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FLUID EQUALIZER FOR COMPRESSION MACHINES

Filed Dec. 10, 1928

2 Sheets-Sheet 1

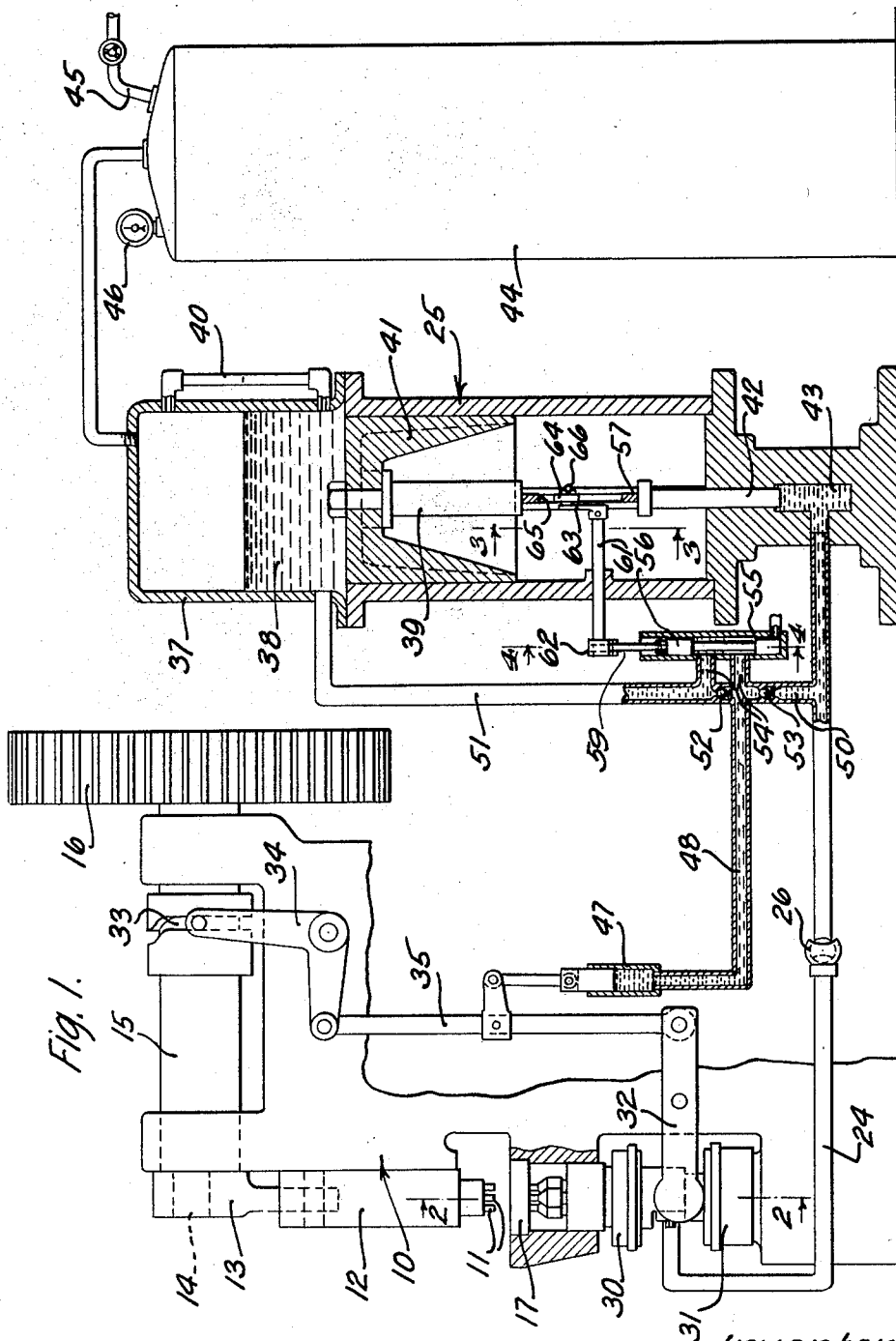


Fig. 1.

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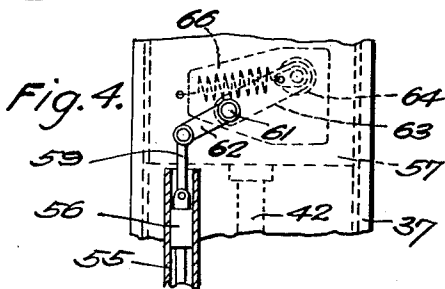
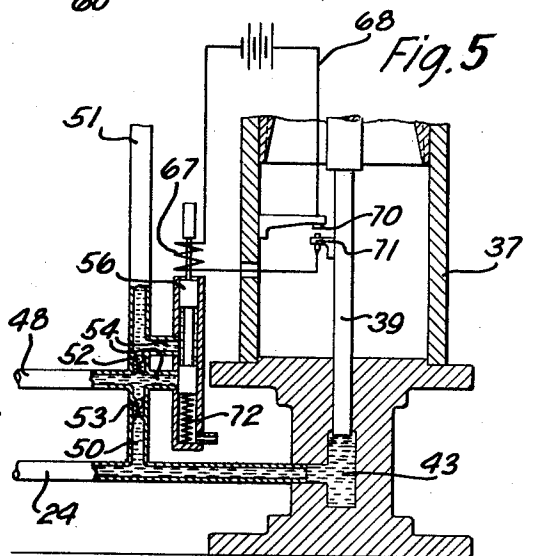
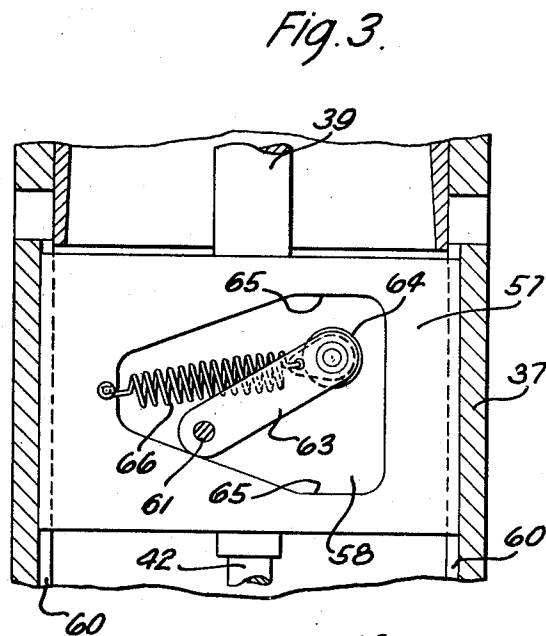
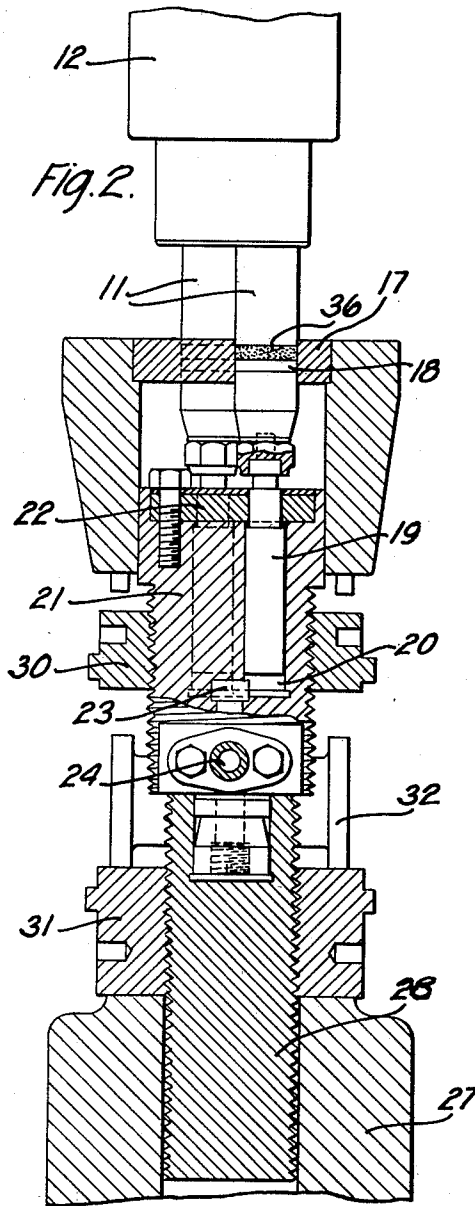
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FLUID EQUALIZER FOR COMPRESSION MACHINES

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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FLUID EQUALIZER FOR COMPRESSION
MACHINESBernard Francis Irwin, Riverside, Ill., assignor to
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3 Claims. (Cl. 18—16)

This invention relates to fluid equalizers for compression machines, and more particularly to hydraulic equalizers for molding presses or similar machines wherein a plurality of tablets, pills, buttons or similar articles are simultaneously formed in molds at each stroke of the press.

In presses of this type, the articles are formed by placing the raw material in a plurality of molds and compressing it by a corresponding number of pressure members which are positively and simultaneously advanced through a fixed distance, the pressure members being then retracted and the finished articles ejected from the molds by suitable ejecting mechanism. If the molds are rigidly supported in place during the pressing operation, the pressure applied to the material in each mold will vary according to the amount of material in the mold, and this will result in the finished articles having different degrees of hardness and other physical characteristics.

An object of this invention is to provide an equalizer for the molds of the press, whereby all of the articles produced at a given stroke of the press will be subjected to the same pressure, and the pressure applied to articles produced at different strokes of the press will also be constant.

A further object of the invention is to provide fluid equalizing means wherein the fluid pressure may be maintained at an accurate value, thereby tending to uniformity in the articles produced.

A further object of the invention is to provide fluid equalizing means which shall be automatically regulated to maintain the fluid pressure constant within narrow limits.

In accordance with one embodiment of the invention a plurality of molds is provided to receive carbon powder or other material to be compressed, and an equal number of compression members are arranged to be positively and simultaneously advanced through a predetermined distance into the molds to compress the material. The bottoms of the molds comprise yielding pistons which are supported by a body of liquid under high pressure. An intensifier is provided which maintains the pressure of the liquid at an accurately constant value, and a pump supplies liquid to the intensifier to compensate for leakage and other losses.

The invention will be more fully understood from the following description, taken in connection with the appended drawings in which,

Fig. 1 is an elevation, partly in section, of

a compression machine and equalizer embodying the invention,

Fig. 2 is an enlarged sectional view of the mold mechanism and associated parts, corresponding to a section taken on line 2—2 of Fig. 1,

Fig. 3 is an enlarged sectional view of the valve control mechanism and corresponds to a view taken on the line 3—3 of Fig. 1,

Fig. 4 is a detailed sectional view corresponding to a section taken on the line 4—4 of Fig. 1, and

Fig. 5 is a sectional view of a modified form of the valve control mechanism.

In the specific embodiment illustrated in the drawings, a press 10 of any construction suitable to the work to be done is provided with a plurality of punches or male members 11 which are rigidly connected together and adapted to be reciprocated by means of a head 12 which is reciprocally mounted in the press and pivotally connected to a pitman rod 13 mounted on an eccentric stud 14 which is fixed to a main drive shaft 15. Shaft 15 may be driven by means of a gear wheel 16 connected to a suitable source of power (not shown).

A mold plate 17 is mounted below the punches 11 and is provided with a plurality of apertures in each of which is slidably fitted a bearing plate 18, forming the bottom of the mold and supported by a vertically movable piston 19. The pistons 19 are mounted in cylindrical bores 20 formed in a block 21, and are limited in their upward movement by a plate 22 which abuts against shoulders formed on the pistons. At their lower ends, the cylindrical bores communicate with a common pressure chamber 23 adapted to receive oil or other fluid under pressure, so that if the pressures exerted by the punches 11 on the bearing plates 18 are unequal, pressure fluid will flow from one bore to another through the pressure chamber until equilibrium is established. The pressure chamber 23 is supplied with pressure fluid by means of a pressure conduit 24 which leads from an intensifier 25, to be described below, the conduit being provided at a point between the intensifier and the pressure chamber with a joint 26 of any desired construction to permit a hinging action in the conduit.

The ejecting mechanism is generally similar to those known in the art, and comprises a guide pin 28 fixed to the block 21 and having sliding engagement in the base 27 of the press. Collars 30 and 31 are fixed to block 21 and pin 28, respectively, to provide engagement with the free

end of a pivoted ejector bar 32. A cam track 33 is mounted on the shaft 15 and is shaped to oscillate a bell crank lever 34 pivoted to the press frame and having a pin engaging in the cam track. A link 35 connects the free arm of the bell crank lever to the ejector bar 32. It will be seen from the construction thus far described that upon each revolution of the shaft 15 the punches 11 will be moved downwardly to compress the material 36 in the molds, and that if unequal amounts of material have been placed in the molds, the pressure fluid will shift from one to another of bores 20 to equalize the pressure on the material. If the presence of an excessive amount of material in the molds as a group renders necessary a slight retirement of the group of pistons 19 under an excessive pressure of the punches, such retirement is permitted by the fact that the rods 42 and 39 and the piston 41 may be raised a trifle against the elastic resistance of the compressed air in the chamber 37 by back pressure transmitted through the conduit 24 from the chamber 23 to the chamber 43.

The position of the parts when punches 11 reach the lowermost point of their path is shown in Fig. 2. From that position, the punches move upwardly, and during such upward movement the cam track 33 actuates lever 34 to cause the free end of ejector bar 32 to abut against collar 30 and move members 18, 19, 21 and 28 upwardly to thereby eject the finished articles from the molds. The articles are then removed from the mold plate 17 by suitable means (not shown), the parts are moved from ejecting to normal position by the free end of bar 32 abutting against collar 31, and the molds are refilled by suitable means known in the art and also not shown. The parts have now assumed the position shown in Fig. 1 and the cycle just described is repeated.

The intensifier 25 comprises a container 37 the upper portion of which is adapted to contain compressed air and a supply of oil or other liquid 38, the level of which may be indicated by a sight gauge 40. The container 37 has a cylindrical bore in which is mounted a differential piston 41 which comprises a piston rod 39 having its lower end 42 acting against the fluid in a pressure chamber 43 which communicates with the conduit 24. A compressed air reservoir 44 communicates with the container 37 above the level of liquid 38 and is of relatively large capacity so that when it is filled to a given pressure by means of an inlet pipe 45 the pressure, as indicated by gauge 46, will remain substantially constant for a considerable time without further attention. This arrangement maintains the pressure on the upper surface of piston 41 accurately constant, and maintains a correspondingly constant pressure in pressure chambers 43 and 23.

In order to supply oil or other pressure liquid to compensate for leakage and other losses, a pump 47 is provided, which may be driven by means of link 35, as shown, or may be connected to any other suitable reciprocating part of the machine, but it is preferred to connect it in such a way that it makes its power stroke while the punches 11 are being withdrawn from the molds, as such arrangement tends to minimize sudden fluctuations in the pressure of the liquid due to its inertia and the inertia of piston 41. The outlet conduit 48 of pump 47 is connected by pipe 50 either to conduit 24, as shown, or directly to chamber 43, and a supply conduit 51 leads from container 37 to pipe 50. It will be seen that the

body of liquid 38 thus forms a seal for piston 41 and also constitutes a reserve supply which may be fed into the pressure system as it is needed.

Check valves 52 and 53 are disposed in conduits 51 and 50 to prevent upward flow of the liquid, and passages 54 connect with a valve casing 55 having a pressure-balanced valve 56, the arrangement being such that when the valve 56 is in its lower position the check valve 52 will be bypassed. In the position shown in Fig. 1 the liquid displaced by the pump will be forced into conduit 24, but when the valve 56 is moved to its lower position the liquid, on the downward stroke of the pump, will flow through passages 54 and casing 55 back to container 37, thus by-passing check valve 52 and rendering the pump 47 inoperative.

The means for controlling valve 56 is shown in detail in Fig. 3, and comprises a sliding plate 57 interposed between the upper and lower ends of rod 39, having an aperture 58, and adapted to move vertically in grooves 60 in the walls of container 37. A shaft 61 is journaled in the wall of the container 37 and carries an arm 62 at its outer end which is connected to valve 56 by means of a pivoted link 59 so that oscillation of the shaft causes reciprocation of the valve.

On its inner end, shaft 61 has an arm 63 carrying a roller 64 which is disposed within apertures 58 (Fig. 3) in such a position as to contact with its upper and lower surfaces 65 when the plate 57 moves upwardly or downwardly through a predetermined distance. A tension spring 66 has its ends connected respectively to roller 64 and plate 57 and holds arm 63 in whichever of its extreme positions it may be in until a dead center point is passed, when it moves the arm quickly to the other of its extreme positions.

When the parts are in the position shown in Figs. 1, 3, and 4 the pump is inoperative, since the check valve 52 is by-passed by the valve 56. As the volume of liquid in chamber 43 decreases on account of leakage and other causes the plate 57 is lowered until the upper surface 65 of the aperture 58 carries roller 64 past the dead center point, whereupon the valve 56 is moved to its upper position wherein it obstructs the flow of liquid through passages 54, and the pump resumes the pumping of liquid to chamber 43.

In the modification shown in Fig. 5, the valve 56 is shown in its upper position, and is actuated by a downwardly acting solenoid 67 which is in a circuit 68 comprising a fixed contact 70 and a moving contact 71 carried by piston rod 39. The valve is urged upwardly by a compression spring 72 which holds it in its upper position until solenoid 67 is actuated by the closing of the circuit through contacts 70 and 71, whereupon the valve is moved downwardly to by-pass check valve 52 and render the pump inoperative in the same manner as described in connection with Figs. 1 and 3.

While the invention has been described with reference to the specific embodiments shown in the drawings, it is to be understood that it is not limited except by the language of the following claims.

What is claimed is:

1. In a compression machine, a plurality of rigidly interconnected pressure members, a plurality of cooperating molds for receiving material to be compressed, each of such molds comprising a yielding member, supporting means for said yielding members comprising a container for pressure fluid, means for supplying fluid under pressure to the container during the operation of the machine,

and means for governing the operation of the fluid supplying means to maintain the volume of pressure fluid within predetermined limits.

2. In a compression machine, a plurality of
5 molds comprising movable members, fluid pressure means supporting said movable means, ejecting mechanism for said molds, an intensifier for supplying pressure fluid to said fluid pressure means and including a pump and a differential
10 piston, and means responsive to movement of the differential piston to render the pump inoperative.

3. In a compression machine, a plurality of

reciprocating members, a plurality of cooperating movable pressure members, fluid pressure means supporting said pressure members, means for supplying pressure fluid to the fluid pressure means and comprising a reciprocating pump, and common driving means for the pump and the pressure
80 members operative to move the pump through its power stroke while the first mentioned pressure members are being moved away from the movable pressure members.
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