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METHOD OF AND APPARATUS FOR THE PRODUCTION OF CORES, SHELL MOULDS OR THE LIKE FOR CASTING PURPOSES

Filed June 22, 1954 3 Sheets-Sheet 1

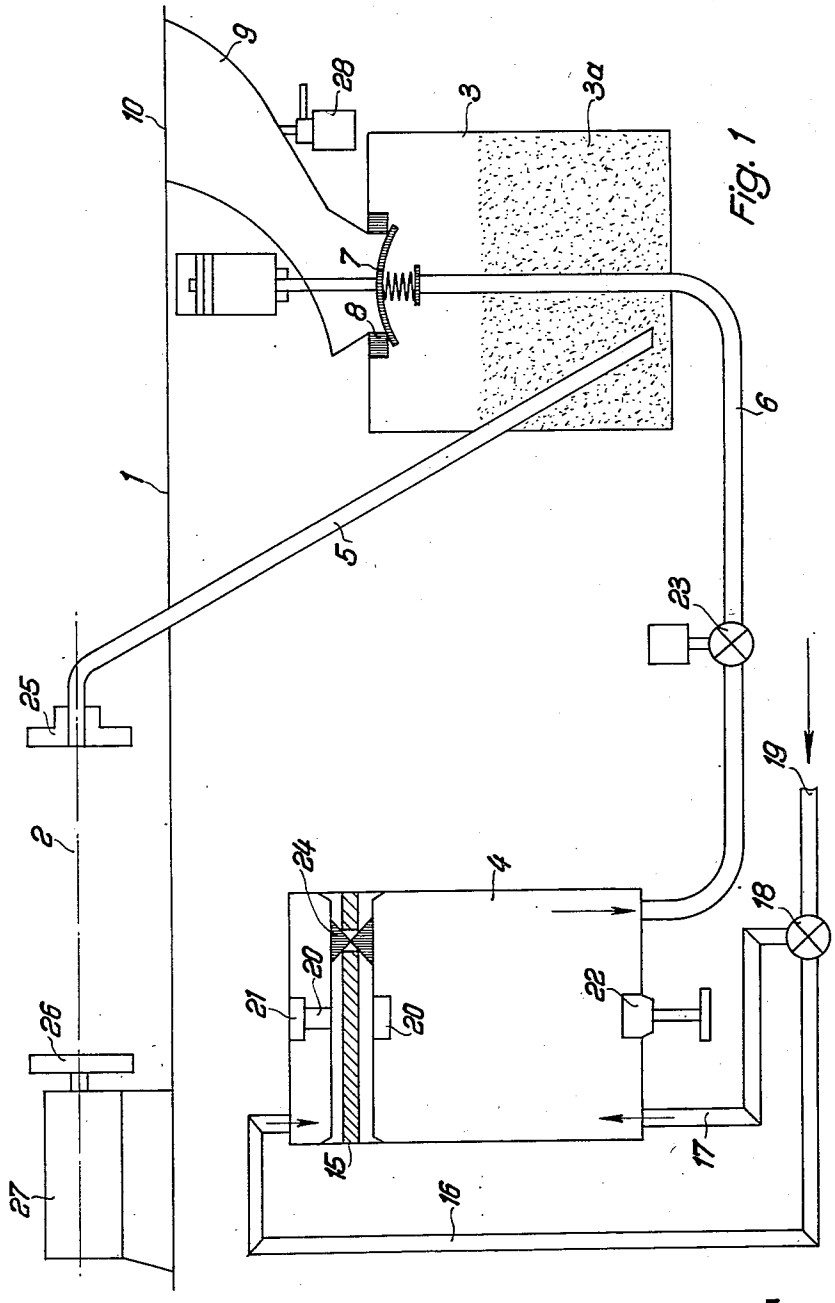

Fig. 1

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Filed June 22, 1954 3 Sheets-Sheet 2

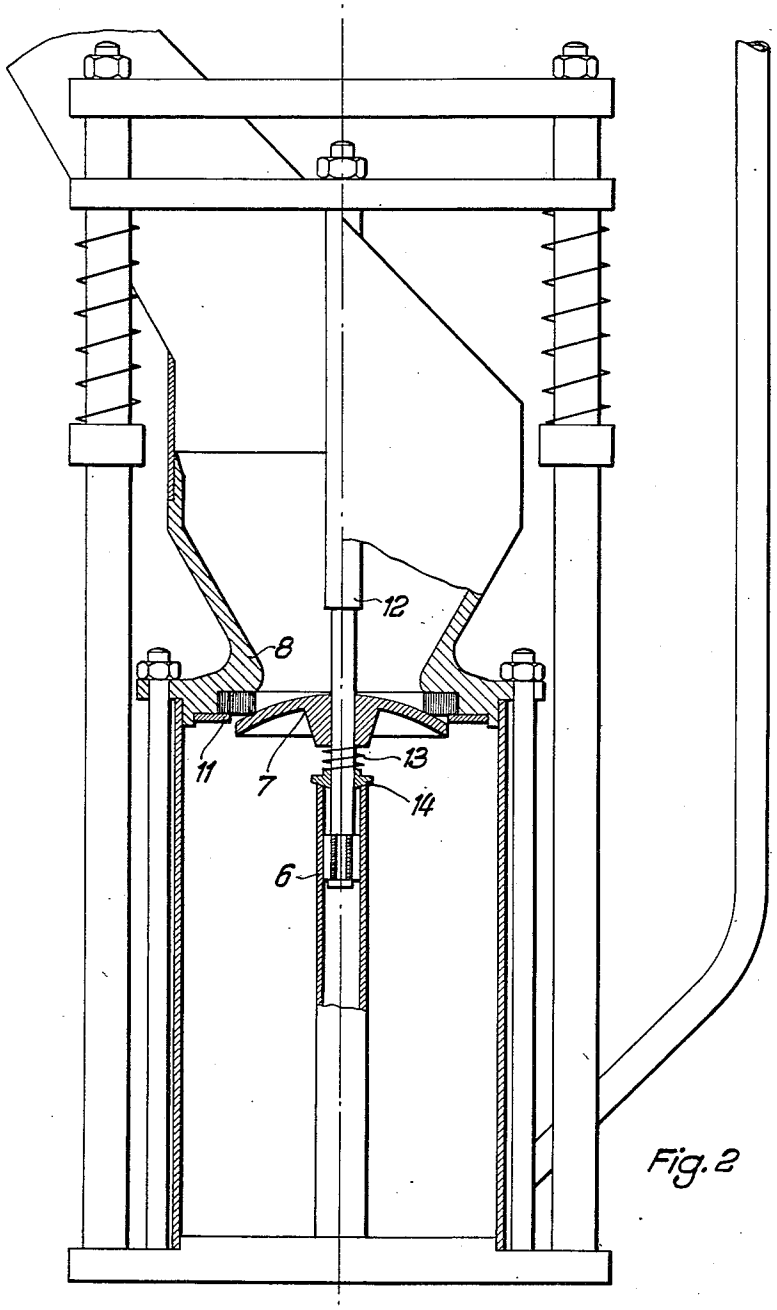

Fig. 2

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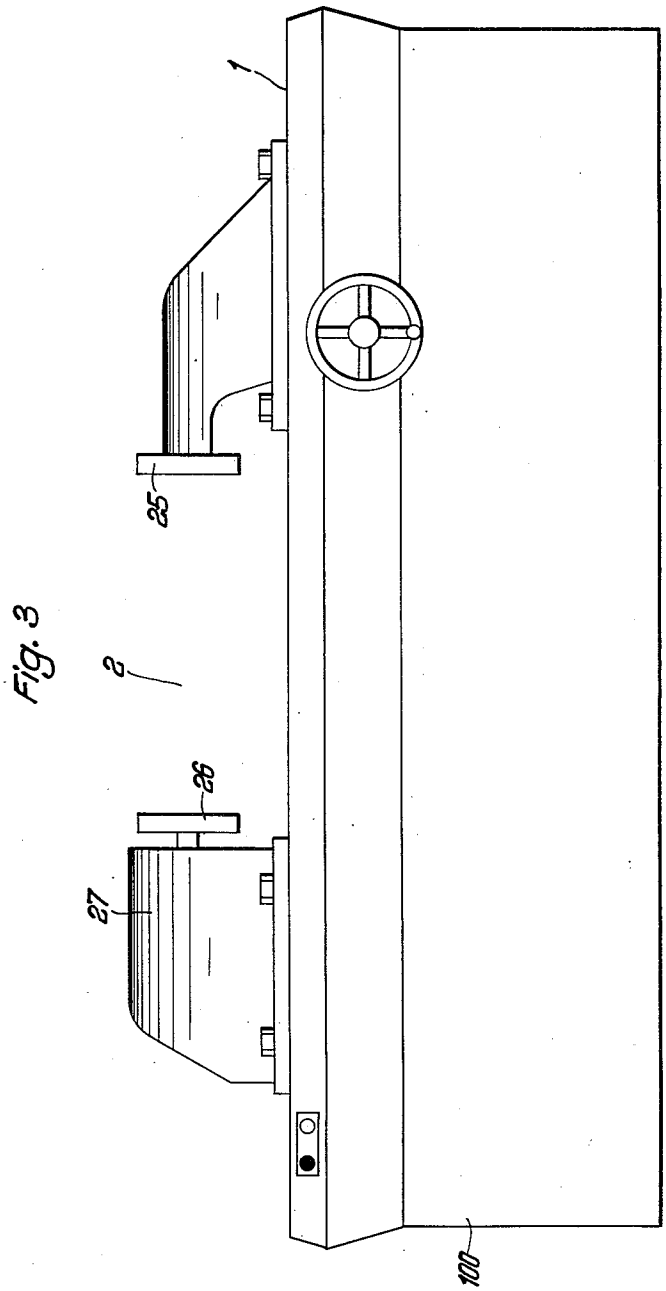

Fig. 3

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METHOD OF AND APPARATUS FOR THE PRODUCTION OF CORES, SHELL MOULDS OR THE LIKE FOR CASTING PURPOSES

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Claims priority, application Germany June 24, 1953

4 Claims. (Cl. 22—10)

The present invention relates to a method of and apparatus for the production of cores, shell moulds or the like for casting purposes whereby the moulding material is blown into or on to the core box or mould by compressed air. Blowing apparatus of this type have been evolved more particularly for the production of cores, and relatively high pressures are used in this operation, so that the moulding material is said to be shot into the core boxes. Such apparatus comprises essentially a pressurised container (hereinafter called the "sand container") from which the material, which is sand or a mixture of sand and a synthetic binder, for example synthetic resin, is shot into or on to the core box or mould. A tube projecting into the material leads to the blowing station, i. e., where the material is delivered into or on to the core box or mould, e. g., where the core box is fitted in a sealed relation to the apparatus, and another tube so extends into the container as to terminate above the material therein. If the container is subjected to pressure through the medium of air under pressure supplied by the last-mentioned tube or pipe, material is forced through the other tube or pipe to the blowing station.

These apparatus have a number of disadvantages. Firstly, there is a risk that the stream of compressed air introduced into the container will cause eddying of the material and an undesired air-separating or winnowing action, the synthetic resin in particular separating from the mass of material. Non-uniform products may therefore result unless care is take constantly to stir and hence remix the material. The requisite quantity of compressed air cannot be accurately regulated, and it is therefore necessary to work with an excess thereof, which involves energy loss. The blowing period is unduly long, even though relatively high pressures are used.

The invention aims to obviate or lessen these disadvantages. It is more particularly the intention to provide an apparatus which permits of sudden or impacting delivery of the material from the sand container to the blowing station, with little or no risk of the components of the material separating. It is also the intention so to construct the apparatus that the quantity of compressed air can be regulated by simple control means.

To these ends, the invention proposes to dispose a deflector, e. g., a part-spherical plate, above the material in the sand container and to arrange the compressed air pipe producing the ejection pressure in the said container so that it is directed towards the deflector whereby to spread outwards the compressed air discharged substantially centrally from the pipe and produce substantially uniform pressure on said material whilst suddenly expelling the same. The pressure is therefore delivered towards the material surface in the manner of a dome and so drives the material through the blow-pipe that little or no eddying and hence little or no air separating or winnowing effect occurs. These means alone ensure a satisfactorily sudden or impacting ejection of the material from the container to the blowing station, but the sudden ejection effect can be increased by disposing before the

sand container a charging vessel containing air under a predetermined pressure and from which compressed air is suddenly supplied to the sand container by suddenly opening the supply piping. For example, the charging vessel may be a cylinder containing a piston which is subjected to pressure and which moves, e. g., downwardly under pressure when the supply line to the sand container is opened so that a quantity of air trapped under pressure in the cylinder is suddenly expelled into the sand container aided by the piston pressure. Since the stroke of the piston can be made adjustable, accurately regulated quantities of air may be supplied to the sand container to enable the material to be forced along the blow pipe and shot into or on to the core box or mould. Thus, not only is the compressed air supplied to the sand container at high pressure while the chosen pressure is maintained constant or substantially so, but the quantity of compressed air is also accurately regulated so that compressed air is saved and the blowing time reduced to the lowest possible period.

The control device for effectively fulfilling this function, is relatively simple and requires little space, and the whole installation may be contained in a closed machine table upon the top of which there are merely the blowing station and clamping means for the core box or mould.

A preferred constructional form of the invention is illustrated by way of example in the accompanying drawings in which Fig. 1 is a diagrammatic section, Fig. 2 is a section taken through the part-spherical plate and Fig. 3 is a complete side elevation. A description of the invention will be given hereinafter in greater detail with reference to the said drawings, and other features of the invention will be described in the description.

Referring to Figure 1, there is operatively positioned on the top **1** of the closed table a blowing station **2** which is formed in the example selected, as a core blowing station. Located within the closed table **700** (Fig. 3) are the sand container **3** and charging cylinder **4**.

The material consisting of sand or of a mixture thereof with synthetic resin is indicated at *3a* in the shooting container **3**. A pipe **5** projecting into the material *3a* leads to the core blowing station **2**. A compressed air line **6** is led into the vessel **3** from below and is directed towards a part-spherical plate **7** disposed on the cover of the vessel **3**.

The function of the part-spherical plate **7** towards which the pipe **6** is directed is so to deflect the centrally entering stream of compressed air that the latter presses upon the surface of the material *3a* as if contained within a dome or bell and expels the material shot-wise through the pipe **5**. Due to the fact that the compressed air, which preferably enters suddenly is deflected into this dome-like or bell-like shape, eddying of the material *3a* is prevented or reduced whether the same is dry and ready to trickle or whether it is damp, while a uniform pressure effect is also obtained. In this way the separating even of completely dry materials which may be a mixture of materials of different specific weights is prevented or lessened.

The part-spherical plate **7** may also serve as a valve or closure member for the charging aperture **8**. Leading to the latter is a hopper **9**, the top of which is covered with a filter **10** on the upper part of the table. The required quantity of material *3a* is shaken into the vessel 3 through the said filter, and the material which overshoots during blowing may be shaken back into the vessel 3 through the filter **10**. The part-spherical deflecting plate and the associated additional equipment thereof are more clearly apparent in Figure 2. Disposed at the aperture 8 is a packing **11** against which the heavy part-spherical plate **7** bears when in the closed

position. The plate 7 is thrust downwardly by the spring-loaded guide 12 so that the aperture 8 is opened for charging the container with material. A spring 13 bearing against the plate 7 depresses the valve 14 for the pipe 6 to prevent material from entering the pipe 6 when the vessel is being charged or when surplus material is being shaken back after each blowing operation. When the pipe 6 is subjected to pressure, the valve 14 lifts and thrusts the part-spherical plate 7 against the packing 11 through the medium of the spring 13, and the immediately following stream of compressed air completes the sealing of the plate 7 against the packing ring 11.

Although the apparatus described with the container 3 and the plate 7 is effective even if the container 3 is directly supplied from the compressed air network, it is particularly advantageous to work with a regulated quantity of compressed air, and to this end the charging cylinder 4 is disposed before the container 3, the line 6 leading from the cylinder 4 to the container 3.

The cylinder 4 is completely enclosed and located therein is a piston 15 which has two packing rings. The line 16 leads to the space above the piston, and the line 17 leads to the space below the piston, the lines 16 and 17 being connected to the compressed air network 19 through a four-way valve 18.

The piston has rubber buffers 20 co-operating with rubber buffers 21, 22 which yieldingly arrest the to and fro movements of the piston. The height of the lower rubber buffer 22 can be adjusted to some extent. The initial position of the piston can be adjusted by means not shown in detail, so that a predetermined volume of air will be enclosed below the piston. This volume of air is at the pressure of the compressed air network. The pressure can be produced by fitting in the line 6 a three-way valve 23 which closes the line to the charging vessel 3.

Also fitted to the piston 15 is a relief valve 24 in the form of a flutter valve.

The operation of the charging cylinder 4 connected on the input side and of the equipment associated with the said charging cylinder is as follows:

The three-way valve 23 and four-way valve 18 are so interconnected that, when the three-way valve 23 is closed, the supply line 17 to the space below the piston 15 is open through the four-way valve 18. The pressure raises the piston 15 into the previously adjusted starting position and a predetermined quantity of compressed air required for the blowing operation is now contained below the piston 15. When the blowing operation is to be effected, the three-way valve 23 is opened and the four-way valve simultaneously so shifted that the line 17 is closed and the line 16 opened. The quantity of compressed air below the piston therefore discharges suddenly into the charging vessel 3 and impels the material to the blowing station. Simultaneously, the piston 15 subjected to the pressure of the compressed air network so aids the expulsion of the volume of air into the container 3 that the abrutly expelled volume of air enters the container 3 at a constant pressure. Depending in each case upon prevailing circumstances, pressures of up to 6 atmospheres absolute, preferably 3 atmospheres absolute, can be employed for the operation. The high pressure together with the sudden or impacting pressure effect makes it possible to produce very thick cores, shell moulds or the like.

After the blowing operation has been terminated, the valves 23 and 18 are reset to their initial position so that the air space below the piston 15 is again filled with compressed air, the piston 15 rising automatically into its initial position. The necessary pressure discharge from the top to the bottom of the piston is effected through the valve 24.

Since the apparatus operates at high pressures acting suddenly or in impacting manner special attention must be given to removing, at the blowing or shooting point, the air enclosed in the mould or the core box. A clamping station 2 for core boxes is illustrated in the constructional example (Fig. 1). The core boxes or core dies are clamped between the stationary clamping plate, in which the pipe 5 terminates, and a movable clamping plate 26. The latter can be moved by an air-operated clamping cylinder 27. It has been the general practice heretofore to provide a core box with air vents (e. g. nozzles) to allow the enclosed air to escape when the material is forced in. The core boxes are at a relatively high temperature in order that the material consisting of sand and synthetic resin or the like cakes or sets on to the walls when the synthetic resin melts, in order to produce the core shape. However, the air vents in a core box of this type become clogged, more particularly when high pressures are used impulse-wise, since the material also sets and cakes in the air nozzles. In order to obviate this, instead of providing the core boxes with air vents the latter may be located in the clamping plates which remain cool. Advantageously the stationary clamping plate 25 also containing the pipe 5 has the said air vents so that the enclosed air is expelled rearwardly from the enclosed material.

The blowing operation only lasts for a fraction of a second and is effected without substantial loss of compressed air since the volume of air required can be adjusted, while the excess of non-caking material is also maintained within narrow limits. The operator removes the blown core box from the clamping device and shakes the small quantity of surplus material through the filter 10 into the hopper 9, whence the said surplus material re-enters the charging vessel 3. A vibrator 28 can be arranged on the hopper 9 in order to ensure regulation of the material flowing through the hopper.

What we claim is:

1. Apparatus for the production of cores, shell molds or the like for casting purposes comprising a sand container, a compressed air pipe and a deflector having a dished deflecting surface, said pipe extending medially into the container and its discharge end being directed towards the medial region of said deflector so that when the container is charged with the molding material the compressed air will be discharged from the pipe medially on to the deflector above the level of the material and will spread outwards and downwardly and produce substantially uniform pressure on the material whilst suddenly expelling the same and a core box or mold supporting means and a conduit leading thereto from the lower region of said container, so that the material expelled will pass into or on to the core box or mold, said container having a charging aperture for the molding material and said deflector serving as a valve for said charging aperture.

2. Apparatus for the production of cores, shell molds or the like for casting purposes comprising a sand container, a compressed air pipe and a deflector, said deflector having a dished deflecting surface, said pipe extending medially into the container and its discharge end being directed towards the central region of the concave face of said deflector, a charging cylinder containing a piston, means for supplying compressed air to said cylinder and valve means for trapping compressed air therein, said pipe communicating between said cylinder and said container, said valve means being operable for releasing said compressed air for passage from said cylinder through said pipe to the interior of said container and to enable compressed air to reach the other side of the piston to give rapid movement thereto so that the transfer of the said compressed air from the cylinder to the container is rapidly effected and when the container is charged with molding material the said compressed air displaced by the piston will be discharged from the pipe medially on to the concave face of said deflector above the level of the material in the container and will spread outwards and downwardly and produce substantially uni-

form pressure on the material suddenly to expel the same and a core-box or mold supporting means and a conduit extending thereto from the lower region of the said container, so that the material expelled will pass through said conduit into or onto the core box or mold.

3. Apparatus according to claim 2 in which the said piston has a relief valve.

4. Apparatus according to claim 2 having resilient stop means for said piston.

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