

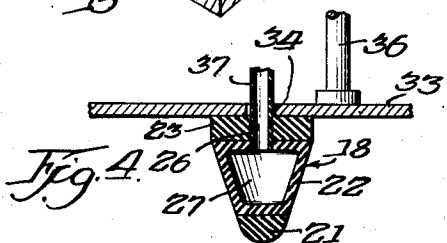
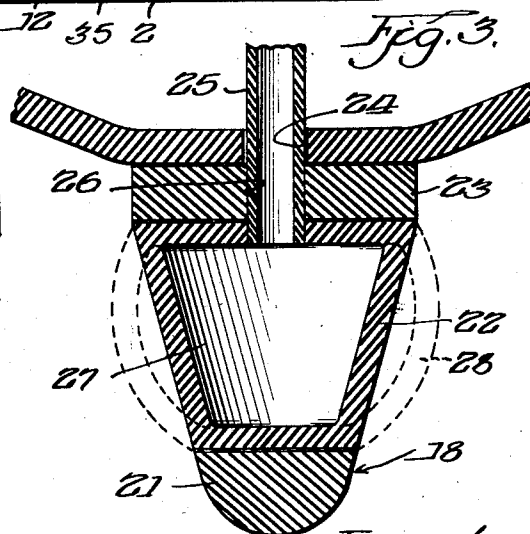
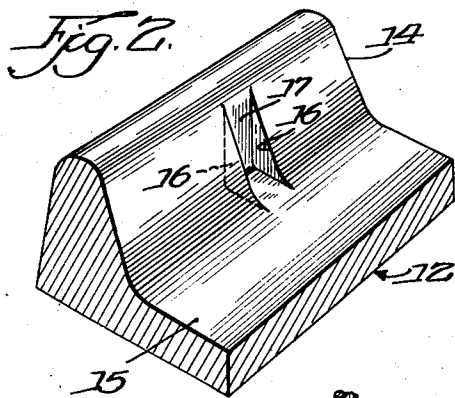
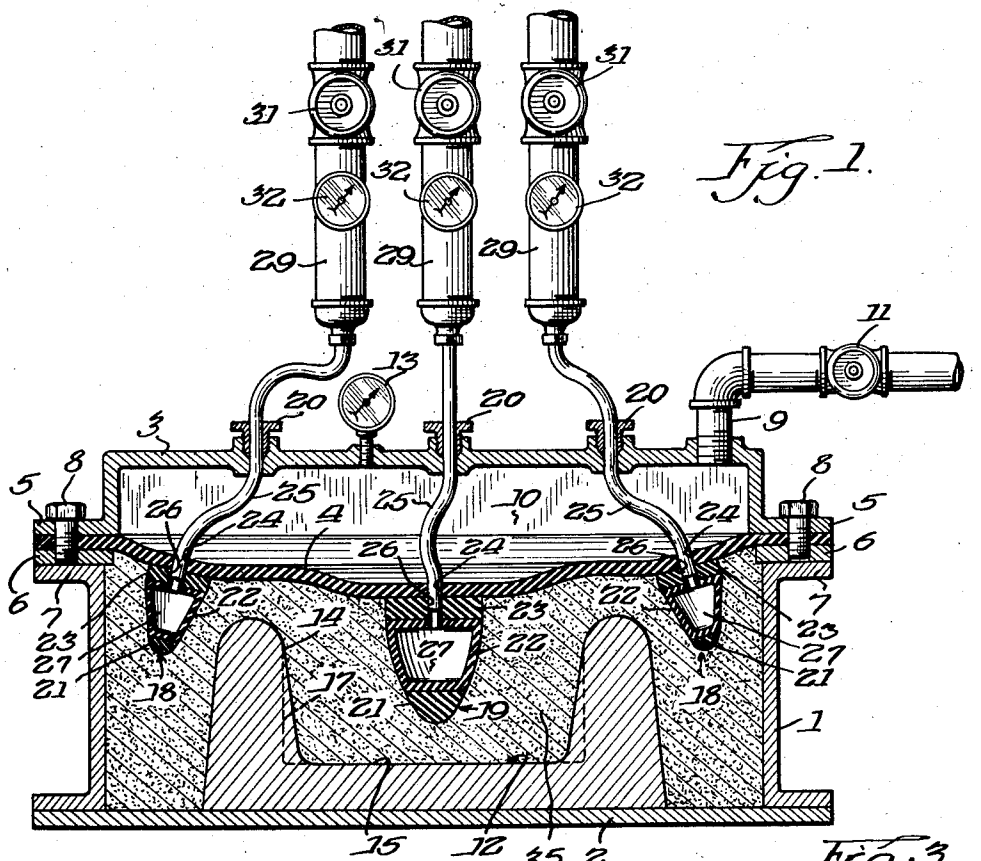
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FLEXIBLE PRESS HEAD FOR PRESSURE MOLDING

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1

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## FLEXIBLE PRESS HEAD FOR PRESSURE MOLDING

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8 Claims. (Cl. 22-42)

The present invention relates to a novel method of pressure molding, and more particularly relates to a molding method utilizing an auxiliary expansible pressure responsive member in combination with a main compression member such as a diaphragm or plunger or the like.

It should be appreciated at the outset that sand even in its finest form does not behave as a liquid. Consequently, a compression load applied to sand in a molding flask, for example, is transmitted substantially unidirectionally, the said sand compression taking place along the axis upon which the latter load is applied. Although some force components of the applied compression load are transmitted laterally to the direction of the applied load, these components do not approach the force needed to effect a mold of uniform sand density. As hereinafter shown, it will be quite apparent that the sand adjacent the side walls of the pattern by virtue of its frictional engagement with the wall surface prevents further downward transmission of the compressing force, and the force is dissipated in relative proximity to the member applying the compression load. Similarly, in the making of molds from patterns having comparatively deep recesses or pockets and high wall portions, the compression forces are once more wasted in the frictional engagement between sand and pattern wall portion. This situation results in a soft mold in the vicinity of the recessed portion of the pattern and the lower wall portions of the pattern, as no force is able to extend to these depths.

A previously attempted solution of this problem was the employment of a flexible diaphragm as the direct impartor of the compressional forces. The indirect source of the latter forces was a fluid pressure which is evenly distributed over the entire upper surface of the flexible diaphragm. Utilizing such flexible diaphragm, the sand in the vicinity of pattern projections will also project while the sand in proximity to pattern recesses will dip as the diaphragm seeks out the soft spots in the underlying sand. Consequently, the flexible diaphragm will bend and follow the general contour of the pattern beneath. As before mentioned, however, the flowability of even the finest sand is not great. Therefore, although an improvement over the flat, rigid, platen method of sand molding, the use of a flexible diaphragm is not a complete solution to the problems the non-flowability of sand present. Consequently, in molds made from patterns having steep side walls and deep recesses, the aforementioned problems resulting in soft mold portions once more appear. It should at this time be noted, however, that my auxiliary expansible members are readily adaptable for use with a rigid platen member as hereinafter illustrated in Fig. 4 and are not restricted to use with a flexible diaphragm.

It is a main object of my invention, therefore, to utilize an auxiliary compression force in addition to the forces imparted by a flexible diaphragm or rigid platen whereby those sections of molding sand remotely posi-

2

tioned relative to the main compression member may be compressed to a desired degree equal to that effected in any other mold portion. As a result, utilizing my invention, a mold of consistent density will result regardless of the pattern configuration.

In addition, it is a further object of my invention to provide an auxiliary apparatus to be utilized in molding which may easily be constructed to conform to the specific requisites of any pattern configuration.

It is a still further object of my invention to provide an auxiliary compression force which may be effected by a plurality of discrete elements each of which may be controlled by a separate pressure source.

The above and other objects of my invention will become more readily apparent upon proceeding with the following detailed description read in the light of the accompanying drawings, in which

Fig. 1 is a sectional assembly view of a fluid pressure molding device utilizing my invention.

Fig. 2 is an enlarged fragmentary view of the pattern shown in Fig. 1.

Fig. 3 is an enlarged sectional view of an auxiliary compression device which is the essence of my invention.

Fig. 4 is a sectional view of an auxiliary compression device modified to be employed with a rigid platen member.

Similar reference numerals refer to similar parts throughout the several views.

Referring now more particularly to Fig. 1 as one example of an adaptation of my invention, a molding flask 1 is depicted positioned on a pattern plate 2. The latter plate has a conventional pattern 12 affixed thereto, an enlarged fragment thereof being illustrated in Fig. 2.

A pressure cap or cover 3 engages the periphery of the diaphragm 4 in fluid-sealing relationship with the cooperation of the ring member 6 which compresses the diaphragm periphery against the annular flange portion 5 of the pressure cap 3. The ring member 6 is affixed to the latter flange portion 5 by means of the illustrated cap screws 8. The ring member 6 also abuts the upper peripheral flanged portion 7 of the flask 1 in the normal course of molding operation. Any suitable clamping or holding means (not shown) of course may be utilized to maintain the ring member 6 and upper flask flange 7 in tight abutting relationship in the course of applying the molding pressure as hereinafter described.

The inlet pipe 9 allows any suitable fluid such as air or water to enter the pressure chamber 10 and the pressure input may be manually regulated by the valve 11. The pressure in the chamber 10 may be read on the gauge 13. It is obvious that mechanical pressure regulators (not shown) may be utilized in conjunction with the illustrated apparatus which it will be apparent is readily adaptable to full automatic operation.

Referring now to Fig. 2, an enlarged fragment of the pattern 12 positioned in the flask 1 as depicted in Fig. 1 is shown. It will be noted that the elevated rim-like portion 14 of the pattern 12 has a slotted recess positioned substantially normal to the base portion 15. The recess is defined by the opposed triangular wall portions 16 and the interposed rectangular wall portion 17, all the surfaces of which are substantially normal to the base portion 15 and also parallel to any compressional forces which may be applied by the diaphragm member 4. Consequently, it has been found that upon applying fluid pressure to the ordinary flexible diaphragm member which is used in compression molding, downward compacting of the sand takes place but with no substantial component of applied force being expended radially from the direction of the force application or normal to the slotted wall portions 16 and 17. As a result, it has been noted that the sand constituting the slotted portion of the

3

pattern 12 as defined at 16 and 17 is insufficiently compacted.

The molding sand in the vicinity of the top portion of the rim 14 of the pattern 12 would be sufficiently compacted by the diaphragm 4 under ordinary circumstances. However, the frictional engagement between sand and the upper wall portions of the rim 14 prevents transmittal of compression forces downward to any substantial depth. It is also readily appreciated that the compressive forces received by the molding sand is decreased in proportion to the distance from the diaphragm 4, this situation being further aggravated by sidewall frictional engagement. The lateral compressive forces exerted on the molding sand, especially on slotted wall surfaces 16 and 17 where such forces are desirable, are negligible owing to the inability of the sand particles to function as a liquid in accordance with Pascal's Law. As a result, the molding sand in the vicinity of the base portion 15 and the lower portions of the rim 14 will be objectionably soft.

It is to remedy the above two conditions that the expansible members 18 and 19 which comprise the essence of my invention are utilized. Expansible member 18 shown in enlarged detail in Fig. 3 incorporates a thickened nose portion 21 which may be integral therewith or a discrete member of hardened material cemented or otherwise suitably affixed to the base of the expandible body portion 22. The nose portion thereof facilitates sand penetration by the entire member 18 upon the application of fluid pressure to the diaphragm member 4 assuring a desirable location in the mold. The base portion 23 of the expansible member may be cemented or otherwise suitably attached in fluid sealed relation to the underside of the diaphragm 4. The latter member is appropriately apertured as at 24 to allow penetration of the pressure hose 25 which is suitably affixed in fluid-sealing relation to the aperture periphery 26 centrally positioned in the base portion 23. It will be noted that hose 25 enters pressure chamber 10 through stuffing boxes 20, obviating the possibility of air leakage. Upon the entrance of fluid pressure into the expandible chamber 27 of the member 18, a configuration similar to that illustrated by the dotted lines 28 (Fig. 3) is assumed. The expanded surface represented by dotted lines 28 radiates compression forces in directions normal and substantially normal to the direction of the main compression force exerted by the diaphragm 4. Following the application of compression forces to the mold, the expansible members 18 and 19 are allowed to return to resume their normal configuration by releasing the inflating pressure and the diaphragm 4 and auxiliary members 18 and 19 are raised as a unit thereby obviating distortion of the molding sand. It may be desirable with patterns having unusual configurations to fill in the expansible member recesses after their withdrawal to insure a mold of sufficient strength during casting operations.

Referring now once more to Fig. 1, it will be noted that three expansible members, the larger centrally positioned member 19, and the twin members 18, are connected to pressure pipes 29 by means of the pressure hoses 25. Each expansible member has a regulating valve 31 and gauge 32 whereby the fluid pressure in each member may be accurately controlled. In the normal course of operation, the application of pressures takes place in the following sequence. Valve 11 is opened to the desired pressure as indicated by gauge 13. This operation forces the diaphragm 4 into contact with the top surface of the molding sand 35 thereby exerting a uniform downward pressure. Simultaneously, the expansible members 18 and 19 are driven into desired positions in the sand. Regulating valves 31 are then opened, allowing pressures, if desired, in excess of that shown on gauge 13 as indicated on gauges 32 to enter the expansible members 18 and 19. Desired compacting forces are thereby created substantially normal to the opposed surfaces of the rim portions 14 of the pattern 12. These forces follow as a result of the ex-

4

panded condition of the expansible members 18 and 19 as illustrated by the dotted lines 28 as shown in Fig. 3. Therefore, it will be clear that a mold of overall desired compactness is assured in all mold portions including the sand opposing the pattern slot surfaces 16 and 17.

It is apparent that the expansible members 18 and 19 are designed to suit the configuration of the pattern 12, strengthening the resulting mold where the unidirectional compacting force of the rubber diaphragm is ineffectual, and also radiating lateral compacting forces which the diaphragm 4 alone is incapable of delivering.

It should be understood that a diaphragm with strategically positioned auxiliary expansible members may be provided to suit the individual configuration of any pattern which may be positioned in the flask. Utilizing my invention, therefore, the compressing forces may be tailor-made to suit the sand bulk surrounding the pattern no matter how intricate the pattern design. I do not wish to be limited, therefore, to the specific design of the auxiliary expansible members illustrated. An auxiliary expansible member may obviously be designed with one thin side wall only to effect compression in one desired direction where the need arises.

Referring now to the modification shown in Fig. 4, a rigid platen 33 is illustrated utilizing an auxiliary compression member 18 which is suitably affixed to the underside of the platen. The latter member is apertured at 34 to allow passage of the pressure hose 37. If a pipe is utilized the member 18 may project into the flask apart from the platen 33, if deeper penetration of the member 18 is desired.

The auxiliary expansible compression member 18 operates in precisely the same way as when used with the flexible diaphragm 4. Instead of fluid pressure directly forcing the diaphragm 4 into compressive contact with the sand in the flask 1 any suitable mechanical force may be used to lower the platen 33 by means of rod 36, the auxiliary compression member 18 functioning as before mentioned.

It is apparent to those skilled in the art that the essence of my invention is readily adaptable to automatic operation in which uniform pressures are essential. Consequently, I do not wish to be limited by the basic construction illustrated, as my auxiliary expansible members may be employed in either manually operated or automatic molding machines. I, therefore, wish to be limited only by the scope of the appended claims.

I claim:

1. In an apparatus substantially as described, the combination comprising a flexible diaphragm, said flexible diaphragm being apertured at predetermined positions on said flexible diaphragm surface, auxiliary expansible means connected to said flexible diaphragm, means conveying fluid pressure through said flexible diaphragm selectively to said auxiliary expansible means, said conveying means being connected in fluid sealing engagement with said flexible diaphragm and said expansible means.

2. The subject matter of claim 1, in combination with a pressure cap, said pressure cap being appropriately apertured for passage of said conveying means.

3. In an apparatus substantially as described, a flask for containing moldable material, compression means abutting said flask exerting compressional forces substantially along the vertical axis of said flask, auxiliary expansible means cooperating with said compression means and having relatively thin flexible annular wall portions and thickened nose portions depending therefrom and positioned in said flask in the normal course of operation, fluid pressure means in communication with the flexible wall portions of said auxiliary expansible means whereby said auxiliary expansible means wall portions may be expanded relative to said compression means in the normal course of the mold making operation and predeterminedly move said depending thickened nose portions relative to the moldable material.

4. In a device substantially as described, the combination comprising a flask containing moldable material, a pressure cap in abutting relationship with said flask member, a flexible diaphragm member peripherally affixed in fluid sealing engagement to said pressure cap thereby forming a pressure chamber, at least one auxiliary expandible member affixed to the underside of said flexible diaphragm member, said underside portion being oppositely disposed to said pressure chamber, discrete fluid pressure lines in fluid-sealing relationship with the interior of said pressure chamber and the interior of said auxiliary expandible members, regulating means interposed in said pressure lines whereby said fluid pressure may be controlled, and gauge means interposed in said pressure lines whereby said fluid pressure may be readily ascertained.

5. In an apparatus substantially as described, the combination of a flask, a pressure chamber in juxtaposition to said flask, the surface of said pressure chamber adjacent said flask comprising a flexible diaphragm, at least one auxiliary expandible member affixed to the underside of said flexible diaphragm, said pressure chamber and said auxiliary expandible members being in communication with separate sources of fluid pressure, and means for regulating the fluid pressure in said auxiliary expandible members in relation to said pressure chamber.

6. In a pressure applying mold construction of the character described, a flexible pressure responsive element cooperating with a mold to compress the sand therewithin, pressure responsive means cooperating with said first named pressure responsive element, the said latter pressure responsive means being supported by said flexible pressure responsive element and comprising expandible means thereon augmenting compression forces

exerted by said flexible pressure responsive element, and conveying means cooperating with the mold and connecting said flexible pressure responsive element and pressure responsive means to a source of fluid supply to initiate predeterminedly the actuation of said flexible element and the expandible means to compress the sand in a plurality of directions.

7. In a pressure applying molding means of the character described, a first means comprising a thin wall diaphragm spanning the molding means for applying a compressive force to molding sand or the like, a second means comprising a hollow projecting means on the thin wall portion of the diaphragm for applying a supplemental compressive force to the sand, said second means depending from said first named means in fluid sealing relation to the latter means, and fluid supply means for said first and second means.

8. In an apparatus for making molds, a pressure cap, a flexible diaphragm cooperating with said pressure cap forming a fluid tight chamber therewith, at least one auxiliary expandible member, said auxiliary expandible member being disposed adjacent said flexible diaphragm member to form a projection on an undersurface thereof, said expandible member also being oppositely disposed to said fluid-tight chamber, a pressure source for said flexible diaphragm and a separate pressure source for said expandible member.

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