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MOLDING DEVICE

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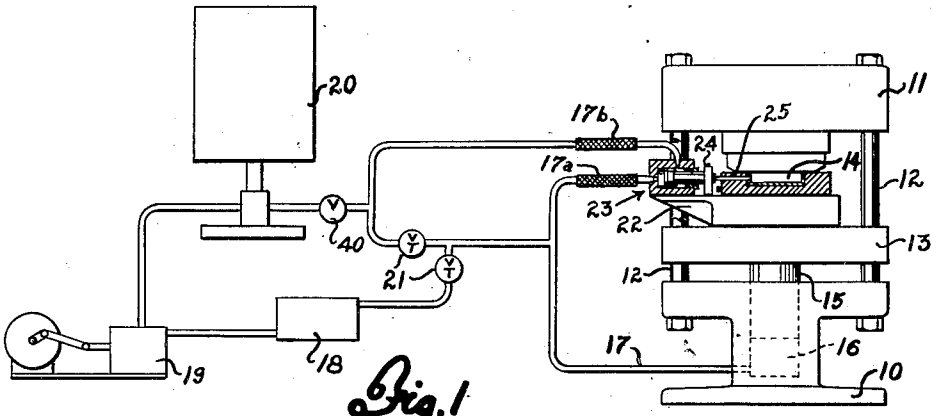



Fig. 1

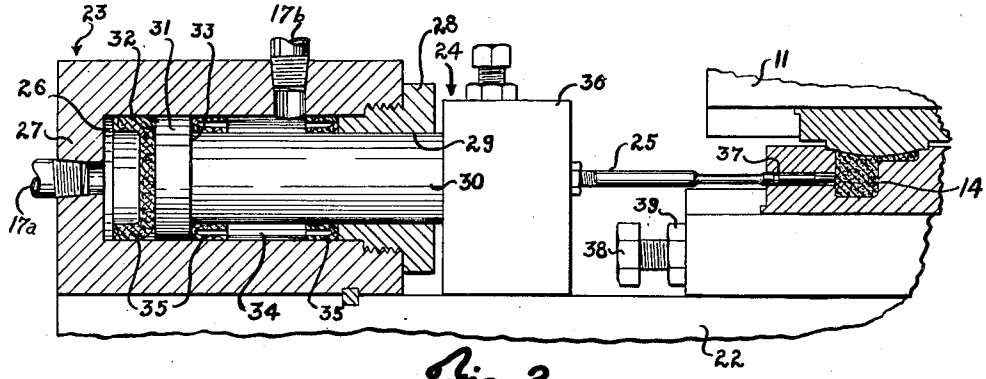



Fig. 2

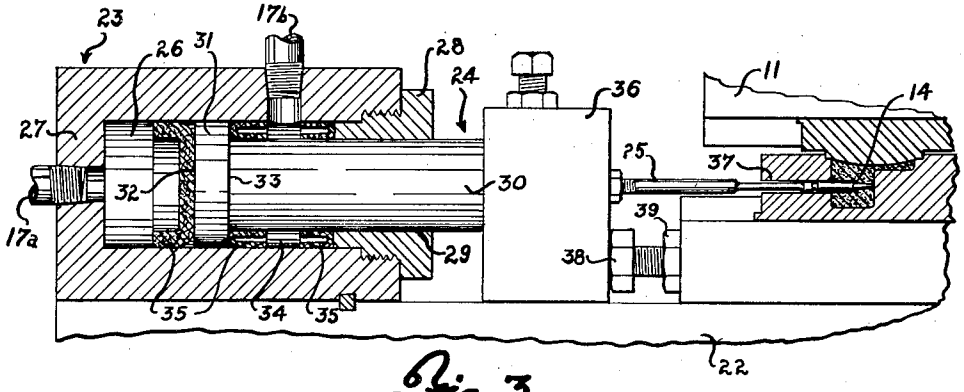



Fig. 3

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## MOLDING DEVICE

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10 Claims. (Cl. 18—17)

This invention relates to automatic molding machines more particularly to molding machines in which side cores are to be used in the compression chamber.

In using the compression mold having a fixed and a moving portion cooperating by moving together along a straight line under the impelling force of a fluid-pressure operated piston, it is essential to avoid all projections which result in an undercut, otherwise the completed article of manufacture may not be removed from the molding chamber. To avoid these undercuts, the projections are made movable to and from the molding chamber in timed relation with the motion of the fluid-pressure operated piston creating the compressive force.

Heretofore this action has been attained through the use of cams and eccentrics. The invention provides an automatic means for attaining the desired end through the use of pistons actuated by fluid pressures, the timing relations being made dependent upon the variations in pressure in the main cylinder which initiates the compressive force. In this way there is provided an automatic system in which the movement of the side cores is dependent upon the controlling factor, viz; the operating pressure in the main cylinder, thereby preventing undue breakage due to improper timing. The operation is fully automatic and requires no manipulation other than the actuation of the throttle controlling the operating pressure in the main cylinder.

It is, therefore, an object of this invention to provide an automatic system for moving side cores in the compression chamber of a fluid-operated press, to and from operable position in timed relation with the compression stroke of the press.

It is a further object of this invention to provide an automatic system of bucking fluid-pressure operated cylinders for moving side cores to and from the compression chamber of a fluid-pressure operated mold, in which a normal-pressure cylinder tends to move the side core from the compression chamber, but whose force is bucked and overcome by a second cylinder tending to move the side core into the compression chamber, the latter cylinder being responsive to the pressure in the main cylinder of the mold where the compressive force is initiated.

It is a further object of this invention to provide an automatic fluid-pressure operated molding machine in which side cores are moved to and from operable position by fluid-pressure operated means; the operator of the machine controlling the machine solely by manipulation of the throttle controlling the pressure in the main cylinder.

It is a further object of this invention to provide a molding machine in which the component parts are moved to and from operable position by force differentials arising through the bucking of varying fluid-pressures to obtain proper timing between the movements of the parts.

It is a further object of this invention to provide an automatic molding machine having component parts moving in timed relation in which the simplest unitary control is employed to reduce rejections for inaccuracy to a minimum.

It is a further object of this invention to provide a molding machine in which undercut molded articles may be readily formed, especially by the molding of resinous materials and the like which may be molded under pressure and/or heat.

Other objects and advantages of this invention relating to the arrangement, operation and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture, will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawing forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is a diagrammatic view showing the invention applied to a molding machine.

Fig. 2 is an enlarged sectional elevation of actuating cylinder and its cooperating parts.

Fig. 3 is a view similar to Fig. 2.

Referring to Figure 1 of the drawing, there is shown in diagram a molding machine to which a preferred embodiment of the invention has been applied. The molding press may be of any type as, for example, one having a base member 10, a fixed portion 11 connected to the base by rods 12, a moving portion 13 sliding on the rods 12 into operable relation with the fixed portion 11 to form a compression chamber 14. To actuate the moving portion 13, there is provided a depending piston 15 cooperating with a fluid-pressure cylinder 16 formed in the base 10 of the machine.

The cylinder 16 is in communication with a fluid-pressure system through the medium of the pipe 17, the fluid-pressure system comprising generally, of a supply tank 18, a compressor 19, an accumulator 20, and a throttle 21, cooperating as shown diagrammatically in Figure 1. These elements are well known in the art, both as to their

function and operation and need not be described in further detail.

A preferred embodiment of the invention is preferably attached to the moving portion 13 of the machine. A laterally extending platform 22 carried on the moving portion 13 may be provided to which the bucking cylinders, generally referenced 23 may be attached in any convenient manner. A thrust member 24 is provided to be acted upon by the cylinders, and a laterally extending stem 25 in the nature of a core or undercutting means is attached thereto to move to and from operable relation with the molding chamber 14 under the influence of the piston. The cylinders 23 are in communication with the fluid-pressure system aforementioned with reference to the main cylinder, thru the medium of flexible tubes 17a and 17b the function and operation of which will be described hereinafter.

Referring to Figures 2 and 3 of the drawing, there is disclosed in an enlarged sectional view, the details of construction of the cylinders 23. The cylinder proper is a bore 26 closed at one end with a wall 27 into which the tube 17a is threaded so that the bore 26 is in communication with the fluid-pressure system to be subjected to a pressure equal to that in the main cylinder 16. The tube 17b is in a similar threaded relation with the side of the cylinder 23, so that the bore 26 will also be in communication with the fluid system through the medium of the tube 17b, which will direct full accumulator pressure to the bore.

At the opposite end, the bore 26 is closed by means of a threaded plug 28, which has an aperture 29 to receive the connecting stem 30 of the thrust member 24. The connecting stem 30 is provided with a piston head 31 to fit snugly into the bore 26, the pressure therein issuing through the tube 17a acts upon the face 32 of the piston head. The opposite face 33 of the piston head, whose area is determined by the relation of the diameters of the bore 26 and the connecting stem 30 is acted upon by the pressure issuing from the tube 17b into the annular space 34 between the connecting stem 30 and the bore 26. Packings 35 are provided at the points shown in Figure 2 to prevent leakage around the piston head and its stem.

The thrust member 24 is provided with a guide block 36 to which the connecting stem 30 of the piston head and the laterally extending stem 25 are rigidly attached. In this manner the thrust developed by the pressure in the bore, tending to move the guide block 36 in either direction will move the stem 25 positively in the same manner. The stem 25 has adjacent to its end a contour in the nature of a core which moves laterally into the compression chamber 14 through an aperture 37 in the wall of the chamber to conform the molded material therein in a predetermined manner, under the compulsion of the thrust initiated by the pressure in the cylinders 23.

The movement to the right (Figure 3) of the block 36 is limited by a stop 38 shown as a protruding bolt from the base structure 22 with a stop nut 39 to adjust its position.

The operation of the machine incorporating a preferred embodiment of the invention is as follows: Assuming that the accumulator 20 is capable of delivering a sufficient quantity of fluid at a relatively high pressure, for example, 3,000 pounds per square inch to operate the machine without appreciable drop in the pressure, and that all the parts are at rest with the valve 40 closed and the piston 15 down in the cylinder 16, the first action of the operator is to close the throttle valve 21 which at the same time opens the valve to the supply tank 18 and allows the main cylinder 16 to discharge through the pipe 17 into the supply tank 18. At this point everything in the system is at rest. The operator then opens the valve 40, which immediately subjects the right side 33 of the piston head to the full accumulator pressure through the medium of the tube 17b. This assures the position of the stem 25, as the piston head 31 under compulsion of the high pressure will move as far to the left as possible.

The operator then places the material to be molded such as phenol condensation products or the like, into the open molding or compression chamber, and opens to a slight degree the throttle valve 21 in the pressure line, which at same time closes the valve in the exhaust line to the supply tank 18. This allows fluid to flow into the lines 17 and 17a and builds up a pressure in both the main cylinder 16 and the bucking cylinder acting on the face 32 of the piston head. As a small pressure, for example, 10 or 15 pounds per square inch, in the main cylinder 16 is sufficient to raise the piston 15 and move the portion 13 upwards to close the compression chamber 14, the pressure in the lines 17 and 17a will remain at this point till the compression chamber is closed, then the pressure may rapidly build up to a value approaching the accumulator pressure.

As the pressure builds up in the lines 17 and 17a, the main cylinder 16 will be exerting the necessary pressure to form the material in the mold, at the same time the bucking cylinder acting on the face 32 is subjected to the same pressure so that a force differential is obtained which at low pressures will be insufficient to overcome the force of the high accumulator pressure on the face 33 of the piston head, but as the pressure builds up, the greater area of the face 32 as compared with face 33, allows the force acting on the face 32 to overcome the force on the face 33 and the piston head will begin to move to the right and thrust the stem 25 with its core end into the compression chamber of the mold. At peak pressure, that is substantially accumulator pressure, the piston head will have advanced as far to the right as possible as defined by the stop 38 contacting the guide 36.

When the peak pressure has been reached, the molding operation per se is complete and it is now necessary to retract the parts to allow the article of manufacture to be removed from the molding or compression chamber and a new charge put in its place for a repetition of the process. The stem 25 must, therefore, be retracted and the mold opened by the lowering of the portion 13. To do this the operator actuates the throttle 21, which closes the valve in the supply line and opens the valve in the discharge line to the supply tank 18. This allows a more or less gradual decrease in pressure in the lines 17 and 17a. It must be remembered that the line 17b in the interim has at all times been subject to full accumulator pressure, and that a small pressure of 10 or 15 pounds is ample to hold the portion 13 in cooperation with the fixed portion 11 to keep the mold closed. Then as the pressure drops by the fluid flowing to the supply tank 18, the high pressure acting on the face 33 of the piston head overcomes the diminishing pressure acting on the face 32, and moves the

piston head to the left again, removing the stem 25 and the core end from the molding chamber. At the same time the compression has fallen to a relatively small value, so that the residual compression is inadequate to crush the article of manufacture before the mold opens. As the pressure drops below 10 to 15 pounds per square inch, the piston moves down into the cylinder 16 and opens the compression chamber. The operator then removes the molded article, puts in a new charge of material and begins a new cycle of operations by opening the throttle 21.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawing, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

I claim:

1. In a hydraulic mold with a divisible molding chamber having relatively movable parts, a source of hydraulic pressure, and a hydraulic chamber to exert pressure in the molding chamber, means cooperating with the walls of the molding chamber to enter the molding chamber, hydraulic means automatically operated by the pressure in the hydraulic chamber to thrust the means entering the molding chamber into and to remove the same in timed relation with the movement of the walls of the molding chamber.

2. In a mold having relatively movable portions to form a compression chamber, a fluid-pressure system, fluid-pressure responsive means to move one of movable portions to apply pressure to the compression chamber, means cooperating with the walls of the compression chamber to enter the compression chamber to form an undercut, a second fluid-pressure responsive means cooperating with the first fluid-pressure responsive means in the fluid-pressure system to operate the means cooperating with the compression chamber into operable position and back in timed relation with the movable portions.

3. In a mold, relatively movable portions cooperating to form a compressive chamber, conforming means cooperating with the sides of the chamber to conform the chamber, fluid-pressure actuated means to operate one of the movable portions, fluid-pressure operated means to move the conforming means into the chamber, and fluid-pressure operated means to remove the conforming means from the chamber, the first and second fluid-pressure operated means being subject to the same fluid-pressure.

4. In a mold, a fixed portion, a movable portion cooperating therewith to form a compressive chamber, undercutting means cooperating with the chamber to conform the chamber, fluid-pressure actuated means to operate said movable portion, fluid-pressure actuated means to move the undercutting means into cooperation with the chamber, both aforementioned fluid-pressure actuated means interconnected to operate at the same pressure, and another fluid-pressure actuated means acting constantly to move the undercutting means out of cooperation with the chamber and bucking the means to move the undercutting means into cooperation with the chamber.

5. In a mold, a fixed portion, a movable portion cooperating therewith to form a compressive chamber, laterally moving means cooperating with the sides of the chamber to conform the chamber, a source of fluid pressure, fluid-pressure operated means to hold the laterally moving means outside the chamber, fluid-pressure operated means to actuate the movable portion, fluid-pressure operated means to buck the holding means to move the laterally moving means into the chamber to conform the same, and throttle means to control the pressure to actuate the two last mentioned means, which are in communication with each other and subject to the same fluid pressure.

6. In a mold, a divisible compressive chamber, laterally moving means cooperating with the sides of the chamber to conform the chamber, a source of fluid pressure, fluid-pressure operated means to actuate the divisible compressive chamber to open and shut the compressive chamber for successive operation, throttle means to control the actuating means, piston means to operate the laterally moving means to and from conforming relation with the chamber, and cylinder means for the piston means to establish a force differential to move the piston, one force of the differential adapted to move the laterally moving means outside the chamber, the force being substantially constant, the second force of the differential adapted to move the laterally moving means into conforming relation with the chamber, the force being proportional to the pressure developed by the actuating means.

7. In an automatic mold, a compression chamber formed with a fixed and a movable portion, a source of fluid pressure, throttle means to control the fluid pressure, operating means actuated by the fluid pressure to open and close the mold at relatively low pressure and to exert high compression at relatively high pressure near the closed position, laterally moving conforming means cooperating with the chamber, and piston means to move the conforming means to and from position in the chamber, said piston means being operated by a force differential created by the action of the relatively high pressure on a relatively small area and a varying pressure on a relatively large area, the bucking force of the varying pressure on the relatively large area moving the conforming means into the chamber, the varying pressure being obtained from the operating means.

8. In a hydraulic machine, a divisible compressive chamber having relatively movable parts, a source of fluid pressure, fluid-pressure operated means to open and close the chamber and to create high conforming pressure therein, conforming means cooperating with the chamber to create undercuts therein, a fluid-pressure operated differential motor to control the conforming means actuated by a force differential between the fluid pressure of the source and the fluid pressure of the fluid-pressure operated means and adapted to move the conforming means into the compressive chamber with a force created by the fluid pressure actuating the fluid-pressure operated means, and adapted to move the conforming means from the compressive chamber by the fluid pressure of the source when the fluid pressure in the fluid-pressure operated means has diminished in value sufficient

to release the conforming pressure but not sufficient to open the chamber.

9. In a hydraulic molding machine, a source of fluid pressure, a divisible compressive chamber, fluid-pressure actuated means to control the movements of the parts of the chamber, throttle means to control the pressure to the fluid-pressure actuated means, being adapted to move the parts of the divisible compressive chamber at a relatively low pressure and to exert a compressive force in the chamber at a relatively high pressure, conforming means cooperating with the chamber to conform the chamber, a differential fluid-pressure motor to control the conforming means to move the conforming means into and out of the chamber, the pressure differential arising from the bucking of a predetermined pressure and the variable pressure as controlled by the throttle means in the fluid-pressure actuated means, the balance in the force differential being relatively nearer the relatively low pressure than the relatively high pressure in the fluid-pressure actuated means.

10. In a device of the class described, a divisible compression chamber having relatively movable parts, a source of fluid pressure, fluid pressure operated means to open and close the compression chamber, conforming means cooperating with the compression chamber to create undercuts therein, a fluid-pressure operated differential motor to control the movements of the conforming means having a relatively large area piston and a relatively small area piston bucking each other, the force differential between the two pistons acting to move the conforming means, conduit means connecting the fluid pressure operated means for opening and closing the compression chamber to the portion of the differential motor acting on the relatively large area piston connecting both to the fluid pressure source, valve means to control the fluid pressure in the conduit means, a second conduit means to connect the portion of the differential motor acting on the relatively small area piston directly to the source of pressure.

HUGH L. DECKER.

CERTIFICATE OF CORRECTION.

Patent No. 2,124,733. July 26, 1938.

HUGH L. DECKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 8, claim 9, before "being" insert the words the fluid-pressure actuated means; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of September, A. D. 1938.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.