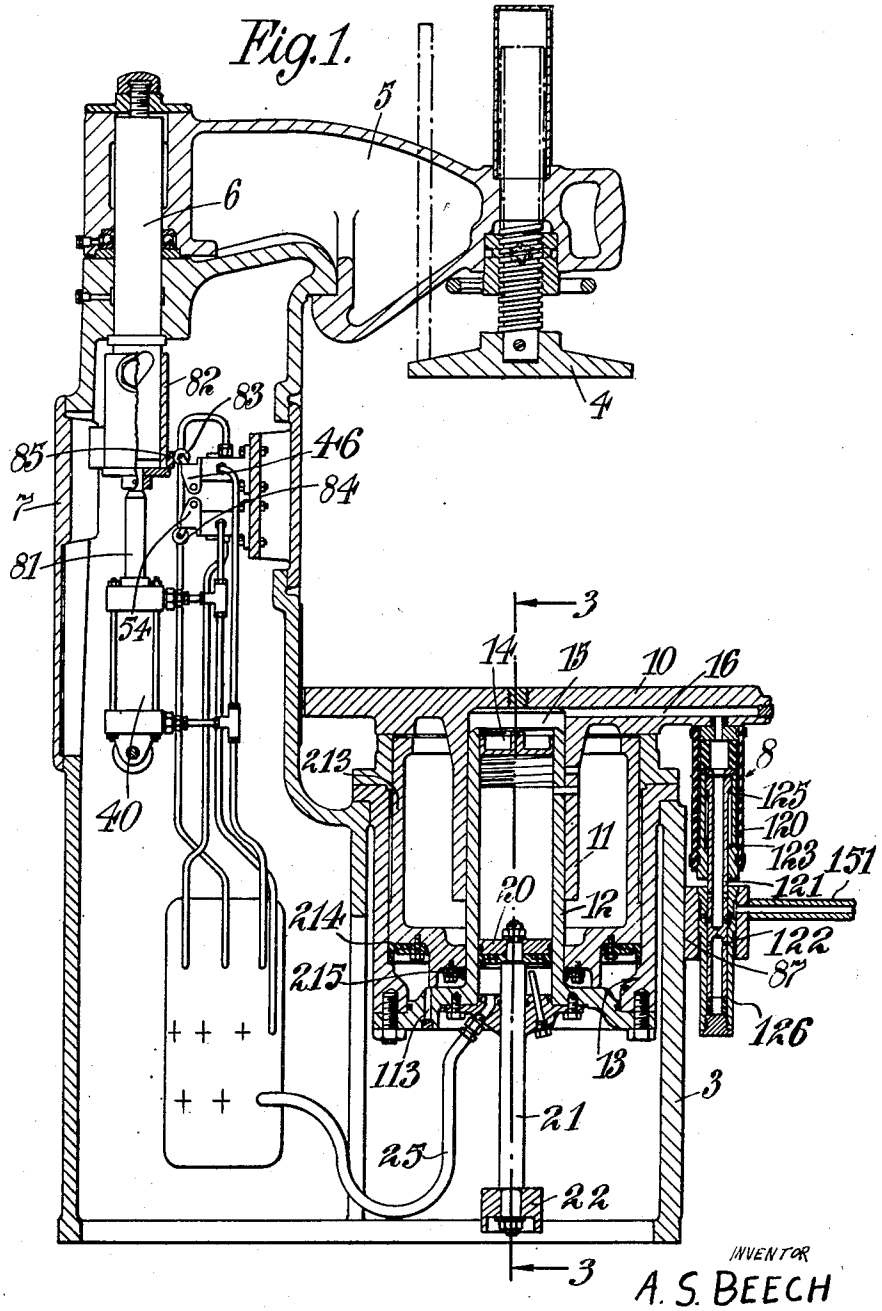
May 27, 1958 A. S. BEECH 2,835,939

FOUNDRY MOULDING MACHINES

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Fig. 1.



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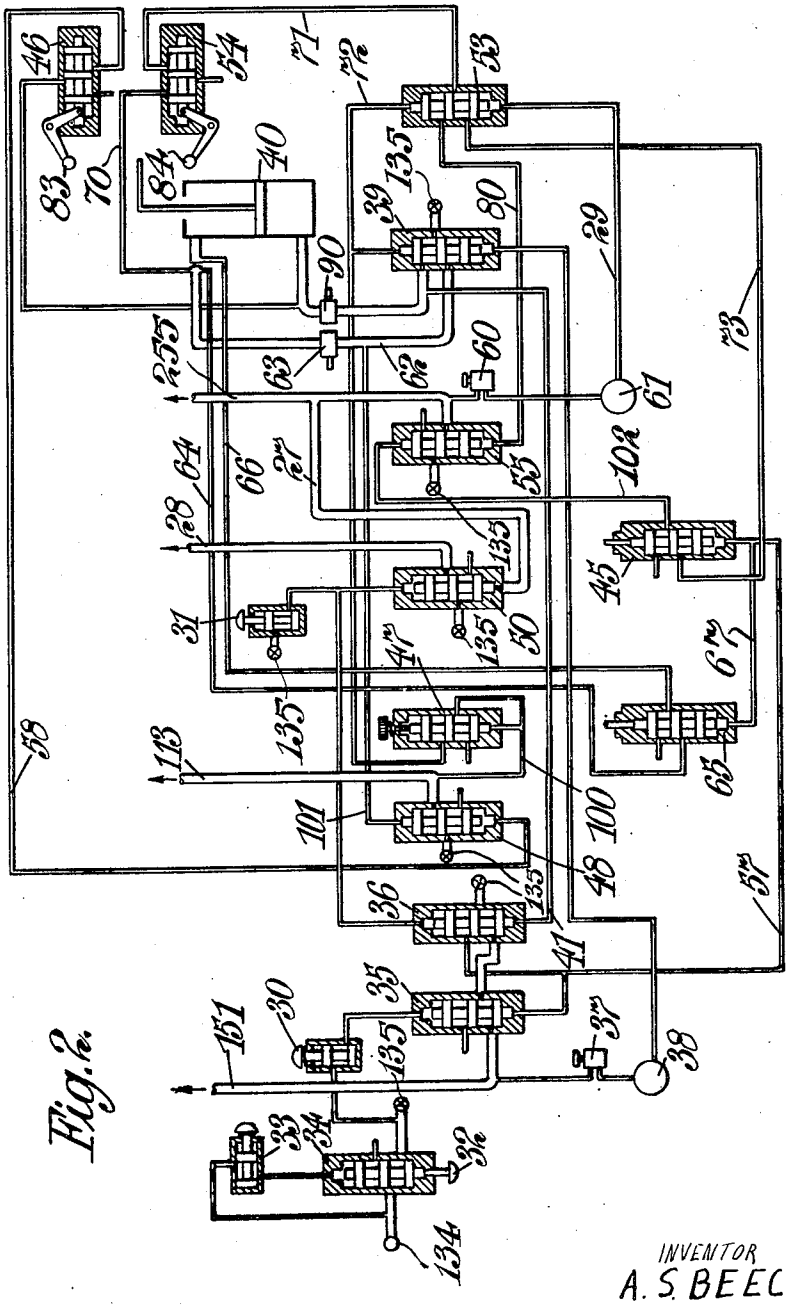


Fig. 2.

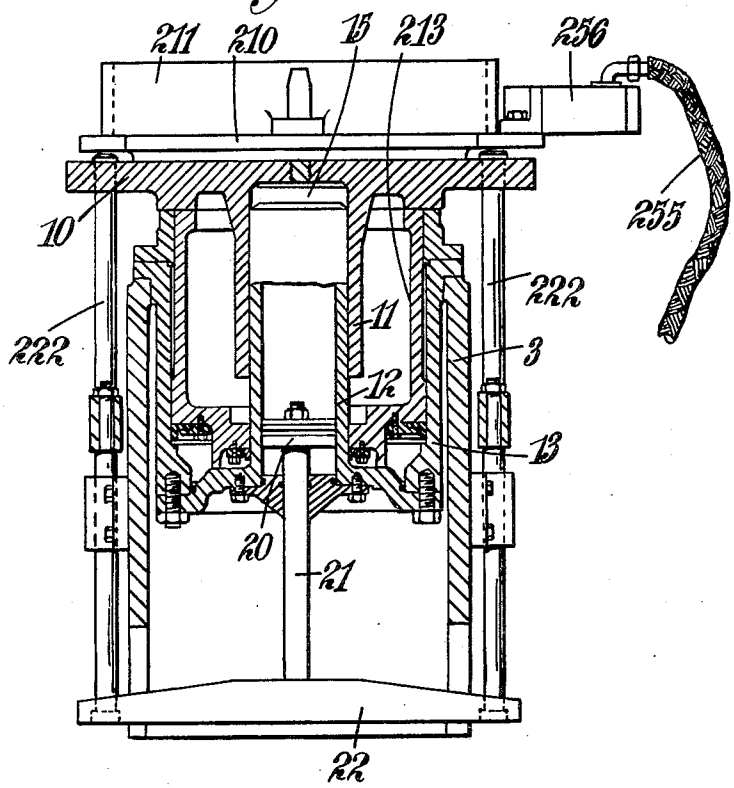
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Fig. 3.



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FOUNDRY MOULDING MACHINES

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Application November 8, 1954, Serial No. 467,547

10 Claims. (Cl. 22—29)

The present invention relates to mould-producing machines of the type comprising means for effecting a squeezing operation to compress moulding material about a pattern, and means for stripping the mould from the pattern when it is completed. These machines may also be provided with a fluid operated unit for effecting a jolting operation. These machines, as at present constructed, normally require a pit as they usually have projections below floor level.

It is an object of the present invention to provide an improved machine of the type described.

According to the present invention a mould-producing machine comprises means for effecting a squeezing operation to compress moulding material about a pattern, means for stripping the mould from the pattern, and means for causing the stripping means to commence operation automatically at the end of the squeezing operation. The machine may also be provided with vibrating gear, and means to cause the vibrating gear to be actuated automatically at the end of the squeezing operation at the same time as or just before the stripping means commences operation.

In one of its aspects the invention provides means to perform a jolting operation and means, initiated at the end of the jolting operation, to cause the squeezing, vibrating and stripping operations to be performed automatically in the correct sequence to produce the required mould. Preferably the automatic means are fluid pressure operated.

In another of its aspects the invention provides a machine of the type described in which the jolting operation may be effected by reciprocating the table on an upstanding tube in the main squeeze cylinder, which tube may further act as an operating cylinder for the stripping gear.

Preferably the machine is provided with an emergency stop device to stop the machine by exhausting it to atmosphere and simultaneously cutting off the main fluid supply.

The following is a description by way of example of one embodiment of the invention reference being made to the accompanying drawings in which:

Figure 1 is a sectional side elevation of the moulding machine and,

Figure 2 is the circuit diagram of the pressure fluid control system.

Figure 3 is a cross-section on the line 3—3 of Figure 1, looking in the direction of the arrows, but with a pattern and moulding box shown in place.

A moulding machine has a base 3 and is provided with a screw adjusted head 4 on the swinging head arm 5. The arm 5 is mounted on a ball race in an upstanding post 6. The post extends downwardly within the vertical member 7 of the machine and is attached to head swinging gear in a manner hereinafter described.

In this example the table 10 of the moulding machine on which the pattern plate 210 (Figure 3), with the moulding box 211 upon it, is placed, is provided with a downwardly directed jolt cylinder 11 in the form of a central boss which is reciprocably mounted on an upstanding stripping-cylinder 12 in the main squeeze cylinder 13. The top of the cylinder 12 is closed at 14, thus providing a space 15 into which fluid pressure may be admitted through the line 16 from the jolt mechanism 8, so as to lift the table 10 to provide the jolting operation of the machine. The jolt mechanism 8 is hereinafter further described. A flexible seal of the bellows type (not shown) may be provided between the underside of the top of table 10 and the outside of squeeze cylinder 13.

A stripping piston 20 is mounted for reciprocation within the upstanding tube 12 in the main squeeze cylinder 13 which piston is connected through a rod 21 to a cross head 22, the cross head 22 having connections to stripping pins 222 (Figure 3) spaced apart upon it. The application of fluid pressure to the underside of the piston 20 through the line 25 causes it to slide upwardly within the cylinder 12 raising the cross head 22 and also the stripping pins to cause the mould stripping action of the machine.

The squeeze cylinder 13 contains an annular squeeze piston 213 which is provided with cup leathers 214, 215 around its inner and outer lower peripheries and which nearly abuts on the underside of table 10. The application of pressure through connection 113 to this cylinder will cause piston 213 to raise and apply upward squeezing pressure to the table 10.

The machine is controlled by four operating push buttons, the start cycle button 30, the stripping pin return and resetting button 31, the emergency stop button 32 and the reset and continue button 33, all of which are mounted on a control panel separate from the machine. For normal operation only the start cycle 30 and stripping pin return buttons 31 are used but in case of emergency the emergency stop button 32 opens an emergency stop stop valve 34 and exhausts the machine to atmosphere. All the main fluid supplies to the valves pass from pressure main 134 through the emergency stop valve 34 to a distribution main 135; when button 32 is pressed, simultaneously with exhausting the machine, by connecting main 135 to exhaust, the emergency stop valve 34 also cuts off the supply main 134. The distribution main 135 is not shown as a continuous main in the drawing Figure 2, but is indicated by a circle with a cross wherever it appears.

To initiate the cycle of operations for the manufacture of the half mould by the machine the start cycle button 30 is pressed (it is shown in the drawing in the pressed-in position), an impulse of air operates a jolt cylinder valve 35 connected to the jolt cylinder 11 through jolt mechanism 8 by pipe 151. The valve 35 is shown in the operated position, in which it is allowing mains air to pass from a jolt interlocking valve 36 in to the valve 35 and so to the jolt cylinder 11 by pipe 151, causing the machine to commence jolting as hereinafter described in connection with mechanism 8 of Figure 1. Whilst this operation is continuing, impulses of air are passing through a jolt regulator 37 which has a non-return valve into a pressure vessel 38 where pressure builds up until adequate to operate a head swinging valve 39 to open it i. e. to move it upward as shown in Figure 2.

On opening the valve 39, air is allowed to pass from the distribution main 135 through a flow regulator 90 to the bottom of a head-swinging cylinder 40 and to the top swinging head roller valve 46 and an impulse is also sent to the jolt interlock valve 36, via the pipe 41, which then reverses the valve 35 and the jolting is stopped. Squeeze-table-operated valves 45, 65, which are underneath the squeeze table 10, are also reset at the same

time by an impulse through pipes 57, 67. The valves 45, 65 ensure that the table is in its lowermost position before the stripping and vibrating, which follows squeezing and jolting, take place.

When the head-swinging cylinder 40 reaches the end of its stroke, it opens swinging-head roller-operated valve 46 and allows air to pass through that valve via pipe 58 to open a squeeze cylinder valve 48 which then operates the squeeze cylinder 13 by passing mains air through the valve 48 to the squeeze cylinder 13 by inlet 113.

Air passes to a pressure selector valve 47, via pipe 100 which is closed, and the pressure in the squeeze cylinder 13 is built up until it overcomes a spring, loading the pressure selector valve 47. As soon as the pressure in the squeeze cylinder 13 reaches the pressure of the spring of the valve 47 an impulse of air is passed by the spring-loaded valve 47 through the pipe 72 to the swinging head valve 39, and also to a strip interlock valve 53 via the pipe 72, reversing them. The reversal of valve 39 also reverses the squeeze cylinder valve 48, because there is an impulse of air caused to pass along pipe 101 from pipe 62, connected to valve 39, thus causing the squeezing stroke to be terminated. The pressure at which the pressure selector 47 opens can be varied by increasing or decreasing the tension of its spring. The head swinging valve 39 being reversed, air is allowed to pass to the opposite end of the swinging head cylinder 40 via lines 62, flow regulator 63, line 64, table operated valve 65 and line 66, and the swinging head swings out of the way. Table operated valve 65 prevents air passing to the swinging head cylinder 40 until the table has returned by gravity, reversing table operated valve 65. When this cylinder reaches the end of its stroke, it operates a second swinging head roller operated valve 54 and allows an impulse to pass from line 70 through the valve 54 and via line 71 through valve 53 which has been reset by valve 47 through line 73, and through valve 45, which has been reset by the valve 36 via line 102 to open a vibrator-control valve 55 which controls a vibrator 256 (Figure 3). Table-operated valve 45 prevents air passing to the vibrator valve 55 until the table is returned to its seated position.

On opening the vibrator valve to start the vibrator an impulse is transmitted via pipe 27 to the strip valve 50, thus opening it and allowing mains air to pass into the strip cylinder 12, by way of pipe 28, thereby initiating the stripping gear.

In order to obtain an initial slow movement of the stripping gear, the air under pressure which actuates the gear, is made to pass through two tanks (not shown) containing oil, which are connected by a small orifice such that the relative rates of flow of oil and air through the orifice are used to obtain two different stripping speeds.

The oil level in the tanks can be varied to provide varying degrees of initial slow movement.

The vibrator-control valve 55 on opening operates the vibrator 256 through pipe 255 and also sends an impulse through a vibrator regulator 60, having a non-return valve, into a tank 61, and from the tank to the strip interlock valve 53 via the line 29. An impulse is then transmitted back to the vibrator valve 55 from the strip interlock valve 53 via the line 80 to reverse the vibrator valve 55 so providing an adjustable period of vibration.

The return stripping pin button 31 resets the valve 59 which brings down the stripping pins and also reacts valve 36 for the next cycle, thus completing the operations.

The vibrating gear 256 used is preferably attached to the pattern plate 210 as shown in Figure 3 and is of the standard "free piston" type vibrator. The swinging head cylinder 40 is provided with an upwardly extending ram 81 (Figure 1) which connects with the swinging head block 82. The downwardly extending post 6 is provided with a plurality of helical grooves which provide cam faces for ball followers on the swinging head block 82. The up and down action of the ram thereby causes the head 4 to be rotated. The rollers 83 and 84 of the roller

valves 46 and 54 are operated by a cam projection 85 on the block 82.

Fixed at 87 to the machine base 3 is the telescopic jolt mechanism 8 which is of such construction as to be capable of extending slightly with the rise of the table and at the same time opening a port to atmosphere exhausting the cylinder 15 thus causing an intermittent jolting action with minimum cushioning of the downward stroke of table 10.

This mechanism 8 consists of a slide valve, comprising three parts, namely (*a*) the outer valve bush 120, which has an annular recess 123 in its bore and which is attached to table 10; (*b*) a sliding control tube 121 closed at one end and with eight port holes 122 in three groups at different heights drilled radially through it and (*c*) a lower fixed bush 126 surrounding the lower end of tube 121 and containing the air supply 151. Jolting pressure is applied through pipe 151, the middle holes 122, bore of control tube 121 and passage 16 to the interior of jolt cylinder 11. The operation is effected by the control tube 121 being lifted by the projection afforded by recess 123 abutting against the flange 125 after the table has risen, say three inches (i. e. the length of the recess 123). During the next movement of the order of, say, half an inch, the air supply is cut off by the rising of control tube 121 and the air in the cylinder simultaneously exhausted, via ports in the table and the four upper holes 122 in the control tube which rise clear of the bush 126. When the control tube is lifted by the table, mains air is allowed to enter beneath the closed end of the tube via the four lower holes 122 and maintains the tube in the lifted position. The control tube is returned to the starting position by the table when it has dropped to within a very small distance of the jolt anvil. On return of the central tube the jolting action continues until it is timed out (i. e. until air pressure is cut off from pipe 151 by the valves shown in Figure 2).

Both the number of jolts and the duration of vibration can be varied by altering the regulators provided in their respective circuits. The pressure on the squeeze can also be varied by the pressure selector 50, thus varying conditions can be provided for. This is a considerable advantage as the number of jolts and the duration of vibration can be set for every particular pattern and not left to the whim of the operator. Thus maximum efficiency can be obtained. All the valves referred to in this example are preferably piston valves.

It will be understood that the term "fluid" as used in this specification can mean air or any suitable hydraulic liquid such as oil. Although the specific example is drawn to a pneumatically operated automatic control circuit for the machine, the automatic control circuit, with appropriate alterations, may be alternatively hydraulically-operated and may be used for example in connection with the machines which are the subjects of the United States Patent Application No. 395,861 now Patent 2,817,127 issued Dec. 24, 1957.

I claim:

1. A mould-producing machine having a fluid-pressure operated table arranged to support a pattern, a head against which the mould is squeezed by a pattern on the table, which head is swingably mounted so as to be capable of being positioned in the "closed" position over the mould, for the squeezing operation, or in the "open" position clear of the mould, jolting mechanism for imparting an up and down small adjustable amplitude movement to the table, vibrating gear for vibrating the pattern in the mould, stripping gear for removing the completed mould from the pattern, fluid-pressure-operated units for operating each of the head-swinging, squeezing, jolting, vibrating and stripping movements, a squeeze-timing device, valve means for controlling each unit, fluid-pressure operated means responsive to the swinging-head unit for starting the squeezing operation and the squeeze-timing device, means initiated by the

said timing device to stop the squeezing action and to start returning the swinging head to the "open" position, fluid-pressure-operated means responsive to the returning of the head for starting the vibrating gear, the stripping gear and the vibrator timing device, and means actuated by the vibrator timing device to stop the vibrator.

2. A mould-producing machine comprising in combination a table, a head above the table, a squeeze-cylinder below the table, a movable squeeze piston therein to raise the table toward the head, a stripping cylinder within and concentric with the squeeze piston, a stripping piston in the stripping-cylinder having a piston rod which projects downwardly therefrom and is connected to a stripping cross-head below the squeeze cylinder, a jolting-cylinder within and concentric with the squeeze-piston, said jolting-cylinder fitting around and utilizing the exterior of the stripping-cylinder as a jolting-piston, means to convey operating fluid supplies under pressure to each of said cylinders, and means to control each of said fluid supplies.

3. A mould-producing machine as claimed in claim 2, wherein the means to control each of the fluid supplies comprise valve units and fluid-pressure operated means for each valve unit, so connected together that each unit operates the next unit sequentially.

4. A machine as claimed in claim 1, wherein the valve means for initiating the jolting action comprises a manually operated starting valve, a main jolt valve operated thereby and connected to the jolt cylinder, and a jolt interlock valve between the jolt-valve and the jolt-cylinder.

5. A machine as claimed in claim 1, wherein the said

means responsive to the swinging-head for starting the squeezing operation comprises a trip valve which is operated cam fashion by the head when it reaches its "closed" position.

6. A machine as claimed in claim 1 wherein the squeeze timing device is a spring loaded valve.

7. A machine as claimed in claim 1 wherein the means responsive to the returning action of the swinging-head is a trip valve.

8. A machine as claimed in claim 1 wherein the vibrator timing device comprises a flow regulator valve and a reservoir which device opens a main operating valve when the pressure behind it has built up to a predetermined value.

9. A mould-producing machine as claimed in claim 1 wherein the operating medium for the control fluid is air under pressure.

10. A mould-producing machine as claimed in claim 1 wherein an emergency stop device to stop the machine by exhausting it and simultaneously cutting off the main fluid supply is provided in the circuit.

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