March 9, 1965 R. W. ELLMS 3,172,173

FOUNDRY MOLDING MACHINE WITH MULTIPLE AREA SQUEEZE HEAD

Filed July 26, 1961 4 Sheets-Sheet 1

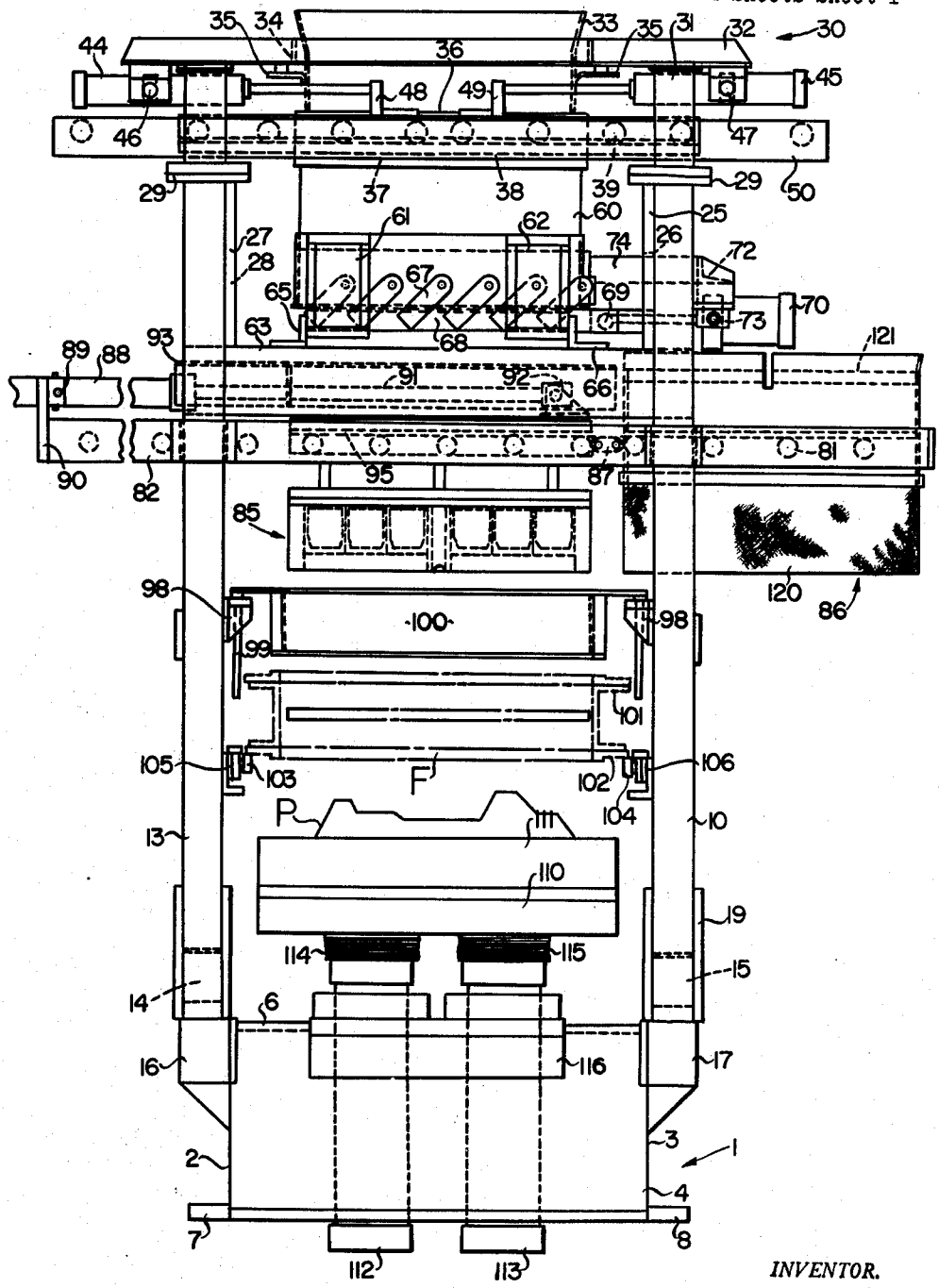


FIG 1

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Filed July 26, 1961 4 Sheets-Sheet 2

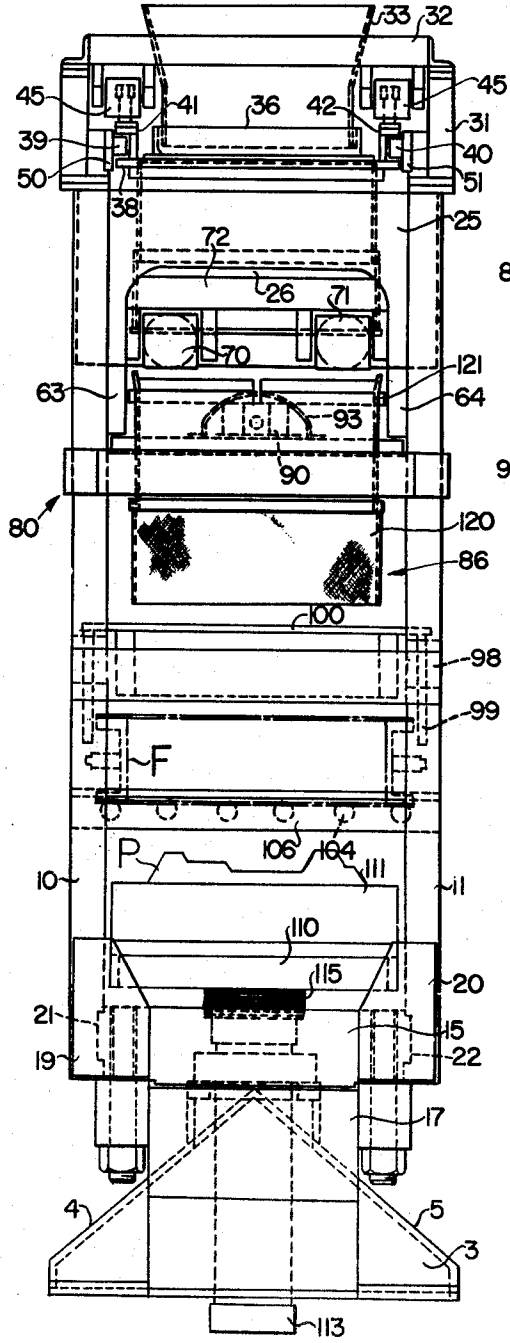


FIG 2

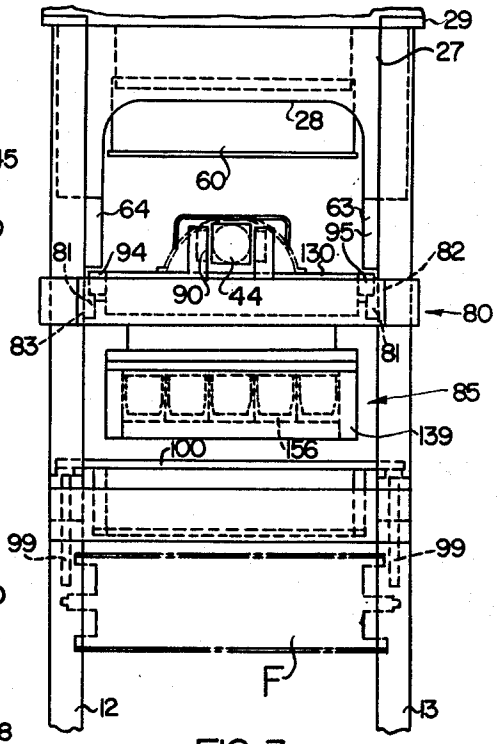


FIG 3

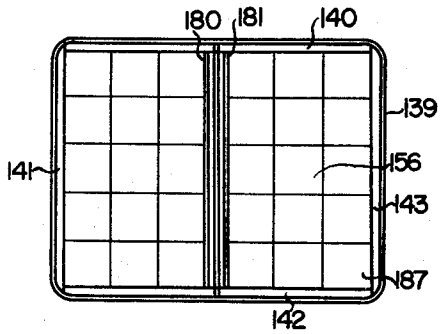


FIG 4

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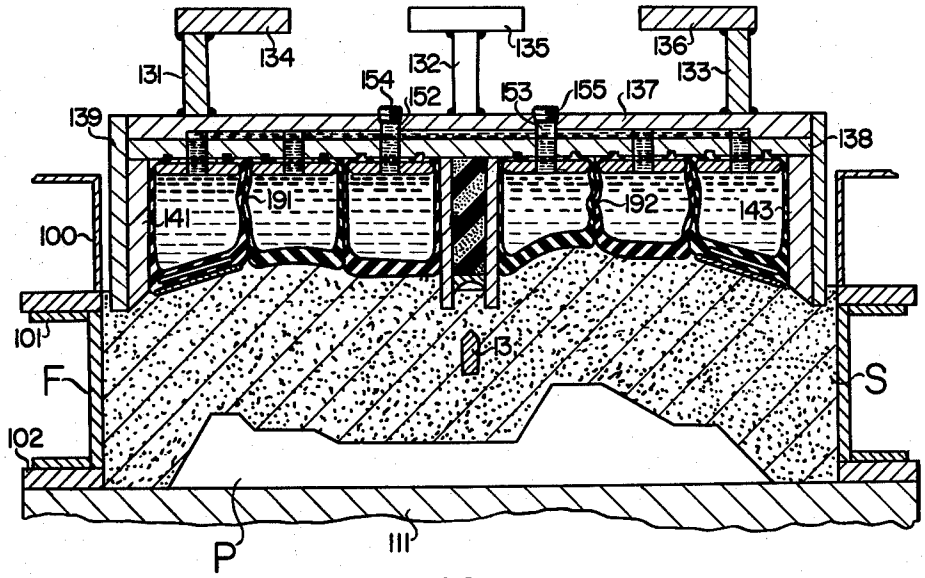


FIG 6

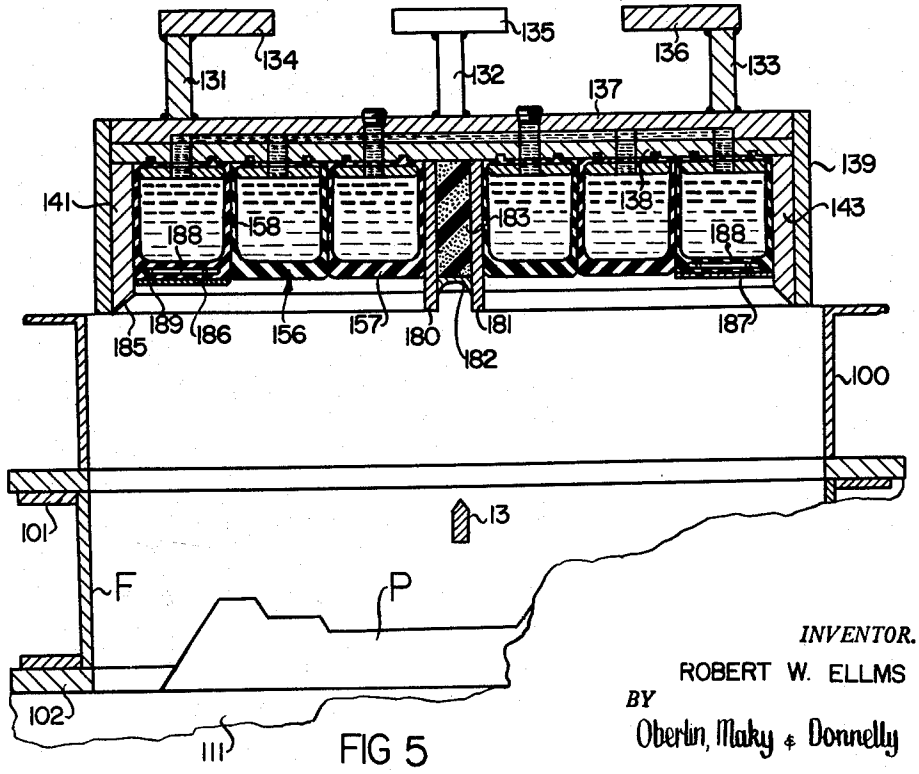


FIG 5

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FOUNDRY MOLDING MACHINE WITH MULTIPLE AREA SQUEEZE HEAD

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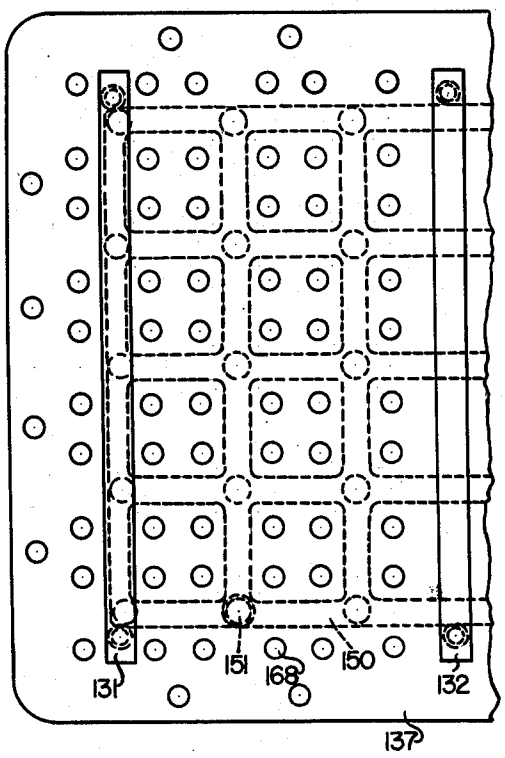


FIG 7

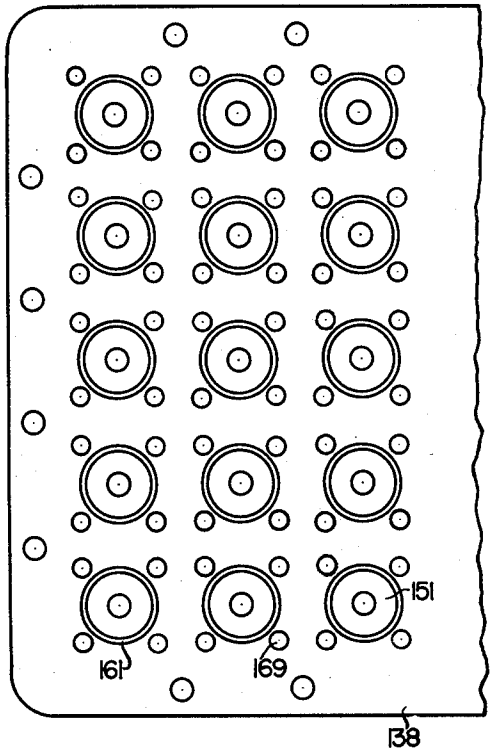


FIG 8

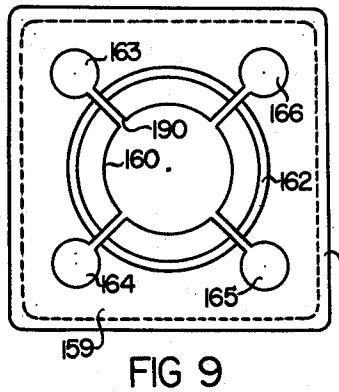


FIG 9

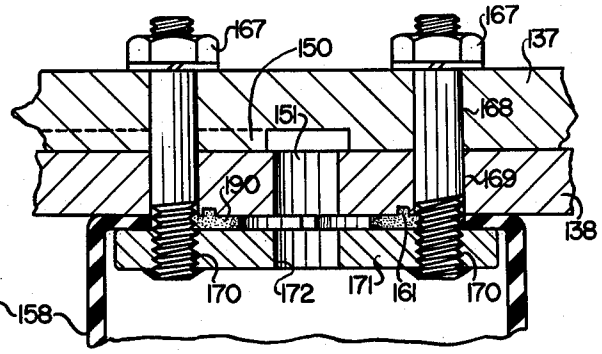


FIG 10

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United States Patent Office 3,172,173 Patented Mar. 9, 1965

3,172,173

FOUNDRY MOLDING MACHINE WITH MULTIPLE AREA SQUEEZE HEAD

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9 Claims. (Cl. 22—26)

This invention relates generally, as indicated, to a foundry molding machine with a multiple area squeeze head and more particularly to a foundry molding machine employing a squeeze head comprised of a multiplicity of fluid filled resiliently deformable squeeze blocks.

Heretofore, it has, for example, been proposed to squeeze foundry sand molds with large flexible fluid backed diaphragms in order to afford an equalized pressure squeeze over the surface of the foundry sand mold despite the varying depth of the sand overlying the pattern. Such diaphragms are, as a rule, quite expensive and, at the working pressures of such foundry molding machines, may not infrequently rupture, the replacement thereof being expensive and resulting in substantial downtime of the machine. Moreover, when employing several large diaphragms, it is difficult to avoid large lands between the individual diaphragms and when using flasks having bars thereacross or skeleton flasks, down gates, sprues, etc., it is difficult for a large single diaphragm to be fully effective.

It is accordingly a principal object of the present invention to provide a foundry molding machine which will have a large area squeeze head affording the advantages of a single diaphragm without the aforementioned working problems.

It is another principal object to provide a foundry molding machine having a diaphragm-type squeeze head which can more easily be serviced.

It is another object to provide a foundry molding machine having a diaphragm squeeze head which can be employed with barred flasks, down gates, sprues, etc.

It is still another object to provide a foundry molding machine having a diaphragm squeeze head which can readily be replaced with a head of a different diaphragm arrangement facilitating its use with such barred flasks, down gates, sprues, etc.

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 a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

FIG. 1 is a side elevation of a foundry molding machine in accordance with the present invention;

FIG. 2 is an end elevation of such molding machine;

FIG. 3 is a fragmentary end elevation as seen from the opposite side of the machine;

FIG. 4 is a bottom plan view of the squeeze head of the present invention;

FIG. 5 is a sectional view of such squeeze head showing the squeeze blocks thereof in an undistorted non-working position;

FIG. 6 is a view of FIG. 5 showing the squeeze blocks in their sand pressure applying position;

FIG. 7 is a fragmentary top plan view of the squeeze head plate of the present invention;

FIG. 8 is a fragmentary bottom plan view of such squeeze head plate;

FIG. 9 is a fragmentary top plan view of a squeeze block that may be employed with the present invention; and

FIG. 10 is a fragmentary vertical section illustrating the manner in which the squeeze block is secured to the squeeze head.

Referring now to the annexed drawings and more particularly to FIGS. 1, 2 and 3, there is illustrated a machine in accordance with the present invention. Such machine comprises a base 1 comprised of side plates 2 and 3 and sloping top plates 4 and 5, such top plates 4 and 5 meeting at ridge 6. The triangular-shape base thus precludes sand from collecting on the top surface thereof and in effect makes the machine more easily cleaned. The machine may be bolted directly to the floor through flanges 7 and 8. Extending upwardly from the base 1 are four tubular section legs 10, 11, 12 and 13. The legs 10, 11 and 12, 13 are horizontally spaced and supported by cross-frame members 14 and 15, such cross-frame members being in turn bolted to the brackets 16 and 17 secured directly to the side plates 2 and 3 of the base 1. Pairs of gusset plates 19 and 20 may be employed to rigidify the connection between the legs 10, 11 and the cross-frame member 15. Similar gusset plates will be provided between the legs 12 and 13 and the cross-frame member 14. Also, a tongue and groove connection may additionally be employed as shown at 21 and 22.

The top of legs 10 and 11 are interconnected by a plate 25 having an arch cutout portion 26 shown more clearly in FIG. 2. Similarly, the legs 12 and 13 are joined by a plate 27 having an arch cutout portion 28.

Each of the legs 10 through 13 terminates in plates 29 which support thereon a sand charging mechanism shown generally at 30. Such mechanism is supported on a frame which is in turn supported on the plates 29, which frame comprises legs 31 and a rectilinear top frame 32, supported thereon. The sand hopper 33 is supported within the frame 32 by means of cross-frame members 34 and brackets 35 secured thereto. Such hopper extends within a fill ring 36 mounted on the tops of horizontally movable cutoff plates 37 and 38. Such cutoff plates are mounted for horizontal movement on rollers 39 and 40. The cutoff plates 37 and 38 are each provided with U-shaped side guides as shown at 41 and 42 in FIG. 2 with the rollers 39 and 40 fitting therewithin and thus supporting the plates. Movement of the cutoff plates is obtained by pairs of piston-cylinder assemblies 44 and 45 which are pivoted to the frame 32 as shown at 46 and 47 respectively and connected to the plates as shown at 48 and 49 respectively. The rollers 39 are mounted on roller support bars 50 and 51 extending between the legs 31 of the sand charging frame 30.

A sand measuring box 60 is supported on brackets 61 and 62 which are in turn supported on cross-frame members 63 and 64 with angle members 65 and 66 extending therebetween. Cutoff louvers or gates 67 pivotally mounted in the bottom of the box 60 are actuated by a horizontally movable frame 68. The frame 68 is connected as shown at 69 to the rods of piston-cylinder assemblies 70 and 71. Such piston-cylinder assemblies are pivotally mounted on angle bracket 72 as shown at 73 and a hood 74 extends through the cutout 26 protecting the rods of such piston-cylinder assemblies from loose sand. In this manner, actuation of the piston-cylinder assemblies 70 and 71 will control the position of the louvers 67 to permit a desired amount of sand to fall therethrough from the sand reservoir or box 60, such reservoir being charged with sand from the hopper 33

by movement of the cutoff plates 37 and 38 as the result of actuation of the pairs of piston-cylinder assemblies 44 and 45.

Slightly spaced beneath the louvers 67 there is provided a box 80 frame having inwardly directed rollers 81 supported on the side frame members 82 and 83 thereof. Mounted on such rollers for horizontal reciprocation therealong, there is provided a carriage composed of the squeeze head 85 and a sand chute 86. The squeeze head and chute are interconnected for movement as a unit by means of links 87 and such movement is obtained by means of a piston-cylinder assembly 88 shown broken away in FIG. 1 having a pivotal connection 89 with bracket 90 secured to the frame 80. The rod 91 of such piston-cylinder assembly is pivotally connected to the bracket 92 which is in turn connected to the squeeze head 85. Both the squeeze head 85 and the chute 86 are provided with side guide flanges which ride on top of the rollers 81 and reciprocation of the rod 91 will afford reciprocation of the head and chute as a unit. A hood 93 is mounted on the top of the squeeze head for movement therewith and it will be seen in FIG. 1 that the hood will always overlie the rod 91 in its extended position to protect the rod from falling sand. It is noted that the laterally extending flanges 94 and 95 of the squeeze head underlie the frame members 63 and 64 when the squeeze head is beneath the sand box 60 or centrally located in the machine.

The legs 10 through 13 are provided with brackets 98 to receive guide and aligning pins 99 of a fill frame unit 100. The fill frame 100 has a marginal interior dimension slightly larger than the marginal peripheral exterior dimension of the squeeze head 85. This relative dimensioning of the squeeze head and fill frame permits the squeeze head to enter within the fill frame as the fill frame is raised by upward movement of the flask F. The flask F is provided with top and bottom flanges 101 and 102 with the bottom peripheral flange 102 serving to support the flask on parallel rows of rollers 103 and 104 mounted on frames 105 and 106 extending horizontally between frame legs 12–13 and 10–11. It will be understood that these rollers will form a continuation of a conveyor roller system adjacent the conveyor to permit flasks F readily to be moved into and discharged from the machine.

Positioned beneath the flask F is a table 110 supporting a pattern plate 111 and a pattern P, and vertical movement of such table is obtained by a pair of piston-cylinder assemblies 112 and 113. The rods of such assemblies are connected to the table 110 and surrounded by flexible boots 114 and 115 protecting the same from sand. The upper ends of such piston-cylinder assemblies are secured adjacent the apex of the triangular base 1 by means of suitable framing 116. It can now be seen that a pattern upon the plate 111 can be raised to enter the flask F and the continued upward movement of the pattern plate and table will cause the flask to be raised from the rollers 103 and 102 to engage the fill frame 100. This then assembles the fill frame, flask, and pattern plate as a mold box to be filled with sand through the sand charging mechanism 30. When such box is to be filled with sand, the chute 86 will be positioned beneath the louvers 67 and the top edge of the fill frame 100 will be closely adjacent the bottom peripheral edge of a reinforced cloth guide 120 which is supported from the guide carriage frame 121. The fill chute 86 then constitutes a guide or continuation of the peripheral dimensions of the sand box 60 so that the sand falling through the louvers 67 opened by the piston-cylinder assemblies 70 and 71 will fall directly into the mold box which is comprised of the assembled fill frame, flask, and pattern plate.

When the mold box has been filled, the louvers 67 will be closed by the piston-cylinder assemblies 70 and 71 and actuation of the piston-cylinder assembly 88 will shuttle the chute 86 out of the way and position the squeeze head 85 properly in the squeezing position directly above the flask and fill frame or the assembled mold box. Suitable stops, of course, will be employed to guarantee the proper positioning of the squeeze head. Elevation of the mold box will be momentarily halted during the filling operation with the top periphery of the fill frame 100 closely adjacent the cloth guide 120. After the fill operation and the correct positioning of the squeeze head, the upward elevation of the mold box can continue causing the fill frame to move upwardly around the squeeze head with the squeeze head performing the proper squeeze operation on the sand within the mold box against the pattern P. As seen more clearly in FIG. 3, the slide flanges 94 and 95 of the carriage frame 130 of the squeeze head 85 underlie the frame members 63 and 64 to provide a positive backup for the squeeze head in its squeeze position.

The carriage frame 130 supports the squeeze head by means of three transverse frame members 131, 132 and 133 having top plates 134, 135 and 136 secured thereto which may be bolted, for example, directly to the frame 130. The squeeze head itself is comprised of top and bottom manifold plates 137 and 138 to which a peripheral downwardly projecting plate frame 139 is marginally secured. Side reinforcing members 140, 141, 142 and 143 may be secured to the bottom plate 138 as well as the marginal plate frame 139 providing a recess or cavity for the squeeze blocks of the present invention.

The bottom surface of the top head plate 137 is provided with a reticulate pattern of shallow grooves as shown at 150 which communicate with a plurality of regularly spaced vertically extending openings 151 in the bottom head plate 138. The top surface of the top head plate 137 is provided with threaded apertures as shown at 152 and 153 provided with plugs 154 and 155. These apertures communicate with the reticulate system of grooves within the bottom of the top plate 137 whereby the same may be filled with fluid. The grooves cooperate with the top surface of the bottom plate 138 to form a system of passageways interconnecting all of the openings 151 which communicate with the interiors of rubber blocks 156.

Such rubber blocks 156 have relatively thick bottom walls 157 and relatively thin side walls 158. The top wall 159 of such blocks is provided with a central aperture 160 which in the assembled position will be concentric with the aperture 151 in the plate 138. This positioning is obtained by the interfitting of a groove 161 in the bottom surface of plate 138 and a series of quadrant ridges 162 in the top wall 159 of the block. The top wall of the block is provided with four smaller openings 163, 164, 165 and 166 to accommodate clamping bolts 167 which extend through four similarly spaced apertures 168 in the top plate 137, four similarly spaced and aligned apertures 169 in the plate 138 and four threaded apertures 170 in clamping plate 171. Such clamping plate has a central aperture 172 which is adapted to be aligned with the aperture 160 in the top wall 159 of the block and the aperture 151 in the bottom plate 138.

In the illustrated embodiment of the invention, slightly more than one-half of the head shown in FIGS. 7 and 8 will accommodate fifteen of the blocks 156 in side-by-side juxtaposed relation completely to cover the bottom surface of the bottom head plate 138 from the member 141 to the vertically extending plate 180 which is slightly spaced from a similar vertically extending plate 181. A vertically movable member 182 having an arcuate bottom surface is interposed therein and is provided with a sponge rubber or foamed elastomer backup 183. In this manner, the flask F may be provided with a central horizontally extending bar B which the member 182 will engage if the plate is forced sufficiently far within the flask F. If the head does engage it, the sponge rubber or elastomer 183 will compress thus preventing damage to such barred or skeleton flask. The head may be generally symmetrical

about the center thereof and each of the blocks 166 may be provided with powdered mica therebetween to enable them readily to flex and rub against each other.

It is noted that the members 140, 141, 142 and 143 are beveled as shown at 185 so that the rigid peripheral squeeze obtained by the frame 139 and such members 140 through 143 will direct the sand slightly inwardly to be compressed by the deformable blocks 156. Since the pressure or abrasive action of the sand diverted thereby will be strongest against the peripheral blocks 156, such blocks are provided with reinforcing plates as shown at 186 and 187. These peripheral blocks are provided with horizontally extending hollow portions in the enlarged bottom walls thereof whereby the plates 186 and 187 can be fastened directly thereto as by suitable fastening means 189 such as nuts and bolts.

It can now be seen that each of the rubber blocks 156 can readily be replaced simply by unscrewing the clamping studs 167 to disconnect the generally square clamping plate 171 so that a ruptured block 156 can readily be pulled from the assembly. It is noted as shown more clearly in FIG. 9 that the top wall 159 of the block 156 is provided with four inwardly directed slots 190 extending from the apertures 163 through 166 to the aperture 160. This then divides the ridge 162 into four quadrant-shape ridges which makes the top wall sufficiently flexible readily to enable the ridge 162 to be inserted in the groove in the bottom of plate 138 and to permit the top wall 159 to be deformed so that the square clamping plate 171 may be inserted therein and removed therefrom. It can now be seen that such blocks 156 are readily removable and replaceable in the assembly and for different squeezing operations, a different arrangement of the fluid passageways and the clamping holes may be provided in the plates as shown in FIGS. 7 and 8 to obtain any arrangement of the fluid block as desired.

Preferably, each of the blocks will be filled with water and also the reticulate system of passageways in the plates 137 and 138 will also be filled with water and the plugs 154 and 155 will seal the manifolding of the blocks. Thus the water being an incompressible fluid will provide a displaceable but firm pressure head for the squeezing of the sand within the mold box. It will, of course, be understood that water need only partially fill the blocks and interconnected manifold system and that a certain amount of air may be left on top of the system to provide a compressive fluid if desired. It can now be seen that each of the blocks is interconnected with every other block so that an increase in pressure in one will result in a similar increase in pressure in all. Also, if the volume of one decreases, the decreased volume will be spread equally among all the other blocks.

In operation, the sand within the hopper 33 is placed within the sand box 60 and the sand chute is placed in position in the center of the machine in the fill position. The pattern plate 111 on the table 110 is elevated to engage the flask F which in turn engages the fill frame 100. Preferably the fill frame will be stainless steel and dimensioned peripherally to receive the squeeze head 85 therein. As soon as the mold box composed of the fill frame, flask and pattern plate is assembled in position beneath the chute 86, the piston-cylinder assemblies 70 and 71 are actuated to open the louvers 67 to dump the fluffed or uncompressed sand within the mold box. The louvers are then closed and the actuation of piston-cylinder assembly 88 will shift the chute to the right as shown in FIG. 1 and position the squeeze head 85 directly over the assembled mold box with such components in the position more generally shown in FIG. 5. Further elevation of the mold box by means of the piston-cylinder assemblies 112 and 113 will cause the squeeze head to enter the fill frame and flask resulting in a mechanical squeeze pressure on the sand S within the mold box causing the fluid filled flexible blocks to distort in generally the manner indicated. It can readily be seen that the pressure of the sand on the more thick bottom walls of the fluid blocks will cause the side walls to distort and interengage as shown at 191 and 192 thereby transferring the squeezing pressure produced on the bottom surface thereof throughout the area of the head or from one block to the adjacent block. This is also accomplished by the manifold system and it can readily be seen that a pressure equalizing squeeze operation is obtained. The bottom sand engaging surface provided by the squeeze blocks comprises a large number of individually movable sections in side-by-side relation adapted to conform to sand surface irregularities and yet exert a uniform pressure over the entire surface.

The piston-cylinder assemblies 112 and 113 may be hydraulically operated and when a certain predetermined squeeze pressure is obtained, the direction of movement of the table 110 will be reversed to draw the mold box from the squeeze head and the pins 99 will pass through the brackets 98 separating the fill frame from the flask and the rollers 103 and 104 will engage the lower flange 102 of the flask separating it from the pattern plate drawing the pattern therefrom. The flask with the sand mold therein can then be trundled away from the machine on the conveyor rollers 103 and 104. A new flask will be positioned in place and the above-described cycle can then be repeated.

Whereas the illustrated machine discloses a squeeze head wherein each of the bags or squeeze blocks is manifolded, it is entirely possible to seal off individually each bag so that interengagement of the sides as shown at 191 and 192 would be relied upon for the pressure equalization. It is, of course, possible with certain type of sand squeezing operations to use only blocks filled with a foamed elastomeric material. The blocks of the present invention may suitably be made of neoprene, rubber or other elastomeric materials such as polyurethanes.

It can now be seen that there is provided a foundry mold squeeze head of a flexible construction in which it is more easy to replace a small fluid backed block should one become ruptured than it would be to replace an entire large diaphragm. Moreover, any desired arrangement of such blocks can be obtained which permits such a head to be used with barred flasks, down-gates or sprues. It is, of course, possible to use such device as a fluid weight resting directly freely on the sand surface in a weighted jolt machine.

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.

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

1. A foundry molding machine comprising a base, an upstanding frame secured to said base, a pair of elevating cylinders mounted in said base and supporting a pattern plate thereon, means on said frame to position a flask above said pattern plate to be raised from said means when said pattern plate is raised by said piston-cylinder assemblies, a sand hopper at the top of said frame, a sand box within said frame beneath said sand hopper, and louver means to control the gravity discharge of sand from said sand box, conveyor means extending horizontally transversely in said frame, carriage means positioned on said conveyor means, and means to shuttle said carriage means back and forth beneath said louver means; said carriage means comprising a sand chute adapted to be aligned with said louver means and said pattern plate and flask in one position thereof, and a sand squeeze head adapted to be aligned with said pattern plate and flask in the other position thereof, said piston-cylinder assemblies being operative to raise said pattern plate and flask against said squeeze head when so aligned to squeeze the sand therein, said means to shuttle said carriage back and forth comprising a

piston-cylinder assembly having the rod thereof connected to said carriage means, and hood means mounted on said carriage means operative always to overlie the rod of said piston-cylinder assembly to protect the same from falling sand.

2. The machine set forth in claim 1 including a fill frame of the same marginal dimensions as said flask and slightly larger than the marginal dimensions of said squeeze head supported on said frame and adapted to be raised by engagement of said flask therewith to form with said flask and pattern plate an open top sand receiving mold box.

3. The machine set forth in claim 2 wherein said sand squeezing head comprises a downwardly opening cavity, and a plurality of fluid-backed flexible blocks nested in said cavity.

4. The machine set forth in claim 3 wherein said fluid-backed blocks are hollow and in direct fluid communication with each other.

5. The machine set forth in claim 4 wherein the fluid backing of said fluid blocks is fixed as to quantity.

6. A squeeze head for foundry molding machines and the like comprising a squeeze head frame, a downwardly facing cavity in said frame, a plurality of hollow resiliently deformable squeeze blocks secured to the inside of said cavity each having vertically continuous side walls in nested engaging relationship with the side walls of adjacent blocks, clamping plates in said squeeze head clamping said blocks to said frame, and means in said head providing direct fluid communication between each of said hollow sequeeze blocks.

7. A squeeze head for foundry molding machines and the like comprising a squeeze head frame, a downwardly facing cavity in said frame, a plurality of hollow resiliently deformable squeeze blocks secured to the inside of said cavity each having vertically continuous side walls in nested engaging relationship with the side walls of adjacent blocks, clamping plates in said squeeze head clamping said blocks to said frame, and means in said head providing direct fluid communication between each of said hollow squeeze blocks, said squeeze blocks having a thick bottom surface adapted to engage sand in a foundry molding process, while forming a flexible sand engaging surface comprised of individually movable sections.

8. A foundry molding machine comprising a frame, means for assembling a mold box within said frame, means to charge said mold box with sand, means to position a squeeze head adjacent said mold box, and means to force said mold box against said squeeze head, said squeeze head comprising a plurality of laterally juxtaposed fluid-backed flexible blocks having parallel vertically extending side walls which interengage with the contiguous side walls of adjacent blocks on deformation thereof, and means providing direct fluid communication between said blocks.

9. A squeeze head for a foundry molding machine comprising a hollow cavity, a plurality of hollow elastomeric blocks secured in said cavity in nested interfitting side-by-side position, and means providing direct fluid communication between said blocks, said blocks having bottom walls forming a generally coplanar bottom surface providing a squeeze surface for said head comprised of a plurality of individually movable sand engaging sections, and thinner side walls vertically continuously juxtaposed with side walls of adjacent blocks.

References Cited in the file of this patent

UNITED STATES PATENTS

331,208	Moore	Nov. 24, 1885
995,690	Landis	June 20, 1911
2,411,043	Klassen	Nov. 12, 1946
2,686,345	Young	Aug. 17, 1954
2,830,337	Shelby et al.	Apr. 15, 1958
2,857,636	Whitesell	Oct. 28, 1958
2,962,775	Rekart	Dec. 6, 1960
2,968,846	Miller	Jan. 24, 1961
2,988,789	Taccone	June 20, 1961
3,056,183	Pigeot	Oct. 2, 1962

FOREIGN PATENTS

128,980	Russia	Nov. 3, 1960