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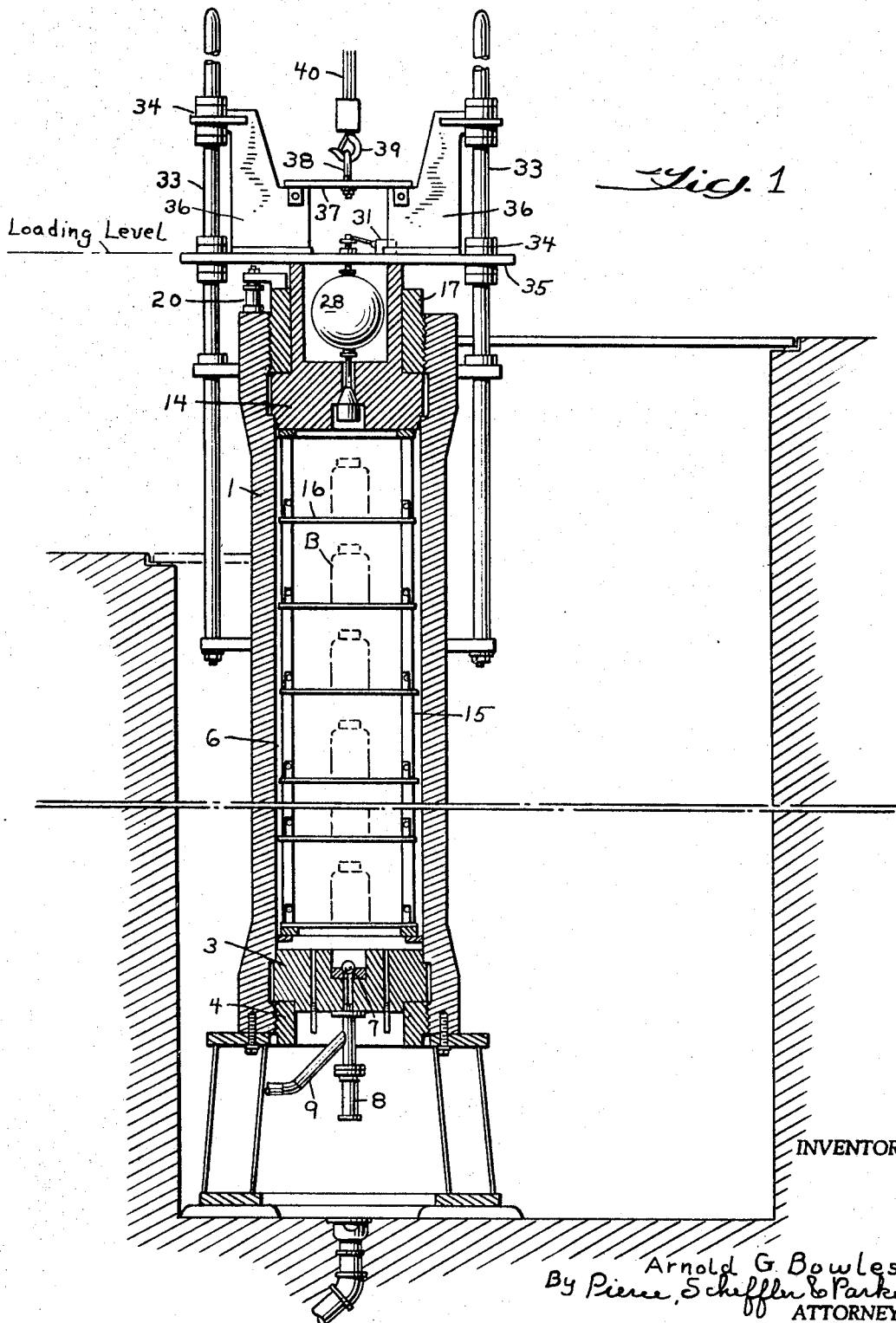
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3,451,101

AUTOMATICALLY OPERATING AIR VENT FOR ISOSTATIC MOULDING PRESS

Filed July 5, 1967

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Fig. 2

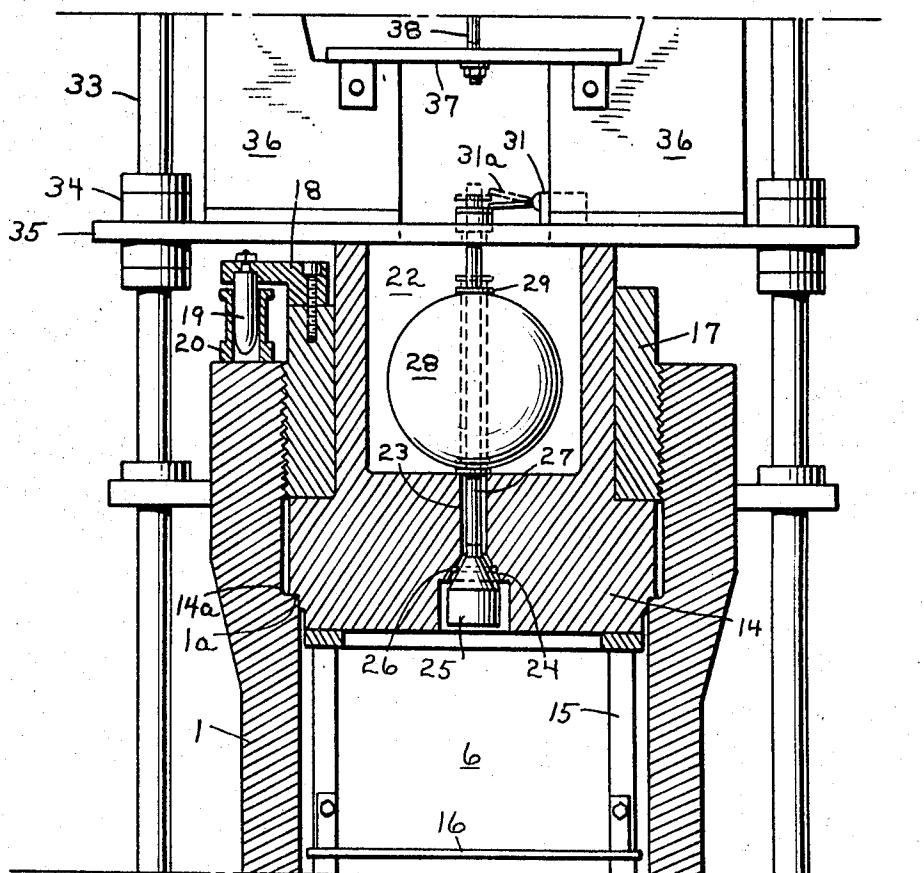
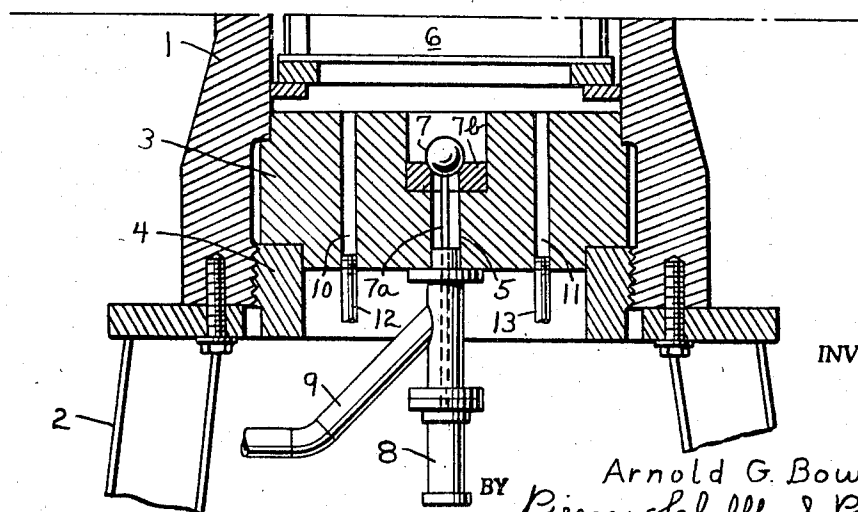


Fig. 3



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AUTOMATICALLY OPERATING AIR VENT FOR ISOSTATIC MOULDING PRESS

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5 Claims

ABSTRACT OF THE DISCLOSURE

An isostatic moulding press of the so-called "wet bag" type is comprised of a vertically arranged pressure chamber into which is lowered a multi-level support structure on which are placed a plurality of elastomeric bags containing granular or powdered material to be moulded by high-level isostatic pressure exerted on a liquid which fills the chamber. The support structure for the bags depends from an upper end plug which closes off the top of the chamber and a vent valve is incorporated in this plug. After the pressure chamber has been completely filled with the liquid to be pressurized, excess liquid flows through the then open vent valve into a reservoir containing a float which is coupled to the valve in such manner that the valve closes after the float has been raised by the liquid. The float action also serves to close a switch which is connected into a signalling circuit to signal that the vent valve has been closed and the chamber is now ready for pressurization.

This invention relates to an improvement in isostatic moulding presses and more particularly to presses of the so-called "wet bag" type wherein granular or powdered material to be moulded is confined within a bag made of rubber or similar elastomeric material, the bag then being placed within a liquid filled chamber where it is subjected to very high isostatic moulding pressure of the order of 30,000 lbs./sq. in. or more.

In the operation of an isostatic moulding press of this type, it is necessary that all air first be removed from the pressure chamber before starting pressurization. A usual method for removing air, prior to the present invention, has been to provide a high-pressure valve on the top cover member for the pressure chamber and which is left open until liquid starts to flow out through the valve, at which time it is then closed. This assures that the pressure chamber will be completely filled with the liquid before pressurization of the liquid is started. However, this technique involves a manual operation and is suitable only for relatively small laboratory presses. On larger presses, not only is an operator required but the high-pressure valves themselves are unsatisfactory because they must be equipped with a relatively small air bleed orifice which obviously retards removal of air and thus increases production costs because of the comparatively long air-removal time between successive moulding cycles of the press.

The principal object of this invention is to provide an improved air-venting structure for the pressurization chamber and is characterized principally by the use of a float valve in association with an overflow reservoir located atop the pressurization chamber. The gravity-actuated float valve remains open during the time that the pressurization chamber is being filled with the liquid thus forcing the air upwardly and out through the valve. When the pressurization chamber has been filled completely with the liquid, the latter flows through the valve into the reservoir, and then raises the valve float causing the valve to close. When pressurization has been completed thus isostatically moulding the objects within the elastomeric bags, the chamber is emptied of liquid by a pumping op-

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eration and when the pressure within the chamber has been reduced below atmospheric by the action of the drain pump, the vent valve will automatically re-open due to the pressure differential which then exists, thus draining the reservoir of liquid and admitting atmospheric air to the chamber and facilitating its opening so that the moulded objects can be withdrawn and the next moulding cycle initiated.

The foregoing as well as other objects and advantages inherent in the invention will become more apparent from the following description of one suitable embodiment thereof and from the accompanying drawings wherein:

FIG. 1 is a vertical central section through an isostatic moulding press as improved;

FIG. 2 is also a vertical central section showing only the upper portion of the press but at a larger scale to make the essential details of the invention clearer; and

FIG. 3 is also a vertical central section through the lower portion of the press to better illustrate details at that part of the press.

With reference now to the drawings, the overall structure of the isostatic moulding press includes an upright cylindrical moulding housing 1 which is supported upon a pedestal 2. This housing has rather thick walls and is made of steel so as to enable it to withstand isostatic moulding pressures up to 30,000 lbs./sq. in. or higher. The lower end of housing 1 is closed by an end plug 3 retained in place by a threaded ring 4. Plug 3 is provided with a comparatively large central bore 5 terminating in a ball valve 7 connected to a valve stem 7a which passes through bore 5 and is arranged to be actuated in a longitudinal direction to open and close the ball valve 7 with respect to its seat 7b. The stem 7a can be actuated by any suitable type of motor having a reciprocating drive such as a double-acting pneumatic cylinder 8. A comparatively large bore pipe 9 which communicates with the bore 5 is connected to a centrifugal pump, not shown, and serves to supply the liquid medium at comparatively low pressure to the moulding chamber 6 within housing 1 when the chamber is filled. The large bores thus enable the chamber to be filled in a comparatively short time. End plug 3 is also provided with two other bores 10 and 11 which have comparatively small areas. Bore 10 is connected to a high-pressure pipe 12 which leads to a high pressure liquid pump, not illustrated, that serves to pressurize the liquid within chamber 6 after it has been filled and charged with the bag-enclosed material to be moulded. Similarly, bore 11 is connected to high-pressure pipe 13 for initially discharging some liquid from chamber 6 at the end of the moulding operation to effect de-pressurization of the chamber until it is nearly atmospheric, at which time the power exercitable by pneumatic cylinder 8 will be sufficient to enable valve 7 to be raised from its seat and thus open bore 5 so that the level of the liquid remaining within the moulding chamber 6 can be reduced to the desired level within a comparatively short time.

The upper end of the moulding housing 1 is closed by a removable cover member 14 having an external shoulder 14a which seats upon an internal shoulder 1a within the housing. Secured to and depending from the end cover member 14 is a frame 15 providing a plurality of horizontal racks 16 arranged in superposed spaced relation on which are supported the objects to be moulded. These latter have been depicted only in schematic outline, the elastomeric enveloping bags being indicated by B.

Cover member 14 is retained in place by a breech nut 17, i.e. a nut with interrupted threads which engages interrupted threads provided at the upper end of housing 1. Locking and unlocking of the breech nut takes place

by a rotation of the nut through an angle of 45°. For rotating the nut, it will be seen that an arm 18 is secured to the upper end of nut 17 and extends laterally therefrom above the upper end of housing 1. Depending from arm 18 is a pin 19 engageable with an actuator 20 which is operated by an air cylinder not shown when the cover member 14 and breech nut 17 are in the position depicted in the drawings, and thus rotates the breech nut through the 45° angle necessary to lock or unlock it. After unlocking, the breech nut, along with the cover member and frame 15 are then free to be raised from the housing.

End cover member 14 also includes a chamber open at the top to atmospheric pressure and which constitutes an overflow reservoir 22 into which the liquid flows after having filled the moulding chamber 6. As seen more clearly in FIG. 2, end cover 14 is provided with a longitudinal through bore 23 which enlarges at the bottom into a tapered valve seat 24 cooperative with a conical valve closure member 25 equipped with an O-ring seal 26 and attached to a valve stem 27 which extends upwardly through the bore 23 into reservoir 22. Valve stem 27 passes through a ball float 28 in reservoir 22 and is secured in place upon the valve stem by means of retaining collars 29. The upper end portion of the valve stem serves as an operator for the actuating arm 31a of an electrical switch 31 which is connected in a supervisory circuit, not illustrated, to signal whether the vent valve structure 24-27-28 is open or closed.

As seen in FIG. 1, the upper portion of the end cover member 14 is secured to a reciprocable structure 32 by means of which the end cover member 14 together with frame 15 and racks 16 may be removed vertically from and reinserted into the moulding chamber 6 when the breech nut 17 is unlocked. Structure 32 includes a system of vertically extending stationary guide rods 33 surrounding the housing 1 and mounted on these rods 33 are slides 34 between which is supported a transversely extending plate 35 secured to the upper edge of end cover 14 and upon which the signal switch 31 is mounted. Extending upwardly from plate 35 are a plurality of circumferentially spaced plates 36 guided by an upper set of the slides 34 and bridged by a bar 37 to which is secured a lifting eye 38. A hook 39 is adapted to be fitted into the eye 38 and is secured to a hoist 40 for raising and lowering the overall structure 32.

Operation

The manner in which the improved isostatic moulding press operates is believed to be obvious from the detailed description which has been given but will now be reviewed in general. In initiating an operating cycle for the press, and with breech nut 17 unlocked, the upper end cover 14 together with frame 15 secured thereto is hoisted by cables 40 out of the moulding chamber 6 to a height sufficient to provide ready access to the supporting racks 16, and the material to be moulded and enclosed by the elastomeric bags B is loaded onto the racks. Frame 15 and end cover 14 are then lowered until the position as shown in FIG. 1 is reached and breech nut 17 is then locked.

The liquid which is to be used for isostatic pressing of the bags B is then introduced into chamber 6 through the low pressure fill pipe 9 and valve 7. As the liquid level rises within the chamber, the air above the surface of the liquid will be pushed upward and out through the now open exhaust valve 24, 25 into reservoir 22 which, as previously explained is in communication with the atmosphere. When pressure chamber 6 has been completely filled with liquid, the liquid will then flow through valve 24, 25 into reservoir 22 and build to a level which causes float 28 to rise, taking the valve stem 27 with it and closing the exhaust valve as valve member 25 engages its seat 24. This serves to seal the chamber 6. The upper end of valve stem 27 will also have then actuated switch 31 which provides a signal that pressure

chamber 6 is now completely filled and that the air exhaust valve has been closed.

The pressure on the liquid in chamber 6 is now gradually increased to the desired pressurization level by high pressure pumping through pipe 12 and bore 10 and maintained until the bags B have been isostatically pressed for the period required to mould the articles inside the bags. At the end of the pressurization phase, the pressure is reduced by pressure relief through bore 11 and pipe 13 and liquid is then removed rapidly from chamber 6 through pipe 9 until the desired starting level is reached. Operation of the drain pump is continued after liquid removal until the pressure within chamber 6 is reduced below atmospheric. The pressure differential existing at valve 25, 27 now results in a downward force on float 28 causing the latter to lower and hence open this valve thus venting moulding chamber 6 to atmospheric. This action serves to permit the end cover 14 to be more easily raised after the retaining breech nut 17 has been unlocked. Without venting through valve 25, 27, the downward force on end cover 14 due to atmospheric pressure would have to be overcome when raising it.

Following unlocking of breech nut 17 end cover 14 and frame 15 along with the breech nut are then raised by the hoist line 40 until frame 15 is clear of chamber 6 whereupon the moulded articles in their bags B are removed, thus completing the moulding cycle.

In conclusion, while a preferred embodiment of the invention has been described in accordance with the requirement of the patent statutes, it is to be understood that this specific structure may be modified in various respects without, however, departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. An isostatic moulding press comprising a pressure chamber into which mouldable material encased in an elastomeric bag is placed for isostatic pressing by a pressurized liquid introduced into the chamber, an air vent valve located at the upper part of said chamber and through which air from said chamber is discharged as said chamber is filled with the liquid to be subsequently pressurized, a reservoir for overflow liquid located above said pressure chamber, and a float in said reservoir, said float being connected to said valve and effecting closure thereof as the liquid level rises in said reservoir.

2. An isostatic moulding press as defined in claim 1 and which further includes a detector switch responsive to closure of said vent valve for indicating that said pressure chamber has been completely filled with the liquid to be pressurized.

3. An isostatic moulding press as defined in claim 1 wherein said pressure chamber is constituted by a vertically disposed cylinder and includes a removable end plug in which said air vent valve is located.

4. An isostatic moulding press as defined in claim 3 wherein said air vent valve is comprised of a movable valve member cooperative with a valve seat located in said end plug, and a valve stem extending upwardly into said reservoir and to which said float is secured.

5. An isostatic moulding press as defined in claim 4 wherein said float is mounted directly upon said valve stem and the upper end of said valve stem which is located above said float actuates said detector switch.

References Cited

UNITED STATES PATENTS

2,781,273	2/1957	Koch.
3,363,037	1/1968	Levey et al.
3,408,432	10/1968	Tumm et al.

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U.S. Cl. XR