

Aug. 19, 1958

D. PULVERMACHER

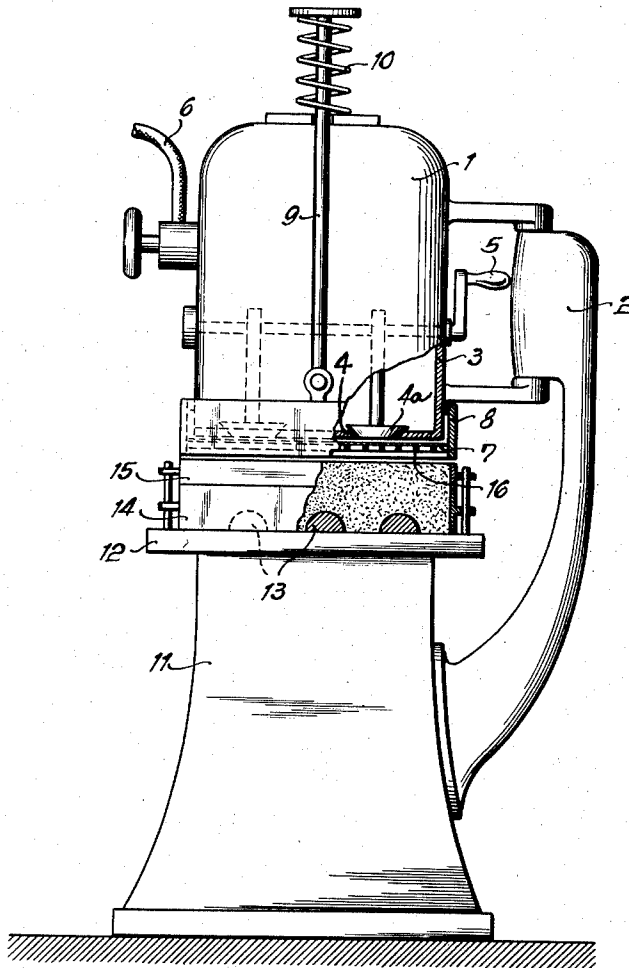
2,847,736

DEVICE FOR MAKING SAND MOLDS FOR METAL CASTING

Filed Dec. 31, 1954

3 Sheets-Sheet 1

FIG. 1



INVENTOR
Dietrich Pulvermacher

Aug. 19, 1958

D. PULVERMACHER

2,847,736

DEVICE FOR MAKING SAND MOLDS FOR METAL CASTING

Filed Dec. 31, 1954

3 Sheets-Sheet 2

FIG. 2

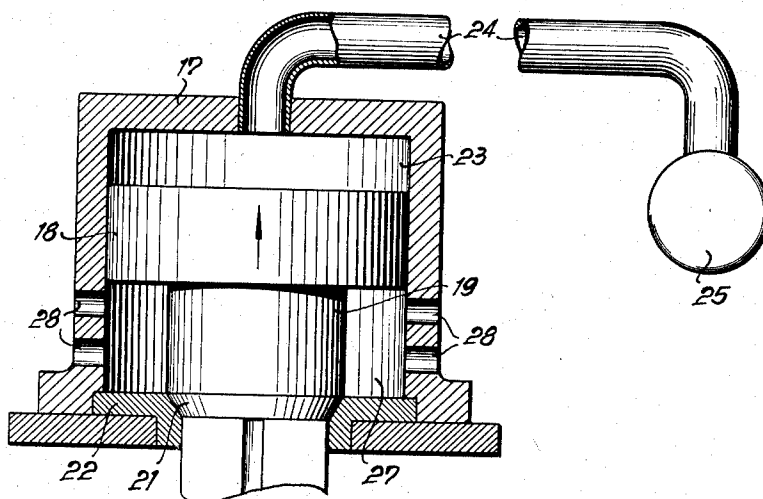


FIG. 3

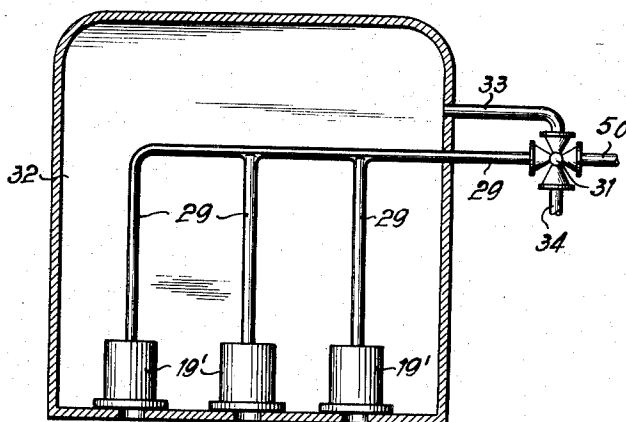
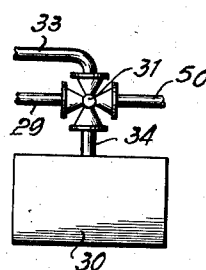


FIG. 3a



INVENTOR
Richard Pulvermacher

Aug. 19, 1958

D. PULVERMACHER

2,847,736

DEVICE FOR MAKING SAND MOLDS FOR METAL CASTING

Filed Dec. 31, 1954

3 Sheets-Sheet 3

FIG. 4

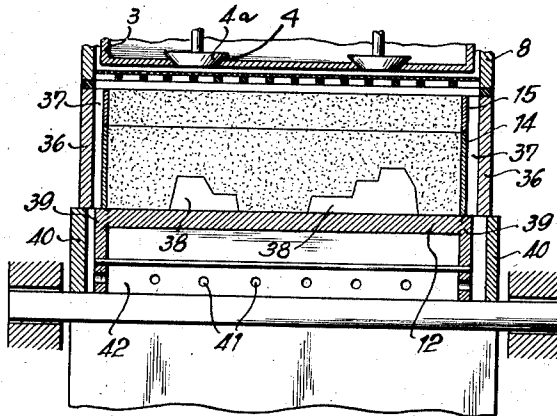
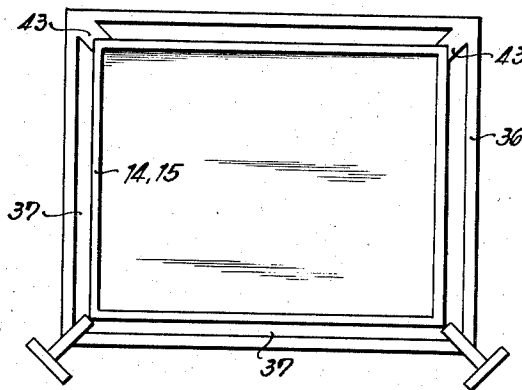


FIG. 5



1

2,847,736

DEVICE FOR MAKING SAND MOLDS FOR METAL CASTING

Dietrich Pulvermacher, Hagen, Westphalia, Germany

Application December 31, 1954, Serial No. 479,135

16 Claims. (Cl. 22—36)

The present invention relates to a process and devices for making sand molds for metal casting, more particularly for casting iron. The device is one of the type, in which the sand is placed in a frame, sometimes called casting box, onto the pattern, and compressed thereon by compressed air.

The known machines of this kind have a storage vessel or the like, from which sand is blown onto the pattern by means of a jet of compressed air. Since the direction of force with which the sand is blown out of the storage vessel is practically the same at all times, whereas the patterns vary in their shape, the sand in the mold will not be compressed uniformly. There will be less sand above the pattern (in the direction of blowing) than in any other spot. The casting will therefore be uneven due to the varying density of the sand and there will be a large amount of waste. Also, a large amount of time will be necessary for filling-in the sand into the storage vessel which has to be sealed air-tight after each filling. Another difficulty is the measuring of the amount of the sand. Finally, the control of the compressed air and the distribution of pressure on the mold flask presents difficulties in the known machines.

It is the object of the present invention to provide means for overcoming the above-mentioned drawbacks.

This is accomplished according to the invention by bringing the sand in the conventional manner, loosely, either directly on to the patterns in the correct amounts, or in a casting frame which is provided with a sieve bottom. Upon the frame filled with sand and completely covering the same, a container with compressed air is placed, which may have the shape of a bell; or in another embodiment of the invention, the frame filled with sand is moved underneath the bell. Air is pressed out of the container pulsatingly, by means of valves adequately dimensioned, and compresses the entire surface of the sand, which, in loose condition, behaves similarly to a liquid and propagates the pressure evenly to all sides.

During this action, sand is pressed through the sieve box, is thrust onto the pattern and evenly compressed. When the sand is filled into the mold flask right away, compression is accomplished immediately with the first jet of air.

When pressure is exerted upon the entire surface, sand smoothly encloses the pattern of a pattern plate, so that an even thickness is accomplished as desired. Pressure is exerted pulsatingly, as stated above, for short periods at a time, several pulsations in succession being advantageous. Particularly upon several pulsations being applied, compressed air will penetrate the upper layer of sand and will leave behind a desired porosity.

Between the bell and the casting frame or filling frame an air gap serves for aeration.

Every single jet of air requires only fractions of a second. The compression proper of the sand consequently occurs in a very short time, and considerable time is saved as compared to the known compression processes.

During a thrust of compressed air, the bell lies closely

2

against the edge of the frame filled with sand and seals the frame sufficiently in a very simple manner.

When sand is to be filled directly on a pattern in a casting frame, it is desirable to place a filling frame on the casting frame which corresponds in volume to the volume decrease of the sand upon compression.

It has also proved advantageous to arrange a sieve below the bell-shaped container. The sieve is preferably suspended yieldingly, or movably, in order to set itself as a seal onto the edge of the molding frame or filling frame when air is pressed in. It may be advisable to provide the edge of the sieve with a resilient packing means, e. g. a rubber ring which lies between the frame and the sieve.

The sieve is arranged in a strong, rigid frame, which is yieldingly supported.

The casting frame, filling frame, and intermediate frame, if any, are preferably cylindrical and the sieve, as well as the bell, are shaped accordingly.

In order to take care of the varying height of the patterns the bell should not only be movable, for instance, pivotable, but it should also be adjustable as regards its height, which is easily accomplished by screw means.

The bell can be pivotable in the manner of a cap. The movements of the bell may be controlled manually or, in heavy machines, by mechanical drive means.

According to the present invention, the entire surface of the casting frame is resiliently placed under compressed air. In this way, the cumbersome and time-consuming transportation of sand by means of compressed air becomes unnecessary, since air pressure is directed immediately onto the filled-in and measured sand. This also simplifies the operation of the machine considerably and helps to avoid disturbances.

It is possible to arrange several pattern plates on a revolving table and to pass them under the bell. The compression of the sand can be brought about by automatic control of the compression thrusts, so that the operating personnel has only to fill the sand onto the patterns and to remove the finished forms. The molding occurs automatically and is adjustable to a considerable extent by selection of pressure and control of the number of compression thrusts. The operation can be handled by unskilled labor. In the compression of the sand, differences as they occur in manual operation are no longer possible. All forms show even structure of the sand, so that perfect castings will be the result.

It is also possible to provide for automatic feeding of sand to the patterns.

The invention may be applied to the molding of cores and for molding patterns in dust-like materials, as it is used in castings finding application in the pharmaceutical industry.

A very useful control valve for regulating the compressed air thrusts consists, according to the present invention, of a cylinder, closed at one end, in which a piston is movably arranged. The piston supports a preferably cone-shaped valve body at its face directed toward the closed cylinder end. The open end of the cylinder is covered by a plate having an opening which serves as a valve seat. The surface of the piston is smaller on the valve-supporting side. The cylinder head is attached to pipe lines joining the cylinder above and below the piston and which comprise a common control valve. Upon both cylinder chambers being filled with the same compressed air, the piston with the valve body remains on the valve seat, since the larger piston surface facing the valve body receives a larger amount of pressure. When air escapes from this chamber, the piston with the valve body is lifted from the plate and moves into the chamber of the cylinder head. The pressure fluid to be controlled

can then pass through the opening in the plate. As soon as the chamber in the cylinder head is again set under pressure by setting of the valve, the piston moves to the plate and seals the opening therein with the valve body. The control valve may be a three-way cock and may either join the cylinder head chamber as pressure space with the pressure means, or the said chamber with a pressureless or low pressure zone in order to open the valve.

It is obvious that several valves may be made to form a unit which can be controlled by a single control valve.

The valve which regulates the jets of compressed air for carrying out the present process, permits the escape of a larger amount of compressed air from a container of compressed air, very suddenly. In carrying out the process according to the present invention the combination of several valves to a group to be served from a single control valve is of particular advantage.

In the machine operating according to the present invention it has further proved to be advisable to exert an even pressure from all directions upon impingement of the compressed air onto the mold flask which is placed upon the patterns and in which the sand is compressed; otherwise, the flask would yield under the impinging jet except when it has sufficient mechanical resistance. An arrangement which will serve the purpose comprises a second frame which is placed around the mold flask in the manner of known centering frames, thereby producing a hollow space between the two structures into which compressed air can penetrate. In this manner, the mold flask is evenly surrounded by compressed air at each incoming jet and is therefore in a state of equilibrium.

It is preferable to arrange a hollow space also around the plate carrying the patterns so that compressed air maintains the pattern carrier in equilibrium. In this way, all parts can be made much lighter and remain free of mechanical stress when subject to compression. The operation of the machine is very much simpler, since lower weights are to be moved and all parts undergo less strain. The castings obtained correspond to size in a better way since the patterns cannot move when hit by compression thrusts and will not be exposed to other changing influences. The pattern carrier may be in the form of a turnover plate which is supported preferably by a counter-sunk piston.

The invention will now be described with reference to the accompanying drawings in which a few embodiments thereof are shown by way of illustration and not of limitation, but it should be understood that many changes in the details can be made without departing from the spirit of the invention.

In the drawings,

Fig. 1 is a front elevation of the machine according to the invention,

Fig. 2 is a central longitudinal section of the control valve,

Fig. 3 illustrates a group of valves with common control means,

Fig. 3a illustrates a detail of a special embodiment of Fig. 3,

Fig. 4 shows part of the machine in central longitudinal section, on an enlarged scale, and

Fig. 5 is a top view of the same part.

Referring now to the drawings, a bell 1 filled with compressed air is shown pivotally arranged on a support 2. The bell-shaped structure 1 comprises a bottom 3 with openings 4 closed by valves 4a. The valves may be abruptly opened by means of a lever 5. Compressed air is admitted to the bell-shaped container 1 by means of a pipe line 6 and of a shut-off valve. Below the bell, a sieve 7 is arranged in a frame 8 and suspended by means of a rod 9 which is spring-controlled as at 10. The machine is supported on a standard

11 which carries a pattern plate 12 with patterns 13, mold flask 14, and filling frame 15. Below the sieve 7, which serves for pressure equalization, a grid 16 is arranged in frame 8, said grid serving to prevent the sieve from sagging under the impact of the compressed air. The frame 8 comprises packing means which provide a seal with the bell 1 or with the filling frame 15 respectively as the case may be.

The mold flask 14 and the filling frame 15 are filled in a known manner with sand while bell 1 is pivoted on its seat. Then the bell is pivoted back over the filling frame and compressed air is pressed onto the sand through sieve 7 by lifting valves 4a. The sand is compressed by the air jet as desired and a mold is thereby formed which has an even sand structure. In the embodiment here described, both the filling frame 15 and the mold flask 14 are filled with sand, the sand originally filled into frame 15 compensating for the decreasing volume of the sand upon compression in the mold flask 14, so that the latter remains filled to the upper edge.

In another embodiment the filling frame 15 can take the necessary amount of sand alone. For that purpose the filling frame has to be provided with a strong bottom which is perforated like a sieve and through which sand is pressed by air pressure into the mold flask and onto the pattern. It is obvious that in this case the filling frame has to be higher so as to be capable of receiving the entire quantity of sand required. By filling the entire quantity of sand into the filling frame, the charging of the machine with sand is simplified.

In another embodiment it is possible to cover the sand with a resilient plate after it has been filled into the mold flask. Such a plate acts like a yielding piston and compresses the sand in a single stroke, while usually several jets of compressed air are necessary for compression of the sand without the plate. The plate is preferably provided with apertures, so that air can penetrate into the sand and produce pores in the same.

Fig. 2 shows a preferred form of a valve. It comprises a valve cylinder 17 in which a piston 18 is slidably arranged. A valve body 19 with a cone-shaped part 21 is attached to piston 18, said cone-shaped part 21 being pressed onto a seat 22 by means of the pressure prevailing in the upper chamber 23 of cylinder 17. Compressed air is admitted to chamber 23 through a conduit 24 under the action of a control valve 25. The lower chamber 27 of cylinder 17 communicates by means of openings 28 or by means of a special pipe line (not shown) with the pressure means for control. Since the upper pressure surface of piston 18 is larger than the lower one, the valve remains closed when equal pressure prevails in 23 and 27. If upon operation of the control valve 25 the pressure in chamber 23 is reduced, the piston 18 moves in the direction, of the arrow, i. e. in upward direction and valve body 19 is lifted to free the opening in plate 22. When, on the other hand, compressed air is again admitted to chamber 23 by means of valve 25 alternately connecting to two different pressure areas (as will be explained in more detailed in connection with Figs. 3 and 3a), piston 18 descends in the opposite direction and closes the opening in plate 22.

It is possible to use two different pressure supplies in the chamber 23, and in the chamber 27 for moving piston 18 to close and open the valve. Also, the pressure applied in both chambers may be different. In this case, however, piston 18 has to be sealed at the internal wall of cylinder 17. The diameter of piston 18 and of valve body 19 has also to correspond to the pressures applied.

Fig. 3 illustrates the combination of three valves 19' connected in a group by means of pipes 29. The entire group is controlled by a control valve 31. Actuation of the control valve 31 operates at the same time the piston 18. Valves 19' are mounted in the interior of a container 32 for the compression means, more particularly

5

at the bottom of 32. When container 32 is filled with compressed air, air will escape from the bottom of container 32 abruptly as soon as the upper chamber 23 is evacuated. The closing of valves 19' likewise occurs abruptly as soon as compressed air is filled into the upper chamber 23 of valves 19'.

A valve 31 connects valves 19' via conduits 29, 33 as well as the container 32 to a conduit 50 supplying compressed air, whereby the valves 19' are closed. Alternatively the valve 31 connects the conduit 29 through the short conduit 34 to a normal pressure area, whereby the valves 19' are opened.

In a different embodiment illustrated in Fig. 3a, the conduit 34 connects to a container 30 within which a pressure lower than that supplied by the conduit 50 prevails to effect the opening of the valves 19'. This embodiment is advantageous when very high pressures are used, since the comparatively small reduction of the pressure compared to reduction to normal pressure results in a saving in compressed air when the valves 19' are closed again.

In Figs. 4 and 5 the arrangement of an auxiliary frame 36 is illustrated which surrounds casting box 14 and filling frame 15. Frame 36 encloses a space 37 adjacent to 14 and 15. Likewise, a frame 40 is provided which surrounds a plate 12 carrying patterns 38, said plate being supported on a frame 39. The interior walls of frame 40 are at a certain distance spaced from frame 39. In the latter frame bores 41 are provided leading into a hollow space 42 below plate 12. The structures 14 and 15 are guided by members 43 in frame 36.

When an air jet strikes the sand, compressed air penetrates through space 37 and bores 41 to surround structures 14 and 15 as well as plate 12 from all sides and maintains the parts in equilibrium. Since equal pressure prevails inside and outside of 14 and 15, these structures may be made with thin walls so that the manipulation thereof is considerably facilitated. Alternatively, the compressed air surrounding the filling frame 15 and the mold flask 14 may be supplied independently of the compressed air directed into the sand.

It should be understood that many variations of the device described are possible. The device may, for instance, be provided with control means for releasing the compressed air at a certain pressure only. In one embodiment, the pressure at which the control means releases compressed air may be regulated by barometric means, if desired, automatically.

In one arrangement, the releasing means for the compressed air may become active when the mold flask slides under the air vessel.

Automatic means for feeding sand to the molding device may likewise be provided.

What I claim is:

1. A machine for making sand molds for metal castings by pressing the sand onto a pattern, comprising a container adapted to receive the pattern and a predetermined amount of sand, the sand being distributed over the entire pattern surface, and means for forcing, at least once, compressed air onto and, at least partially, into the sand in said container, said means comprising a bell-shaped vessel containing compressed air and said container consisting of a mold flask adapted to receive the pattern at its lower end and a filling frame positioned at the upper end of said mold flask, said vessel being mounted for temporary engagement with said filling frame, at least one valve in the wall of said vessel which temporarily engages said filling frame, and means for operating said valve.

2. A machine as claimed in claim 1 in which said filling frame has a sieve bottom.

3. A machine as claimed in claim 2 in which said vessel, said filling frame, said mold flask and the pattern plate have a substantially circular cross-section.

6

4. A machine as claimed in claim 1 in which a sieve is arranged in front of said valve.

5. A machine as claimed in claim 4 further comprising a yieldingly suspended frame, said sieve being mounted in said frame.

6. A machine for making sand molds for metal castings by pressing the sand onto a pattern, comprising a container adapted to receive the pattern and a predetermined amount of sand, the sand being distributed over the entire pattern surface, and means for forcing, at least once, compressed air onto and, at least partially, into the sand in said container, said means comprising a vessel containing compressed air, said vessel being pivotally mounted at the side of the container for temporary engagement with said container, at least one valve in that wall of said vessel which temporarily engages said container, and means for closing and opening said valve.

7. A machine as claimed in claim 6 in which said vessel temporarily engages substantially the entire upper surface of said container, whereby the valve-containing wall of said vessel is positioned in close proximity to the initial surface of the sand.

8. A machine as claimed in claim 7 in which a plurality of valves is arranged to spacedly cover substantially the entire upper surface of said container.

9. A machine as claimed in claim 6 further comprising an apertured resilient plate positioned on the sand.

10. A machine as claimed in claim 6 further comprising a wall spacedly surrounding all outside walls of said container to form a first intermediate space, and means for supplying compressed air to the space each time compressed air is forced into the sand in said container.

11. A machine for making sand molds for metal castings by pressing the sand onto a pattern, comprising a container adapted to receive the pattern and a predetermined amount of sand, the sand being distributed over the entire pattern surface, and means for forcing, at least once, compressed air onto and, at least partially, into the sand in said container, said means comprising a vessel containing compressed air, said vessel being pivotally mounted at the side of the container for temporary engagement with said container, at least one valve in that wall of said vessel which temporarily engages said container, means for closing and opening said valve, said vessel temporarily engaging substantially the entire upper surface of said container, whereby the valve-containing wall of said vessel is positioned in close proximity to the initial surface of the sand, a plurality of valves arranged to spacedly cover substantially the entire upper surface of said container, a pattern plate carrying the pattern, a wall substantially parallel to and spaced from the plate on the side opposite the pattern to form a second intermediate space, said two intermediate spaces being connected for compressed air distribution.

12. A machine as claimed in claim 9 in which said means for supplying compressed air comprises said vessel and said valve.

13. A machine as claimed in claim 6 in which said vessel comprises at least one cylinder having a circular opening in its bottom adapted to serve as seat for said valve, further comprising a piston slidably mounted in said cylinder and dividing it into an upper and a lower chamber, said valve having a large circular cross-section and being integral with and suspended from said piston, and pressure means connected to both said chambers for raising and lowering said piston.

14. In a machine as claimed in claim 13, said vessel further comprising a compressed-air reservoir having a flat bottom wall, said cylinder being mounted into said bottom wall with the valve-seat opening extending there-through, the wall of said lower chamber having at least one opening to communicate with the surrounding reservoir, and said pressure means comprising a source of compressed air, a source of comparatively low-pressure air, a control valve separately connecting to both said

7

sources, a first conduit leading from said control valve to said reservoir, and a second conduit leading from said control valve to said upper chamber, said control valve being adapted to connect the compressed-air source to said reservoir and to alternatively connect the source of comparatively low pressure and the compressed-air source to said upper chamber.

15. A machine as claimed in claim 14 in which said source of comparatively low-pressure air is the surrounding atmosphere.

16. A machine as claimed in claim 14 and a plurality of cylinders arranged in said reservoir and an equal plurality of second conduits connecting said control valve with said upper chambers.

5

10

593,267
875,228
1,594,598
2,598,621
2,698,976

172,693
474,118

8

References Cited in the file of this patent

UNITED STATES PATENTS

Adams	Nov. 9, 1897
Witham	Dec. 31, 1907
Campbell	Aug. 3, 1926
Taccone	May 27, 1952
Taccone	Jan. 11, 1955

FOREIGN PATENTS

Germany	June 28, 1906
Italy	Sept. 3, 1952