Feb. 10, 1942. E. F. OYSTER 2,272,816

MOLDING MACHINE

Filed Aug. 10, 1939 2 Sheets-Sheet 1

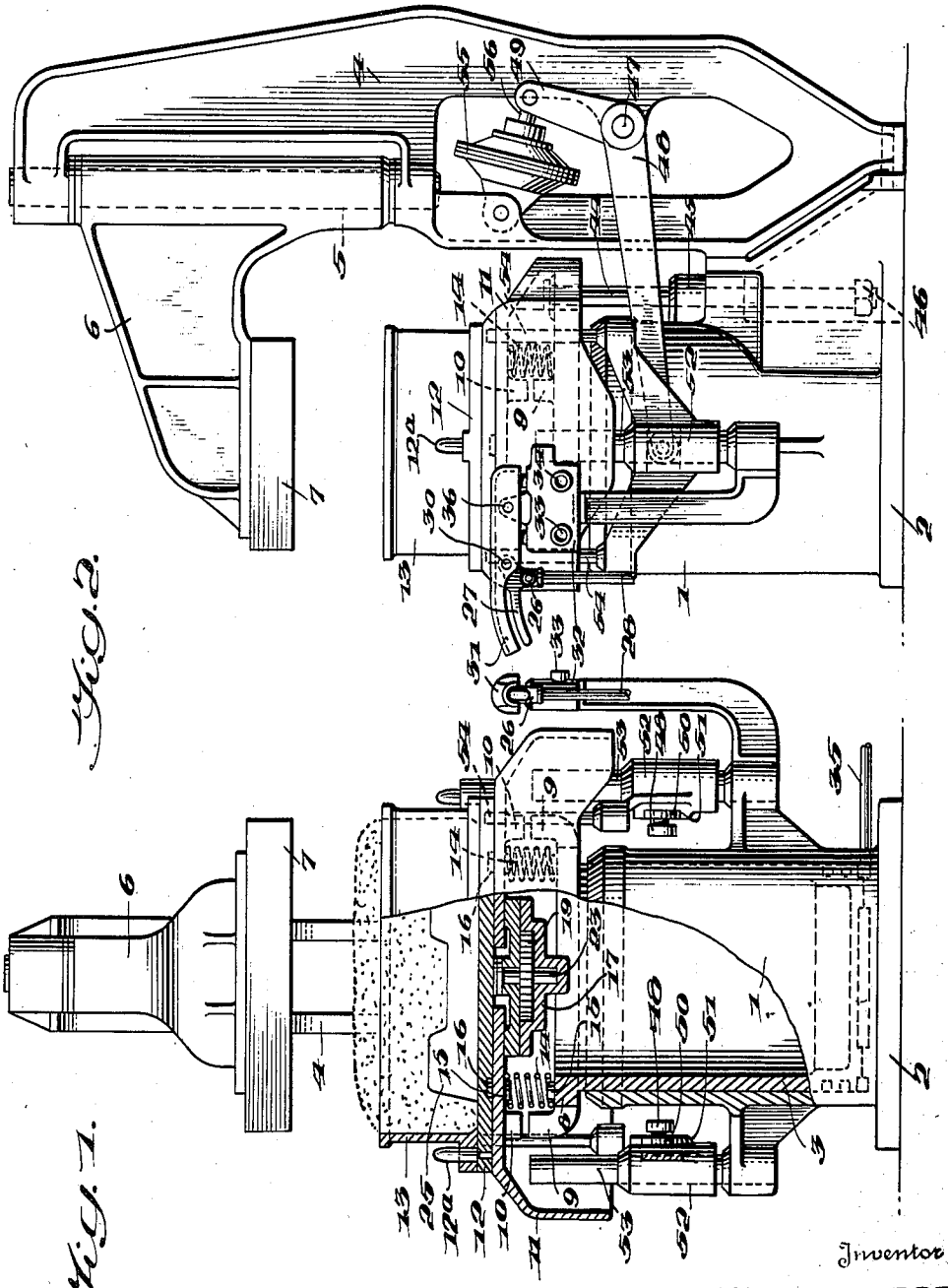


Fig. 2.

Fig. 1.

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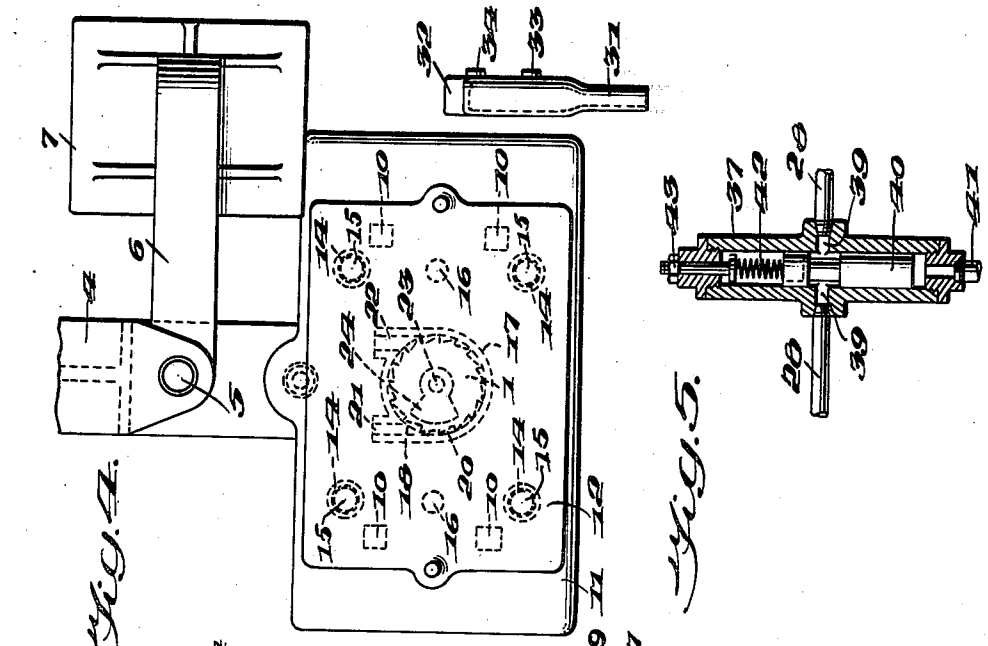


Fig. 4.

Fig. 5.

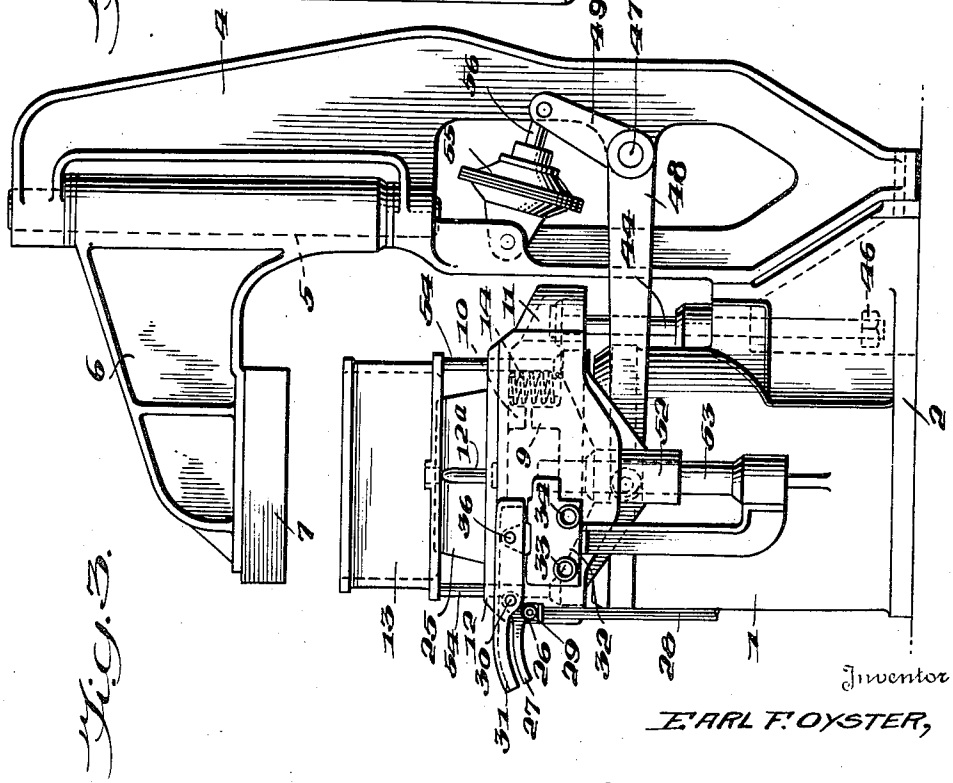


Fig. 3.

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Patented Feb. 10, 1942 2,272,816

UNITED STATES PATENT OFFICE

2,272,816

MOLDING MACHINE

Earl F. Oyster, Cleveland, Ohio

Application August 10, 1939, Serial No. 289,500

6 Claims. (Cl. 22—45)

My invention relates to machines for making molds of sand or other similar suitable molding material and it has for its principal object the provision of improved means for compacting the molding material about the pattern so that all surfaces of the mold will be smooth and of substantially uniform density.

Heretofore it has been customary to jolt or jar the molding material in a substantially vertical direction in an endeavor to compact the molding material but such jolting or jarring does not result in uniformly packed molds and castings produced in such molds are sometimes defective and frequently have very rough surfaces. I have found, however, that if the molding material is subjected to forces acting in a direction forming an angle with the vertical which cause the material to vibrate, preferably in a gyratory fashion, instead of being subjected to vertical jolts or jars, it will be more quickly and uniformly packed about the pattern and the molding surface of the mold will be smoother and of greater uniform density. Castings produced in such molds will, therefore, have very smooth surfaces and be free of defects.

A primary feature of the invention consists in providing a molding machine with a resiliently mounted table for supporting the pattern plate and flask and with means for vibrating the table in a direction forming an angle with the vertical to compact the molding material within the flask.

Another feature of the invention consists in providing a molding machine with a flexibly mounted table affording a support for a pattern plate and a flask, the table being provided with means for imparting gyratory vibrations thereto for compacting the sand or other molding material within the flask.

Another feature of the invention consists in providing the yieldingly mounted flask supporting table with means revoluble about an axis spaced from its center of mass to cause the table to vibrate and thus compact the sand within the flask.

Other and more specific features of the invention, residing in advantageous forms, combinations and relations of parts, will hereinafter appear and be pointed out in the claims.

In the drawings,

Figure 1 is a front view of a molding machine, partly in elevation and partly in section, embodying my invention.

Figure 2 is a side elevational view of the machine.

Figure 3 is a view similar to Figure 2 showing the relative positions of the parts of the machine at the completion of the pattern drawing operation.

Figure 4 is a plan view of the machine with the squeeze head swung to one side.

Figure 5 is a detail vertical sectional view of one of the control valves of the machine.

Referring more particularly to the drawings, which illustrate what I now regard as the preferred embodiment of my invention, 1 indicates a hollow cylindrical base which is closed at its bottom, as indicated at 2, to form a cylinder for receiving a vertically movable inverted piston 3. Rigid with the lower end of the cylindrical base 1 and disposed to one side thereof is an upright pedestal or frame 4 on the upper portion of which is pivotally mounted, as by a shaft 5, an arm or head 6. Secured to the underside of the free end of the arm is a squeeze board 7 which, when the arm is suitably rotated, may be swung to a position over the cylinder 1 as illustrated in Figures 1 and 2, or to one side thereof as illustrated in Figure 4.

The upper end of the piston 3 is formed with substantially horizontal wall portions 8 which are provided, preferably integrally, with a plurality of offset upwardly extending lugs or stop elements 9 respectively adapted to cooperate with suitable lugs 10 which may be conveniently formed integrally on the under side of a table 11 which constitutes a support for a pattern plate 12 and a flask 13.

The table 11 is yieldably supported above the piston with its lugs 10 out of contact with the lugs 9 of the piston by suitable means, such, for example, as a plurality of coil springs 14, each of which is retained in place and prevented from being horizontally displaced by a pair of bosses 15 which project into the opposite ends thereof and are respectively rigid with the under side of the table 11 and the upper side of the wall portion 8 of the piston. Being thus flexibly connected to the piston, the table is free to vibrate in substantially all directions with respect to the piston, the stop lugs 9 and 10 merely serving to limit the extent to which the springs may be compressed.

As is customary, the flask 13 is interlocked against horizontal displacement with respect to the pattern plate 12 by pins 12a and to prevent the pattern plate from moving or shifting horizontally with respect to the table, the latter may be conveniently provided, in addition to the bolts or screws (not shown) usually employed for con-

necting the pattern plate to the table, with a plurality of upwardly projecting bosses 16 which fit closely within suitable recesses formed in the under side of the pattern plate.

Thus any vibratory motion imparted to the table will be transmitted to the pattern plate and flask.

The vibratory motion which I have found most effective to uniformly compact the sand or other molding material within the flask around the pattern may be imparted to the molding material by mounting a vibration producing means on the under side of the table 11. One form of means which serves to produce the desired vibratory motion consists of an air turbine or motor comprising a housing 17 preferably formed in two parts and provided with an internal chamber 18 for receiving a rotor 19 having a plurality of vanes 20 on its periphery. The housing 17 is also formed with two horizontally disposed passageways 21 and 22 respectively constituting inlet and outlet passages for the fluid, such as air, employed for operating the rotor.

The rotor is mounted for rotary movement about a substantially vertical axis on a shaft 23 to which is rigidly connected a weight 24. The axis of shaft 23 about which the weight 24 revolves is eccentric to or spaced from the center of mass of the weight and consequently rapid rotation of the weight by the rotor 19 will impart to the table 11, as well as to the pattern plate and to the flask, a gyratory vibration which will cause the molding material to pack uniformly around the pattern 25 on the plate 12.

Suitably mounted on the base of the machine is a valve 26 having an operating handle 27 for controlling the passage of fluid under pressure from a convenient source of supply, not shown, to the rotor 19. Valve 26 has a port communicating with pipe 28 leading from the source of fluid under pressure and it also has a port 29 which is adapted to be connected by a suitable pipe 28 to the inlet 21 of the air turbine.

The handle 27 of the valve 26 may be conveniently pivotally connected, as indicated at 30, to a handle 31 for operating the valve mechanism 32 controlling the supply of fluid under pressure to the squeeze piston 3. The valve mechanism 32 has a port 33 adapted to be connected by a pipe, not shown, to a fluid pressure supply source and has a port 34 which is adapted to be connected to a pipe 35 leading to the bottom of the squeeze cylinder 1. When the handle 31 is rotated in one direction about its pivotal axis 36, fluid under pressure passes through the valve mechanism 32 to the lower end of the squeeze cylinder and thus causes the piston 3 to move upwardly to subject the molding material within the flask to a squeezing action, and when the handle is rotated in the opposite direction the pressure within the squeeze piston is exhausted to the atmosphere whereby the piston is enabled to return to its normal inoperative position.

While it may be found desirable in the operation of the machine to set the vibration producing means into operation prior to the admission of fluid under pressure to the squeeze piston, the packing or settling of the molding material is so quickly accomplished that the vibration producing means need not be set in operation until air is admitted to the squeeze cylinder. During the upward movement of the squeeze piston, the rotation of the eccentrically mounted weight 24 imparts a rapid vibratory movement to the table, pattern plate and flask which causes the molding material to firmly and uniformly pack about the pattern 25. As the flask approaches the squeeze board 7, the upper portion of the sand which is mounded above the top of the flask will engage the squeeze board and thus be compressed or squeezed. The pressure to which the molding material is subjected is far in excess of the force exerted by the coil spirngs 14 so that, during the major portion of the squeezing operation, the lugs 10 on the under side of the table 11 will be in engagement with the lugs 9 on the upper end of the squeeze piston. As it has been found that a better mold is produced if the vibration producing means is cut off before the maximum squeeze pressure is attained, a valve 37 is interposed in the pipe 28 leading from the valve 26 to the inlet port 21 of the air motor. This valve includes oppositely disposed communicating ports 39 which are adapted to be closed by a reciprocating plunger or piston 40 whereby the supply of fluid under pressure to the air motor is cut off even though the valve 26 is still maintained in open position. To automatically operate the piston 40 to cut off the flow of fluid pressure to the air motor, when a predetermined pressure is built up in the squeeze cylinder, the lower end of the piston is subjected to the pressure within the squeeze cylinder through a pipe 41, while a compression spring 42 acts upon the upper end of the piston. A suitable adjusting screw 43 is provided to adjust the tension of spring 42 so that piston 40 will move upwardly to cut off the supply of fluid pressure to the air motor when the desired pressure is attained in the squeeze cylinder 1.

After the molding material has been subjected to a somewhat higher pressure than that required to automatically shut off the air motor, valves 26 and 32 are then closed. Air is then exhausted from the squeeze cylinder by suitable operation of handle 31 to enable the cylinder, the table 11, the pattern plate and flask to move downwardly.

To prevent the squeeze piston 3 from rotating within the cylinder 1 as the piston is being elevated or lowered, a guide pin 44 is connected to the table 11 and extends downwardly therefrom for slidable movement within a bearing boss 45 which may be conveniently formed integrally with the cylinder 1. The lower end of the pin may be provided with a nut or collar 46 which by cooperating with the boss 45 serves to limit upward movement of the squeeze piston.

While any suitable means may be provided for drawing the pattern, it is preferred that this be accomplished as the squeeze piston returns to its normal position. To this end, the pattern drawing mechanism includes a bell crank consisting of a horizontally disposed shaft 47 which is journaled in the pedestal or frame 4 of the machine and is rigidly provided with a pair of relatively long substantially parallel arms 48 and with a single relatively short arm 49. The outer ends of the arms 48 are provided with rollers or other suitable means 50 which are respectively disposed within recesses or the like 51 formed in yokes 52 mounted on opposite sides of the machine. Each of the yokes is mounted for vertical movement on a guide pin 53 supported from the base of the machine and each is provided at its ends with pins 54 which normally extend upwardly through apertures in the

table 11 and pattern plate 12 and terminate just below the bottom edges of the flask 13.

To operate the bell crank and thus elevate the yokes 52, a fluid pressure operated diaphragm 55 may be conveniently connected by a rod 56 to the outer end of the bell crank arm 49. When air is admitted into the diaphragm with the parts shown in the position illustrated in Figure 2, the bell crank and draw yokes will be elevated into the positions shown in Figure 3. While the operation of the bell crank and its associated parts may be deferred until after the piston, pattern plate and flask have descended to their normal positions following the squeezing operation, whereby the pattern would be drawn by causing the flask to move upwardly with respect to the pattern plate, the drawing operation may be greatly facilitated if, as is preferred, the bell crank is operated to elevate the yokes 52 before the squeeze piston and the parts carried thereby start to descend for in this manner the flask will contact the upper ends of the lift pins 54 and be supported thereby in an elevated position during the descent of the piston and continued downward movement of the piston and pattern plate will, therefore, result in drawing the pattern from the mold.

From the foregoing, it will be appreciated that, because the table for supporting the flask and pattern plate is flexibly or yieldably mounted, the rotating off-center weight 24 will subject the flask to a vibratory action such as will cause the sand or other molding material to settle into a compact and relatively dense mass and that, when the squeezing force is applied to the material, a mold of uniform density having very smooth surfaces will be produced.

While the invention has been shown as applied to one type of molding machine, it is evident that it may be applied with equally satisfactory results to molding machines of other types. Furthermore, it will be apparent that many modifications of the invention may be made without departing from the spirit and scope thereof as defined in the appended claims.

This application is a continuation in part of my former application, Ser. No. 180,126, filed December 16, 1937, now Patent No. 2,169,279, dated August 15, 1939, which covers a method of forming the mold described herein.

What I claim is:

1. The improvement in molding machines including a base member, a table flexibly mounted thereon, said table affording a support for a pattern plate, a pattern mounted on said plate, a flask containing molding material surrounding said pattern, rotatable means mounted on said table, said means being revoluble about an axis spaced from the center of its mass, and means for rotating said rotatable means to cause said table to vibrate and thereby compact the molding material within the flask about said pattern.

2. The improvement in molding machines of the character having a squeeze head, a pattern plate having a pattern mounted thereon and flask supporting table, said table also supporting the pattern and pattern plate, and a squeeze piston for moving the table and flask upwardly for compressing the molding material within the flask against the squeeze head, said improvement consisting of resilient means operatively interposed between said table and piston affording a yielding mounting for said table, and means for vibrating said table in a direction forming an angle with the direction of movement of said piston to compact the molding material within the flask.

3. The improvement in molding machines of the character having a squeeze head, a pattern plate having a pattern mounted thereon and flask supporting table, said table also supporting the pattern and pattern plate, and a squeeze piston for moving the table and flask upwardly for compressing the molding material within the flask against the squeeze head, said improvement consisting of resilient means operatively interposed between said table and piston affording a yielding mounting for said table, and means carried by said table for imparting gyratory vibrations thereto to compact the molding material within the flask.

4. The improvement in molding machines of the character having a squeeze head, a pattern plate and flask supporting table, and a squeeze piston for moving the table and flask upwardly for compressing the molding material within the flask against the squeeze head, said improvement consisting of resilient means operatively interposed between said table and piston affording a yielding mounting for said table and positioned beneath the same, and means carried by the table for imparting substantially horizontal gyratory vibrations thereto as the piston and flask are being moved upwardly.

5. The improvement in molding machines of the character having a squeeze head, a pattern plate and flask supporting table, and a squeeze piston for moving the table and flask upwardly for compressing the molding material within the flask against the squeeze head, said improvement consisting of resilient means operatively interposed between said table and piston affording a yielding mounting for said table, means carried by said table including a rotatable member revoluble about an axis spaced from its center of mass, and means for inducing rotation of said member as the piston and flask are being moved upwardly to cause the molding material to settle within the flask.

6. The improvement in molding machines having a squeeze head, a pattern plate and a flask supporting table, and a fluid pressure operated squeeze piston for moving the table and flask upwardly toward the squeeze head for subjecting the molding material within the flask to a predetermined maximum pressure, said improvement consisting of resilient means operatively interposed between the table and piston affording a yieldable mounting for the table, movable means operable while the molding material is being subjected to pressure for causing the table to vibrate in a direction forming an angle with the direction of movement of said piston, and means responsive to the fluid pressure operating means of said piston for arresting operation of said movable means before the molding material is subjected to said predetermined maximum pressure.

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