

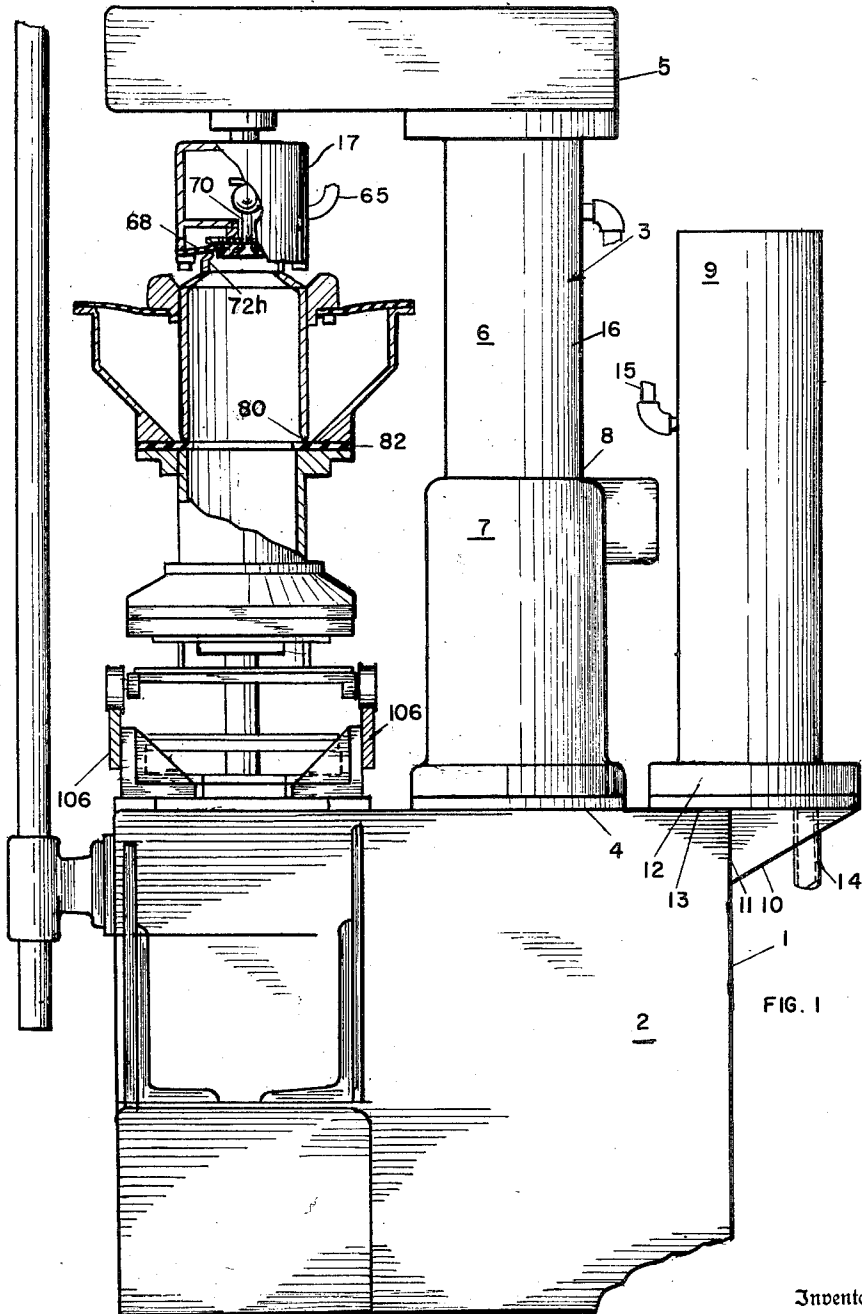
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C. R. HARRISON
CORE BLOWING MACHINE

2,864,134

Filed Jan. 27, 1955

5 Sheets-Sheet 1



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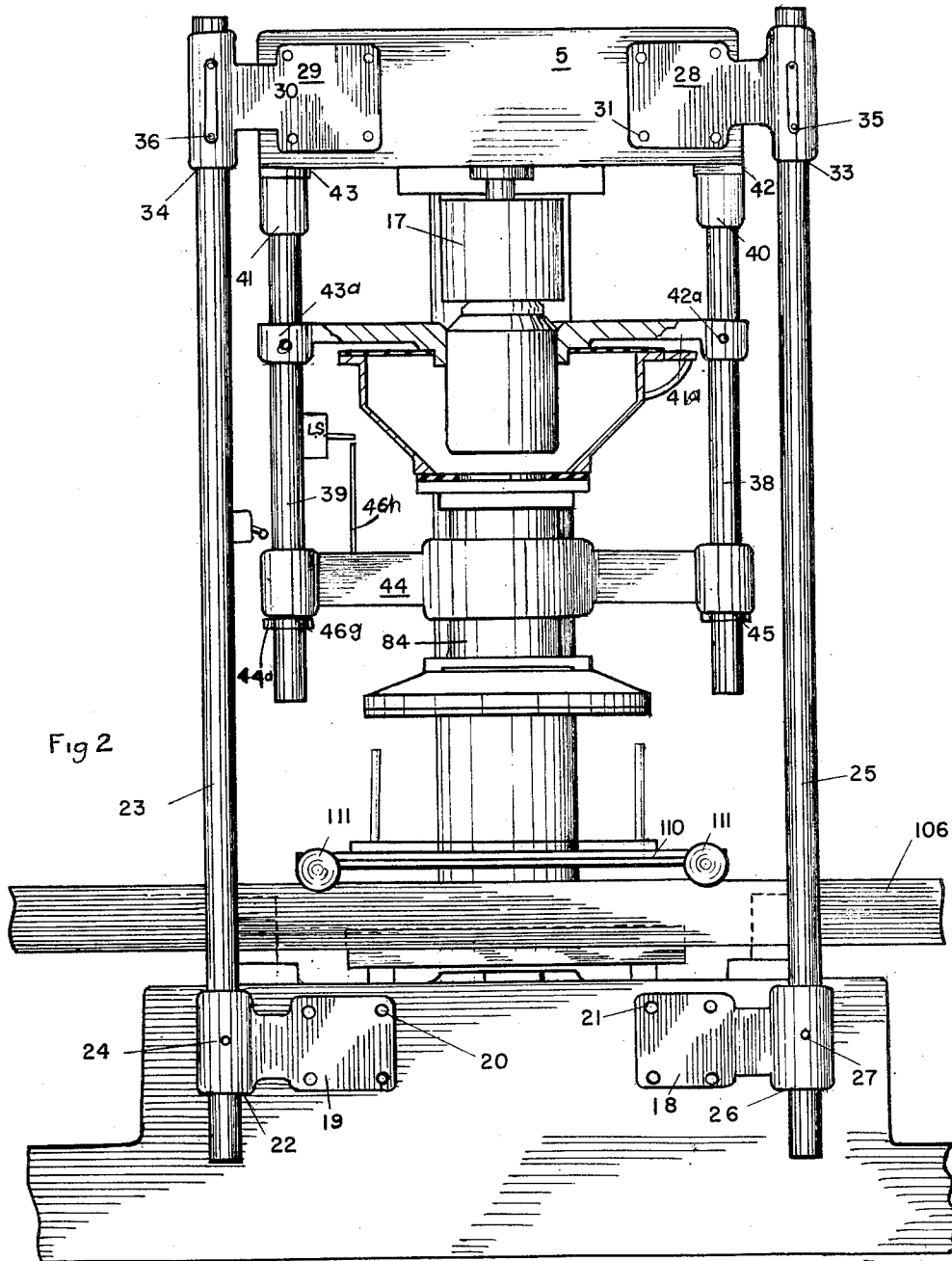
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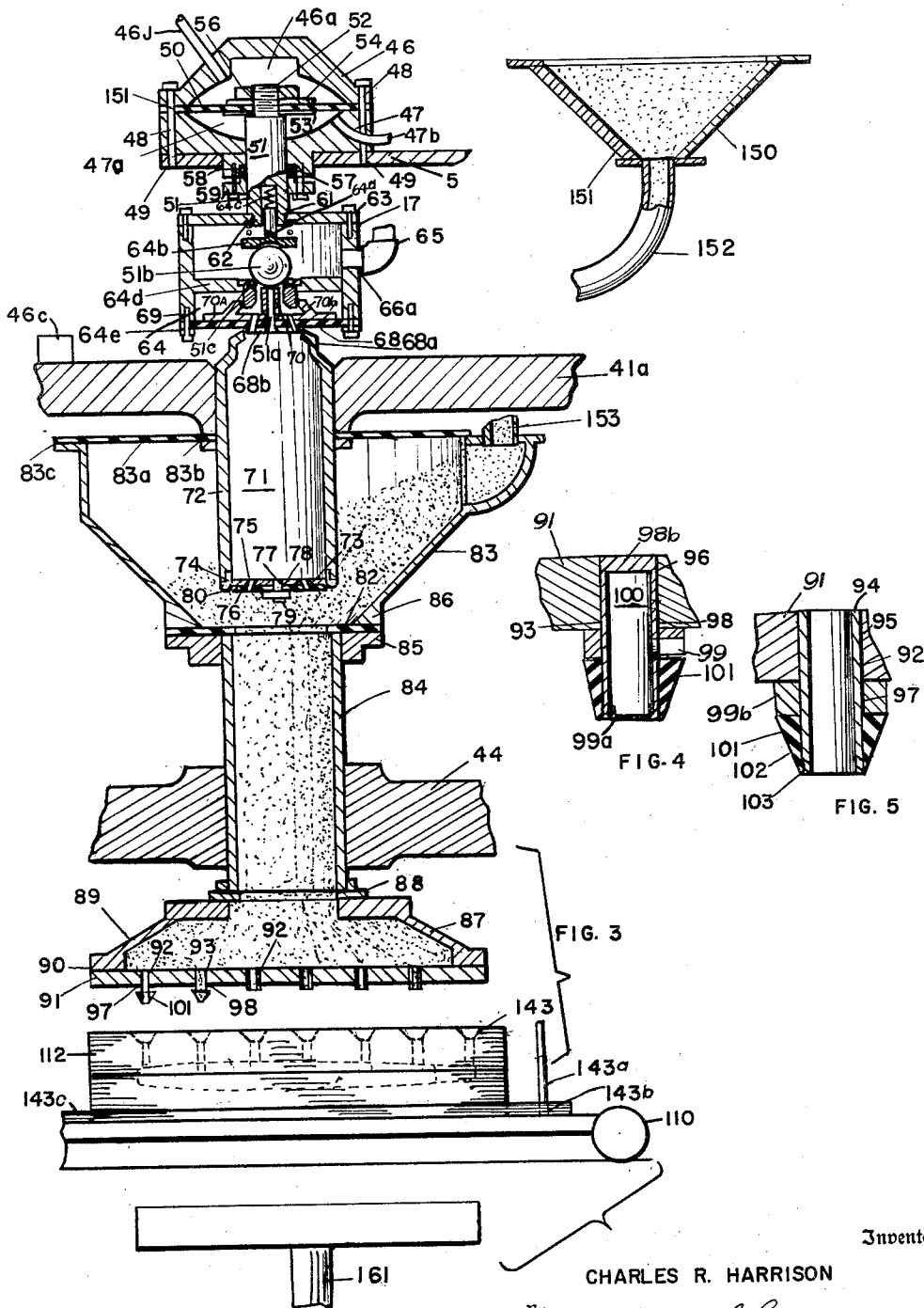
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5 Sheets-Sheet 3



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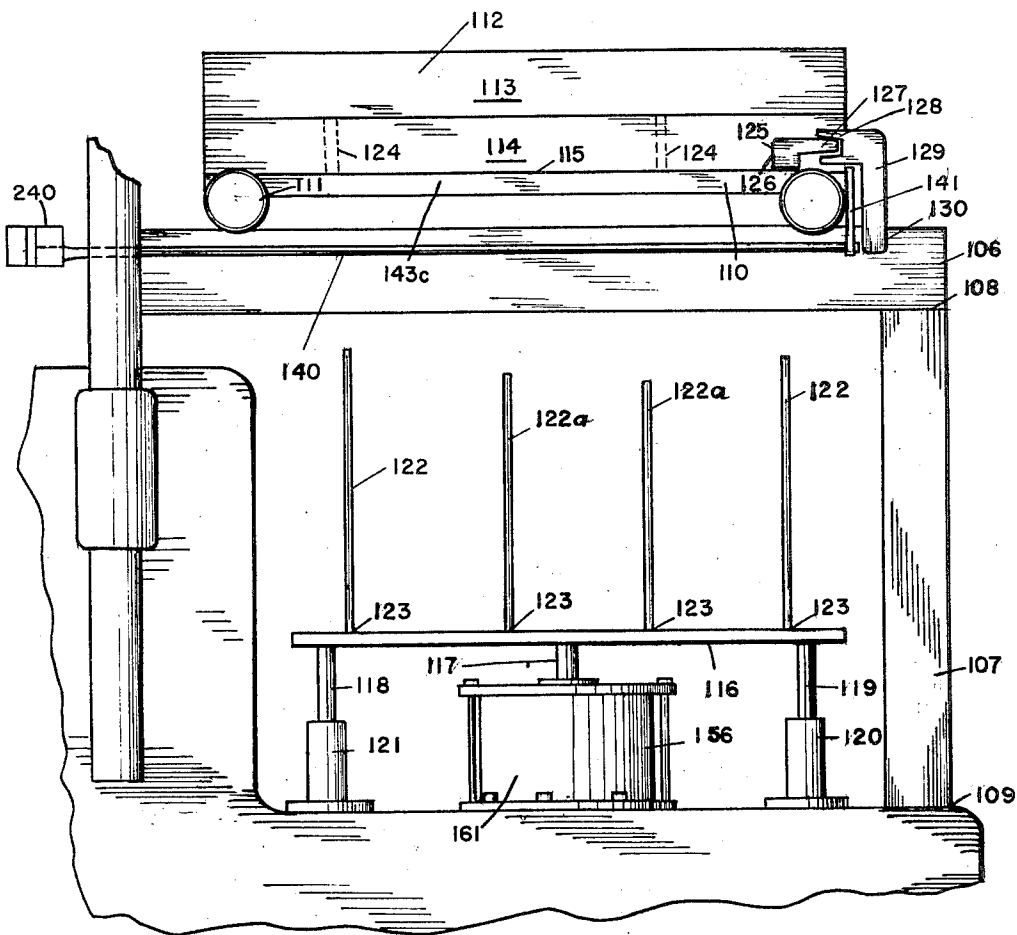


FIG. 6

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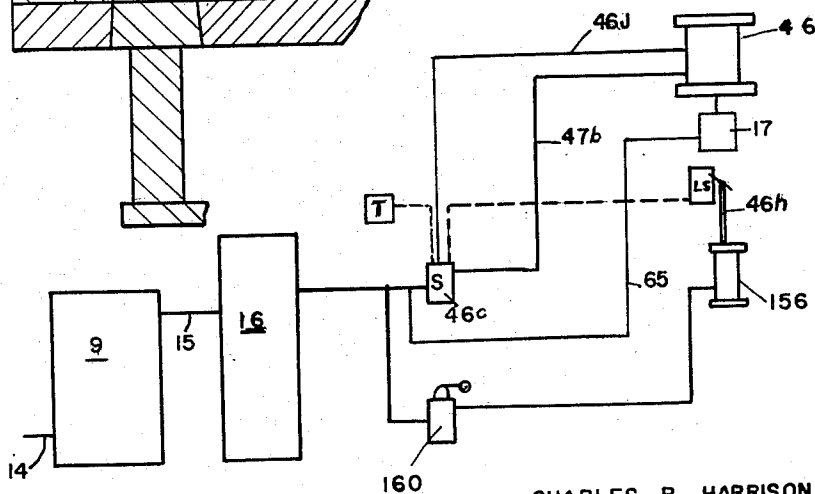
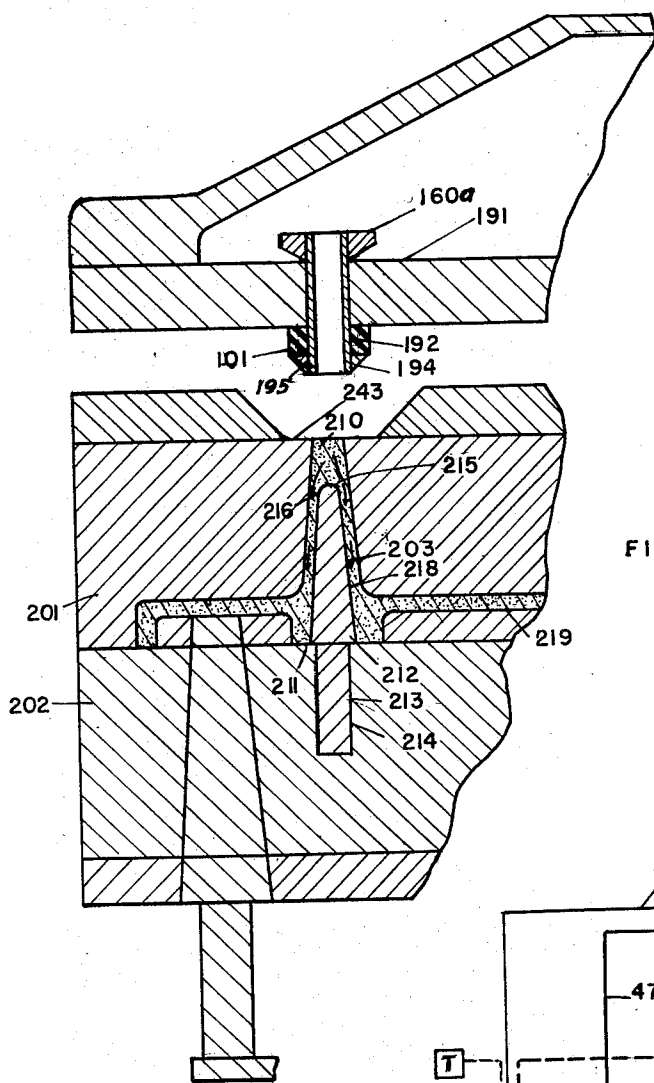
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5 Sheets-Sheet 5



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2,864,134

CORE BLOWING MACHINE

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Application January 27, 1955, Serial No. 484,376

15 Claims. (Cl. 22—10)

This invention relates to foundry equipment and more particularly to machines for automatically blowing sand coated with thermosetting material or the like into a mold wherein the coating material may be cured and hardened, either by heat, aging, or the like whereby the sand held in a matrix of the coating material accurately conforms to the shape of the mold into which it was blown. It will be clear to those skilled in the art that the novel machine could be used to blow any suitable molding material.

In core and shell blowing machines made according to prior designs, it was deemed necessary to provide a valve in the sand feeding mechanism to interrupt the flow of sand into the mold or to blow the sand upward into the mold in order to prevent excess sand from entering the mold between blowing cycles. It has been discovered that with coated molding sands now in general use, the sand can be prevented from falling through a tube without a valve to check the sand. Further, in machines made according to prior inventions, portions of the machine which came in contact with the heated mold received heat therefrom by conduction and attained a temperature high enough to cause the sand to cure and harden in the feeder tubes, thereby interfering with the constant flow of sand and causing other difficulties. It has been discovered that by use of the heat resisting and non-thermal conducting material between the mold and the feeding or blowing mechanism, clogging of the feeder mechanism is prevented and other related difficulties are abated. Other difficulties experienced in prior machines included sand entering the machine blowing mechanism and blowing back into the air supply when the machine was as the end of a blowing cycle. The latter problem has been solved by providing a particular design of check-valve between the blowing mechanism and the sand hopper mechanism.

More specifically, an object of this invention is to provide a mold for sand and thermosetting material wherein the machine is simple in construction, economical to manufacture, and simple and efficient in use.

Another object of this invention is to provide a machine wherein the supply of sand to be injected into a mold up until the time the sand enters the mold is thermally isolated from the molds and mold boxes in which the shells and cores are being formed.

Another object of the invention is to provide a seal for the feeder tube of a molding machine to prevent air trapped in the sand tube of the sand carrier from puffing through the hopper into the blow head and carrying molding material with it.

A further object of the invention is to provide a locking device for a stripping mechanism for removing the core or shell from a mold.

Another object of the invention is to provide a novel mold structure.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in

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the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Fig. 1 is an end view partly in cross section of the novel core and shell blowing machine;

Fig. 2 is a front view partly in cross section of the machine shown in Fig. 1;

Fig. 3 is a vertical transverse cross sectional view of the feeding mechanism of the machine shown in Figs. 1 and 2;

Fig. 4 is a cross sectional view of a vent tube;

Fig. 5 is a cross sectional view of a blow tube;

Fig. 6 is an enlarged view of the mold stripping apparatus;

Fig. 7 is a diagram of the air control circuit; and

Fig. 8 is a view of a novel mold.

Now with more specific reference to the drawings, a core or shell blowing machine 1 is shown having a bottom frame casting 2 with a supporting mechanism 3 mounted thereon at 4 for supporting a transverse casting 5 which has certain of the air mechanisms housed therein. The upper portion 6 of the supporting mechanism 3 telescopically engages the lower portion 7 at 8 with a sliding fit therein whereby the transverse casting 5 can be raised and lowered by a conventional lifting mechanism. The support mechanism contains an air reservoir indicated at 16 to adjust the spacing between the blowing mechanism and the mold in order to accommodate various sizes of molds and sand cartridges of various lengths between the bottom frame casting 2 and transverse casting 5.

A surge tank 9 is mounted on the machine 1 and a bracket 10 extends back and is attached to the base casting 2 at 11. The front portion of the base 12 of the surge tank 9 rests in part on the rear edge of the machine base at 13. A source of compressed air is connected to the surge tank 9 at 14 and the surge tank 9 may be connected through pipe 15 to the hollow lift 16 and from there through a pipe 65 to the blow head 17. The surge tank 9 and reservoir 16 are provided in order to insure an adequate volume of air in the short interval of time necessary to carry out the blowing operation.

The front portion of the base casting 2 has the brackets 18 and 19 fastened thereto by means of the bolts 20 and 21 and the brackets 18 and 19 have vertical bores 26 and 22, respectively, through which the upwardly disposed support member 23 extends. The support member 23 may be locked in position by means of a set screw 24 and the upwardly disposed support member 25 may be locked in the vertical bore 26 by means of a set screw 27 or by similar means.

Brackets 28 and 29 are fixed to the transverse casting 5 by means of bolts 31 and 30, respectively, and have the longitudinal bores 33 and 34, respectively, which receive the upper end of the vertical supports 25 and 23 and the brackets 28 and 29 are locked to the vertical supports 25 and 23 by means of set screws 35 and 36, respectively.

Downwardly depending blow mechanism supports 38 and 39 are attached to the transverse casting 5 by means of brackets 40 and 41 which are attached to the casting 5 at 42 and 43, respectively. The blowing mechanism supports 38 and 39 are locked to the top spider 41a by means of set screws 42a and 43a. The sand tube bracket 44 is slidably received on the lower end of the blow mechanism supports 38 and 39 at 45 and 46g and is freely slidable up and down thereon and forms a guide thereon for the sand tube 84, guiding the sand tube 84 in a definite path. Collars 44a are adjustably supported on supports 38 and 39 and limit its downward movement.

Mounted on the casting 5 best shown in Fig. 3 is a blow head and diaphragm casing. The diaphragm casing is made up of mating casing members 46 and 47 forming a closure divided into two chambers by diaphragm 50. The members 46 and 47 are held together by means of bolts 43 which clamp the diaphragm 50 between the members 46 and 47. The upper chamber 46a is connected through pipe 46j to three way valve 46c. The lower chamber 47a is connected through pipe 47b to the three way valve 46c. Therefore, when the rod 46h engages the limit switch LS, the limit switch LS actuates the solenoid valve S which allows air to flow through the pipe 46j, therefore putting pressure on the chamber 46a above the diaphragm 50. The diaphragm 50 with stem 51 attached thereto is forced down by air flowing from the pipe 46j. This will bring the blow head and the diaphragm 68 therewith down into engagement with the upper ends 68a of the air tube 72 as shown in Fig. 1. The stem 51 of the blow head 17 has a reduced size threaded portion 52 which extends through the washers 53 and 54 which are disposed at either side of the diaphragm 50. The nut 56 locks the diaphragm 50 between the washers 53 and 54. An air seal 57 of conventional design is disposed in a groove 58 in the lower end of the diaphragm casing 47 and the collar 59 clampingly engages the seal or packing 57. The blow head stem 51 has the lower reduced size portion 61 which extends through a threaded hole 62 in the upper disk 63 of a cup shaped member 64. The stem 51 is bored at 64a to receive a plunger 64b which is urged by spring 64c to urge ball 51b into engagement with seat 51c to control air from pipe 65. The interior of the cup shaped member 64 is connected to the reservoir 16 by means of the pipe 65 which communicates with the interior of cup shaped member 64 through a fitting 66a.

The interior of the blow head 17 is divided into two chambers by a partition 64d and diaphragm 68 is secured to the end of the blow-head 17 by collar 64e which is held thereto by bolts. A valve lifter 70 extends through a foot piece 68b at the lower side of the diaphragm 68 and upwardly through a threaded opening in the lifter 70. The valve lifter 70 comprises an upwardly extending projection and a radial flange 70a extending to spaced proximate relation to the inside of the walls 64 of the blow head 17. A spaced radial flange 70b terminates adjacent the seat 51c.

The upper end of the air tube 72 has an inwardly tapered flanged end 68a which is spaced from the diaphragm 68 at times between blowing cycles. Diaphragm 68 is adapted to move into sealing engagement with flange 68a during blowing as will be explained later. The lower portion of the air tube 72 has a disk shaped closure 73 attached to the end at 74 and the disk shaped member 73 has downwardly and outwardly divergent holes 75 formed therein. A disk 76 of flexible material such as rubber is supported on the member 73 by means of a centrally located stud 77 which threadably engages a hole 78 and has a nut 79. The disk 73 preferably has a peripheral ridge 80 formed thereon which is adapted to sealingly engage a rubber disk 76 at the end of the blowing operation. The flexible rubber disk 76 acts as a check valve to prevent sand from the hopper from blowing back into the air tube 72 at the end of a blowing cycle. The air tube 72 is pressed into bracket 41a and is held against vertical axial movement relative to supports 38 and 39 by bracket 44 which has its downward movement limited on supports 38 and 39 by collars 44a and 45. A hopper 83 is supported on the sand cartridge 84 and has the rubber washer 82 clamped between the ring 85 and the flange 86. Ring 85 is pressed on the end of the sand cartridge 84 and, thereby, fixed thereto. The cartridge 84 is pressed into bracket 44.

The cartridge 84 extends downwardly through the bracket 44 and is attached to the sand carrier 87 by means of the collar 88 and forms a press fit with the bracket 44. The sand carrier 87 has outwardly flaring sides 89 which

are attached through the collar 90 to the adapter head 91. The adapter head 91 has bores 92 and 93 therein to receive the upper ends 94 and 96, respectively, of the blow tubes 97 and the vent tubes 98. The blow and vent tubes 97 and 98 may be identical in shape; however, the vent tubes 98 have a laterally extending bore 99 communicating with the interior 100 thereof while the blow tubes 97 are entirely closed. Further, the vent tubes 98 have a screen 99a in the form of a cup pressed into the end thereof and the upper ends of the vent tubes 98 are closed at 98b. Both blow tube 97 and vent tube 98 have the gasket member 101, preferably made of silicon or some other low heat transfer material, extending around the tubes at 102 and having metal collar 99b holding gaskets 101 in spaced relation to the plate or adapter head 91. Collar 99b engages the ends of the gasket 101. The tubes 97 and 98 are pressed into the plate 91. The gaskets 101 are generally the shape of a frustum of a cone and are preferably made of silicon material which will stand a great deal of heat yet will have an extremely low co-efficient of thermal conductivity. A track 106 is supported at each end thereof by means of supports 107 which engage the ends of the track 106 at 108 and are supported on the base at 109. Cars 110 having wheels 111 thereon are adapted to traverse from one side to the other on the track 106 urged by an air actuated cylinder shown schematically at 240 having rods 140 attached to the cars 110.

During operation, there would generally be two cars 100. One can be in position at a side to have the core or shell therein removed while the other is having a shell or core blown therein. A mold 112 having an upper portion 113 thereon and having a cavity therein of the shape designed to be formed is supported on the top of the car 115. The mold 112 may be electrically heated in a conventional manner. A stripping mechanism made up of the carrier 116 which has the piston rod 117 attached thereto and the guide members 118 and 119 telescopically received in the guides 121 and 120, respectively, has the upwardly extending pins 122 attached thereto at 123. The pins 122 are adapted to extend through holes 124 in the bottom portion of a mold to engage the core or shell formed therein to lift it out of the mold. The lower portion 114 of the mold 112 has a lug 125 attached thereto at 126 and an outwardly extending end 127 which forms an end member to be received in the bifurcated portion 128 of the bracket 129 which is attached to the track 106 at 130. The lug 125 is preferably attached to the lower portion of the mold or the portion thereof resting on the car 110 so that the car 110 and hopper part of the mold 112 will be held to the track 106 and not be lifted off the track 106 by pins 122 when they are forced upwardly by the cylinder 156, forcing the shell or core out of the mold 112.

A sand reservoir 150 is supported on the transverse casting 5 at 151 and the downwardly extending sand tube 152 communicates through the opening 153 with the sand hopper 83. The sand is loaded in the reservoir 150 and it flows down through the sand tube 152, filling the hopper 83 and the cartridge 84 between times that cores are blown when the sand cartridge 84 is in the position shown in Fig. 3. A coated sand is preferably used which will not flow out of tubes 97 when air is not urging it therethrough.

During operation, I start with the car 110 in the position on the track 106 shown in Fig. 6. The mold 112 is loaded on the plate 143c which rests on car 110 and the car 110 moves along the track 106 to the position shown in Fig. 3. Sand will have run down through the tube 152 and the tube 153 into the hopper 83 and will have filled the sand cartridge 84 and hopper 83 and will have built up in the hopper 83 below and around the air tube 72.

When the car 110 is in position under plate 91, the operator opens the valve 160 which causes the lift 161 to

engage the mold on the car 110 and raise it up, guided by pins 143a which are fixed to car 110 and freely slide in holes 143b in the plate 143c into engagement with the conical gaskets 101, causing the conical gaskets 101 to engage the conical openings 143 and form sealing engagement therewith. As the piston in the cylinder 156 continues to raise the mold 112, it forces the sand cartridge 84 and the bracket 44 attached thereto, along with the hopper 83, upward, sliding the bracket 44 upwardly on the supports 38 and 39, since the spider 41a is fixed against vertical movement, the diaphragm 83a is attached to the spider 41a, at 83b, and the diaphragm 83a is sealingly attached to the hopper 83 at 83c, the diaphragm 83a will, therefore, deflect and the lower ends 80 of the air tube 72 will form sealing engagement with the washer 82 as shown in Fig. 1; that is, the ends 80 of the air tube 72 will cut through the sand between the ends 80 and washer 82 and form an air tight seal with the washer 82.

During upward movement of the bracket 44, the rod 46h will move upward therewith and the limit switch LS will be adjusted on the support 39 so that the end of the rod 46h will actuate the limit switch LS at the time that the ends 80 of the air tube 72 seal with the washer 82. The limit switch LS, when actuated, will energize the solenoid valve S which will cause air to flow through the pipe 46j, thereby allowing air to flow into the chamber 46a and applying pressure to the diaphragm 50 and forcing the member 51 with the blow head 66 attached thereto downward and bringing the diaphragm washer 68 into sealing engagement with the shoulders 68a of the air tube 72 as shown in Fig. 1. As the blow head 17 continues its movement downward, the shoulders 68a will continue to deflect the diaphragm washer 68 as shown in Fig. 1 until the valve lifter 70 lifts the ball valve 51b off of its seat 51c. As the ball 51b lifts from its seat 51c, air rushing thereunder from pipe 65 will deflect the spring 64c, raising the ball 51b still further from its seat 51c and allowing a blast of air to flow through the divergent openings 68d into the air tube space 71 and through the openings 75, forcing the flexible disk 76 away from the closure 73. The air under pressure reacting on the sand in the sand cartridge 84 will force the sand through the tubes 97 into the mold 112. Air exhausting from the mold 112 will flow outward through the tubes 98 and will be vented through the openings 99 therein to the open air above the mold 112. The screens 99a will prevent sand from escaping through the vent tubes 98.

When the air has flowed through pipe 65 for a predetermined time which has been set at the time required to form a mold, the timer T will actuate the solenoid valve S to direct the flow of air into the space 47a under the diaphragm 50. This will force the diaphragm 50 with the blow head 66 attached thereto upward. This will release the pressure on the shoulders 68a and allow the valve lifters 70 to move away from the ball 51b, allowing the ball 51b to drop onto the seat 51c, stopping the flow of air into the air tube 72. The flexible member 76 will then be forced back onto the closure 73 by residual air pressure in the mold 112, stopping the flow of air from the mold 112 and sand cartridge 84 back into the air tube 72 and, therefore, preventing any sand from blowing back therethrough. As the blow head 66 continues to be lifted, it will lift the diaphragm washer 68 entirely clear of the shoulders 68a, thereby providing a vent between the diaphragm washer 68 and shoulders 68a. The lift 161 will then be lowered. This will pull the peripheral edges of diaphragm 83a down and, thereby, put a partial vacuum on sand cartridge 84, aiding in stopping the flow of sand through tubes 97. The air cylinder attached to rod 140 may then actuate to push the car 110 with the mold 112 thereon out to the position shown in Fig. 6. The air cylinder 156 can then be actuated to move the stripping pins 122

into engagement with the top part of the mold 112 and the shorter pins 122a will then engage the shell to remove it from the mold.

Fig. 8 shows another embodiment of a mold which may be used on the novel molding machine. The mold is made of two parts 201 and 202 which have a cavity 203 formed therein in which a shell or core 219 is to be formed. The mold is adapted to be used with a blowing mechanism made up of the adapter plate 191 having blower tubes 192 therein and gasket 101. The gasket 161 is adapted to engage the conical opening 243 similar to the opening 143 shown in Fig. 3. Tubes 192 are pressed into washer 160a and form sliding contact with plate 191. Metal washer 194 is attached to the end of tube 192 at 195.

Instead of allowing the sand to blow through the opening 210 and impinge directly on the bottom of the mold at 211, a deflecting pin 212 is provided having a conical point 215 and a base 213 disposed in a hole 214 in the bottom part of the mold. The sand blows through the opening 210, impinges on the end 215, is diverted laterally as shown by the arrows 216, and, thereby, flows into the mold. As the end 215 of the pin 212 wears down, the pin 212 can be replaced and since the pin 212 forms an opening 218 in the shell or core 219 of the mold, the opening 218 is not objectionable.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A molding machine comprising a frame, a blow head on said frame, means to support a hopper on said frame, said blow head disposed above said hopper, a sand cartridge, said hopper disposed to discharge sand into said sand cartridge, means on said cartridge to engage a mold to communicate with the inside of the mold, means to support a mold box under said means, a main chamber and an auxiliary chamber for fluid under pressure, and a passage connecting said chambers and said blow head, said blow head adapted to move axially in said hopper into sealing engagement with one end of said sand cartridge whereby fluid under pressure from said chambers passes into said blow head and said cartridge and forces sand from said cartridge into said mold box.

2. The molding machine recited in claim 1 wherein said means to engage said mold comprises a tubular member having a flexible thermal insulating member disposed thereon adapted to connect said sand cartridge with said mold box, said flexible insulating member thermally isolating said tube from said mold box.

3. The molding machine recited in claim 2 wherein said flexible thermal insulating member is generally shaped in the form of the frustum of a cone and said insulating member is received in complementary shaped holes in said mold box.

4. The molding machine recited in claim 1 wherein said blow head has a closure over one end thereof, axially extending bores in said closure communicating with the inside thereof, and a sheet of flexible material disposed on the outside of a tubular member and attached at one point thereto whereby the edges of said flexible material are forced away from said closure when a blowing medium is turned on and said flexible member seals the bores in said closure when said blowing medium tends to flow toward said blow head.

5. The molding machine recited in claim 1 wherein said mold box is supported on a car, said car being supported on a track extending generally horizontally under a mold plate, said car being movable on said track from

a position under said molding plate to a loading position spaced from said molding plate.

6. The molding machine recited in claim 5 wherein a bracket having a generally V-shaped laterally extending slot therein is attached to an end of said track remote from said molding plate and a bracket member is attached to the lower portion of said car and movable into said slot to hold said mold against removal from said car.

7. A molding machine comprising a support, an air tube supported on said support, said air tube terminating at the upper end thereof in a peripheral shoulder defining an opening, a blow head attached to said support and disposed above said shoulder in spaced relation thereto, said blow head movable downward to form sealing engagement with said shoulder whereby a closed air passage is formed between said blow head and said air tube, said air tube being disposed in a hopper, the lower end of said air tube terminating in spaced relation to the lower end of said hopper, said hopper being adapted to contain sand, said hopper having an opening disposed below said air tube at the lower portion thereof communicating with a sand cartridge whereby sand from said hopper flows into said sand cartridge, means on said sand cartridge adapted to communicate with the interior of a mold box, said means on said sand cartridge being adapted to be engaged by a mold box whereby said hopper and sand cartridge are adapted to be lifted, bringing said air tube into communication with said sand cartridge and forming a sealed passage from said air tube to said cartridge, means to move said blow head into sealing engagement with said air tube, and means to supply compressed air under pressure to said blow head whereby said air flows from said blow head through said air tube into said sand cartridge, forcing sand from said cartridge into a mold adapted to be supported thereunder.

8. The molding machine recited in claim 7 wherein said means adapted to communicate with a mold box comprises thermal insulating means, said thermal insulating means adapted to form an air tight seal between said sand cartridge and said mold.

9. The molding machine recited in claim 8 wherein a flexible diaphragm forms a closure for the top of said hopper, said air tube extending through said diaphragm centrally thereof, said diaphragm being attached to a fixed member on said support at the central portion of said diaphragm, said diaphragm being attached to the upper edge of said hopper around its peripheral edge whereby said diaphragm is adapted to exert a suction on said sand in said sand cartridge when said sand cartridge and hopper move away from said air tube.

10. The molding machine recited in claim 9 wherein a check valve is disposed over the end of said air tube adjacent said sand cartridge.

11. The molding machine recited in claim 10 wherein a closure is disposed over the end of said air tube adjacent said sand cartridge, said closure having downwardly divergent openings therethrough.

12. The molding machine recited in claim 8 wherein said thermal insulating means comprises a resilient silicon compound.

13. The molding machine recited in claim 7 wherein said means communicating from said sand cartridge to said mold comprises a plurality of tubes, alternate tubes being blowing tubes adapted to conduct sand and a blowing medium from said sand cartridge to said mold, and the other tubes of said plurality of tubes comprising vent tubes, said vent tubes having a screen mesh over the end thereof adjacent said mold, preventing sand from escaping from said mold, and an aperture in said other tubes communicating from the inside thereof to the ambient atmosphere whereby air blown into said mold is vented therefrom.

14. In combination, a molding machine and a mold box for forming a core or the like supported on said machine comprising a hollow mold box having the inside surfaces therein defining a space, said space shaped as the counterpart of a core to be formed, said mold box having an opening communicating from the exterior of said mold box into the space therein, the walls of said mold box being relatively thick and said opening in said body being a substantially long passage, and a pin supported on said mold box on the inside thereof and extending into said passage and having an outwardly facing end, said pin being smaller in cross section than said passage in said mold box wall generally concentric therewith whereby sand blown from a source on said machine disposed in communication with said mold box impinges on said end of said pin and passes through the space between said passage and said pin into said space in said mold box, said pin preventing wear of said mold box wall opposite the passage by said sand adapted to be blown into said mold box.

15. The molding machine recited in claim 1 wherein said means to engage said mold comprises a flexible member made of silicone material having an outside shape substantially conforming to the frustum of a cone and is received in complementary shaped holes in said mold box.

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