial No. 347,898

5 Claims. (Cl. 22—10)

This invention relates, as indicated, to mold and core blowing machines and the like in which sand is blown into a core box, mold or form.

Various types of machines for the above designated purpose have long been known in the art and certain features in their construction have become quite standardized. In those machines which are of the semi-automatic type, pneumatic means are quite generally employed to operate the mold clamping means and other moving parts. Such machines usually comprise an air chamber, a sand hopper, and a sand chamber transversely movable into and out of respective subjacent engagement therewith. Means for supporting a core box or mold below the sand chamber when the latter is in blowing position are also provided, such means being adapted to be elevated to bring the top of the mold or core box into engagement with the lower end of the sand chamber. Movable jaws are provided to assist in firmly positioning the mold or core box on such supporting means.

While compressed air has quite generally been used to elevate the core supporting means to bring the same into engagement with the sand chamber, this has not proven entirely satisfactory for the following reasons. Since a very firm and tight seal must be obtained between the upper end of the core box and the lower end of the sand chamber, it is necessary to exert considerable air pressure to hold such core box in tight engagement. Furthermore, the requisite air cylinders are very bulky and make for an inconveniently large and awkward machine. When drawing cores it is of course extremely important that the movement be slow but firm and steady. This is difficult to achieve when employing pneumatic elevating means, such means generally tending to allow too rapid and unsteady a draw.

It is therefore a primary object of this invention to provide a mold and core blowing machine which will be rapid and semi-automatic in operation but which will not require the usual excessive and wasteful employment of high pressure air.

A further object of this invention is to provide such a machine which will be operable to permit of a slow and steady draw when drawing cores.

Another object of this invention is to provide a machine as indicated above which will not be of the usual bulky dimensions and which will be quick and convenient in operation.

Other objects of this invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a side elevational view, partly in cross section, of my new machine showing certain of the piping and other connections in diagrammatic fashion;

Fig. 2 is an enlarged end view of the upper portion of such machine showing the valve which controls the operation of the final clamping means;

Fig. 3 is an enlarged sectional view of such valve;

Fig. 4 is a further sectional view of such valve taken along the line 4—4 on Fig. 3;

Fig. 5 is a top plan view of the machine with a somewhat diagrammatic layout of the valve and piping system;

Fig. 6 is a top view of the master control valve;

Fig. 7 is a sectional view of such valve taken along the line 7—7 on Fig. 6;

Fig. 8 is a view of such valve taken along the line 8—8 on Fig. 7;

Fig. 9 is a sectional view of such valve taken along the line 9—9 on Fig. 8;

Fig. 10 is a top view of the rotatable valving member of such valve;

Fig. 11 is a top view, partly in cross section, taken along the line 11—11 on Fig. 12, of the fluid check and velocity control valves employed to regulate the flow of hydraulic fluid in the machine of my invention;

Fig. 12 is a vertical sectional view of such valves taken along the line 12—12 on Fig. 11; and

Fig. 13 is a vertical sectional view of the flow regulating valve taken along the line 13—13 on Fig. 11.

Referring now more particularly to the above-identified drawings, and especially Figs. 1 to 5 inclusive, the machine of my invention comprises a base member 1 supporting four columns 2, 3, 4 and 5. Carried by the upper ends of said columns are a sand hopper 6 and a blow chamber 7. Mounted below said air chamber and hopper and transversely movable into and out of respective subjacent engagement therewith is a sand

chamber 8. The position of said sand chamber is controlled by air pressure in cylinder 9 acting on piston 10 against the force of a coil spring (not shown). A diaphragm valve 11 is provided above blow chamber 7, sealing the same from adjacent air pressure chamber 12.

Mounted in hydraulic cylinder 13 in base 1 of the machine is a piston 14 supporting a horizontally disposed frame member 15 which in turn carries table 16 upon which the mold or core box is placed. An abutment 17 fixedly mounted on said frame member 15 together with movable jaw 18 forms the lateral clamping means for holding the mold or core box rigidly on said table. A reservoir 19 for hydraulic fluid is also provided in the base of the machine, said reservoir communicating with the lower end of cylinder 13 by way of pipe 20, flow control valve 21 and check valve 22.

The various control valves will be described in connection with the explanation of the operation of the machine.

Beginning the cycle of operation with the sand chamber 8 in receiving position beneath hopper 6, after said chamber has received its charge, air is admitted to cylinder 9 by operation of valve 23 which admits air from low pressure inlet 23' causing piston 10 to move chamber 8 laterally into position beneath blow chamber 7. A core box or mold will of course have been placed upon table 16. The sand chamber is now in blow position.

Main control valve 24 (see Figs. 6 to 10) is now turned to the "up" position simultaneously operating double acting high pressure valve 25 by means of reciprocable yoke 26 and plungers 27 and 28. When valve 24 is turned to the "up" position low pressure air from inlet 23' enters through valve inlet 29 and passes to outlet 30 and thence through line 31 to oil reservoir 19, forcing oil through line 20, flow control valve 21 and check valve 22 into the lower end of cylinder 13. Piston 14 is thus caused to rise to bring the top of the mold or core box into engagement with the lower end of sand chamber 8. A line 32 leads from port 33 of valve 24 to cylinder 34 of valve 22, being adapted to convey air pressure thereto which, acting upon piston 35, may serve to open said valve. At the moment, however, said port 33 is bridged to exhaust port 36 of valve 24 since no additional pressure is required to hold said valve 22 open in view of the oil flowing therethrough under the pressure of the air introduced to reservoir 19 through line 31. Check valve 22, however, serves to lock piston 14 against downward movement since the hydraulic fluid in substantially non-compressible.

The turning of the handle of valve 24 to the "up" position also acts to close the exhaust side of valve 25 and open the pressure inlet side of such latter valve. High pressure air is thus admitted to valve 37 by way of line 38 but said valve 37 prevents further passage of the high pressure air until the core box has been sufficiently elevated by the hydraulic means to engage the lower end of sand chamber 8 and slightly raise the same together with sand chamber carriage member 39. A bracket 58 on said carriage member then engages the operating plunger of valve 37 opening the same and permitting high pressure air to flow through line 40 to operate lateral clamp 18 and also by way of a branch line 41 to enter the space between the diaphragm 42 and the lower face of the frame member 15. The diaphragm 42 rests on the upper end of the piston 14 so that introduction of high pressure air to the space between the diaphragm and the frame member 15 will cause the latter to be moved upwardly forcing the upper end of the core box into a final tight and firm seal with the lower end of the sand chamber 8. It will be observed that the effective cross sectional area of the diaphragm 42 thus acting as a pneumatic ram is considerably greater than the effective cross sectional area of the piston 14. This large effective cross sectional area of the diaphragm, the same being substantially greater than the effective cross sectional area within the sand chamber 8, insures that the core box will always be forced upwardly with a greater total force than the pressure of the sand blowing air which tends to force the core box downwardly. A sleeve 43, attached to frame member 15 extends downwardly therefrom to maintain proper alignment with piston 14. The core is now ready to be blown. High air pressure is maintained in chamber 12 by means of a large pipe, not shown, connected to the opening at the top of such chamber, such supply pipe being connected to a suitable compressor. High pressure air line 44 receives its supply of high pressure air from chamber 12.

High air pressure is therefore maintained in chamber 12 so that it is necessary to likewise maintain high pressure above diaphragm valve 11 to keep such valve closed. High pressure air from line 44 is therefore conducted through valve 45 and line 46 to the cavity above said diaphragm valve 11. Another line 47 also leads from said valve 45 to the cavity above diaphragm valve 11 via valve 48. Valve 48 is designed somewhat similarly to valve 37 to be opened when sand chamber 8 is elevated by the rising core box, and serves as a safety valve as will shortly appear. Valve 45 is then thrown, closing pressure line 46 and opening line 47 to exhaust. As valve 48 has now been opened, the air pressure above diaphragm valve 11 is released permitting said last named valve to open and admit the high pressure air from chamber 12 to blow the core. The safety feature of valve 48 will now be understood inasmuch as if the core box were not brought into tight engagement with sand chamber 8, thus lifting the latter, such valve would not be open so that even on the throwing of valve 45 the pressure in the cavity above valve 11 would not be diminished and no air would be admitted to the sand chamber.

When it is desired to stop the blow, the valve 45 is operated in reverse direction admitting air pressure through line 46 to close diaphragm valve 11 and simultaneously closing off exhaust line 47. The return of air pressure in line 46 also serves to actuate another valve, not shown, to release the air pressure in blow chamber 7 and sand chamber 8.

The valve 24 is now turned to the "down" position, acting through yoke 26 on plunger 27 to close off high pressure line 40 and, by releasing plunger 28, opening exhaust line 49, thus releasing the pressure actuated side clamp 18 and cylinder 42. Simultaneously, upon returning valve 24 to the "down" position, port 30 and exhaust port 36 are connected to relieve the pressure in oil reservoir 19. Low pressure inlet 29 and port 33 leading to line 32 are likewise connected, introducing air pressure into cylinder 34 of check valve 22, forcing such valve open and permitting the flow of oil therethrough from cylinder 13 and then through flow control valve 21 to reservoir 19. By adjustment of screws 50 and 51 balls 52

and 53 may be limited in the degree to which they may be displaced by the flow of liquid so as to ensure a steady and gradual rise of piston 14 and a similar slow and steady descent. As indicated above, this is very important when drawing cores. It will of course be understood that if a core is to be drawn the upper section of the core box will be fixed to sand chamber 8. It is likewise obvious that while the foregoing description has been specifically concerned with the blowing of core boxes and molds, the machine of this invention may be adapted for any similar operation involving the elevation of a container to tightly engage blowing means.

The mold or core box may now be removed from the table 16 and sand chamber 8 returned to filling position beneath hopper 6 by turning valve 23 to exhaust position.

Certain of the valves above referred to will now be described in more detail in order that the arrangement of their parts may be fully understood. Referring to Figs. 7, 9 and 10, valving member 54 comprises two cavities 55 and 56 designed to selectively bridge the ports in lower valve member 57. Cavity 56 is also in communication with cavity 63 of casing 64 in order that the pressure on member 54 may be balanced.

Referring now to Figs. 2, 3 and 4, the manner in which valve 37 is operated is therein illustrated in detail. Carriage member 39 carries a bracket 58 which in turn supports a sliding bar 59 adapted to engage the lower end of valve member 60. By adjusting screw 61 bar 59 may be adjusted to maintain exactly the amount of clearance desired. Thus when carriage member 39 is raised relatively to frame piece 62 by elevation of sand chamber 8 the end of bar 59 will engage the end of valve member 60, opening the valve and permitting the passage of high pressure air from line 38 to line 40.

From the foregoing description of the construction and operation of my improved machine, it will be observed that the core box supporting table is moved to and from the core blowing position by a combination of a relatively small hydraulic ram and a high-pressure, short-stroke air ram. The advantages of this arrangement may be enumerated as follows:

By this expedient, low pressure air may be employed to force the incompressible hydraulic fluid into the hydraulic ram for the purpose of raising the core box throughout the major portion of its movement. After the core box has thus been moved into engagement with the sand chamber 8, the check valve is closed, locking the incompressible hydraulic fluid in the hydraulic ram, which then acts as a rigid strut for the support of the high pressure air ram which is employed for the purpose of moving the core box into sealing engagement with the sand chamber with the high pressure necessary to be maintained during the blowing operation. If the entire movement of the core box were effected by a pneumatic jack, obviously all of such movement would have to be secured by high pressure air. If a compressible medium such as low pressure air were relied upon to move the core box throughout the major portion of its movement, i. e. into engagement with the sand chamber 8, such low pressure air would be unable to sustain the core box table in its elevated position during the application of the high pressure air required to force the core box into sealing engagement with the sand chamber with the force necessary during the blowing operation. By the use of incompressible fluid for the purpose of moving the core box during the major portion of its movement, such incompressible fluid may be trapped in the closed chamber of the hydraulic ram for any position of the core box, whereupon such hydraulic ram, as indicated above, becomes a rigid strut supporting the high pressure pneumatic means which then is required to move the core box for only a very small distance.

Use of a hydraulic jack in the manner described above makes possible not only this advantage in moving the core box to the sand blowing position, but also makes possible the drawing at the necessary slow and uniform rate as above described. The hydraulic fluid actuated by low pressure air is effective to perform the drawing operation at the necessary and even rate which could not be secured if the drawing operation were performed by the use of high pressure air. Moreover, the application of the low pressure air to the hydraulic fluid, and the operation of the jack in turn by such hydraulic fluid, results in smoother operation of the jack than would be obtained by direct application of the low pressure air to the jack.

It will therefore be seen that a novel machine has been provided for blowing molds, core boxes and the like which has numerous advantages over those previously known to the art, being both more easy and convenient of operation as well as more efficient. In the claims, where "core boxes" are referred to it will be understood that molds and the like constitute equivalents and that the invention is in no way limited to the blowing of cores.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In core blowing machines and the like having a blow chamber, a sand chamber therebelow, and a support adapted to support a core box or the like below such sand chamber; the improvement comprising hydraulic means operative to elevate such support, means operative to lock such support against downward movement, and air pressure means supplemental to said hydraulic means operative to further elevate said support to bring such core box into close engagement with such sand chamber.

2. In core blowing machines and the like having a sand chamber from which sand is blown into a core box or the like supported therebelow; the improvement comprising a vertically arranged hydraulic piston cylinder assembly, a core box support carried by an element of said assembly, check valve means operative to prevent downward movement of said element when said hydraulic assembly has been operated to elevate said support, and air pressure means interposed between said element and said support to further elevate said support to hold a core box carried thereby in tight engagement with said sand chamber.

3. In core blowing machines and the like having a sand chamber from which sand is blown into a core box supported therebelow; the improvement comprising a vertically arranged hydraulic piston cylinder assembly, a core box

support carried by said piston, relatively low pressure pneumatic means operative to act on hydraulic fluid to operate said hydraulic assembly, check valve means associated with said hydraulic assembly operative to prevent downward movement of said piston when said hydraulic assembly has been operated to elevate said support, and relatively high pressure pneumatic means interposed between said piston and said support to further elevate said support to hold a core box carried thereby in tight engagement with said chamber.

4. In core blowing machines and the like having a sand chamber from which sand is blown into a core box supported therebelow; the improvement comprising a vertically arranged hydraulic piston cylinder assembly, a core box support carried by said piston, relatively low pressure pneumatic means operative to act on hydraulic fluid to operate said hydraulic assembly to elevate said support until a core box carried by said support engages and slightly raises such sand chamber, a check valve in association with said hydraulic assembly adapted to prevent downward movement of said piston, a pneumatic diaphragm interposed between said piston and said support, valving means operative to admit relatively high pressure air to said diaphragm to further urge such core box against said sand chamber, and means connected with said sand chamber operative to open said valving means when said sand chamber is raised.

5. In mold making machinery, a work supporting table, a stop, hydraulic means operative to move said table toward said stop, means for locking said hydraulic means against return movement, and supplemental pneumatic means operative on said table to press such work against said stop.

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