April 21, 1959 E. B. REDHEAD 2,882,566

MOLD FORMING APPARATUS

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FIG. 1.

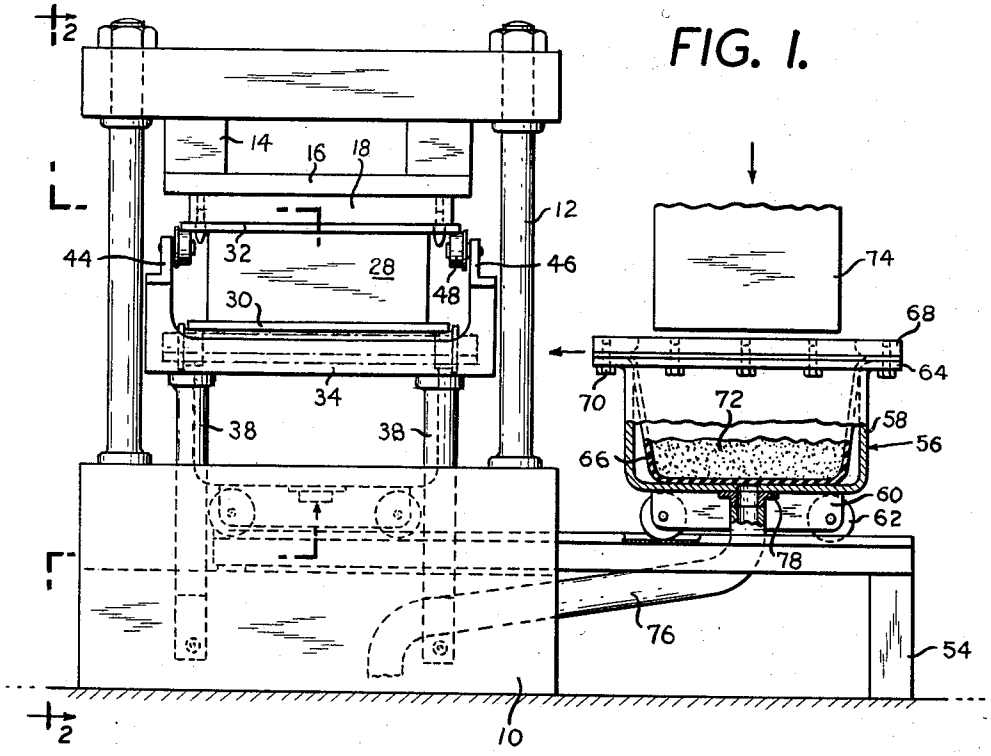
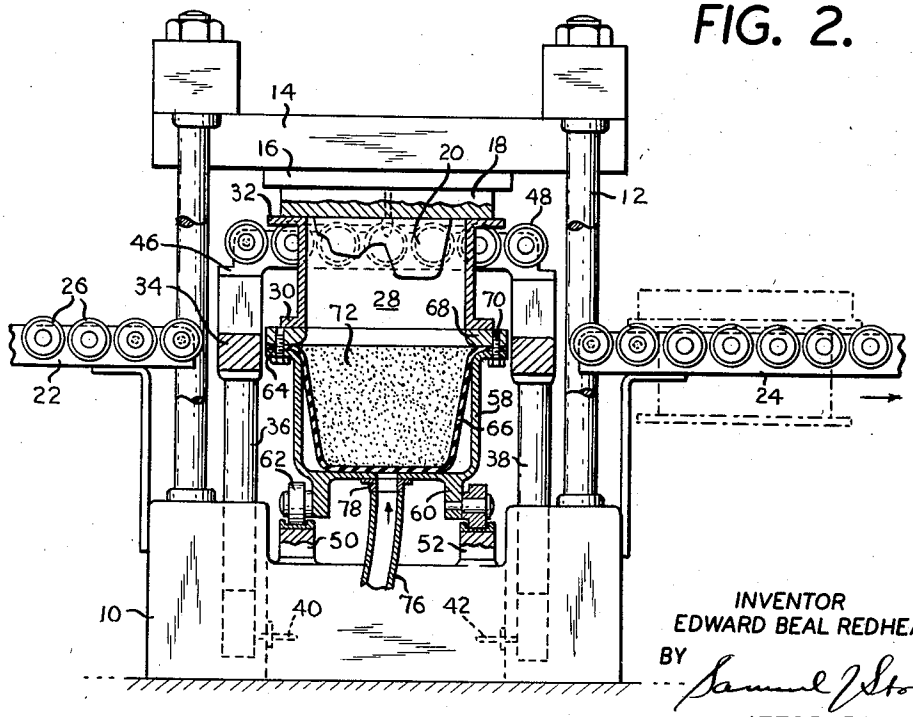


FIG. 2.



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FIG. 3.

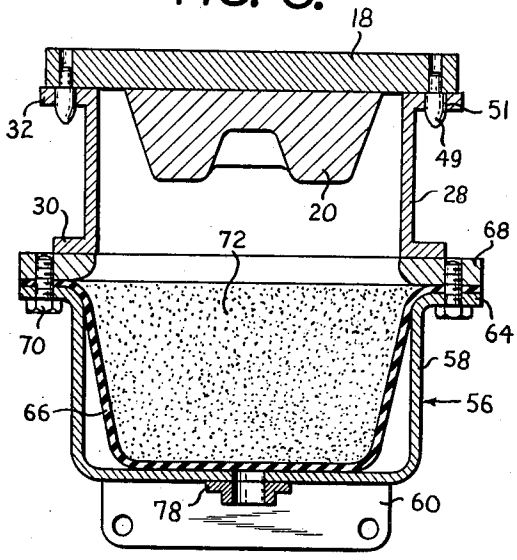


FIG. 4.

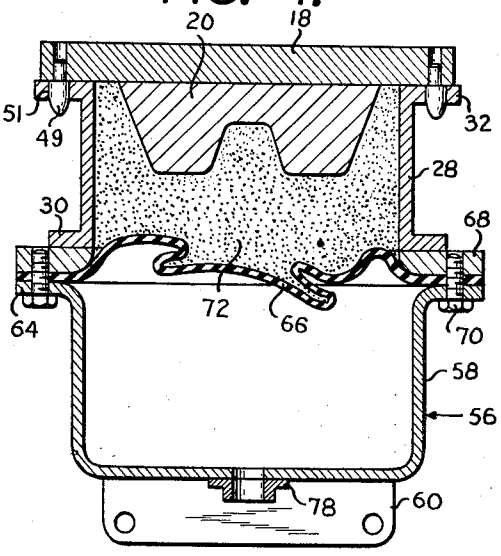


FIG. 8.

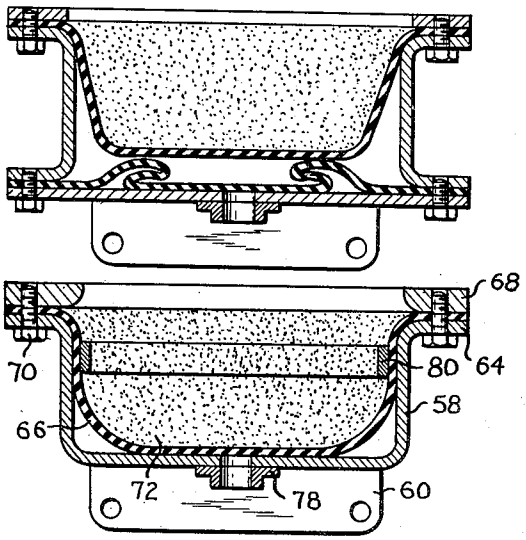


FIG. 5.

FIG. 7.

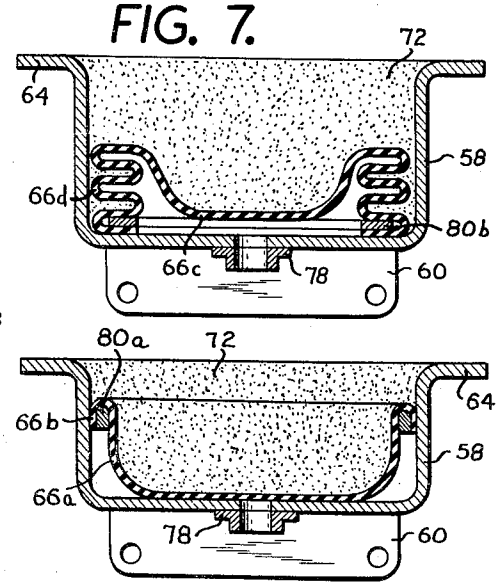


FIG. 6.

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MOLD FORMING APPARATUS

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Application October 17, 1957, Serial No. 690,826
4 Claims. (Cl. 22—36)

This invention relates to a method of and apparatus for introducing sand, powder or other free-flowing material upwardly into an open-bottomed receptacle such as a mold, flask, tank or bag, for the purpose of either fully or partially filling the receptacle and then compacting the material, generally, but not necessarily, into a dense mass.

For the purpose of illustrating a typical practical application of this method, the description contained in this specification applies to a foundry molding machine for the making of green sand molds. It is recognized, however, that this method can be adapted for use in other molding practices such as core making and shell molding, as well as in unrelated fields wherein upward injection of free flowing materials would prove advantageous over conventional gravity feed or other downward flow methods.

The illustrated form of the invention pertains to the making of sand molds used in metal casting procedures. The sand is molded in flasks to form a cope and a drag, which will then be placed together to form the complete mold. In the formation of these sand molds patterns are used, and the sand is pressed under high pressure against these patterns to form the desired contours.

Speaking generally, there are two methods of applying pressure to the sand. One involves the use of a fixed platen and a movable ram. The pattern is usually mounted on the ram, and a flask encloses it on all sides. Sand is then deposited into the flask and onto the pattern, and the ram then elevates both the pattern and flask in the direction of the platen. The sand is thereby squeezed between the pattern and the platen, and a sand mold is thereby produced.

In the second method, the pattern and flask rest upon a platen or upon a ram, and sand is deposited into the flask and upon the pattern in the usual way. Above the pattern and flask is a diaphragm head, and air under high pressure is introduced into the diaphragm. This causes the diaphragm to press downwardly upon the sand and to squeeze it against the pattern, thereby producing a sand mold.

The present invention constitutes an improvement over the second method above described. It involves a reversal of parts and procedures to produce a most unconventional machine and process, resulting in very substantial advantages over the prior art.

Specifically, the instant invention requires that the pattern be placed above the sand, rather than below it as is conventional procedure in all cases. The present invention also requires that the diaphragm also be placed below the sand and not above it. Furthermore, instead of depositing the sand into the flask, the sand is deposited into the diaphragm, which functions in the manner of a pouch prior to the molding operation herein described.

More specifically, the pattern in the present machine is secured to an overhead pattern plate or platen. A conveyor carries the individual flasks to operative position immediately below the pattern, and a ram or elevator then elevates the flasks into engagement with the pattern-supporting platen. The flask is now in operative position ready to receive a charge of sand.

The diaphragm is situated in a carriage which is movable into a position below the sand hopper and from there into position directly below the pattern. The carriage is moved into position below the sand hopper, and a charge of sand is deposited into the diaphragm. The carriage is then moved into its second position, which is below the pattern, and air under high pressure is introduced between the carriage and the diaphragm. This causes elevation of the diaphragm and its sand contents and causes the sand to be injected into the flask. The diaphragm now serves as the floor of the flask, and further air pressure upon it causes it to squeeze the sand against the pattern, thereby producing a sand mold.

There are important advantages in this procedure, not the least of which is the favorable positioning of the flasks. In all current methods of sand molding, the impression of the pattern in the sand is on the underside of the flask and therefore not visible. In the present case, on the other hand, the impression of the pattern in the sand is in the top of the flask and therefore readily inspected. Also, in current methods, a drag mold with exceptionally long sand projections below the face of the mold, needs to be rotated 180 degrees with the pattern remaining in it before the pattern can be drawn from the mold; otherwise, without the pattern remaining in the mold, there would be a strong likelihood that the long sand projections would break off, when the drag mold is rotated the original 180 degrees necessary for placing it in proper position to receive the cope mold. In the present case, the drag mold does not need to be rotated either with or without the pattern in it, as the face of the mold is on the top side of the flask and therefore is already in the proper position to receive the cope mold. Also, in current methods, the introduction of sand into the flask and the subsequent squeezing of the sand are divided into two separate operations. In the present case, however, the injecting and squeezing of the sand are combined into a single operation, thereby substantially reducing the length of time required in the making of a mold. Also, injecting the sand into the flask at high speed as in the present case results in a mold of greater sand hardness than in current methods.

The invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a side elevation of a machine made in accordance with this invention, parts thereof being shown in section to disclose inner features that would otherwise not be seen.

Fig. 2 is a view of the same machine looking in the direction of arrows 2, 2 in Fig. 1, the view in Fig. 2 being partly in vertical section.

Fig. 3 is a vertical section through the flask and pattern and through one form of diaphragm construction.

Fig. 4 is a similar section showing the diaphragm in elevated position, pressing the sand against the pattern in the flask.

Fig. 5 is a sectional view through another form of diaphragm construction.

Fig. 6 is still another section through still another form of diaphragm.

Fig. 7 is still another section through a further modification of the diaphragm construction.

Fig. 8 is a further section through another modification of the diaphragm construction, showing the use of a double diaphragm.

Referring now to Figs. 1, 2 and 3 of the drawing, it will be noted that the sand molding machine shown

therein includes a base 10 and a frame 12 supported thereby. The frame supports a cross-head 14, which is fixed in position relative to the frame and the base. Secured to said cross-head is a stationary platen 16, and mounted on said platen is a pattern plate 18. The pattern 20 is mounted on said pattern plate.

It will be observed that a conveyor 22 is situated on one side of the machine and that a second conveyor 24 is situated on the opposite side of the machine, on the same level. These two conveyors include a plurality of rollers 26, which are adapted to support a flask or a series of flasks 28. Conveyor 22 is the roll-in conveyor by which flasks are moved into the machine. Conveyor 24 is the roll-out conveyor which removes the flasks from the machine.

It will now be seen that each flask 28 is provided with a bottom flange 30 and a top flange 32. Rollers 26 of conveyors 22 and 24 are adapted to support the top flange 32 of the flasks and to carry the flask at a level which would enable the flask to clear pattern 20 on pattern plate 18.

Supported by base 10 is an elevator 34, mounted on a pair of plungers 36 and 38, respectively. Hydraulic or pneumatic means, including lines 40 and 42, elevate and lower the elevator to the extent necessary. At the top of the elevator is a pair of frame members 44 and 46, which support two series of rollers 48. As the drawing clearly shows, these rollers are adapted to engage and support the upper flange 32 of the flask. In the operation of this part of the machine, a particular flask is moved on conveyor 22 into the machine, and particularly with its upper flange 32 riding upon rollers 48. These rollers now support the flask below the pattern, and the elevator is caused to rise in order to elevate the flask to bring its upper flange 32 into abutment with the pattern plate 18. Pins 49 in the pattern plate 18 engage holes 51 in the upper flange 32, and thereby position the flask. The flask is now in operative position, ready to receive a charge of sand. At the conclusion of the molding operation shortly to be described, the elevator is caused to descend in order to enable the flask to clear the pattern, and the flask is then rolled off rollers 26 of conveyor 24. The flask is now ready to be used in a casting operation.

Base 10 supports a pair of tracks 50 and 52, respectively, which run parallel to each other and at right angles to the path of movement of the flasks on conveyors 22 and 24. These tracks extend outwardly from the machine, at least on one side thereof, and at their far ends they are supported on frame members 54. It will now be seen that tracks 50 and 52 are adapted to support carriage 56. Carriage 56 comprises a hollow body portion 58 and frame members 60 supporting said hollow body on a plurality of wheels 62. These wheels ride on tracks 50 and 52 above mentioned.

Body portion 58 has the shape of a flask or container with four side walls and a bottom wall. It is open only at the top. Along its upper edge is an outwardly projecting flange 64. This flange extends along the entire periphery of the body portion 58, and it supports the peripheral edge of a flexible diaphragm 66. A frame 68 is disposed upon said peripheral edge of the diaphragm, and screws 70 secure said frame 68 to said flange 64, to clamp the peripheral edge of the diaphragm between them.

The diaphragm 66 is made of flexible sheet material which may also be elastic. For example, natural or synthetic rubber would be a suitable material for this purpose. The relaxed condition of the diaphragm may be as shown in Fig. 3, wherein it assumes the shape of a pouch whose bottom wall rests on the floor of body member 58. The diaphragm is thus adapted to receive a charge of sand 72 from an overhead sand hopper 74. It will be noted that the hopper is situated off to the side of the machine proper and above an outwardly extending portion of tracks 50 and 52.

With the pouch thus filled with a charge of sand, the carriage is moved into the machine as shown in Fig. 2 of the drawing. The operative position of the carriage is immediately and directly below flask 28. Frame member 68 of the carriage virtually abuts the lower flange 30 of the flask. The machine is now ready for the sand molding operation.

It will now be noted that a flexible hose 76 is connected to a fitting 78 secured to the bottom wall of body 58 of the carriage, and that said fitting is tubular to provide communication with the inside of said body 58 between its inner wall and the diaphragm 66. This hose 76 is a compressed air line which is connected in conventional manner to a source of air under high pressure. When the carriage is in its operative position immediately below the flask, air is introduced through said hose into body 58, and the diaphragm is forced upwardly together with its load of sand. The air pressure is considerable, and the sand is thereby squeezed into the flask and against the pattern. This constitutes the molding operation, and the result is shown in Fig. 4.

The air is now permitted to escape from body 58, and the diaphragm is thereby permitted to fall to its inoperative position, as shown in Fig. 3. The sand, however, remains firm in the flask and, although the flask now has no bottom wall, the sand remains in place nonetheless. The said mold is now completed and the carriage 58 may now be moved away.

The next step is to remove the flask with its sand mold contents from the machine and to a place of use. This is accomplished by lowering the elevator 34 until the upper flange 32 of the flask is level with conveyor 24, and the flask may then be rolled off rollers 48 of the elevator and onto rollers 26 of said conveyor. The operation is now complete, and the sand mold ready for use.

Turning now to Fig. 5, it will be observed that a band 80 is inserted into diaphragm 66 slightly below flange 64 of the body member 58. This band is fixed in place to prevent upward movement of the upper peripheral portion of the diaphragm. The object of this band is to limit the operative portion of the diaphragm to that portion which is disposed below the band.

Fig. 6 shows a variation of the arrangement in Fig. 5. In Fig. 6 diaphragm 66*a* is shown to have its upper peripheral edge 66*b* curled around a band or molding 80*a*. It is this band or molding which secures the upper peripheral edge of the diaphragm to the inside of body member 58 of the carriage. This is simply another way of securing the diaphragm to the carriage and to provide an air-tight seal therebetween.

Fig. 7 shows a further variation wherein the sides of diaphragm 66*c* are folded in accordion fashion to produce the pleats 66*d* shown in the drawing. The lowermost pleat is clamped in place against the floor of body portion 58 by means of a continuous bar 80*b*. The accordion feature of this diaphragm enables the diaphragm to rise readily under the pressure of the air.

Fig. 8 shows another modification of this invention, wherein a double diaphragm is used for the purpose of effecting greater uniformity in the distribution of the sand in the flask and more effective equalization of the compression of the sand. In addition to these advantages, the use of a double diaphragm or, more precisely, a pair of diaphragms, enables the upper diaphragm to distribute itself more evenly across the open face of the flask. As shown in Fig. 8, air is introduced between the lower diaphragm 66*e* and the hollow body 58 of the carriage. Upward pressure upon the lower diaphragm 66*e* brings it into engagement with the upper diaphragm 66*f*, which constitutes the pouch proper, and receives the sand. This upward pressure of the lower diaphragm elevates the upper diaphragm to eject the sand into the flask and to squeeze it against the pattern.

The foregoing is illustrative of preferred forms of this invention, and it will be understood that these preferred forms may be modified and other forms may be provided

within the broad spread of the invention and the broad scope of the claims.

I claim:

1. A sand molding machine comprising a base, a frame on said base, a pattern plate supported at the top of said frame, a pattern supported by said pattern plate and projecting downwardly therefrom, means for positioning a flask against said pattern plate, the flask projecting downwardly from the pattern plate and forming an enclosure for the pattern, a receptacle which is closed at the sides and bottom and open at the top, means for positioning said receptacle immediately below the flask, a diaphragm mounted in said receptacle and adapted to receive a charge of sand, and means for introducing air under pressure between said diaphragm and said receptacle to elevate the diaphragm and thereby to inject the sand into the flask, the air pressure being sufficient to squeeze the sand against the pattern and thereby to form a sand mold, the means for positioning the flask against the pattern plate comprising an elevator which elevates the flask from a position wherein the flask is adapted to clear the pattern to a position wherein the flask abuts the underside of the pattern plate.

2. A sand molding machine comprising a base, a frame on said base, a pattern plate supported at the top of said frame, a pattern supported by said pattern plate and projecting downwardly therefrom, means for positioning a flask against said pattern plate, the flask projecting downwardly from the pattern plate and forming an enclosure for the pattern, a receptacle which is closed at the sides and bottom and open at the top, means for positioning said receptacle immediately below the flask, a diaphragm mounted in said receptacle and adapted to receive a charge of sand, and means for introducing air under pressure between said diaphragm and said receptacle to elevate the diaphragm and thereby to inject the sand into the flask, the air pressure being sufficient to squeeze the sand against the pattern and thereby to form a sand mold,

the flask being provided with top and bottom flanges, a conveyor being provided for supporting the flask by means of its top flange, said conveyor being situated on one side of the machine and at a relatively low level to permit clearance by the flask of the pattern as it enters the machine, and a second conveyor situated at the opposite side of the machine in line with the first conveyor and on the same level therewith, whereby the flask may be removed from the machine following the sand molding operation.

3. The combination of claim 1, wherein the sand injecting diaphragm is pouch-shaped and open at the top, a support for said pouch-shaped diaphragm, and air pressure means between said pouch-shaped diaphragm and said support therefor, said pouch-shaped diaphragm being adapted to receive a charge of sand and said air pressure means being adapted to force said pouch-shaped diaphragm upwardly in the direction of the pattern, to introduce the sand into the flask and to squeeze it against the pattern.

4. In a molding machine in accordance with claim 3, wherein a second diaphragm is disposed between the pouch-shaped diaphragm and the hollow body, said second diaphragm being adapted to receive the pressure of the fluid and to transmit it to the pouch-shaped diaphragm to elevate said pouch-shaped diaphragm and thereby to eject its contents.

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