Dec. 30, 1958 L. F. MILLER 2,866,242

FOUNDRY MOLDING PROCESS

Filed July 8, 1955 3 Sheets-Sheet 1

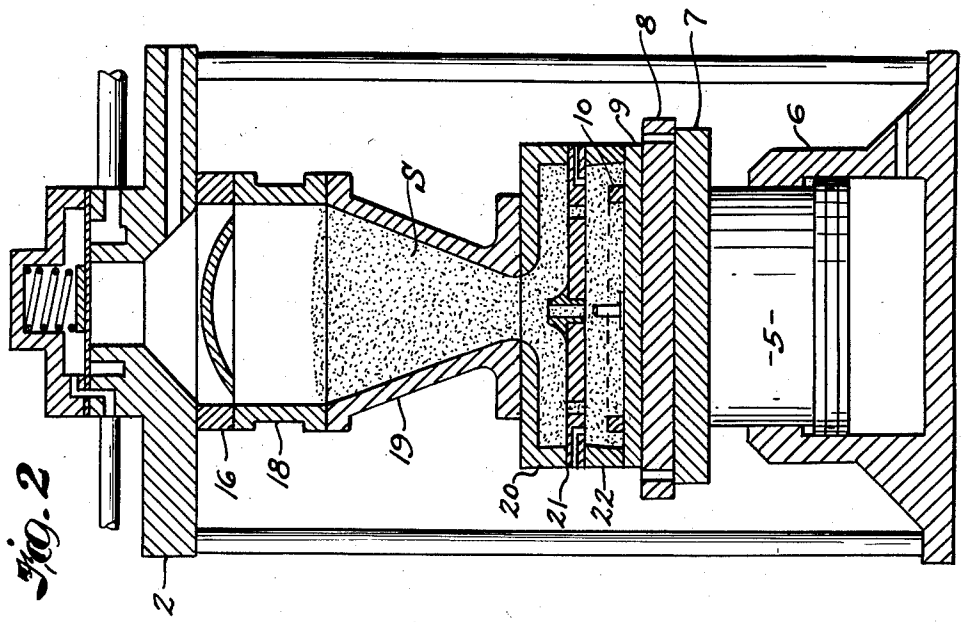



Fig. 2

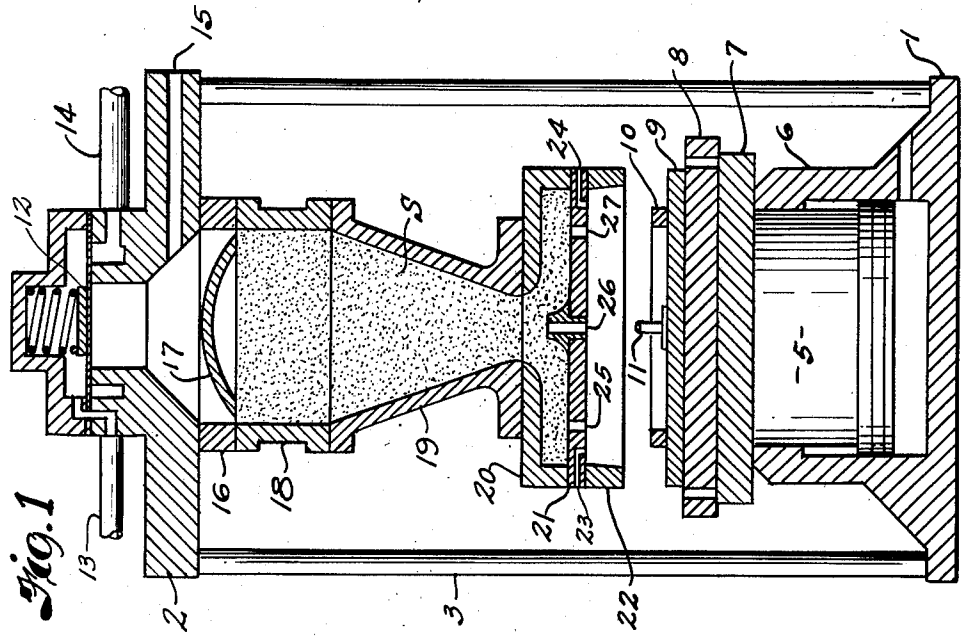



Fig. 1

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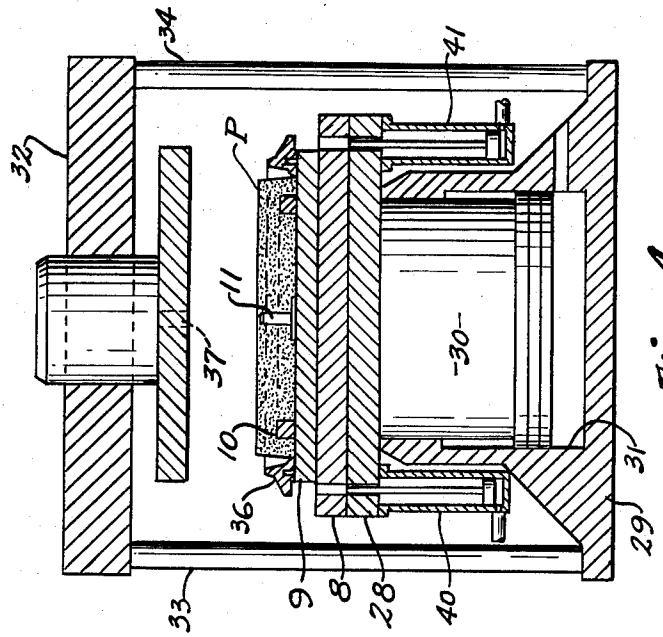



Fig. 4

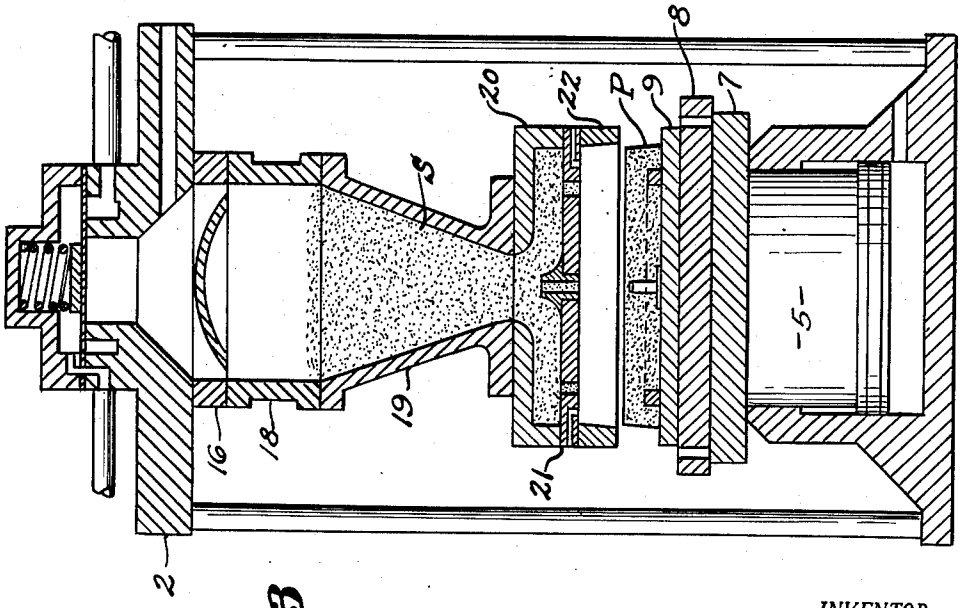



Fig. 3

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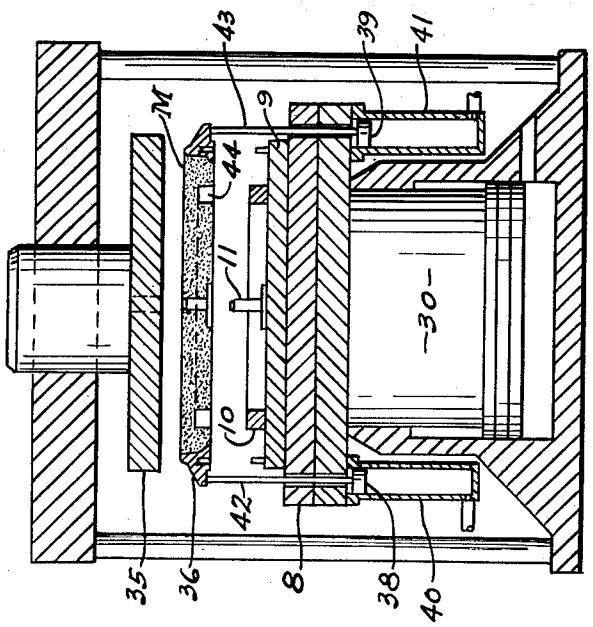



Fig. 6

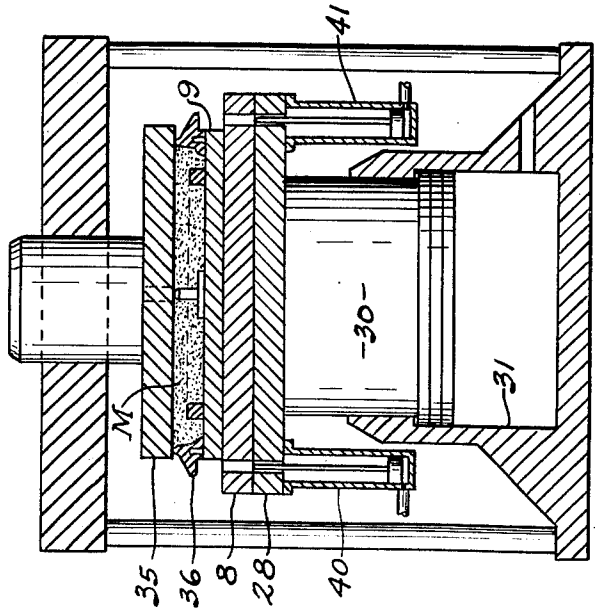



Fig. 5

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2,866,242

# FOUNDRY MOLDING PROCESS

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Application July 8, 1955, Serial No. 520,714

9 Claims. (Cl. 22—193)

This invention relates as indicated to a foundry molding process, and more particularly to a process utilizing the more desirable features of both core blowing and squeezing or jolt-squeezing operations.

The most common method of preparing a sand mold for foundry purposes is to place a flask about a pattern mounted on a pattern board and after filling such flask with an excess of sand, to squeeze or jolt and squeeze the sand to compact the same in the flask tightly against the pattern. While molds produced in this manner are satisfactory for many purposes, they often do not afford as smooth sand surfaces in the mold cavity as may be desired, and with the more difficult pattern shapes there may be a problem in obtaining a sufficiently hard and firm sand surface in certain places. Core blowing machines such as that illustrated and described in Ellms Patent 2,545,944, for example, are suitable for blowing cores of quite complicated shape and generally produce relatively hard firm sand surfaces against all parts of the pattern. Molds may be blown as well as cores, but this has involved certain difficulties inasmuch as flasks designed for blowing molds directly therein are required to make a tight fit with the pattern plate and with the core blowing machine and cannot be allowed to become dented, etc., in use. Furthermore, they must be very strongly made and are quite expensive. On the other hand, it is not feasible to blow a mold directly in the usual foundry flask since the latter ordinarily includes considerable openwork in its sides, and in any case has too irregular a lip or edge to afford an airtight seal with the adapter of the core blowing machine.

It is accordingly a principal object of my invention to provide a novel foundry molding process which will combine the advantages of core blowing and squeeze molding.

Another object is to provide such method which will not require the employment of special flasks.

A further object is to provide such method which will produce relatively firm, smooth mold surfaces and which may be utilized to produce molds suitable for subsequent use in stack molding.

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

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing 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 principle of the invention may be employed.

In said annexed drawing:—

Figs. 1–3 inclusive show in semi-diagrammatic fashion successive operations in the production of a pre-formed mold in a blowing machine; and Figs. 4–6 inclusive illustrate a subsequent series of successive operations upon such pre-formed mold after transfer to a squeeze molding machine.



The molding medium such as the usual foundry sand is first blown into an appropriately shaped box containing the pattern. The pre-formed mold section and pattern are drawn as a unit from such box and transferred to the squeeze molding machine where a flask is placed about the mold and the mold squeezed to complete the ramming of sand within the flask. The flask and mold are then drawn from the pattern.

Referring now more particularly to the drawing and especially Figs. 1–3 thereof, a core blowing machine is there illustrated comprising a base 1 and a head 2 joined by standards or tie rods such as 3 and 4. A large vertically reciprocable piston 5 is mounted in cylinder 6 in such base and carries a table 7 supporting platen 8, pattern plate 9, and pattern 10 (in the example illustrated, a pattern for a large piston ring). The pattern may also include an upstanding central stud or boss 11 with a rib or ribs extending therefrom to pattern 10 to form a sprue passage for the mold if the latter is to be employed in stack molding.

The head of the machine includes a diaphragm blow valve 12 controlled by air pressure admitted through inlet 13 and adapted when opened to admit high pressure air from line 14 to the interior of the blow head. An exhaust passage 15 is connected with a valve (not shown) whereby excess air pressure may be relieved after performance of the blowing operation. Immediately below the blow head is a rim blow gasket plate 16 and a spreader 17. The sand reservoir includes an upper adapter 18 adapted closely to fit the underside of the gasket plate 16 and a funel shaped portion 19 joined to the lower adapter 20 which carries blow plate 21 and mold preform section 22. The blow plate may be laterally vented as indicated at 23 and 24 and will be provided with properly arranged blow holes such as 25, 26 and 27.

As is conventional in core blowing machines, the reservoir and associated parts comprising elements 18–22 inclusive are mounted for reciprocation from a fill position beneath a hopper to a blow position as shown herein. In the Fig. 1 view, the reservoir has been filled with sand S and is ready for the blow as soon as piston-cylinder assembly 5, 6 as been operated to raise the pattern plate firmly into engagement with box 22.

When the pattern plate has been thus elevated, high pressure air is admitted into the blow head, and sand is blown through the openings in blow plate 21 into box 22 and around pattern 10 as shown in Fig. 2. The mold thus produced will have the usual desirable characteristics of cores and the like which are similarly blown, notably very firm, uniform, dense and smooth sand surfaces contacting the pattern 10.

Piston 5 and table 7 are now lowered as shown in Fig. 3 to draw the pre-formed mold P from the box 22. It will be noted that such box will desirably have slightly inwardly tapering side walls both to facilitate such draw and also to facilitate the subsequent squeezing operation described below.

Platen 8, pattern plate 9, pattern 10 and pre-formed mold P are removed from the core blowing machine and transferred to table 28 of a squeeze machine semi-diagrammatically illustrated in Figs. 4–6 of the drawing. Such machine may comprise a base 29 with a large piston 30 mounted for vertical reciprocation within cylinder 31. Upper frame 32 is connected to such base by means of tie rods such as 33 and 34 and carries a squeeze plate 35. A flask 36 is placed on pattern plate 9 closely encircling the pre-formed mold P at the base of the latter. Due to the taper of such pre-formed mold, there is clearance between the greater part of the pre-formed mold and such wall. Moreover, such pre-formed mold will stand a substantial distance above the top of the flask to provide the proper amount of additional sand required com-

pletely to fill the flask level with the upper edge of the latter. The squeeze plate 35 may have a central recess 37 therein aligned with pattern stud 11 and adapted to receive the upper end of the latter.

As shown in Fig. 5, piston 30 and table 28 will now be elevated to squeeze the pre-formed mold against squeeze plate 35 to distribute the excess sand standing above the upper edge of flask 36 into the space between such mold and the flask wall and also uniformly compacting the sand generally throughout the mold body. It will ordinarily not be desired to jolt or vibrate the mold prior to such squeezing operation but in certain cases such jolting or vibrating may also be utilized in well-known manner.

After completion of the squeezing operation, piston 30 and table 28 will again be lowered as shown in Fig. 6, thereby lowering the flask and mold below squeeze plate 35. Pistons 38 and 39 may then be reciprocated in cylinders 40 and 41 to extend rods such as 42 and 43 to engage the underside of flask 36 and draw the mold from the pattern as the latter continues its descent. The flask with the finished mold M is now removed from the machine. In the particular embodiment illustrated and described, the molds thus formed are suitable for stack molding, a number of the molds being vertically arranged so that molten metal may be poured down the aligned central sprues and conducted through lateral passages (not shown) to the mold cavities 44. Of course, molds may be formed in the same manner adapted to be assembled as copes and drags for the production of various types of castings.

It will be seen that I have provided a novel method of producing foundry molds which is quite expeditious (the blowing operation being a very rapid one) and which is adapted to produce a mold having a very superior surface so that the castings produced therein will require a minimum of machining or other surface finishing operations. The final squeezing operation is utilized to secure the pre-formed mold in a proper mold flask and also to distribute and uniformly compact the main body of sand.

It is usually very desirable that the flask be rather carefully centered on the pre-formed mold (Fig. 4) and that the lower periphery of the flask conform to the lower periphery of the pre-formed mold. The upper portion of the pre-formed mold side will ordinarily be slightly laterally spaced from the flask wall prior to performance of the final squeezing operation and usually also that such pre-formed mold project upwardly above the upper edge of the flask, especially when it is desired to squeeze the sand flush and level with such upper edge. The side of the pre-formed mold may be shaped to slope inwardly in an upward direction or the side of the flask may be shaped to slope outwardly in an upward direction, or both, as shown, to provide such clearance. If, however, a tapered flask is employed conforming exactly to the taper of the pre-form, then no clearance need be provided.

Since the sand is already quite hard and smooth against the pattern in the blown pre-formed mold section, the ramming action of the subsequent squeeze operation is usually quite sufficient to produce a finished mold of high quality and uniformity without need of jolting. It is desirable to avoid jolting when possible, as it is a very noisy operation, hard on equipment, and requires more time and expenditure of compressed air. When the pre-formed mold section is tapered as shown (the degree of taper being somewhat exaggerated for purposes of illustration) the flask employed therewith may be of the ordinary straight-sided type ordinarily having a sand strip within its lower edge which should preferably closely fit the lower edge of the pre-formed mold. Conventional locating pins on the pattern board may engage the flask properly to center the same. If the box 22 is formed with sides which are laterally movable when not locked in closed position, then their inner faces need not taper to facilitate drawing of the pre-formed mold and a conventional mold flask as above described may be utilized with the latter. The slightly tapered box 22 will, however, ordinarily be preferred. It is desirable that the flask should fit the pre-formed mold section as closely as is conveniently feasible.

Other modes of applying the principle 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. The method of forming a mold suitable for use in a foundry stack molding operation comprising the successive steps of blowing a pre-formed sand mold upon a pattern in a box to obtain a uniform and smooth sand surface in all portions of the mold cavity, such mold having downwardly outwardly sloping sides and extending a substantial distance above the pattern; drawing such mold and pattern as a unit from such box; placing a flask closely about the lower periphery of such mold but with the upper edge of such flask spaced from the sloping side of the mold and also spaced below the upper surface of such mold, squeezing such mold within such flask to distribute the sand uniformly to fill such flask level with the upper surface of the latter and to compact the main body of sand, and then drawing such pattern from the finished mold and flask.

2. The method of claim 1 wherein such pattern includes an upstanding sprue forming element which is shorter than the vertical depth of the blown pre-formed mold but is sufficiently long to extend at least to the upper surface of the mold in such flask subsequent to such squeezing operation.

3. The method of forming a foundry mold having firm uniform mold surfaces in all regions of the mold cavity which comprises blowing a pre-formed sand mold about a pattern in a blowing machine, drawing the pre-formed mold and pattern as a unit from the box of such machine, placing such pattern and mold on the table of a squeeze machine, placing a flask on such table surrounding such mold and centered thereon with lateral clearance between the upper portion of the flask wall and the side of such pre-formed mold, such pre-formed mold projecting above the top of such flask, squeezing such pre-formed mold within such flask to ram the same uniformly to fill such flask level with the upper surface of the latter and to compact the main body of sand, and then drawing such pattern from the finished mold and flask.

4. The method of claim 3, wherein the lower edge portion of such flask initially conforms to the lower portion of such mold prior to squeezing.

5. The method of forming a foundry mold having firm uniform mold surfaces which comprises blowing a pre-formed sand mold about a pattern within a box to obtain a uniform and smooth sand surface in all portions of the mold cavity, drawing the pre-formed mold and pattern as a unit from the box, placing a flask about such pre-formed mold and centered thereon with lateral clearance between the upper portion of the flask wall and the side of such pre-formed mold, squeezing such pre-formed mold within such flask to ram the sand uniformly therein, and then drawing such pattern from the finished mold.

6. The method of forming a foundry mold having firm uniform mold surfaces which comprises blowing a pre-formed sand mold about a pattern within a box to obtain a uniform and smooth sand surface in all portions of the mold cavity, drawing the pre-formed mold and pattern as a unit from the box, placing a flask about such pre-formed mold, squeezing such pre-formed mold within such flask to ram the sand uniformly therein, and then drawing such pattern from the finished mold.

7. The method of claim 6, wherein the lower edge portion of such flask initially conforms to the lower portion of such pre-formed mold prior to squeezing, and such flask flares outwardly in an upward direction somewhat to space the side of such pre-formed mold from the upper portion of the wall of such flask.

8. The method of claim 6, wherein the lower edge portion of such flask initially conforms to the lower portion of such pre-formed mold prior to squeezing, and the sides of the pre-formed mold slope inwardly in an upward direction somewhat to space the side of such mold from the upper portion of the wall of such flask.

9. The method of claim 6, wherein the lower edge portion of such flask initially conforms to the lower edge of such pre-formed mold prior to squeezing, and the sides of such pre-formed mold above such lower edge are slightly spaced from the opposed flask walls.



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