

April 11, 1961

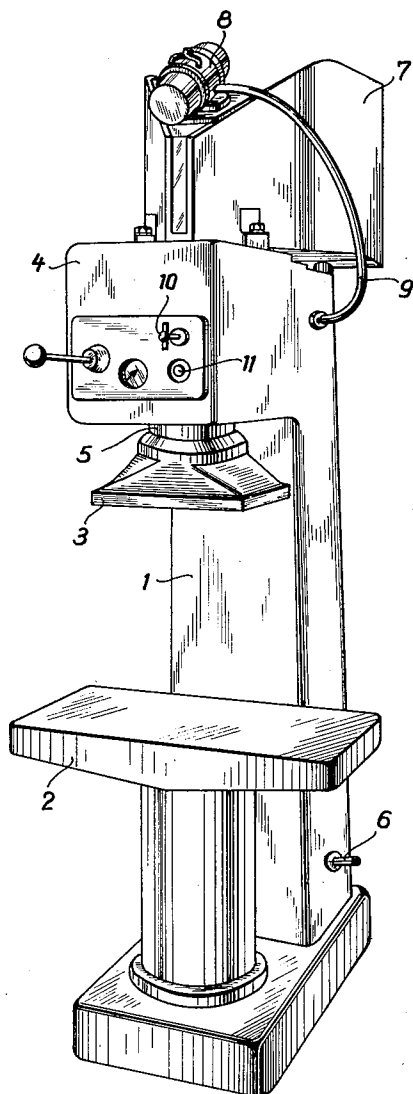
Filed June 18, 1958

F. HANSBERG
MACHINE FOR FORMING FOUNDRY CORES AND
CHARGING CORE BOXES WITH MOLDING SAND

2,978,759

7 Sheets-Sheet 1

Fig. 1



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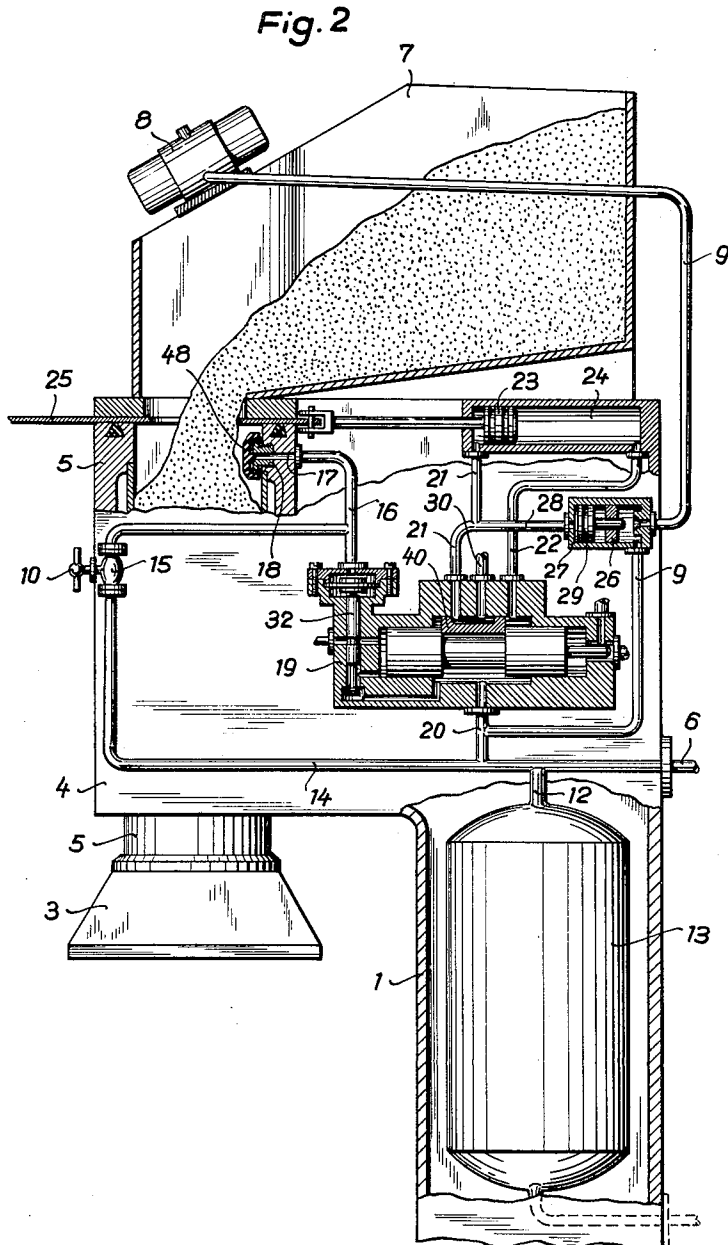
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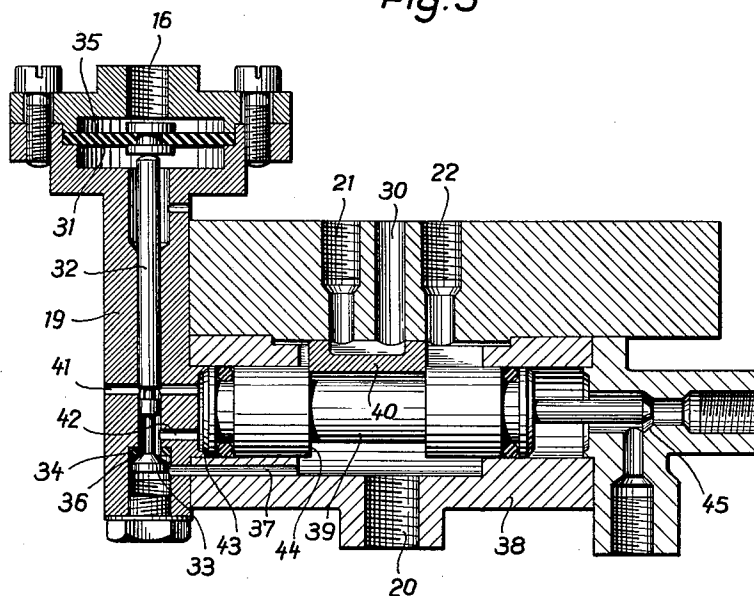
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Fig. 3



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Fig. 4

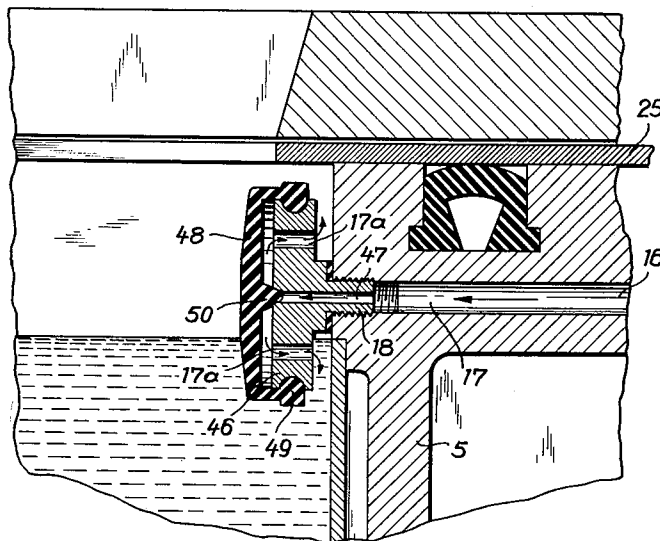
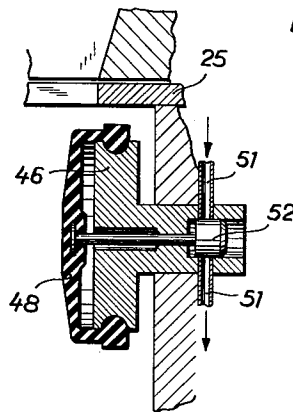


Fig. 5



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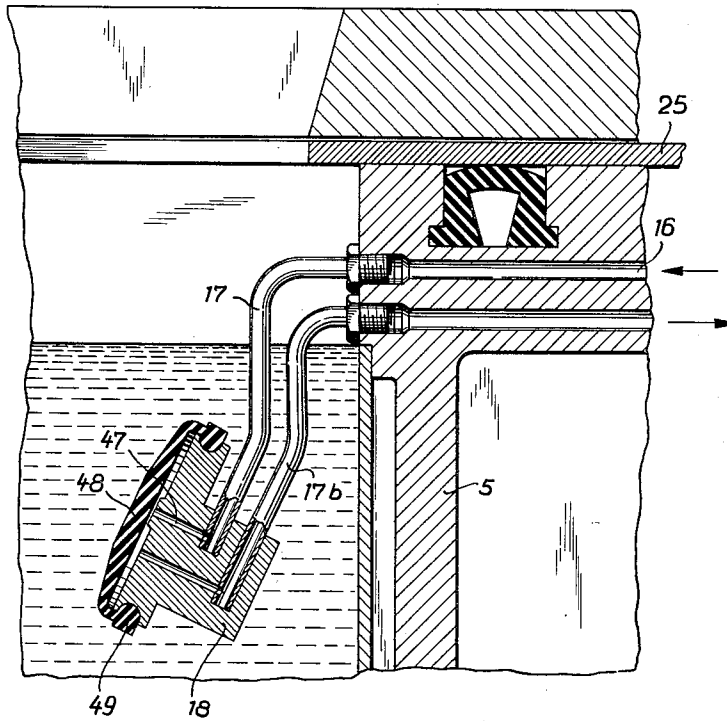
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Fig. 6



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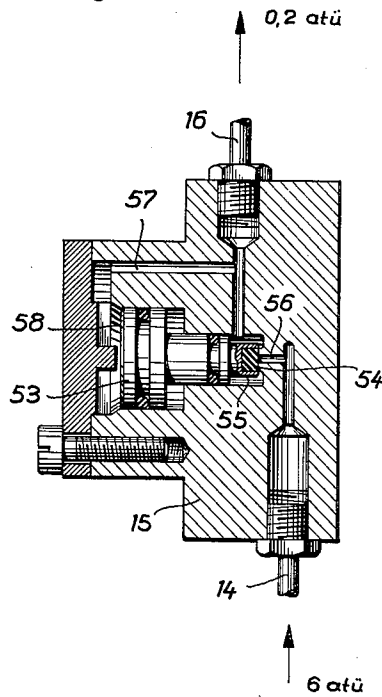
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Fig. 7



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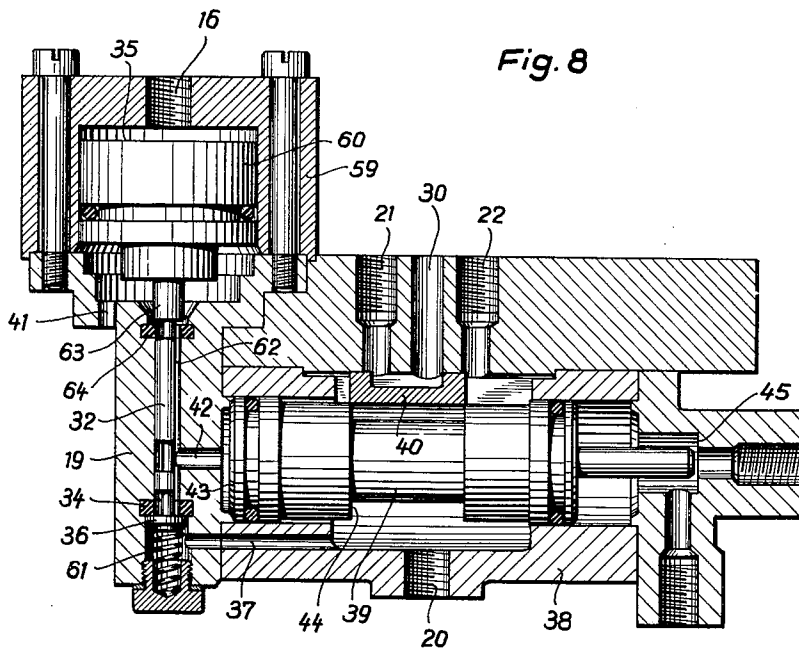
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2,978,759

MACHINE FOR FORMING FOUNDRY CORES AND CHARGING CORE BOXES WITH MOLDING SAND

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Filed June 18, 1958, Ser. No. 742,935

Claims priority, application Germany July 13, 1957

18 Claims. (Cl. 22—10)

The invention relates to the automatic control of the charging of the moulding composition container of a core-shooting or mould-shooting machine for the production of foundry cores or foundry moulds, by means of which machine a core box or mould box is to be filled with core sand or moulding sand or other moulding composition. Such a machine may, however, also be used in other fields with similar operational problems, for example in the field of ceramics or in the building industry for the production of moulded articles of sand and earth.

In the known machines generally used in practice, the core sand or moulding sand is poured into a closable sand storage container and then compressed air is introduced into the closed sand container. Such moulding machines working with compressed air are known in the most varied forms of construction, and a distinction must be made between two fundamentally different types of machine and modes of operation, namely the true blowing machines which work on the mixing or blowing principle with a mixture of air and sand, and the sand-shooting machines in which the moulding sand is simply injected abruptly into the boxes to be filled, without any particular turbulence of mixing with air. The characteristic features are explained in the introduction to United States patent specification No. 2,793,409. A sand-shooting machine is also illustrated and described in the United States patent application No. 518,583 of June 28, 1955.

In such moulding machines, the sand storage container must be refilled at certain intervals with sand, for which purpose the sand storage container is equipped with a sand-feeding slide or the like and there is arranged above the sand storage container a charging device of the type which has long been known in the form of vibrating chutes for the most varied machines and charging tasks. These chutes have vibration motors, generally equipped with out-of-balance weights, which may be electric. In other moulding machines, a pneumatic reciprocating motor is used, the control of which is likewise effected pneumatically.

For the automatic control of the charging of sand-blast moulding machines it is known to equip the sand container of the blowing machine with a source of light and a photo-electric cell opposite the source of light, which controls the replenishment of the blowing container with sand. Since a purely optical electrical control device working with two light barriers is too complicated and too susceptible to trouble, there was a change-over, in practice, to a mixed mechanical-optical control wherein the switching on of the replenishing device is effected through the manually operated control valve or through a slide valve and limit switch, and only the switching off of the replenishing device is effected by means of a light barrier provided at the upper end of the sand container. In permanent operation in practice, however, an inconvenient disadvantage has been found in the fact that with such an optical control device the

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window of the source of light and of the photo-electric cell quickly becomes dirty, as a result of which the control device may become liable to break down. The risk of the optical window becoming soiled and encrusted through the binding agents mixed with the core sand, particularly through core oil, is present to an increased extent in core-shooting machines which may work with any type of core binder.

In order to avoid this disadvantage it is known to control an electric reciprocating motor of a core moulding machine electrically either by means of an electric sonde arranged in the sand storage container or by means of the aerial of an electrical oscillatory system. This electrical control method utilizes the fact that the dielectric values of the core and moulding sands used for the production of foundry cores and foundry moulds, particularly when they are mixed with binding agents such as core oils, as well as other suitable moulding materials are capable of causing appreciable electrical or magnetic changes of state and of causing electrical control systems which are sensitive and react thereto, to respond.

In addition to the sensitivity and liability to breakdown of electrical devices in rough foundry operation, electrical reciprocating motors and their electrical control have the disadvantage of the risk of the metal machine frame becoming live as a result of a defect occurring at any time in the electrical device.

The invention avoids these disadvantages and provides a moulding machine for the production of foundry cores and foundry moulds, particularly a sand-shooting machine, wherein the automatic control of the charging operation is effected by pneumatic means and therefore no electrical power connection is necessary for the moulding machines.

According to the principle of the invention the automatic control is effected pneumatically by means of a current of control air at an excess pressure of a fraction of an atmosphere introduced into the moulding composition storage container in such a manner that a rise in the level of the supply of moulding composition blocks the free outlet for the current of control air and thus initiates the control operation.

In a moulding machine which preferably represents a further development of the invention, but the construction of which may also be used independently of the basic idea of the invention, the reducing valve which is pneumatically connected to the connection for the compressed-air supply or to a compressed-air accumulator and which reduces the excess pressure of the compressed air supplied to the machine to a fraction of an atmosphere, is pneumatically connected by means of a control air line, to a diaphragm valve mounted in the sand storage container at the top and feeds said valve with control air, and the full supply of sand comes to rest against the resilient diaphragm and thus initiates the control operation.

The diaphragm valve preferably consists of a disc-shaped valve body equipped with a central bore and a cap-like diaphragm which is stretched over the valve body and comprises, centrally a rearward valve member.

In a preferred embodiment of the invention, the moulding machine, particularly a sand-shooting machine, is equipped with a pneumatic reciprocating motor which is mounted on the vibrating chute and causes the replenishment of the sand-storage container. For this purpose, the pneumatic reciprocating motor is connected to the compressed-air supply connection either directly or through a compressed-air accumulator from whence it is supplied with compressed driving-air. According to a further development of the invention there is connected between a pneumatic reciprocating motor and the compressed-air supply connection, an automatic compressed-

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air control valve which is connected to both through compressed-air lines in the form of hose or tube and which is connected to the pneumatic relay through a control-air line in the form of hose or tube and is controlled pneumatically by said relay. If the machine also comprises a sand-charging slide which is actuated by compressed air, then it is a particular advantage to connect the automatic compressed-air control valve of the pneumatic reciprocating motor, by means of a compressed-air line in the form of hose or tube, to one of the two compressed-air lines leading from the relay-controlled valve slide to the compressed air cylinder of the sand-charging slide, in such a manner that the sand-charging slide and the automatic compressed-air control valve of the pneumatic reciprocating motor are always opened or closed together.

Embodiments of the invention are illustrated diagrammatically, by way of example only, in the accompanying drawings, in which:

Figure 1 shows in perspective a moulding machine for producing foundry cores and foundry moulds constructed in the form of a sand-shooting machine.

Figure 2 shows the upper half of the machine shown in Figure 1 from the side, partially in section and shows the pneumatic control devices which are built into the machine head or otherwise are hidden by a covering hood.

Figure 3 shows an embodiment of the pneumatic relay shown diagrammatically in Figure 2, on a larger scale.

Figure 4 shows an embodiment of the diaphragm valve.

Figure 5 shows an alternative construction and mode of operation of the diaphragm valve.

Figure 6 shows a modification of the diaphragm valve of Figure 4 with the compressed-control air emerging towards the rear.

Figure 7 is a preferred construction of the pressure-reducing valve of Figure 2 supplying the compressed control-air, and

Figure 8 is a modified construction of the pneumatic relay of Figure 3.

According to Figure 1, the moulding machine consists of a machine frame 1 with a machine table 2 which can be raised pneumatically or hydraulically to receive the core box or moulding box (not illustrated), which is urged in known manner against the shooting head 3 of the sand storage container 5 built into the machine head 4. The connection 6 for the supply of compressed air is here provided at the foot of the machine frame 1. Above the sand storage container 5 which is equipped with a sand-charging slide (not illustrated in Figure 1) is arranged a rocking charging container 7 in the form of a chute which carries the pneumatic reciprocating motor 8 which is fed with driving air through the compressed air line 9 in the form of a hose. At the front of the machine head 4 is a regulating member 10 for adjusting the built-in pressure-reducing valve (not illustrated in Figure 1) supplying the control air, and an actuating push-button 11 by means of which the pneumatic automatic mechanism of the machine can likewise be operated pneumatically.

In the embodiment shown in Figure 2, the connection 6 for the compressed-air supply is arranged at the level of the machine head 4 and is in communication, through a branch pipe 12, with a compressed-air accumulator 13 which is housed in the machine frame 1 and which it feeds with compressed air. However, the connection for the compressed air may also be arranged lower down, as indicated in broken lines, in such a manner that the working air supplied to the machine can only reach the compressed-air line 14, and from there to the compressed-air control device and to the pneumatic reciprocating motor 8, through the compressed-air accumulator 13.

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The moulding machine shown in Figure 2, comprises in the upper portion of the machine head 4, a pressure-reducing valve 15 which, depending on the setting of its regulating member 10, supplies the control air line 16 with pressure-reduced control air, the excess pressure of which only amounts to a fraction of an atmosphere. The control air line 16 leads through a control air outlet 17 into the sand storage container 5 through a diaphragm valve 18, which when the sand storage container 5 is not absolutely full, allows the control air to flow freely out of the line 16 into the interior of the sand storage container 5. Connected to the control air line 16 is a pneumatic relay 19 on which act the pressure variations occurring in the compressed control-air line 16. If the full supply of sand closes the diaphragm valve 18 and thus stops the free emergence of the control air, then a slight pressure rise takes place in the control air line 16 and actuates the pneumatic relay 19.

The working side of the pneumatic relay 19 is connected by means of the compressed air line 20 to the compressed air supply line 14 or the compressed-air supply connection 6 or to the compressed-air accumulator 13 from whence it is supplied with high-pressure working-air. The working side of the pneumatic relay 19 controls the control piston 23 of the compressed-air control cylinder 24 and hence the movement of the sand-charging slide 25 of the machine, through two compressed-air lines 21 and 22. The pneumatic reciprocating motor 8 is further supplied, through the compressed-air line 9 with high-pressure working-air from the compressed-air supply line 14 or the compressed-air supply connection 6 or the compressed-air accumulator 13. Connected into the line 9 is an automatic compressed-air control valve 26, the control-piston side 27 of which is connected by means of a compressed-air line 28 to the pneumatic relay 19, in this case through the compressed-air line 21 leading from the pneumatic relay 19 to the closing side of the compressed-air control cylinder 24. If compressed air is supplied to the compressed-air control cylinder 24 through the compressed-air line 21 so that the sand-charging slide is urged towards the right into its closed position, then the compressed air arriving at the automatic compressed-air control valve 26 through the branch pipe 23 simultaneously urges the control piston 29 into its right-hand closed position and thus shuts off the supply of further driving air to the pneumatic reciprocating motor. On the other hand, if compressed air is supplied to the compressed-air control cylinder 24 through the line 22, then the control piston 23, the closing side of which is simultaneously vented through the line 21 and the outlet 30, is again urged towards the left into its open position and the sand-charging slide 25 is thus opened. At the same time, the control piston 29 of the automatic compressed-air control valve 26 is vented through the lines 28 and 21 and the outlet 30. Thus the control piston 26 is again urged into its left-hand open position as a result of which the pneumatic reciprocating motor 8 is again supplied with compressed driving-air and as a result of the reciprocating motions which it produces, replenishes the now open said storage container 5 with sand from the rocking charging container 7. As soon as the level of the supply of sand reaches the height of the diaphragm valve 18 and thus closes the diaphragm valve 18, the pressure rise in the control air line 16 again actuates the pneumatic relay 19 by means of which it not only shuts off the supply of compressed air to the pneumatic vibration motor 8 but also restores the sand-charging slide 25 to its closed position.

The pneumatic relay 19 illustrated in Figure 3 comprises a differential-valve piston which is here formed by a diaphragm 31, gripped at its margin, and a stem 32 the free end of which is constructed in the form of a tapered head 33 which cooperates with a valve

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packing 34. The larger piston face 35 which is formed by the diaphragm 31 and which receives low-pressure compressed air through the control air line 16, and the smaller piston face 36 which is present at the tapered valve 33, 34 and which receives the high-pressure compressed working-air, are in a ratio of size which is greater than the pressure ratio of the working air supplied through the lines 20 and 37 to the control air supplied through the line 16. The working side of the pneumatic relay 19 controls a valve 38 which is here combined with the pneumatic relay 19 to form a structural unit and in this embodiment comprises a twin piston 39 which moves a two-way slide 40. According to the setting of the two-way slide 40 either the compressed-air line 22 is supplied with working air from the supply line 20, as shown, and at the same time the line 21 is vented through the outlet 30, or conversely, the compressed air line 21 is supplied with working air from the supply line 20 and the line 22 is now vented through the outlet 30. When the pressure rise in the control air line 16 bends the diaphragm 31 downwards and thus opens the valve 34, 36, the stem 32 closes the venting bore 41 of the pneumatic relay 19 and allows the working air supplied through the passage 37 to act through the passage 42 on the large left-hand pressure surface of the twin-piston 39. The piston 39 is thus urged towards the right against the lesser pressure exerted by the working air on the smaller annular piston surface 44. If the excess pressure loading the diaphragm 31 is relieved, then the tapered valve 36 closes and the vent 41 opens, as a result of which the pressure of the working air acting on the annular piston surface 44 moves the twin piston 39 back into its left-hand dead centre position. The right-hand end of the valve slide 38 is constructed in the form of an auxiliary valve 45 which belongs to the remaining pneumatic automatic mechanism of the moulding machine. The pneumatic automatic mechanism (not shown) should be visualized as controlling in conventional manner the various working stages of the machine and also the feeding of high pressure working air into the sand supply container 5, from which the sand is expelled through the head 3. The mechanism can be operated by actuating button 11 when the associated valve 45 is closed and accordingly sand slide 25 is in the closed position. The aforementioned features do not constitute part of the present invention.

The diaphragm valve 18 shown on a larger scale in Figure 4 comprises a disc-shaped valve body 46 which is provided with a central bore 47 and over which is stretched a cap-like diaphragm 48. In order to obtain a reliable grip, the cap-like resilient diaphragm 48 comprises a marginal bead 49 which engages in a corresponding marginal groove in the disc-shaped valve body 46. In this case, the valve-body disc 46 comprises a plurality of outlets 17a distributed around it, for the free exit of the control air flowing in through the control air line 16 and arriving behind the resilient diaphragm 48 through the central bore 47. The central air-outlet bore 47 has a diameter of 2 mm. and may be sealed off by a valve plug 50 which is provided at the rear of the diaphragm and made from resilient material in one piece therewith. When, during the replenishing of the sand storage container 5, the level of the sand supply reaches the height of the diaphragm valve 18, the slight pressure exerted by the sand on the resilient diaphragm 48 is sufficient to seal off the small central bore 47 with the diaphragm-valve plug 50 and hence to stop the free exit of the control air which is at a low pressure. As a result, the pressure in the control air line 16 rises slightly, for example to an excess pressure of 0.1 to 0.2 kg./cm.². Because of the correspondingly large difference in area between the diaphragm 31 and the tapered valve 36 of the pneumatic relay 19, this excess pressure is sufficient to actuate the

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pneumatic relay 19 against the pressure of the working air, usually at 6 atmospheres, loading the tapered valve 36.

In the modified construction of the diaphragm valve shown in Figure 5, it is not a question of a necessarily free emergence of control air and instead it may here rather be a case of influencing the flow in a control air circuit 51. For this purpose, the resilient cap-like diaphragm mounted on the disc-shaped valve body 46 is equipped at its rear with a small control piston 52 to which are transmitted the movements of the diaphragm caused by the lateral pressure of the sand filling.

The diaphragm valve 18 shown in Figure 6 differs from the diaphragm valve in Figure 4 primarily in that the control air supplied through the lines 16 and 17 does not emerge freely into the interior of the sand storage container 5 but is drawn off towards the rear by means of an escape pipe 17b and emerges into the open. When, during the filling with sand, the level of the sand reaches the cap-like resilient diaphragm 48, this is urged against the bore 47 and prevents the further emergence of control air. This has the effect of causing a slight pressure rise in the line 16 and leads to the actuation of the pneumatic relay.

Through the pressure-reducing valve 15 shown in Figure 7, the pressure of the working air which is supplied through the line 14 is automatically reduced to a specific fraction of excess pressure. This is brought about by means of a differential piston 53 which is provided on its smaller rear piston face 55 with a seal 54 which can seal off a bore 56. In the embodiment illustrated, compressed air at 6 atmospheres flows out of the bore 56 until the pressure in the line 16 has reached a pressure of 0.2 atmosphere. As soon as this pressure is reached, the pressure exerted on the larger piston face 58 through the branch line 57 is sufficient to urge the piston 53 with its seal 55 against the outlet bore 56 and to seal this off against the pressure of 6 atmospheres prevailing in the bore 56. As soon as the pressure of the air in the line 16 and hence also in the branch line 57 drops, the piston 53 allows further air to flow out of the aperture 56 until the pressure in the outlet line 16 has again reached the value of 0.2 atmosphere. In this manner the piston 53 swings constantly backwards and forwards and ensures that a pressure of only 0.2 atmosphere prevails constantly in the outlet line 16.

The pneumatic relay 19 shown in Figure 8 differs from the pneumatic relay of Figure 3 primarily in the fact that the diaphragm is replaced by a piston 60 which is displaceable in the housing 59 and the smaller piston face 36 is additionally subject to the pressure of a spring 61. The stem 32 comprises a longitudinal groove 62 which is in communication with the passage 42. If the pressure rises in the control air line 16, it urges the piston 60 downwards and overcomes the pressure exerted by the spring 61 and the working air loading the smaller piston face 36. As a result, the valve 34, 36 is opened and the valve 63, 64 is closed at the same time. The working air supplied through the passage 37 can thus act on the piston face 43 through the longitudinal groove 62 and the passage 42 and displace the twin piston 39 towards the right. As soon as the pressure in the control air line 16 drops again, the spring 61, together with the working air loading the piston face 36, again urges the stem 32 upwards, as a result of which the valve 34, 36 is closed. At the same time, the valve 63, 64 is opened and allows the compressed air loading the piston face 43 to flow away through the passage 42, the longitudinal groove 62 and the venting bore 41 into the open, as a result of which the twin piston 39 can again move towards the left.

I claim:

1. A moulding machine for the production of foundry cores and foundry moulds comprising a replenishable closable sand storage container for conveying sand from

said sand storage container into mould boxes to be filled, a conduit for working pressure air, a charging device for the periodic replenishment of said sand storage container, said charging device being connected to said conduit and controlled by the working air supplied to it, a pressure-reducing valve which is pneumatically connected to said conduit for the working pressure air and reduces the excess pressure of the pressure to a fraction of an atmosphere, said low pressure air constituting control air, a diaphragm valve having a resilient diaphragm and a control air pipe for pneumatically connecting said pressure reducing valve and said diaphragm valve, said diaphragm valve being mounted in the sand storage container in such a manner that a predetermined supply of sand in said container abuts against said resilient diaphragm thereby flexing the same, flexing of said diaphragm varying the air pressure in the control air pipe, and a control means responsive to the variation in the control air pressure and controlling the working air supplied to the charging device.

2. A moulding machine as claimed in claim 1, characterized in that said diaphragm valve consists of a disc-shaped valve body having a central bore and a cap-like diaphragm which is stretched over said valve body.

3. A moulding machine as claimed in claim 1, characterized in that said diaphragm valve comprises at least one outlet for the free emergence of control air, which outlet can be sealed off by said diaphragm.

4. A moulding machine as claimed in claim 1, characterized in that said diaphragm valve consists of a disc-shaped valve body having a central air outlet bore of the order of about 2 mm. diameter and at least one air passage, a cap-like diaphragm which is stretched over said valve body, and at the rear of said diaphragm a valve member in the form of an axially movable tapered valve plug which can seal off said central air outlet bore and which is made of resilient material in one piece with said diaphragm.

5. A moulding machine as claimed in claim 1, characterized in that said diaphragm valve consists of a disc-shaped valve body having a central bore and a marginal groove, and a cap-like diaphragm having a marginal bead, said diaphragm being stretched over said valve body with said marginal bead engaged in said marginal groove.

6. A moulding machine as claimed in claim 1, characterized in that said diaphragm valve consists of a disc-shaped valve body having a central bore, a cap-like diaphragm stretched over said valve body, and a valve member in the form of a small control piston provided at the rear of the diaphragm, which valve member influences said control air pipe.

7. In a machine for forming foundry cores and charging core boxes with moulding sand, in combination, a sand storage container, a source of sand communicating with said container for supplying sand thereto, a sand discharge control member interposed in the communication between said supply of sand and said container and movable between a sand discharge position and a closure position, a first conduit means for high pressure working air coacting with said control member to move the latter into either one of its positions, a pneumatic first control valve included in said first conduit means for controlling the flow of working air through said first conduit means, said control valve being movable between a position causing movement of the discharge control member into the discharge position and a position causing movement of said member into the closure position, a second conduit means for low pressure control air coacting with said first control valve to control the position thereof, and a second control valve included in said second conduit means to control the flow of control air therethrough, said second control valve being sensitive to the pressure conditions in said storage container and controlling the first control valve for causing movement of the discharge control member into the closure position

in response to a pressure within said container above a predetermined value and for causing movement of the discharge control member into the discharge position in response to a pressure in the container below said predetermined value.

8. In a machine for forming foundry cores and charging core boxes with moulding sand, in combination, a sand storage container, a source of sand communicating with said container for supplying sand thereto, a sand discharge control member interposed in the communication between said supply of sand and said container and movable between a sand discharge position and a closure position, a first conduit means for high pressure working air coacting with said control member to move the latter into either one of its positions, a pneumatic first control valve included in said first conduit means for controlling the flow of working air through said first conduit means, said control valve being movable between a position causing movement of the discharge control member into the discharge position and a position causing movement of said member into the closure position, a second conduit means, a pressure reducing valve connecting said second conduit means to said first conduit means for supplying low pressure control air to the second conduit means, said second conduit means coacting with said first control valve to control the position thereof, and a second control valve connected to said second conduit means to control the pneumatic action of control air on said first control valve, said second control valve being sensitive to the pressure conditions of sand in said storage container and controlling the first control valve for causing movement of the discharge control member into the closure position in response to a quantity of sand within said container above a predetermined value and for causing movement of the discharge control member into the discharge position in response to a quantity of sand in the container below a predetermined value.

9. A moulding machine as claimed in claim 8, wherein said second control valve comprises a differential-valve piston having a larger piston face which is subjected to the control air pressure and a smaller piston face which is subjected to the working air pressure, said larger and smaller faces having a ratio of size which is greater than the pressure ratio of working air to control air.

10. A moulding machine as claimed in claim 8, wherein said second control valve comprises a differential-valve piston having a larger piston face which is subjected to the control air pressure and a smaller piston face which is subjected to the working air pressure, said larger and smaller faces having a ratio of size which is greater than the pressure ratio of working air to control air, and said larger piston face being formed by a peripherally supported diaphragm having a stem terminating at its free end in a tapered head which forms said smaller piston face and which cooperates with a valve packing.

11. A moulding machine as claimed in claim 8, wherein said pressure reducing valve comprises a housing, a differential piston mounted in said housing which piston controls the passage of air from said working air conduit means to said low pressure control air conduit means, and larger and smaller piston faces on said differential piston, said smaller piston face being connected to said working air conduit means, and said larger piston face being connected through a branch passage to said control air conduit means, said larger piston face being proportionate in size to said smaller piston face in a ratio which is equal to the pressure ratio between the working air and the control air.

12. A moulding machine as claimed in claim 8, wherein said pressure-reducing valve comprises a housing, a differential piston mounted in said housing, which piston controls the passage of air from said high pressure working air conduit means to said low pressure control air conduit means and larger and smaller piston faces on said differential piston, said smaller piston face being

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connected to said working air supply conduit means, and said larger piston face being connected through a branch passage to said control air conduit means, said larger piston face being proportionate in size to said smaller piston face in a ratio which is equal to the pressure ratio between the working air and the control air, said smaller piston face being in the form of a valve body, said body cooperating with an aperture in the working air conduit means.

13. A machine according to claim 8 wherein said second conduit means has an escape port for the escape of control air into said storage container, and further comprising control means controlling the escape of control air through said port and controlled by the sand level in said container so as to throttle the escape of control air through said port in response to a rising sand level thereby correspondingly varying the control air pressure in said second conduit means, a control air pressure above a predetermined value activating said second control valve to control the first control valve for moving said discharge control member into its closing position and a control air pressure below said predetermined value activating said second control valve to control the first control valve for moving the discharge control member into its open position.

14. A machine according to claim 13 wherein said control means comprises a stationary valve member including a vent communicating with said port and a movable valve member coacting with said stationary valve member and the vent thereof, said movable valve member being biased into a position uncovering said vent for the escape of control air and being responsive to the pressure of sand in said storage container to effect movement of the movable control member into a position closing said vent in response to a sand level above said predetermined value.

15. A machine according to claim 8 wherein said second control valve comprises a cylinder connected to the first conduit means and a valve member slidable in reference to the cylinder, said first conduit means including two working air conduits connecting the cylinder to

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said first control valve, the position of the valve member controlling the flow of working air through either of said conduits to move the first control valve into either one of its positions, the position of the valve member being controlled by the pressure conditions in said storage container.

16. A machine according to claim 8 and comprising a pressure operated reciprocating motor coacting with the storage container for agitating the same, said working air first conduit means being connected to said motor, a third control valve included in the connection between the motor and the first conduit means, and conduit means connecting the third control valve to the second control valve, said third control valve being controlled by the second control valve to supply working air to the motor when the second control valve is activated in response to a pressure in the container above said predetermined value.

17. A machine according to claim 15 wherein said slidable valve member comprises a twin piston and a valve slide, said slide controlling said two working air conduits and being controlled by the position of said piston.

18. A machine according to claim 16 wherein the working air conduit means connected to the motor and the working air conduit means for effecting movement of said sand discharge control member are interconnected for joint control by said third control valve so that simultaneously said control member is moved into the discharge position and the motor is supplied with working air.

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