

# United States Patent

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[54] **FOUNDRY MOLDING MACHINE WITH SAND VALVE SEAL AND DIAPHRAGM BLOW VALVE MEANS**  
**30 Claims, 11 Drawing Figs.**

[52] U.S. Cl..... **164/201;**  
**251/173; 259/9**

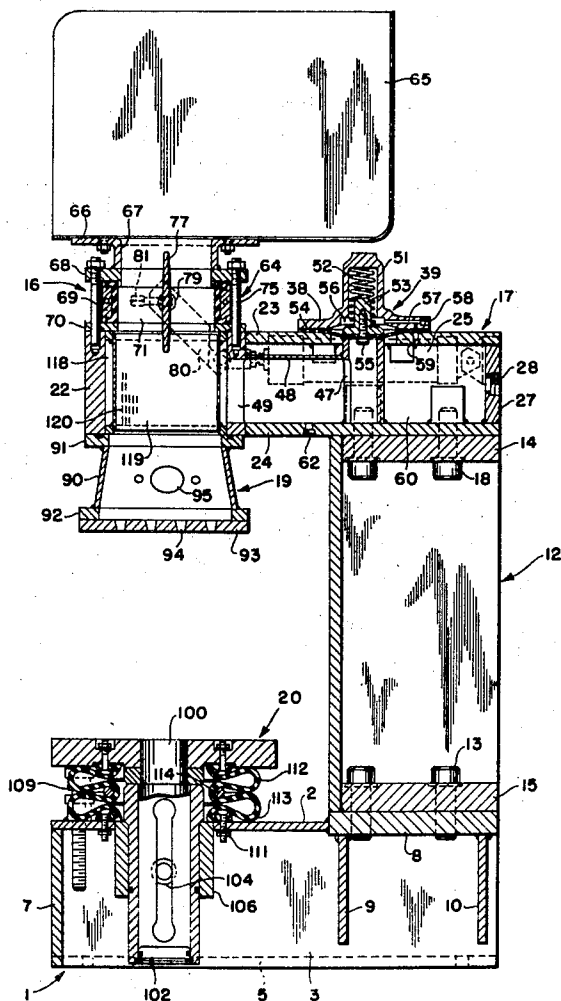
[51] Int. Cl..... **B22c 15/24**

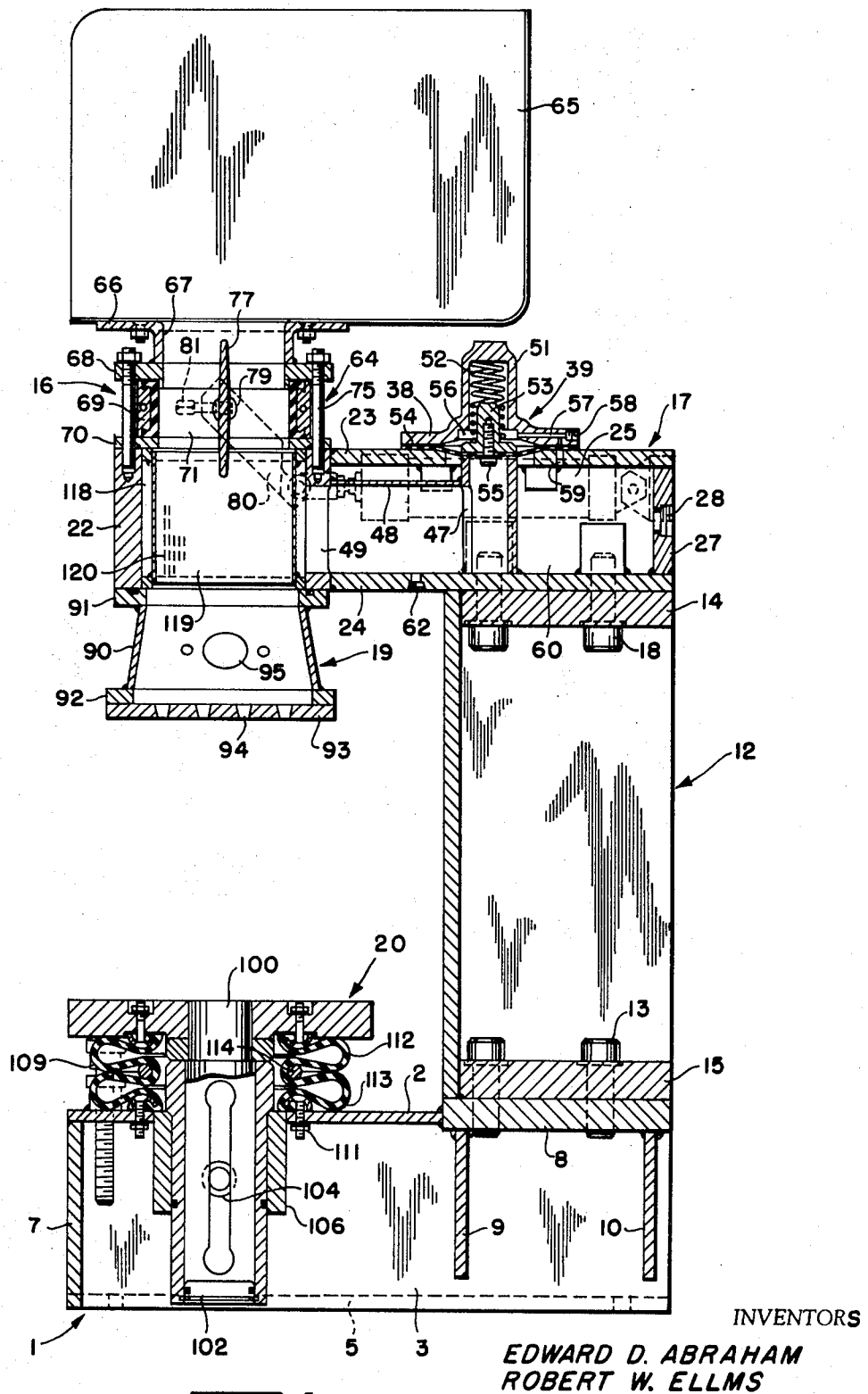
[50] Field of Search..... **164/200,**  
**201, 202, 37; 92/43, 44; 251/173; 259/9**

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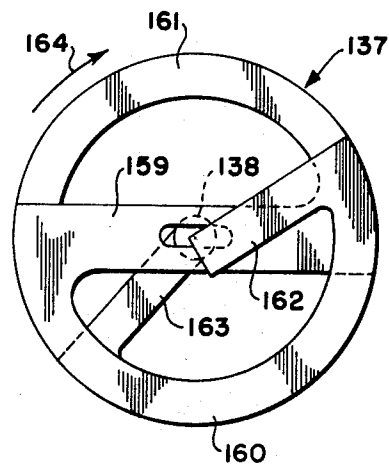
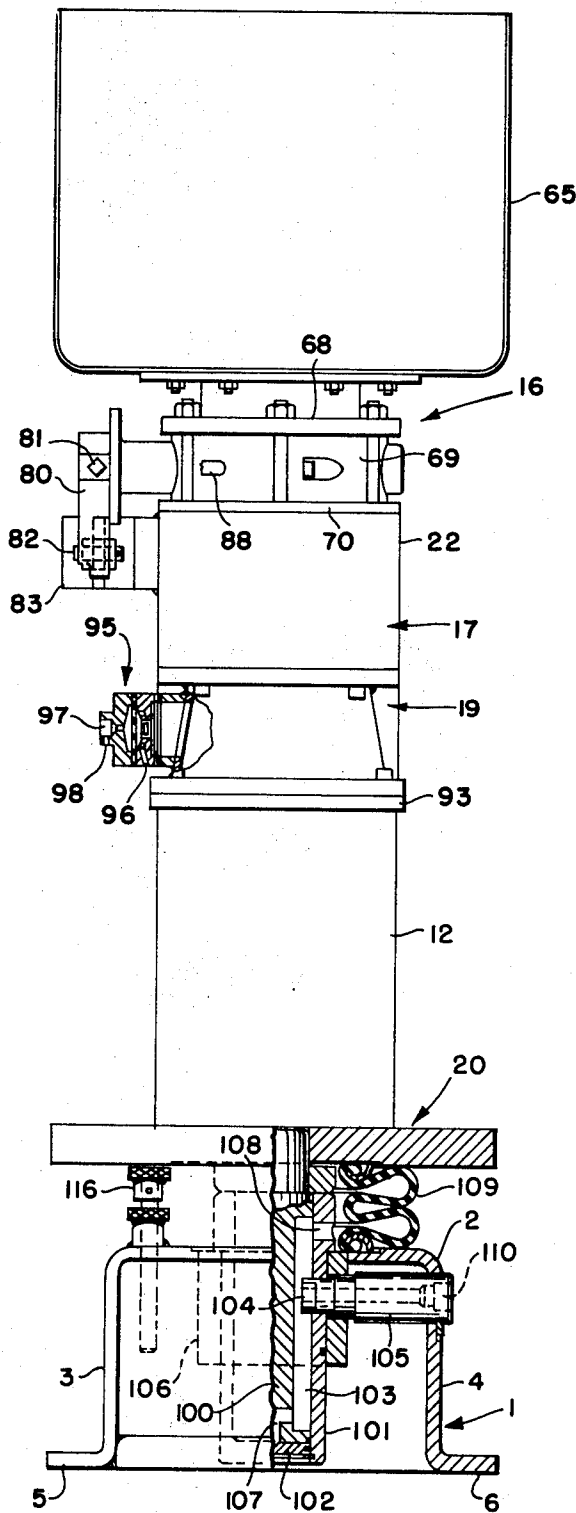
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**ABSTRACT:** A foundry mold or core blowing machine utilizing a bellows type clamp, a blow reservoir which may include an improved agitator or a screen having vertically elongated slits with a tangential introduction of air behind the screen, a butterfly valve having an improved seal for closing the reservoir, and a simplified pneumatic control system using fluid diversion from the blow valve for control interlocks and sequencing.





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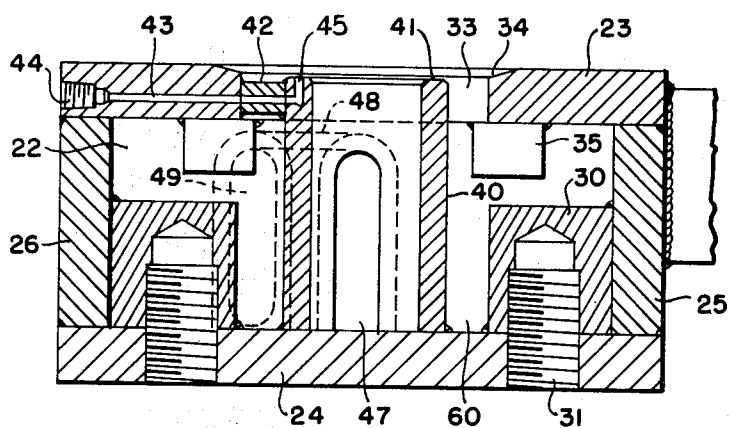
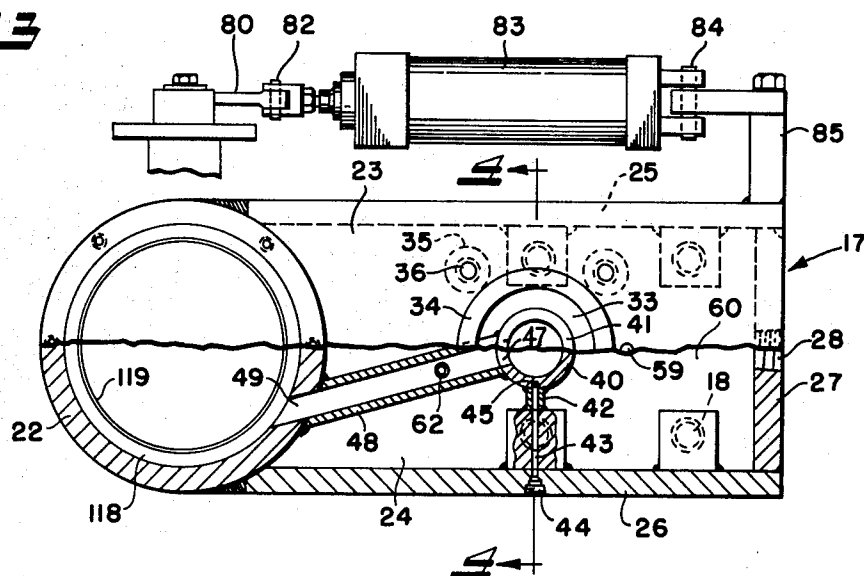
**FIG. 3**

**FIG. 2**

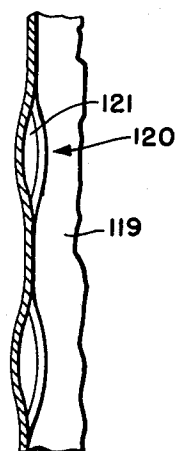
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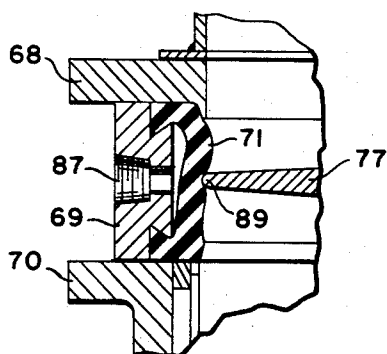
**Fig. 3**



**Fig. 4**



**Fig. 11**



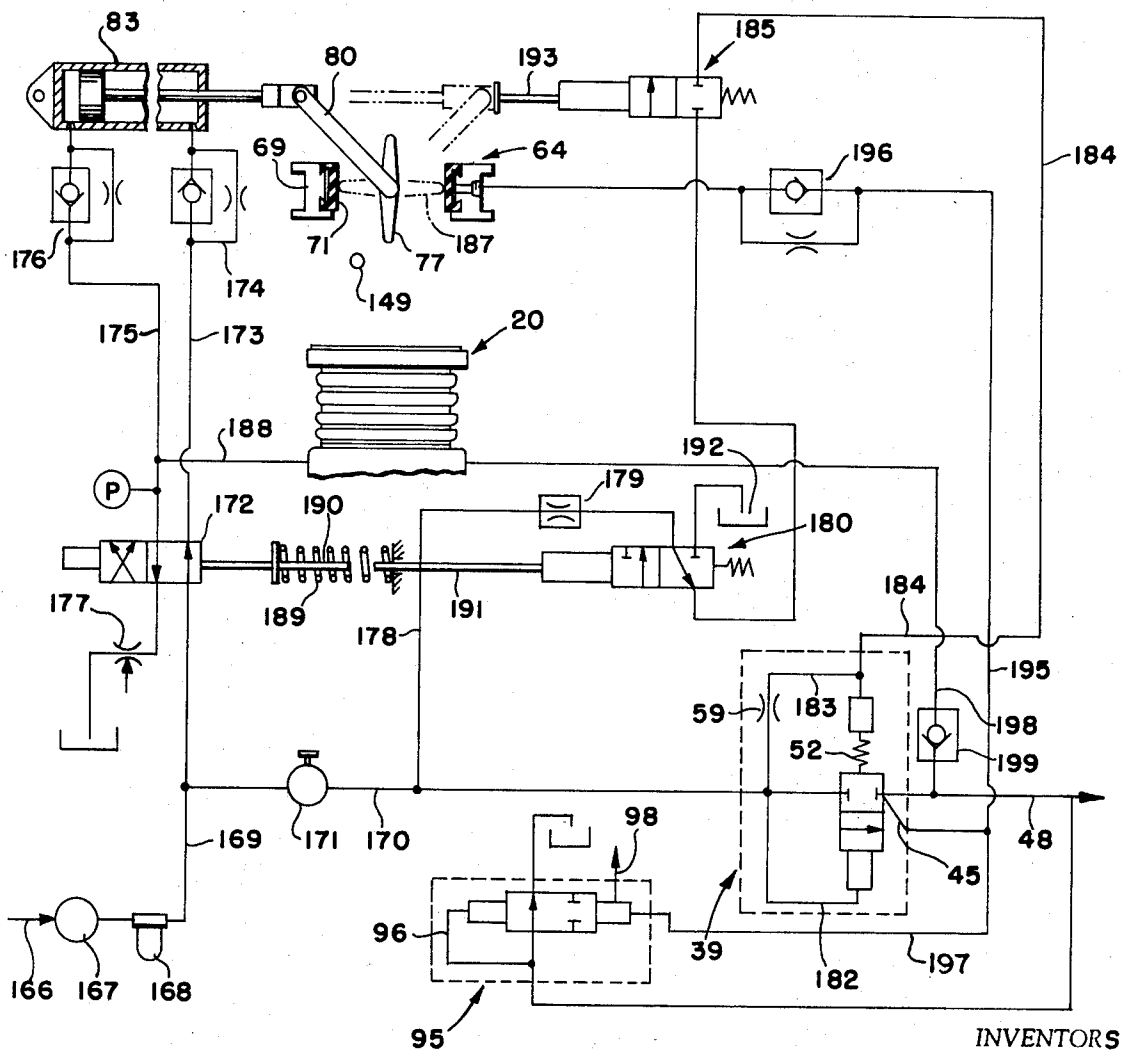
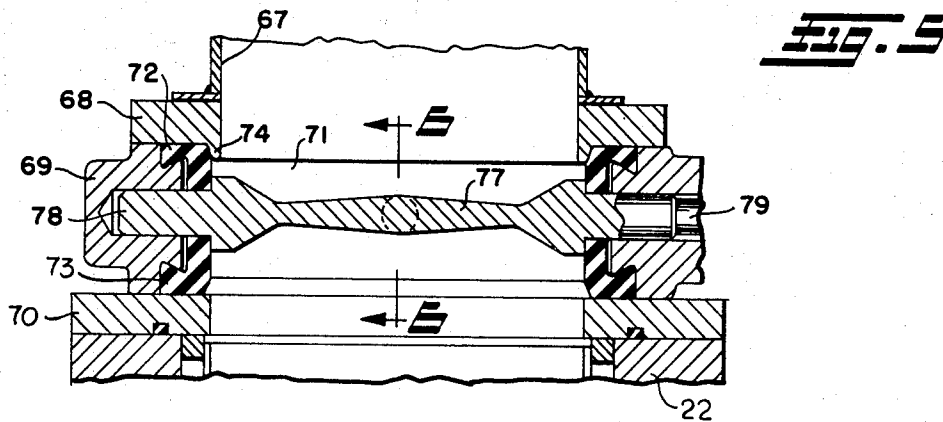
**Fig. 6**

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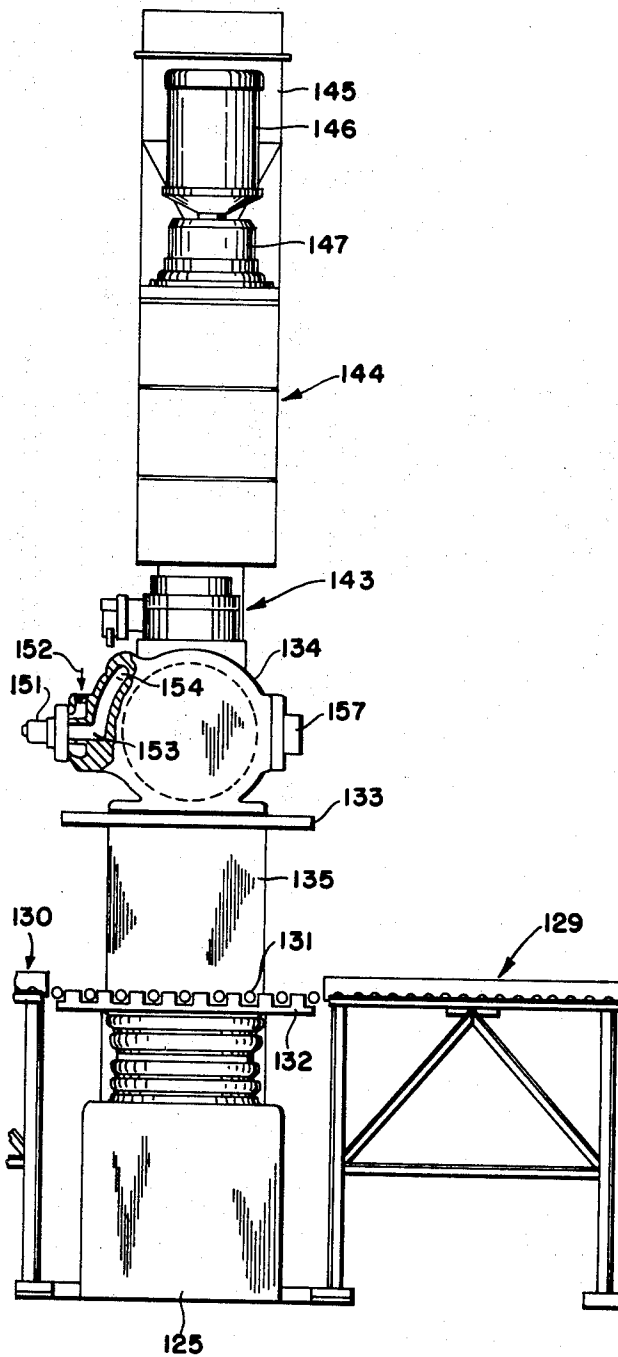
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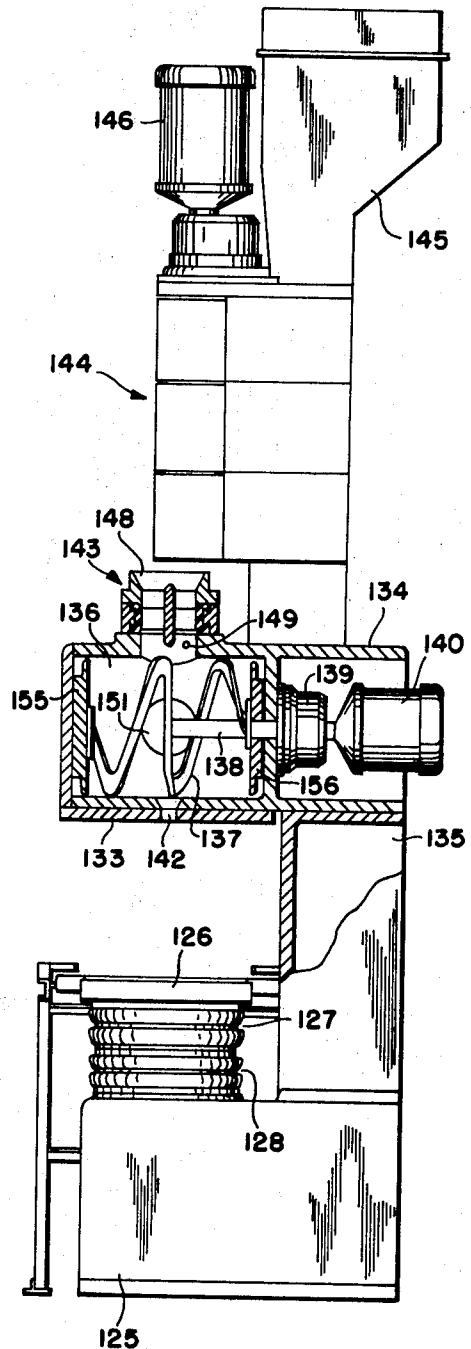
**Fig. 10**

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**Fig. 7**



**Fig. 8**

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# FOUNDRY MOLDING MACHINE WITH SAND VALVE SEAL AND DIAPHRAGM BLOW VALVE MEANS

## DISCLOSURE

This invention relates generally as indicated to a foundry molding machine and more particularly to an improved mold or core blowing machine of economical construction for the rapid production of high quality molds or cores.

It is sometimes difficult to obtain uniform repeatability in the blowing of sand articles. Sand is introduced into a blow reservoir which is then sealed except for communication with the mold or core box clamped thereagainst. Thereupon air under pressure is introduced into the reservoir to force the sand in a packed condition into the vented box to form the mold or core. Improper or uneven distribution of the air pressure may cause the resultant sand article to have nonuniform characteristics. Dead spots may also be obtained in the reservoir which then requires frequent cleaning and, of course, machine downtime. Because of the abrasive quality of the sand used, it is difficult to provide an effective long lasting seal for the reservoir. Sand in the area may also get into the working parts of carefully machined clamp piston-cylinder assemblies again causing wear and abrasion which also results in frequent expensive part replacement.

A core blowing machine, especially one which is manually operated, requires safety interlocks to ensure that sand will not be blown from the reservoir unless the reservoir is in its proper clamped and sealed condition. Mechanical or electrical interlocks may usually be provided, but the latter are, of course, expensive and may require frequent maintenance.

A principal object of the present invention is to provide a mold or core blowing machine having a simplified control system using primarily air pressures to obtain proper interlocks and sequencing.

Another principal object is the provision of a unique blow valve including a diverter for obtaining an ensured sequence.

Another object is the provision of a bellows-type clamp for a mold or core blowing machine not requiring complex machined guide surfaces and ensuring against sand contamination of the moving parts thereof.

A further object is the provision of a blow reservoir having a tangential air inlet which enhances the air flow producing cores or molds of uniform and proper compactness.

Yet another object is the provision of a reservoir sealing valve which ensures a proper complete seal, but which is not subject to wear and frequent replacement.

Still another object is the provision of an improved blow reservoir agitator or mixer obtaining complete throughput of the sand and avoiding frequent cleaning of the reservoir.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

FIG. 1 is a vertical section of a core blowing machine in accordance with the present invention;

FIG. 2 is a front elevation of the machine shown in FIG. 1 with parts broken away and in section for clarity of illustration;

FIG. 3 is a top plan view of the reservoir and the associated blow valve with parts removed and broken away and in section for clarity of illustration;

FIG. 4 is an enlarged vertical section taken substantially on the line 4-4 of FIG. 3;

FIG. 5 is a fragmentary horizontal section of the reservoir sealing valve;

FIG. 6 is a fragmentary vertical section of such valve taken substantially on the line 6-6 of FIG. 5;

FIG. 7 is a front elevation partially broken away and in section of a further embodiment of the present invention;

FIG. 8 is a side elevation partially broken away and in section of the machine shown in FIG. 7;

FIG. 9 is an enlarged end elevation of the agitator or mixer utilized in the blow reservoir of the embodiment of the invention shown in FIGS. 7 and 8;

FIG. 10 is a schematic control diagram which may be used with either the FIG. 1 or FIG. 7 embodiment of this invention; and

FIG. 11 is an enlarged vertical section showing the detail of the perforations in the screen of the reservoir of the FIG. 1 embodiment of the present invention.

Referring now to such FIG. 1, there is illustrated what may be termed a bench type core blower, usually a small manually operated machine which may actually be placed on a bench. However, it will be appreciated that the inventive features of the machine are equally applicable to other and larger types of mold and core blowing machines.

The machine shown in FIGS. 1 and 2 comprises a base 1 of welded fabricated construction including an inverted channel member 2, the legs 3 and 4 of which are provided with flanges indicated at 5 and 6, respectively. The front of the channel is closed by plate 7 while the back of the channel is provided at its top with an enlarged bed plate 8 supported by gussets 9 and 10.

Vertical frame 12 is secured to the bed plate 8 by suitable fasteners indicated at 13. As illustrated, the vertical frame 12 may comprise a suitable channel of welded construction closed at each end by enlarged plate 14 and 15.

The head of the machine indicated generally at 16 comprises a steel weldment frame 17 which is secured to the plate 14 of the vertical frame 12 by the fasteners shown at 18. The frame 17 projects forwardly and supports in cantilever fashion the reservoir 19 vertically aligned with the table 20 in the base 1. The fabricated frame 17 as seen in more detail in FIGS. 3 and 4 includes a cylindrical outer member 22 which comprises the upper cylindrical portion of the reservoir 19. Welded to the cylindrical member 22 are top and bottom plates 23 and 24 joined by sidewall plates 25 and 26. The end of the frame opposite the cylindrical member 22 is closed by plate 27 which is provided with a central tapped port 28. Secured to the top of the bottom plate 24 and to the sidewalls 25 and 26 are bosses indicated at 30 provided with tapped apertures 31 which receive the fasteners 18, being four in number.

The top plate 23 is provided with a circular aperture 33, the upper edge of which is slightly beveled as shown at 34. Four circular bosses 35 are secured to the underside of the top plate 23 equally spaced about the aperture 33 and tapped holes 36 are provided through the top plate into such bosses. These holes receive fasteners to secure to the top plate 23 the cap 38 of diaphragm type blow valve shown generally at 39.

An upstanding cylindrical valve seat member 40 is secured to the bottom plate 24 and projects centrally into the aperture 33, the top rounded edge 41 forming the valve seat being positioned slightly below the slightly beveled edge 34 of the aperture 33.

The valve seat member 40 is connected to the top plate 23 by a small radially extending bridge member 42 welded in place and the bridge member and top plate are provided with a bore 43 connecting tapped port 44 and diverter port 45 projecting upwardly in the valve seat 41.

The seat 40 includes a vertically elongated port 47 in the sidewall thereof which provides communication with vertically elongated tunnel member 48 which extends radially from the valve seat member 40 and tangentially into the cylindrical member 22 with communication being provided through the wall of such cylindrical member by vertically elongated port 49.

The cap 38 of the diaphragm valve 39 includes a spring housing 51 for compression spring 52 urging plunger 53 downwardly. The plunger is secured to the diaphragm 54 by fastener 55, the diaphragm being peripherally secured

between the cap and the top plate 23. The cap is provided with a chamber 56 connected through bore 57 to tapped port 58. A bleed hole 59 interconnects the bore 57 and the chamber 60 within the frame 17 bypassing the diaphragm 54.

The bottom plate 24 is provided with a tapped port 62 in communication with the tunnel member 48 to which a clamp pressure equalizing line is connected as will hereinafter be more fully described. The port 62 is provided away from the sand reservoir 19 and as close as practicable to the blow valve seat.

The frame 17 is, of course, fabricated from airtight welds and should be able to withstand a pressure in excess of 125 p.s.i. The frame serves not only as a cantilever structural member supporting the head 16, but also as an integral part of the blow valve 39, serving in part as a storage tank for compressed air for the blow.

Referring again particularly to FIGS. 1 and 2, it will be seen that the head includes a sand cutoff valve shown generally at 64 positioned vertically between the sand hopper 65 and the reservoir 19. The hopper 65 is supported on top flange 66 of collar 67. The enlarged bottom flange 68 of the collar 67 is mounted on valve ring 69 which is in turn supported on ring 70 sealed to the top of the cylindrical member 22 of the frame 17.

As seen perhaps more clearly in FIGS. 5 and 6, an annular resilient valve seat 71 is secured to the interior of the valve ring 69 with the top and bottom edges of the seat 71 being secured in dovetail grooves shown at 72 and 73 formed by the juxtaposition of the flange 68, the ring 69 and the ring 70. The interior of the bottom flange 68 of the collar 67 is provided with a lip shown at 74 which fits inside the seat 71 and the collar, ring 69 and ring 70 are clamped together and secured to the cylindrical member 22 of the frame 17 by the elongated fasteners 75 which are six in number equally circumferentially spaced.

Circular valve member 77 includes oppositely directed stems 78 and 79 with the latter projecting through the ring 69 and being secured to crank arm 80 by setscrew 81. The crank arm is connected by pin 82 to the rod of piston-cylinder assembly 83. The blind end of the piston-cylinder assembly is provided with a clevis which is connected by pin 84 to bracket 85 secured to the frame 17. Accordingly, extension of the piston-cylinder assembly as seen in FIG. 1 will cause the valve member 77 to pivot to a horizontal position at which the periphery thereof will be contiguous to the valve seat 71.

As seen in FIG. 6, the valve ring 69 is provided with a tapped port 87 to which is connected pressure line 88 shown fragmentarily in FIG. 2 which will function to inflate the valve seat 71 as shown in FIG. 6 to enclose and seal against the edge 89 of the valve of member 77 when in its closed position. In the unexpanded condition of the valve seat, the edge of the valve member may actually slightly rub against the seat to wipe loose sand therefrom so that when the seat is inflated as seen in FIG. 6 excessive sand will not be embedded into the seat causing undue wear. The seal thus provided prevents sand from being blown about the periphery of the valve member 77 which would normally have an abrasive effect upon the valve seat and member and provides an effective sand and air seal for the blow reservoir 19.

The blow reservoir 19 includes not only the cylindrical member 22 of the frame 17, but also flaring frame 90 which includes top and bottom flanges 91 and 92. The top flanges is secured and sealed to the bottom of the cylindrical member 22 while the bottom flange 92 has secured to the underside thereof blow plate 93 provided with an arrangement of blow apertures 94 through which sand will be blown into the mold or core box clamped therebeneath. Exhaust valve 95 is mounted on the sidewall of the frame 90 and like the blow valve may comprise a differential area diaphragm valve. Air is supplied through the bore 96 to lift the diaphragm off the seat to open the valve and it is noted that the port connected to the larger area of the diaphragm shown at 97 is provided with a bleed hole 98.

The clamp table 20 which supports the core or mold box, not shown, includes a downwardly projecting rod 100 fitted within cylinder 101, the bottom of which is closed by seal plate 102. The rod is provided with a vertically extending slot 103 in which fits the projecting end 104 of guide pin 105. The cylinder 101 is mounted in a sleeve 106 which is secured to the top of the channel member 2 forming the base 1. The slot 103 in fluid communication with the bottom of the rod through passage 107 and a vertically aligned port 108 provides fluid communication to the interior of bellows 109. The inlet port for the table may be provided through the pin 105 as indicated at 110.

The bellows is provided with top and bottom beaded edges which are secured by clamps shown at 111 to the bottom of the table and the top of the channel member 2. The bellows 109 in its deflated condition includes annular folded portions 112 and 113 which are connected by an inwardly directed fold about ring 114.

The surface of the rod 100 within the cylinder 103 need not be carefully machined or provided with expensive glands or seals. The inflation of the bellows will quickly elevate the table within the limits of the stop pin 105 to clamp a mold box thereon against the blow plate 93. The clamped beaded edges of the bellows preclude sand from entering the area beneath the table. The bellows serves not only to raise and lower the table, but also serves as a boot to keep dust from the relatively moving parts of the clamp mechanism. Additional bellows may be provided connected in tandem to provide a longer clamp or draw stroke and as hereinafter described a variable restricted orifice may be provided in the clamp table exhaust line to provide a desired slow draw. An adjustable stop shown at 116 may be provided to control the lowermost position of the table 20.

When the blow valve is opened air under pressure will enter the annular chamber 118 in the cylindrical member 22 which is partitioned from the interior of the reservoir 19 by screen 119. Such screen may be mounted on rings at the top and bottom between the ring 70 and the flange 91 and is provided with vertical slits or perforations 120 shown in greater detail in FIG. 11. The stainless steel sleeve may be slit by punching depressions in opposite radial directions just breaking through to leave small openings 121 which actually face circumferentially of the screen. Such perforations in combination with the tangential flow of air about the chamber 118 on the exterior of the screen have been found to enhance air flow and provide more efficient fluidization and packing of the sand into the mold or core box clamped to the blow plate.

Referring now to FIGS. 7, 8 and 9, there is illustrated a further embodiment of the present invention utilizing a different type of reservoir and designed to produce molds or cores from boxes which may be shuttled into the machine. The machine includes a base 125 similar to the base 1 in the FIG. 1 embodiment on which is mounted table 126 on tandem bellows units 127 and 128. Conveyor stands 129 and 130 on opposite sides of the table 126 may be employed to support mold or core boxes for movement into and out of the machine. Spring loaded rollers 131 extend through recesses in the table 126 and provide roller support for movement of the box onto and from the table in its lower position.

Elevation of the table clamps the mold or core box against blow plate 133 on the underside of cylindrical reservoir frame 134 cantilevered from the vertical frame 135. The frame 134 includes a reservoir chamber 136 in which agitator 137 is mounted for rotation on shaft 138. The shaft extends rearwardly of the machine and is driven from reducer 139 and motor 140. The agitator is seen in more detail in FIG. 9.

One or more blow holes in the bottom of the reservoir communicate with corresponding holes in the blow plate 133 as indicated at a 142 through which sand is blown into the mold or core box therebeneath. Sand enters the blow reservoir 136 through the butterfly cutoff valve 143 which may be substantially identical in form and operation to the valve 64 in the FIG. 1 embodiment.



Sand is supplied to the butterfly valve from three-stage mixer 144 mounted on the frame 134 which is in turn supplied from sand hopper 145. Reference may be had to the copending U.S. Pat. application of Edward D. Abraham, Ser. No. 626,782, filed Mar. 29, 1967, now U.S. Pat. No. 3,494,412 entitled "Foundry Mold and Core Blowing Machine" for a more clear disclosure of the three-stage mixer. Such mixer is driven by motor 146 and reducer 147 adding to the sand from hopper 145 a resin binder to facilitate the hardening of the sand upon introduction into the mold or core box. The discharge of the mixer is directly above the inlet 148 to the valve 143 and the mixer is controlled by a sand probe 149 positioned immediately below the valve 143 within the chamber 136. When the sand level has obtained the level of the probe, the motor 146 is turned off. The motor is, of course, also interlocked with the position of the valve.

Blow valve 151 is mounted on the side of the reservoir chamber 136 and such valve may be identical in form to the blow valve 39 of the FIG. 1 embodiment. When the diaphragm is vented, air enters at 152 and moves into the passage 153 which is connected to axial external passage 154 which extends to both ends of the chamber 136 to admit blow air behind discs 155 and 156 at each end of the chamber fluidizing and forcing the sand outwardly through the blow holes 142. An exhaust valve 157 is mounted on the opposite side of the chamber 136 as indicated in FIG. 7.

Referring now to FIG. 9, it will be seen that the agitator 137 includes a center diametral portion 159 from the opposite ends of which extend opposite hand screw flight portions 160 and 161 which terminate in radially inwardly directed scraping blades 162 and 163, respectively. The screw flights are arranged such that rotation of the agitator in the direction of the arrow 164 will move sand from the outer ends of the cylindrical chamber 136 toward the center to the blow hole 142. The end blades 162 and 163 scrape the face of discs 155 and 156, respectively, while the opposite hand flights 160 and 161 scrape the interior of the cylindrical surface of the chamber 136 so that the entire interior surface of the chamber is covered or scraped by the agitator thus precluding the formation of any dead spots within the reservoir on continued use of the machine. This is particularly important in the blowing of molds or cores with a sand-resin mix which hardens rather rapidly.

The operation of the embodiment of FIGS. 7, 8 and 9 will be similar to that of the FIG. 1 embodiment. The mold or core box will be shuttled in on the conveyor stand 129, for example, to be positioned over the table 126. The table will then be elevated to clamp the box against the blow plate 133 in communication with the blow hole 142. With the butterfly valve 143 open, sand is discharged from the mixer into the reservoir chamber 136. When the probe 149 is energized, the valve 143 is closed and the seat of such valve will be inflated by the diverter port in the diaphragm valve 151. Sand is then blown from the reservoir into the mold box when the blow valve 151 is opened. After the reservoir is exhausted by the opening of exhaust valve 157, the mold or core box is unclamped and positioned on the conveyor for removal from the machine.

#### OPERATION AND CONTROLS (FIG. 10)

Referring now to FIG. 10, there is illustrated a pneumatic control diagram which can be utilized with either the FIG. 1 or the FIG. 7 embodiment and the reference numerals describing the components of the machine may thus be used interchangeably. Air enters from source 166 which may be a plant source at approximately 100 p.s.i. passing through filter 167 and lubricator 168 to line 169. Branch line 170 passes through pressure reducer 171 reducing the pressure to less than the line pressure. Line 169 continues to main manual four way operating valve 172 which in its normal unactuated condition supplies pressure to line 173 through flow control unit 174 to the rod end of valve piston-cylinder assembly 83. This maintains the piston-cylinder assembly 83 retracted and

the valve member 77 open as indicated. Also, in the normal unactuated condition of the valve 172, the line 175 connected to the blind end of assembly 83 through flow control unit 176 is connected to atmosphere or reservoir through slow draw needle valve 177.

The line 170 on the downstream side of the pressure reducer 171 includes a branch 178 connected through restricted orifice 179 to blow actuating valve 180. Line 170 continues to diaphragm blow valve 39. Even though pressure is supplied to the blow valve, it will remain closed because of the differential area on the opposite sides of the diaphragm. The area exposed to the reduced pressure on the underside of the diaphragm will be only that area of the annular orifice 33 between the valve seat 41 and the edge of the top plate 23 as seen in FIG. 4. The entire upper surface of the diaphragm is, of course, exposed to the same pressure and, moreover, the spring 52 assists in maintaining the valve closed.

The pressure line tending to open the valve 39 is shown schematically at 182 while the pressure lines tending to close the valve are shown at 183 and 184. The line 183 is connected to the top of the valve through the bleed hole 59 while the line 184 is connected to the blow actuating valve 180 through cam operated blow safety valve 185. When the valve 185 is opened and the valve 180 is in the condition shown, air will be supplied through the line 184 to the top of the diaphragm blow valve 39. When the sand cutoff valve member 77 is open, however, the valve 185 will be closed.

When a core or mold box is properly positioned on the table 20 and the reservoir is filled with sand, the operator will then commence the cycle of operation of the machine by actuating the main operating valve 172. The actuation of this valve initially pressurizes line 175 from line 169 supplying pressure to the table 20 to elevate the same and also to the blind end of the valve operating piston-cylinder assembly 83 to close the sand cutoff valve pivoting the valve member 77 to the horizontal phantom line position indicated at 187. The table, of course, is pressurized from line 188 connected to the line 175. The pressure switch P in line 175 may be employed to ensure that the mixer is turned off before valve 64 closes and also to start the motor of the agitator in the FIG. 7 embodiment.

Continued movement of the valve 172 compresses spring 189 and causes the stem 190 of the valve 172 to engage the stem 191 of the blow actuating valve 180. This mechanically sequences the operation of the valves 172 and 180 so that the valve 180 will be shifted at the commencement of the cycle after the valve 172 and at the end of the cycle before the valve 172. When the valve 180 is shifted, the line 184 is connected to atmosphere or vented as indicated at 192. Since the valve member 77 has been actuated, the rod of the piston-cylinder assembly 83 will engage the stem or cam 193 of the blow safety valve 185 shifting such valve to its open position. When both valves 180 and 185 have thus been actuated, the line 184 is vented which is, of course, connected to the top of the diaphragm blow valve 39. This causes the blow valve now to open. Before it is opened completely, however, pressure will be supplied through diverter port 45 to line 195 connected through flow control unit 196 to ring 69 of the valve 64 which causes the seat 71 to inflate tightly embracing the peripheral edge of the valve member 77. Line 197 connects line 195 to the exhaust valve 95 shifting the same to a closed position. When the blow valve 39 is completely opened, air pressure will be supplied to the blow reservoir through the tunnel 48. This also pressurizes equalizer line 198 which is connected to the table 20. A check valve 199 permits flow only from the blow valve 39 to the table 20, the equalizer line being connected to the port 62 seen, for example, in FIGS. 1 and 3. As long as the blow valve is open and the exhaust valve closed, pressure will be supplied from the blow valve through the equalizer line to the clamp table 20 maintaining the same in its elevated or clamping condition. In this manner, the table cannot be unclamped with the blow reservoir pressurized. This avoids the possibility of sand being blown into the operator's face.

At the completion of the blow portion of the cycle as determined by the operator, he will then release the valve 172 which will first move the blow actuating valve 180 to the position shown prior to the movement of the main operating valve 172 to its position shown. This sequencing is accomplished by the override between the stems 191 and 190 of the respective valves. The shifting of the valve 180 immediately supplies pressure to the line 184 through the open blow safety valve 185 which communicates with the top of the diaphragm of the blow valve 39 closing the same. As soon as the blow valve is closed, the diverter port 45 also is closed which immediately opens the exhaust valve 95 and deflates the resilient seat 71 of the butterfly cutoff valve 64. This opening of the exhaust valve is obtained by the bleed 98 in the exhaust valve, the latter being designed to open immediately on a small pressure drop.

While this is taking place, the valve 172 is moving into the position shown which unclamps the table 20 and supplies pressure to the rod end of the piston-cylinder assembly 83 venting the blind end through the slow draw valve 177 which controls the rate of descent of the clamp table. If for some reason the blow valve is still open or the exhaust valve has failed to open, there will still be pressure in the equalizer line 198 which will be sufficient to hold the table in clamped condition regardless of the position of the valve 172.

As soon as the butterfly valve member 77 moves from the closed phantom line position 187 seen in FIG. 10, the blow safety valve 185 will close so that the condition of the valve 180 will be ineffective to operate the blow valve.

The blow actuating valve 180 which is spring loaded independently of the main operating valve 172 opens last and closes first because of the two-spring and overtravel arrangement. It is also noted that the valve 180 obtains assistance in closing the blow valve from the spring 52 as well as from the pressure obtained from bleed hole 59. The bleed hole 59 will eventually by itself, with the aid of the spring 52, close the blow valve and this acts as a safety feature. This feature also prevents opening of the blow valve 39 due to a loss of pressure in line 184 for an abnormal manual operation or for an accidental line rupture.

It can now be seen that there is provided an improved core or mold blowing machine utilizing simple yet reliable components which will not require frequent replacement and which will obtain in the machine combination improved blown molds and cores. Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We claim:

1. A machine for producing foundry sand articles comprising a reservoir having a fill opening adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, a cutoff valve for the fill opening of said reservoir, and means responsive to the opening of said blow valve to seal said cutoff valve.

2. A machine as set forth in claim 1 wherein said last mentioned means is operative also to close said exhaust valve.

3. A machine as set forth in claim 1 including means operative to maintain the clamping pressure of said clamp table as long as said reservoir is pressurized.

4. A machine as set forth in claim 1 including means responsive to the position of said cutoff valve operative to permit actuation of said blow valve.

5. A machine as set forth in claim 1 including sequentially operable control valve means operative to close said cutoff valve and elevate said clamp table and then open said blow valve upon the attainment of the closed position of said cutoff valve.

6. A machine for producing foundry sand articles comprising a reservoir having a fill opening adapted to be filled with sand, a clamp table adapted to clamp a box against said reser-

voir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, a cutoff valve for the fill opening of said reservoir, and means responsive to the opening of said blow valve to seal said cutoff valve, said last mentioned means comprising a diverter port in the seat of said blow valve operative both to seal said cutoff valve and to close said exhaust valve.

7. A machine for producing foundry sand articles comprising a reservoir having a fill opening adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, a cutoff valve for the fill opening of said reservoir, means responsive to the opening of said blow valve to seal said cutoff valve, said blow valve comprising a spring loaded differential area diaphragm type valve, and a bypass bleed port for the diaphragm of said valve operative to close same after a predetermined time interval.

8. A machine for producing foundry sand articles comprising a reservoir having a full opening adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, a cutoff valve for the fill opening of said reservoir, means responsive to the opening of said blow valve to seal said cutoff valve, said cutoff valve including a butterfly type valve member, a resilient annular seat for said member, and a pressure line connected to said seat operative to inflate the same upon the opening of said blow valve.

9. A machine as set forth in claim 1 including a cylindrical screen in said reservoir, and a passage interconnecting said blow valve and said reservoir entering the reservoir tangentially behind said screen.

10. A machine as set forth in claim 1 wherein said reservoir includes a vertically elongated cylindrical portion having a cylindrical screen therein, said screen including a plurality of vertical slits providing openings directed circumferentially of said screen, and a passage interconnecting said blow valve and said reservoir entering the latter tangentially behind said screen.

11. A machine as set forth in claim 1 wherein said reservoir comprises an axially elongated cylindrical reservoir, and a power driven agitator in said reservoir including a blade moving adjacent the entire interior surface thereof, said blade including opposite hand helical flights moving adjacent the cylindrical wall of the reservoir, each flight terminating in radially inwardly directed blades moving against the end walls of said reservoir.

12. A machine for producing foundry sand articles comprising a reservoir adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, means responsive to the opening of said blow valve to close said exhaust valve, said blow valve comprising a differential area diaphragm type valve having an annular valve seat, and a diverter port in said valve seat connected to said exhaust valve to close the latter when said diverter port is uncovered.

13. A machine as set forth in claim 12 including means responsive to a slight pressure drop in said reservoir operative to open said exhaust valve.

14. A machine as set forth in claim 13 wherein said slight pressure drop is obtained by a bleed hole in said exhaust valve upon the closing of said blow valve.

15. A machine for producing foundry sand articles comprising a reservoir having a fill opening adapted to be filled with sand, a clamp table adapted to clamp a box against said reser-

voir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, and a cutoff valve for the fill opening of said reservoir, said cutoff valve comprising a valve member, means to move said member from an open to a closed position and vice versa, a resilient valve seat, means operative to distort said valve seat in the closed position of said valve member peripherally to seal said valve member and thus said reservoir, and means responsive to the opening of said blow valve to distort said valve seat.

16. A machine as set forth in claim 15 wherein said valve member comprises a plate mounted for pivotal movement on a stem, the edge of said plate in the closed position of said valve member being contiguous with said valve seat in the undistorted condition thereof.

17. A machine as set forth in claim 16 wherein said valve seat comprises an annular member secured at its edges, and means to supply air under pressure behind said seat operative to inflate the same to cause it tightly to embrace the edge of said valve member.

18. A machine as set forth in claim 15 including means responsive to the movement of said valve member to its closed position to condition said blow valve for opening.

19. A machine as set forth in claim 15 including a piston-cylinder assembly operative to move said valve member from its open to its closed position and vice versa, and means to operate said clamp table in conjunction with said piston-cylinder assembly.

20. A foundry sand article blowing machine having a reservoir adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in said flow communication therewith, a boxlike frame supporting said reservoir, said frame including a top and bottom plate, said top plate having an aperture therein, a diaphragm secured to said top plate and covering said aperture, a valve seat member mounted on said bottom plate and projecting into said aperture in operative contact with said diaphragm, a passage interconnecting said seat member and said reservoir, and means operative to pressurize said frame and thus said reservoir when said diaphragm is open to permit pressure flow from said frame through said seat member and passage to said reservoir.

21. A machine as set forth in claim 20 including an exhaust valve for said reservoir, a port in said valve seat member adapted to be opened and closed by said diaphragm, and means interconnecting said port and said exhaust valve operative to close said exhaust valve as said diaphragm is opened.

22. A machine as set forth in claim 21 including a sealable sand cutoff valve for said reservoir, and means interconnecting said cutoff valve and said port in said valve seat member operative to seal said cutoff valve as said blow valve is opened.

23. A machine as set forth in claim 20 wherein said passage extends radially from said valve seat member and enters said reservoir tangentially.

24. A machine as set forth in claim 20 including a cylindrical portion in said frame forming a portion of said reservoir, and a screen in said cylindrical portion, said passage being vertically elongated and substantially vertically coextensive with said screen.

25. A machine for producing foundry sand articles comprising a cylindrical reservoir adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a blow valve adapted to admit air under pressure to said reservoir to force sand into such box, an exhaust valve operative to relieve the pressure in said reservoir, a cylindrical screen in said reservoir, a passage interconnecting said blow valve and said reservoir entering the latter tangentially behind said screen, said blow valve being mounted in a cantilever boxlike frame supporting said reservoir, said frame including a top and bottom plate, said top plate having an aperture therein, a diaphragm secured to said top plate and covering said aperture, a valve seat member mounted on said bottom plate and projecting into said aperture in operative contact with said diaphragm, a passage interconnecting said seat member and said reservoir, and means operative to pressurize said frame and thus said reservoir when said diaphragm is open to permit pressure flow from said frame through said seat member and passage to said reservoir tangentially behind said screen.

26. A foundry sand article blowing machine having a reservoir adapted to be filled with sand, a clamp table adapted to clamp a box against said reservoir in sand flow communication therewith, a frame supporting said reservoir, said frame including a wall with an aperture therein, a diaphragm secured to said wall and covering said aperture, a valve seat member projecting into said aperture in operative contact with the underside of said diaphragm, a passage interconnecting said seat member and said reservoir, and means operative to pressurize said frame and in this manner said reservoir when said diaphragm is open to permit pressure flow from said frame through said seat member and passage to said reservoir.

27. A machine as set forth in claim 26 including an exhaust valve for said reservoir, a port in said valve seat member adapted to be opened and closed by said diaphragm, and means interconnecting said port and said exhaust valve operative to close said exhaust valve as said diaphragm is opened.

28. A machine as set forth in claim 27 including a sealable sand cutoff valve for said reservoir, and means interconnecting said cutoff valve and said port in said valve seat member operative to seal said cutoff valve as said blow valve is opened.

29. A machine as set forth in claim 26 wherein said passage extends radially from said valve seat member and enters said reservoir tangentially.

30. A machine as set forth in claim 26 including a cylindrical portion in said frame forming a portion of said reservoir, and a screen in said cylindrical portion, said passage being vertically elongated and substantially vertically coextensive with said screen.

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