

Nov. 15, 1960

E. L. FRANKENSTEIN
FOUNDRY MOLD FORMING

2,959,828

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2 Sheets-Sheet 1

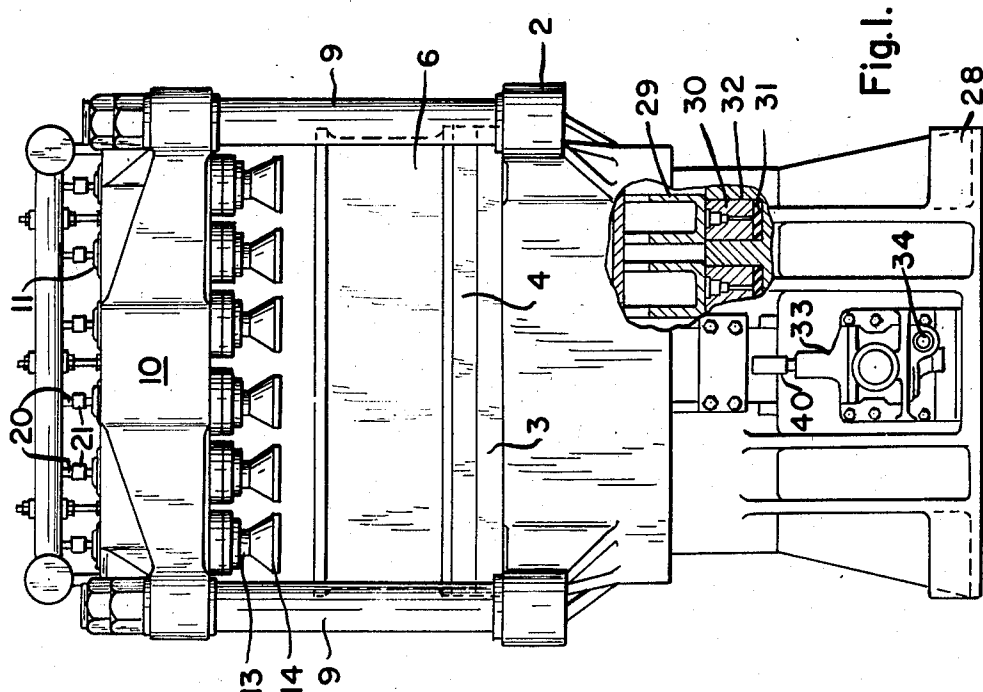


Fig. 1.

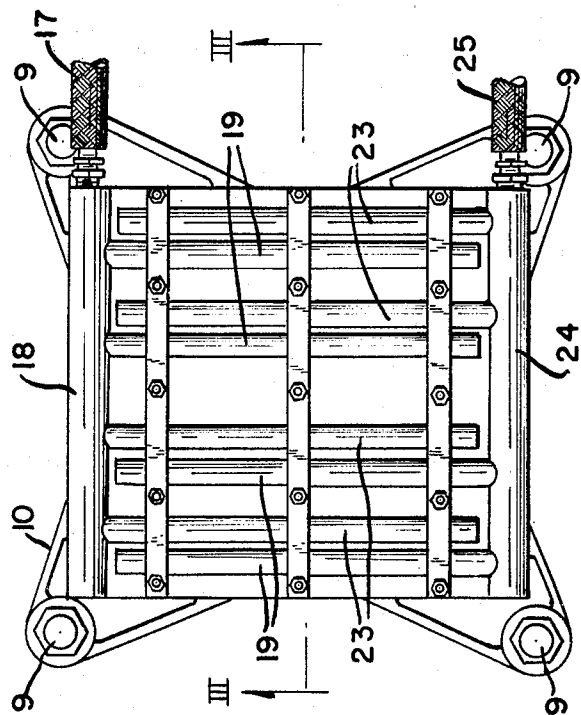


Fig. 2.

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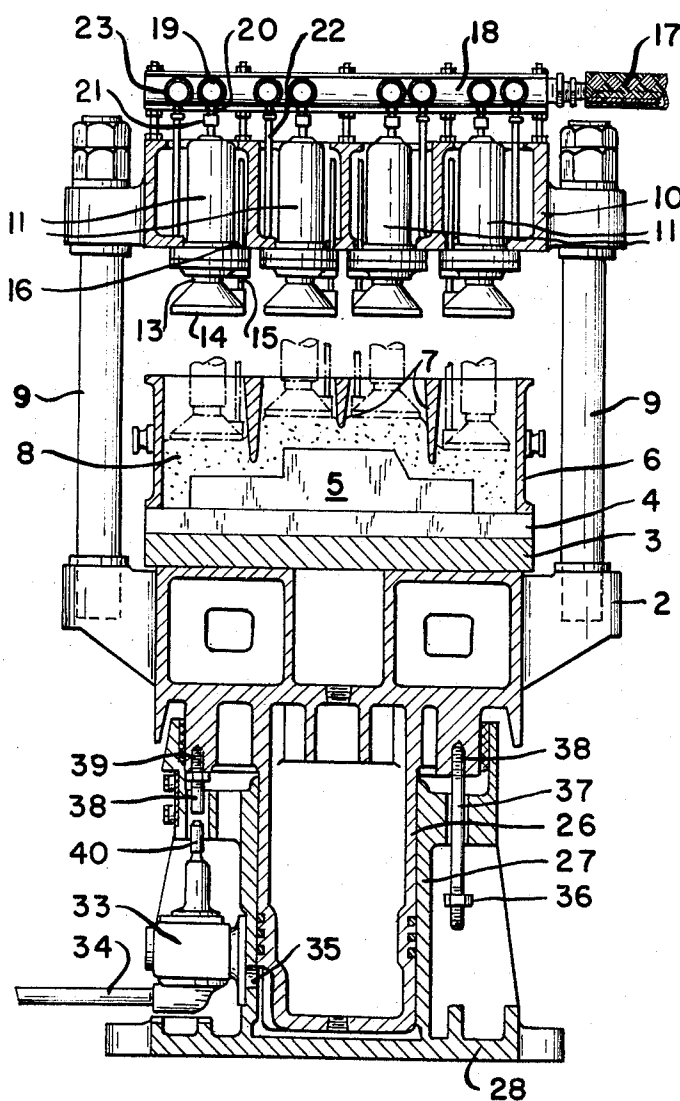
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Fig. 3.



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FOUNDRY MOLD FORMING

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8 Claims. (Cl. 22—45)

This invention relates to foundry mold forming method and apparatus and has to do with the formation of foundry molds by jolting and squeezing. It is conventional in forming foundry molds to dump mold forming material such as sand into a flask assembled to a pattern so that the sand lies upon the pattern within the flask. The flask, pattern and sand may be periodically jolted to assist in distributing and compacting the sand in the flask. Also the sand may be squeezed against the pattern.

In order to get the most effective results of jolting and squeezing it is desirable to accomplish them simultaneously. However, satisfactory results have not been obtained in the efforts prior to my invention to simultaneously jolt and squeeze foundry molds of finely divided mold forming material. The jolting has interfered with effective squeezing. The jolting involves periodic movement of the flask, pattern and sand through a short distance which may be perhaps of the order of an inch, the jolting frequency being perhaps of the order of 300 cycles per minute. When an attempt has been made to squeeze the sand during jolting the squeezing pressure has been affected by the jolting so that the squeezing pressure alternately increases and decreases, resulting in an inferior mold. Also the wear on parts of the apparatus has been excessive.

I have devised foundry mold forming method and apparatus obviating the disadvantages of the prior methods and apparatus above referred to. My foundry mold forming apparatus may comprise means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, means for subjecting the supporting means to periodic jolting action to assist in distributing and compacting the mold forming material in the flask and means carried by the supporting means for squeezing the mold forming material in the flask against the pattern. I desirably provide mounting means carried by the supporting means and extending upwardly therefrom, a head carried by the mounting means above the supporting means and means carried by the head for squeezing the mold forming material in the flask against the pattern. The mounting means may comprise posts at the corners of the supporting means carried thereby and extending upwardly therefrom, and a head may be carried by the posts above the supporting means, and means may be carried by the head for squeezing the mold forming material in the flask against the pattern.

I preferably provide vertically oriented cylinder means mounted in the head which as above indicated is carried by the supporting means, together with piston means operable in the cylinder means and means carried by the piston means for squeezing the mold forming material in the flask against the pattern. A plurality of vertically oriented cylinders are preferably mounted in the head and a piston is provided which is operable in each cylinder, and means are carried by the pistons for squeezing the mold forming material in the flask against the pattern.

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I preferably provide a separate squeezing member carried by each piston as disclosed in co-pending application Serial No. 741,826, filed June 13, 1958, now abandoned. Means are preferably provided for separately operating the squeezing members so that they may move downwardly to different extents whereby to promote optimum distribution and compression of the mold forming material in the flask despite difference in depth of the mold forming material above the pattern at different portions of the pattern. The means for separately operating the squeezing members may when desirable act on at least certain of the squeezing members with different pressures.

I provide a method of forming a foundry mold comprising placing finely divided mold forming material adjacent a pattern in a flask, periodically jolting the flask, pattern and mold forming material to assist in distributing and compacting the mold forming material in the flask and simultaneously with the jolting squeezing the mold forming material in the flask against the pattern by squeezing pressure which gradually increases to a maximum and then is maintained substantially constant despite the simultaneous jolting. The squeezing pressure is preferably separately applied at different portions of the pattern and may be so applied through squeezing pressure of different magnitude. Thus, I form a mold of optimum characteristics with the sand or other mold forming material compacted to the desired extent throughout the mold, either uniformly or non-uniformly as conditions may dictate.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof and a present preferred method of practicing the same proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention and have illustrated a present preferred method of practicing the same in which

Figure 1 is an elevational view, with a fragment in vertical cross section, of foundry mold jolting and squeezing apparatus;

Figure 2 is a top plan view of the apparatus shown in Figure 1; and

Figure 3 is a vertical cross-sectional view taken on the line III—III of Figure 2.

Referring now more particularly to the drawings, my foundry mold squeezing apparatus comprises a base designated generally by reference numeral 2 for supporting in fixed position a carrier plate 3 upon which is mounted a pattern plate 4 carrying a pattern 5, a flask 6 being assembled to the pattern plate and pattern as shown in Figure 3 so as to surround the pattern and extend thereabove. The flask 6 has at its upper portion a grid consisting of crisscross bars 7 each of which has its upper edge generally in the plane of the upper surface of the flask and extends downwardly to aid in anchoring the finely divided mold forming material but not far enough to interfere with the pattern. The grid bars 7 are arranged in rows at right angles to each other and form square or rectangular openings in the top of the flask, which openings are respectively adapted to receive the squeezing members presently to be described. Finely divided mold forming material such for example as molding sand is designated by reference numeral 8 and is introduced into the flask upon and about the pattern as shown in Figure 3. My mechanism is to effectively squeeze the sand within the flask against the pattern during jolting of the mold as will presently be described to form a mold of optimum characteristics suitable for the casting of metal.

A post 9 extends upwardly from the base 2 at each

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of the four corners thereof, and mounted upon the four posts 9 in fixed position above the base is a head designated generally by reference numeral 10. Mounted in the head are twenty-four cylinders each designated by reference numeral 11, the cylinders being arranged in four rows of six cylinders each as clearly shown in Figures 1 and 3.

A piston operates in each cylinder 11. Connected with each such piston is a piston rod 13 which projects downwardly and out of the bottom of the cylinder and has a squeezing member 14 connected therewith at its bottom. The cylinders 11 remain stationary in the head 10 but the respective pistons are adapted to move up and down in the cylinders and to move the squeezing members 14 with them. Each squeezing member carries a guide rod 15 passing through a guiding opening 16 in the cylinder.

Fluid under pressure, desirably hydraulic fluid, is introduced through a fluid supply conduit 17 into a header 18 whence the fluid passes through branch conduits 19 to individual connections 20 to the respective cylinders 11, a pressure control valve 21 being provided in each connection 20 so that the pressure of fluid admitted to each cylinder may be individually controlled. The fluid under pressure is admitted at the top of each cylinder 11 above the piston therein. An exhaust connection 22 extends from the lower part of each cylinder below the piston therein, the exhaust pipes 22 entering branch conduits 23 communicating with an exhaust header 24 which in turn communicates with an exhaust conduit 25.

As shown in Figure 3 the pattern 5 is of non-uniform height. After the carrier plate 3, pattern plate 4 with the pattern 5 thereon, and flask 6 have been assembled in the relationship shown in Figure 3 sand is introduced into the flask atop and about the pattern. The sand as introduced is relatively loose and uncompacted. Normally the flask is filled full of sand and the sand is "struck off" at the upper surface of the flask by any suitable tool.

The squeezing members 14 are of square or rectangular shape and are positioned so that when they move downwardly they enter and largely fill the square or rectangular spaces in the grid 7 at the upper portion of the flask 6. When the sand is to be compacted fluid under pressure is admitted to the upper ends of the cylinders 11 and the respective squeezing members 14 are by the fluid under pressure pressed downwardly to compact the sand against and about the pattern. Since the pattern is of non-uniform height, initially there is a deeper layer of sand atop a shallower portion of the pattern than atop a higher portion of the pattern. As the squeezing members move downwardly there is some lateral flowing or shifting of sand in the flask and the sand flows in such manner as to largely equalize the depth of sand above the pattern despite the fact that the top of the pattern is not in a single horizontal plane. I do not mean that the depth of the sand above the pattern is made precisely uniform throughout the top area of the pattern due to the flow of sand under the action of the squeezing members but the sand flow causes some sand at portions where the sand is initially deeper to flow laterally to other portions of the mold. Since the squeezing members 14 are individually operated, each by its own piston operating in its own cylinder, each may move downwardly within the flask and compress or compact the sand to whatever extent the pressure behind its piston causes it to move. Thus the respective squeezing members move downwardly to different extents as shown in Figure 3. If the pressure control valves 21 are all set for the same pressure the sand beneath the respective squeezing members will be compacted to substantially the same pressure despite the difference in height in the various portions of the pattern and hence of the inner mold wall formed against the pattern. In this way I may form a mold of un-

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precedented uniformity of compactness. On the other hand if a mold is desired having certain portions of the sand compacted to a greater extent than other portions this may readily be accomplished by appropriate adjustment of the pressure control valves 21.

After squeezing a mold the squeezing members 14 may be retracted upwardly by reversing the flow of fluid under pressure, i.e., by admitting fluid under pressure through the conduit 25 and exhausting the fluid above the pistons in the cylinders 11 through the conduit 17. The foundry mold squeezing method and apparatus are claimed in the above mentioned copending application.

The base 2 of the mold squeezing apparatus has integral therewith and disposed centrally thereof a downwardly projecting piston 26 which operates in a vertical cylinder 27 of a jolt base 28. The jolt base 28 is preferably mounted upon and fixedly bolted to a stationary concrete foundation. The base 2 of the squeezing apparatus has at its bottom feet 29 each disposed above superposed discs 30 and 31 disposed in one of a plurality of bores 32 in the jolt base 28. Preferably each disc 31 is resilient and made of rubber or rubber-like material. The discs 30 may be made of steel or similar material. When the discs 31 are not under compression except by the weight of the discs 30 the upper portions of the discs 30 project above the tops of the bores 32. In Figure 1 the discs 31 are under compression and the feet 29 are shown as having pressed the discs 30 down so as to be completely within the bores 32.

A jolt valve is shown at 33 and may be of conventional construction. Fluid under pressure, normally air, is supplied to the jolt valve 33 through a pipe 34 and is by the valve 33 admitted periodically through the passage 35 to the space in the cylinder 27 below the piston 26 so as to raise the piston and hence the base 2 of the squeezing apparatus relatively to the jolt base 28. The extent to which the squeezing apparatus may be raised is limited by an adjustable nut 36 on the lower threaded end of a rod 37 threaded to the lower portion of the base 2 at 38. The rod 37 also prevents turning of the squeezing apparatus base 2 relatively to the jolt base 28. The amplitude of jolting of the squeezing apparatus relatively to the jolt base is of the order of an inch or slightly more. The jolt valve operates in conventional manner as known to those skilled in the art so as to jolt the squeezing apparatus relatively to the jolt base perhaps four or five times per second. The valve may be operated by an adjustable rod 38 connected with the squeezing apparatus base 2 at 39 and adapted to engage a valve operating plunger 40 upon downward movement of the squeezing apparatus base 2 carrying the piston 26. The carrier plate 3 may be dowelled to the squeezing apparatus base 2 to maintain the same against relative transverse or turning movement.

Jolting mechanism of the general type shown at the lower portion of Figure 3 is conventional and well known to those skilled in the art so I have not shown the details of the jolting mechanism. However, it is new so far as I am aware to mount the squeezing apparatus upon the jolting mechanism so that a mold may be simultaneously jolted and squeezed without the disadvantages occurring as above pointed out when the squeeze head is mounted separately from the jolting mechanism. By simultaneously squeezing the mold through the use of squeezing mechanism mounted to move up and down with the mold as the mold is jolted a more uniformly packed mold of optimum molding characteristics is produced. A constantly applied pressure may be exerted against the top of the mold during jolting which causes the mold forming material to flow with unprecedented uniformity into low density areas. Especial advantages are obtained through mounting on the jolting mechanism the self-adjusting squeeze head having the individual squeezing members.

While I have shown and described a present preferred

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embodiment of the invention and have illustrated a present preferred method of practicing the same it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

I claim:

1. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, and means carried by the means for supporting the pattern for squeezing the mold forming material in the flask against the pattern.

2. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, mounting means carried by the means for supporting the pattern means and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern and means carried by the head for squeezing the mold forming material in the flask against the pattern.

3. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, posts at the corners of the means for supporting the pattern carried thereby and extending upwardly therefrom, a head carried by the posts above the means for supporting the pattern and means carried by the head for squeezing the mold forming material in the flask against the pattern.

4. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, mounting means carried by the means for supporting the pattern and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern, vertically oriented cylinder means mounted in the head, piston means operable in the cylinder means and means carried by the piston means for squeezing the mold forming material in the flask against the pattern.

5. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned

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supporting means, mounting means carried by the means for supporting the pattern and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern, a plurality of vertically oriented cylinders mounted in the head, a piston operable in each cylinder and means carried by the pistons for squeezing the mold forming material in the flask against the pattern.

6. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, mounting means carried by the means for supporting the pattern and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern, a plurality of vertically oriented cylinders mounted in the head, a piston operable in each cylinder and a separate squeezing member carried by each piston for squeezing the mold forming material in the flask against the pattern.

7. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the pattern periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, mounting means carried by the means for supporting the pattern and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern, a plurality of squeezing members carried by the head for generally side by side vertically downward movement into the open top of the flask and against the mold forming material to press the mold forming material against the pattern and means separately operating the squeezing members so that they may move downwardly to different extents whereby to promote optimum distribution and compression of the mold forming material in the flask despite difference in depth of the mold forming material above the pattern at different portions of the pattern.

8. Foundry mold forming apparatus comprising means for supporting a pattern with an open-topped flask mounted thereon and finely divided mold forming material in the flask against the pattern, jolting means for subjecting the means for supporting the flask to periodic jolting action to assist in distributing and compacting the mold forming material in the flask, means for supporting the jolting means, said means for supporting the jolting means being separate from the first mentioned supporting means, mounting means carried by the means for supporting the pattern and extending upwardly therefrom, a head carried by the mounting means above the means for supporting the pattern, a plurality of squeezing members carried by the head for generally side by side vertically downward movement into the open top of the flask and against the mold forming material to press the mold forming material against the pattern and means separately operating the squeezing members so that they may move downwardly to different extents whereby to promote optimum distribution and compression of the mold forming material in the flask despite difference in depth of the mold forming material above the pattern at different portions of the pattern, the means separately operating the squeezing mem-

bers acting on at least certain of the squeezing members with different pressures.

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