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(54) **Sand-introducing-type sand molding machine**

Sandzufuhr- und Sandformmaschine

Machine de moulage à introduction de sable

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(56) References cited:
EP-A- 0 960 669 JP-A- 6 277 800
JP-A- 10 099 941 US-A1- 2001 009 184
US-B1- 6 253 827

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Description

[Field of Invention]

[0001] The present invention relates to a sand-introducing-type sand molding machine that produces a sand mold by introducing molding sand into a molding flask or a molding space and by filling the space with it by using compressed air.

[Background of the Invention]

[0002] There has been a blowing-type sand molding machine as one of this kind of machine. It generally comprises a blow head, a plurality of adjusting means for adjusting the pressure and flow of compressed air, wherein outlets of the means communicate with the blow head in parallel, a source of the compressed air that communicates with the inlets of the means, pressure-detecting means for detecting the pressure inside the blow head, and a controller that controls the operations of the adjusting means and the pressure-detecting means that is electrically connected to them. The molding machine supplies compressed air into the blow head to let the molding sand in the blow head move into a molding flask or a molding space and fills it with the sand, and then makes a sand mold by compressing the molding sand that has been filled (see Japanese Patent Laid-open Publication No. H06-277800).

[0003] The conventional blowing-type sand molding machine cannot adequately control the pressure inside the blow head so as to have it correspond to the pattern shape, because the supplied compressed air changes the pressure of its inside in a stepwise manner or slowly, as in Fig. 3. Accordingly, it does not fill enough molding sand into the molding flask, etc., or it wastes compressed air.

[0004] The purpose of the present invention is to resolve these problems and to provide a sand-introducing-type sand molding machine that can adequately control the pressure-variation inside the sand tank to correspond to the pattern shape by supplying the compressed air.

[Summary of the Invention]

[0005] In order to accomplish this purpose, the sand-introducing-type sand molding machine of the present invention produces a sand mold by introducing molding sand into a molding flask or a molding space and filling the space with it by using compressed air. It comprises a sand tank for pressing the molding sand by the compressed air that is equipped with compressed air supplying devices to fluidize the molding sand, a communicating tube that communicates with the sand tank, a plurality of adjusting means for adjusting the pressure and flow of the compressed air which leading the sand tank that are installed in parallel, and each outlet of which is connected to the communicating tube, and each inlet of which is

connected to the source of the compressed air, an electro-pneumatic proportional valve, of which the supply and discharge ports are respectively connected to a source of the compressed air and to the communicating tube, a pressure-detecting means that is provided on the sand tank for detecting the pressure inside it, and a controller that controls the operations of the plurality of the adjusting means and the electro-pneumatic proportional valve that is electrically connected to the plurality of the adjusting means and the pressure-detecting means and the electro-pneumatic proportional valve.

[0006] Compressed air supplying devices to fluidize the molding sand, is the means that blows the compressed air to the inside of the sand tank, and the method is no object. For example, a parting plate of the permeable partitions off dual structure, i.e. the trunk wall of the main body of sand tank making pressure tank structure, and to have a hollow chamber is formed, it is possible with the thing which comprised this parting porous plate. As for this parting plate, a lot of through-holes which a mean pore size is 10-500 μ m, and is smaller than the particle size of the sand particle are provided and thickness can be comprised with the plastic board which is 5 - 20mm.

[0007] Also, even the constitution that the parting plate which does not let air, and drilled a minute bore is possible.

[0008] Also, the sand tank has at least a function to pressurize the top surface of the molding sand by the compressed air which the supplying devices is not put through.

[0009] Also, even the pressure force of a source of the compressed air connected to the adjusting means and a source of the compressed air connected to the electro-pneumatic proportion valve may be adjusted by different or same pressure. In addition, these sources of the compressed air may be integrated into one.

[0010] The apparatus constructed as above first sets the operating conditions of the adjusting means in the controller, and then supplies the compressed air from the adjusting means to control the pressure inside the sand tank to cause it to be less than the appropriate pressure needed for filling the sand so as to have it correspond to the pattern shape in it. Then, under the control of the pressure-detecting means, it opens the plurality of adjusting means in a stepwise manner or all at once, as well as operating the electro-pneumatic proportional valve. In this way, it causes the pressure variation inside the sand tank to correspond to a given ideal curve.

[0011] Here, the given ideal pressure curve is a pressure curve to realize ideal filling density.

[0012] For example, the filling density of the upper part and the lower part of mold become high and the central part of mold with the pattern becomes low in the ideal filling density on a filling cavity, and a mold density is similar within the central, upper and the lower part and mold quality is high when it is compressed afterwards.

[0013] As is evident from these descriptions, the

present invention is under the control of the pressure-detecting means, it opens the plurality of adjusting means in a stepwise manner or all at once, as well as operating the electro-pneumatic proportional valve. Thus it can achieve such a practical effect that the pressure variation inside the sand tank is caused to correspond to an ideal curve so as to correspond to the pattern shape.

[Brief Descriptions of the Drawings]

[0014]

Fig. 1 is a schematic drawing of the sand molding machine of the present invention.

Fig. 2 is a graph that shows a pressure variation inside the sand tank.

Fig. 3 is a graph that shows a pressure variation inside a conventional blow head.

Fig. 4 is a schematic drawing of the sand molding machine of the present invention.

Fig. 5 is a graph that shows an ideal pressure curve inside the sand tank.

Fig. 6 is a compressed air pressure curve supplied to sand tank 1 from VP valve 5.

Fig. 7 is a compressed air pressure curve supplied to sand tank 1 from VY valve 6.

Fig. 8 is a graph that shows a pressure curve inside the sand tank which is added up

[Description of the Preferred Embodiment]

[0015] One embodiment of the sand-introducing-type sand molding machine of the present invention is now explained in detail based on Figs. 1 and 2. As in Fig. 1, the molding machine comprises a sand tank 1 for pressing the molding sand by the compressed air, which sand tank is equipped with compressed air supplying devices to fluidize the molding sand, a communicating tube 2 that communicates with the sand tank 1, a plurality of VP valves 5 (flow- and pressure-control valves) as a plurality of adjusting means for adjusting the pressure and flow of the compressed air that are installed in parallel, and each outlet of which is connected to the communicating tube 2, and each inlet of which is connected to the source of the compressed air 4a through an auxiliary tube 3, VY valve (an electro-pneumatic proportional valve) 6, of which the supply and discharge ports are respectively connected to the source of the compressed air 4b and to the communication tube 2, a pressure-detecting means 7 that is provided on the sand tank 1 for detecting the pressure inside it, and a controller 8 that controls the

operations of a plurality of the VP valves 5 and the pressure-detecting means 7 that is electrically connected to them.

[0016] An electro-pneumatic proportional valve is an electromagnetic valve that supplies compressed air at any pressure on instructions sent by a controller.

[0017] The apparatus constructed as above first sets the operating conditions of a plurality of the VP valves 5 in the controller 8, and then supplies the compressed air from the VP valves 5 to control the pressure inside the sand tank 1 to cause it to be less than the appropriate pressure needed for filling the sand so as to have it correspond to the pattern shape in it. Then, under the control of the pressure-detecting means 7, it opens a plurality of the VP valves 5 in a stepwise manner, as well as operating the VY valve 6. In this way, it causes the pressure variation inside the sand tank 1 to correspond to a given ideal curve as in Fig. 2.

[0018] Using this constitution of the invention that such a given ideal pressure curves can be pictured in, a method to realize ideal filling density is explained below. A schematic drawing of the sand molding machine of the present invention is shown in FIG. 4. A graph that shows an ideal pressure curve inside the sand tank is shown in Fig. 5.

[0019] Fig. 4 is formed almost same as Fig. 1. A controller 8 that controls the operations of the VP valves 5 and the VY valve 6 that is electrically connected to the VP valves 5 and the pressure-detecting means 7 and the VY valve 6, being constituted is different.

[0020] The sand molding machine first sets the operating conditions of a plurality of the VP valves 5 and VY valve 6 and ideal pressure curve in the controller 8, and then supplies the compressed air from the VP valves 5 to control the pressure inside the sand tank 1 to cause it to be less than the appropriate pressure needed for filling the sand so as to have it correspond to the pattern shape in it, under the control of the pressure-detecting means 7, it opens and closes a plurality of the VP valves 5 in a stepwise manner up to the required maximum quantity, as well as operating the VY valve 6.

[0021] As a result of above, at the time of blow-filling up, the filling density of the sand S of the upper part and the lower part is high on a filling cavity, and central part with the pattern becomes low.

[0022] In order to make the uniform density mold, it is necessary to obtain the ideal pressure curve inside the sand tank (FIG. 5) in order it blows and changes the sand tank internal pressure of filling up process, to do this filling up.

[0023] The compressed air pressure curve supplied to sand tank 1 from VP valve 5 is shown in Fig. 6. Also, the compressed air pressure curve supplied to sand tank 1 from VY valve 6 is shown in Fig. 7. In addition, these are synthesized, the pressure curve in sand tank 1 is ideal as shown in Fig. 8.

[0024] The synthesized pressure force curve (FIG. 8) in a sand tank is adjusted to extremely resemble an ideal

pressure force curve (FIG. 5).

[0025] Pressure curve inside the sand tank (Fig. 8) which is synthesized is adjusted in order quite to resemble to ideal pressure curve (Fig. 5).

[0026] As a result of this, the filling density of sand S of the upper part and the lower part is high, and central part with the pattern becomes low, and it is with a high quality and mold density is similar to the central part with the pattern and the lower part on a filling cavity when it is compressed afterwards.

[0027] Note that the pressure force to an adjusting means assumes 0.1- 0.3MPa, the pressure force to an electro-pneumatic proportional valve can be assumed 0.5MPa degree. Here, an electro-pneumatic proportional valve can just use factory air pressure in what can adjust for given pressure by electrical signal.

[0028] In this embodiment, the sand tank 1 has compressed air supplying devices to fluidize the molding sand and a function to pressurize the molding sand by blown compressed air- But the invention is not restricted to this construction. The sand tank may be any construction in so far as it has a function to pressurize the molding sand by the compressed air. Furthermore, if you can obtain ideal sand filling, it is clear for a uniform mold to be possible with the compression after that by squeeze board B1 and B2.

[0029] Also, as for the molding sand of the present invention, the green sand which designates the bentonite as the binder is most desirable. Also, the present invention can be used for sand filling not only to the molding flask which is the tight molding machine of the existence frame but also to the molding space which is the flaskless molding machine.

Claims

1. A sand-introducing-type sand molding machine for making a sand mold by introducing molding sand into a molding flask or a molding space and filling the space with it by using compressed air, comprising:

a sand tank for pressing the molding sand by the compressed air that is equipped with compressed air supplying devices to fluidize the molding sand,

a communicating tube that communicates with the sand tank,

a plurality of adjusting means for adjusting the pressure and flow of the compressed air that are installed in parallel, and each outlet of which is connected to the communicating tube, and each inlet of which is connected to the source of the compressed air,

a pressure-detecting means for detecting the pressure inside the sand tank that is furnished on the sand tank, and

a controller that controls the operations of the plurality of the adjusting means that is electrically connected to the plurality of the adjusting means and the pressure-detecting means, **characterized by**

an electro-pneumatic proportional valve, of which supply and discharge ports are respectively connected to the source of the compressed air and to the communicating tube.

2. A sand-introducing-type sand molding machine according to claim 1, wherein the controller controls the operations of the plurality of the adjusting means and the electro-pneumatic proportional valve and is electrically connected to the plurality of the adjusting means and the pressure-detecting means and the electro-pneumatic proportional valve.
3. A sand-introducing-type sand molding machine according to the claim 1 or 2, wherein the sand tank has at least a function to pressurize the top surface of the molding sand by the compressed air which the supplying devices is not put through.
4. A sand-introducing-type sand molding machine according to the claim 1 or 2, wherein the pressure force of a source of the compressed air connected to the adjusting means and the electro-pneumatic proportion valve being adjusted by different pressure
5. A sand-introducing-type sand molding machine according to the claim 1 or 2, wherein the pressure force of a source of the compressed air connected to the adjusting means and a source of the compressed air connected to the electro-pneumatic proportion valve being adjusted by same pressure.
6. A sand-introducing-type sand molding machine according to the claim 1 or 2, wherein a source of the compressed air connected to the adjusting means and a source of the compressed air connected to the electro-pneumatic proportion valve being integrated into one.

Patentansprüche

1. Sandformmaschine vom Sandzufuhr-Typ zum Herstellen einer Sandform durch Zuführen von Formsand in einen Formkasten oder einen Formraum und Füllen des Raums damit unter Verwendung von Druckluft, umfassend:

einen Sandbehälter zum Pressen des Formsands durch die Druckluft, welcher mit Druckluftzufuhrvorrichtungen ausgestattet ist, um den Formsand zu fluidisieren,
eine kommunizierende Röhre, welche mit dem

- Sandbehälter kommuniziert,
eine Mehrzahl von Anpassungsmitteln zum An-
passen des Drucks und des Flusses der Druck-
luft, welche parallel installiert sind und bei denen
ihr Auslass jeweils mit der kommunizierenden
Röhre verbunden ist und bei denen ihr Einlass
jeweils mit der Quelle der Druckluft verbunden
ist,
ein Druck-Erfassungsmittel zum Erfassen des
Drucks innerhalb des Sandbehälters,
welches auf dem Sandbehälter angeordnet ist,
und
eine Steuereinheit, welche den Betrieb der
Mehrzahl von Anpassungsmitteln steuert, wel-
che elektrisch mit der Mehrzahl von Anpas-
sungsmitteln und dem Druck-Erfassungsmittel
verbunden ist, **gekennzeichnet durch** ein elek-
tropneumatisches Proportionalventil, von wel-
chem Zufuhr- und Auslassöffnungen mit der
Quelle der Druckluft bzw. mit der kommunizie-
renden Röhre verbunden sind.
2. Sandformmaschine vom Sandzufuhr-Typ nach An-
spruch 1, wobei die Steuereinheit den Betrieb der
Mehrzahl von Anpassungsmitteln und das elektro-
pneumatische Proportionalventil steuert und elek-
trisch mit der Mehrzahl von Anpassungsmitteln und
den Druck-Erfassungsmitteln und dem elektropneu-
matischen Proportionalventil verbunden ist.
 3. Sandformmaschine vom Sandzufuhr-Typ nach An-
spruch 1 oder 2, wobei der Sandbehälter mindestens
eine Funktion aufweist zum Unter-Druck-Setzen der
Oberfläche des Formsands durch die Druckluft, wel-
che den Zufuhrvorrichtungen nicht durchgebracht
wird.
 4. Sandformmaschine vom Sandzufuhr-Typ nach An-
spruch 1 oder 2, wobei die Druckkraft einer Quelle
der Druckluft, welche mit den Anpassungsmitteln
und dem elektropneumatischen Proportionalventil
verbunden ist, durch unterschiedlichen Druck ange-
passt wird.
 5. Sandformmaschine vom Sandzufuhr-Typ nach An-
spruch 1 oder 2, wobei die Druckkraft einer Quelle
der Druckluft, welche mit den Anpassungsmitteln
verbunden ist und einer Quelle der Druckluft, welche
mit dem elektropneumatischen Proportionalventil
verbunden ist, durch denselben Druck angepasst
wird.
 6. Sandformmaschine vom Sandzufuhr-Typ nach An-
spruch 1 oder 2, wobei eine Quelle der Druckluft,
welche mit den Anpassungsmitteln verbunden ist
und eine Quelle der Druckluft, welche mit dem elek-
tropneumatischen Proportionalventil verbunden ist,
zu einer Einheit integriert sind.

Revendications

1. Machine de moulage au sable du type à introduction
de sable pour fabriquer un moule en sable en intro-
duisant du sable de moulage dans un châssis de
moulage ou un espace de moulage et en remplissant
l'espace avec celui-ci en utilisant de l'air comprimé,
comprenant :

un réservoir de sable pour presser le sable de
moulage par l'air comprimé qui est équipé de
dispositifs d'amenée d'air comprimé pour fluidi-
ser le sable de moulage,
un tube de communication qui communique
avec le réservoir de sable,
une pluralité de moyens d'ajustement pour ajus-
ter la pression et le débit de l'air comprimé qui
sont installés en parallèle, et dont chaque sortie
est connectée au tube de communication, et
dont chaque entrée est connectée à la source
de l'air comprimé,
un moyen de détection de pression pour détec-
ter la pression à l'intérieur du réservoir de sable
qui est disposé sur le réservoir de sable, et
un contrôleur qui commande les opérations de
la pluralité des moyens d'ajustement qui est
électriquement connecté à la pluralité des
moyens d'ajustement et au moyen de détection
de pression, **caractérisée par**
une vanne électropneumatique proportionnelle,
dont des orifices d'admission et de décharge
sont respectivement connectés à la source de
l'air comprimé et au tube de communication.
2. Machine de moulage au sable du type à introduction
de sable selon la revendication 1, dans laquelle le
contrôleur commande les opérations de la pluralité
des moyens d'ajustement et de la vanne électrop-
neumatique proportionnelle et est électriquement
connecté à la pluralité des moyens d'ajustement et
au moyen de détection de pression et à la vanne
électropneumatique proportionnelle.
3. Machine de moulage au sable du type à introduction
de sable selon la revendication 1 ou 2, dans laquelle
le réservoir de sable a au moins une fonction de mise
sous pression de la surface supérieure du sable de
moulage par l'air comprimé à travers laquelle les dis-
positifs d'amenée ne passent pas.
4. Machine de moulage au sable du type à introduction
de sable selon la revendication 1 ou 2, dans laquelle
la force de pression d'une source de l'air comprimé
connectée aux moyens d'ajustement et à la vanne
électropneumatique proportionnelle étant ajustée
par une pression différente.
5. Machine de moulage au sable du type à introduction

de sable selon la revendication 1 ou 2, dans laquelle la force de pression d'une source de l'air comprimé connectée aux moyens d'ajustement et d'une source de l'air comprimé connectée à la vanne électropneumatique proportionnelle étant ajustée par la même pression. 5

6. Machine de moulage au sable du type à introduction de sable selon la revendication 1 ou 2, dans laquelle une source de l'air comprimé connectée aux moyens d'ajustement et une source de l'air comprimé connectée à la vanne électropneumatique proportionnelle étant intégrées en une seule. 10

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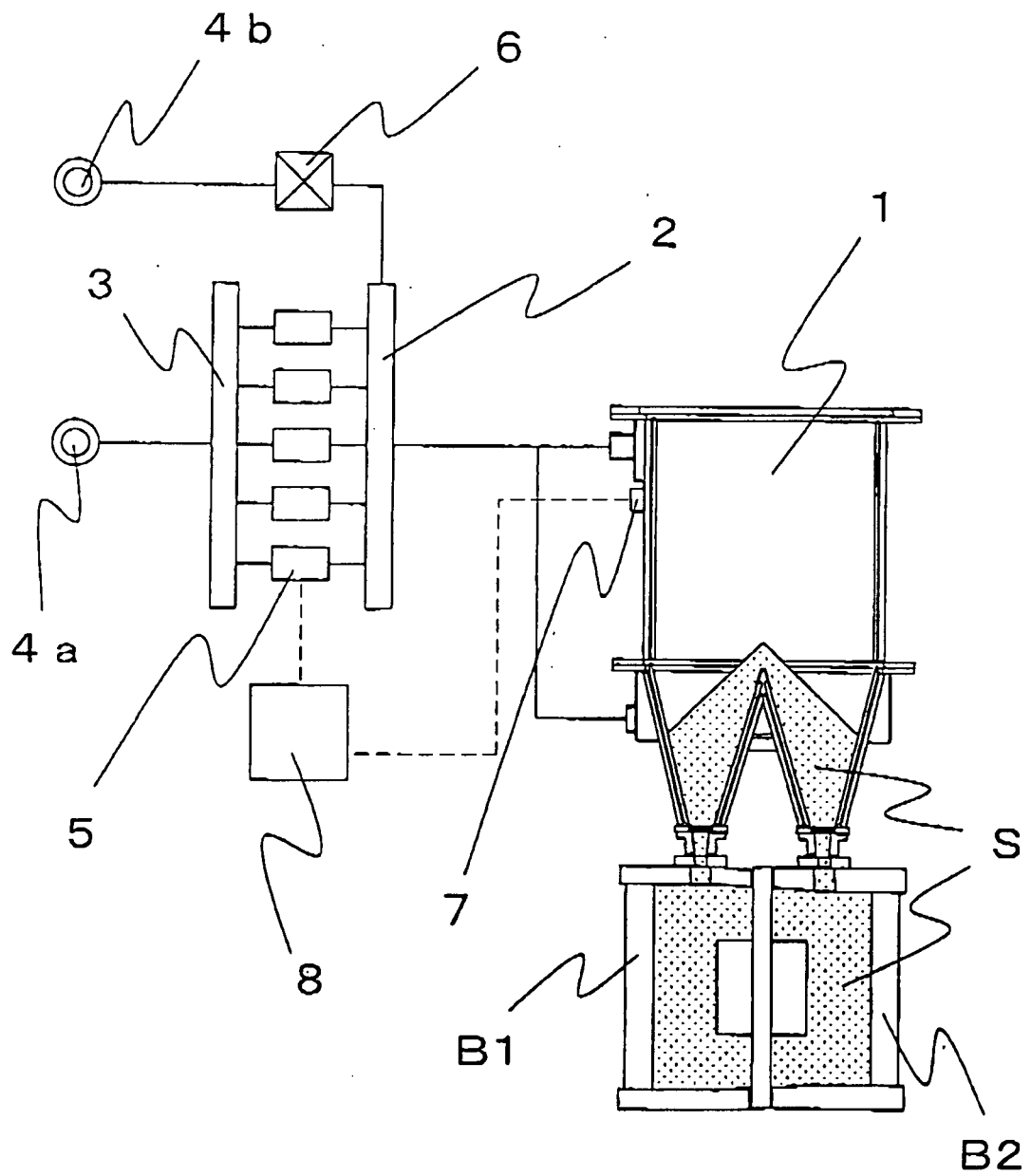


Fig. 1

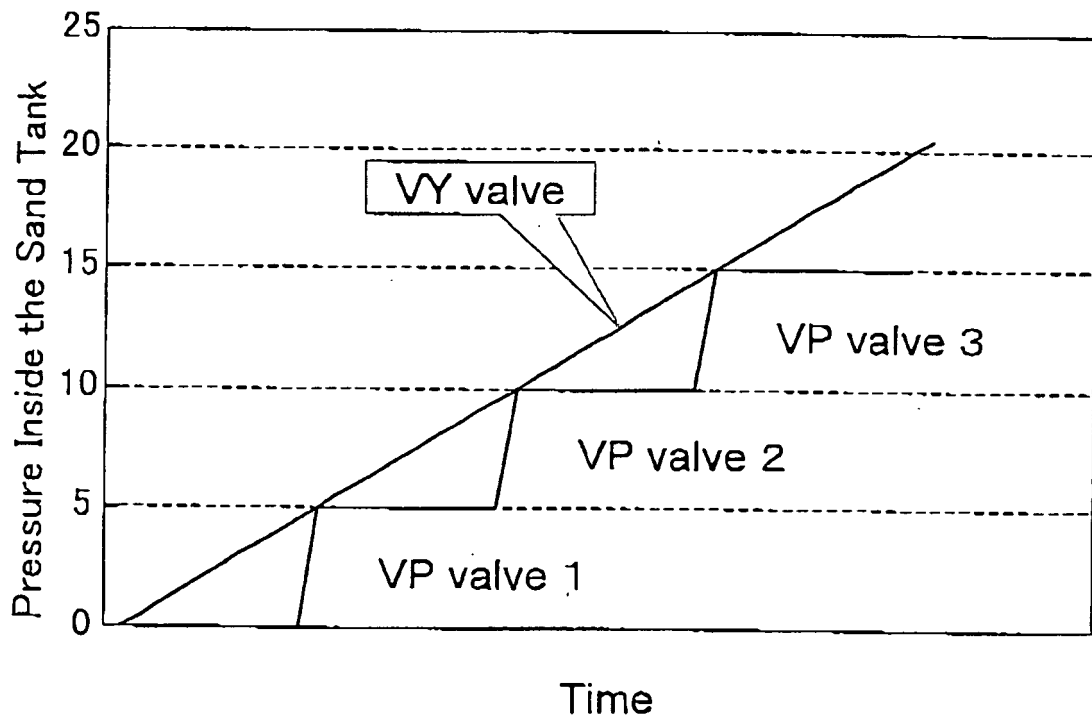


Fig. 2

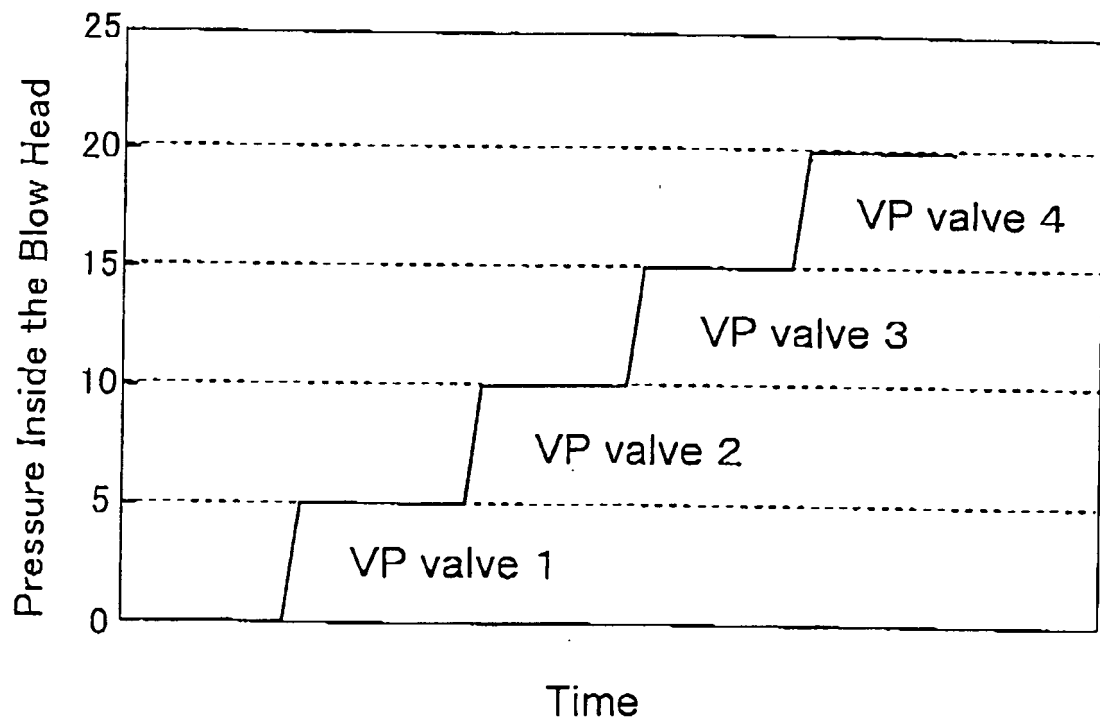


Fig. 3

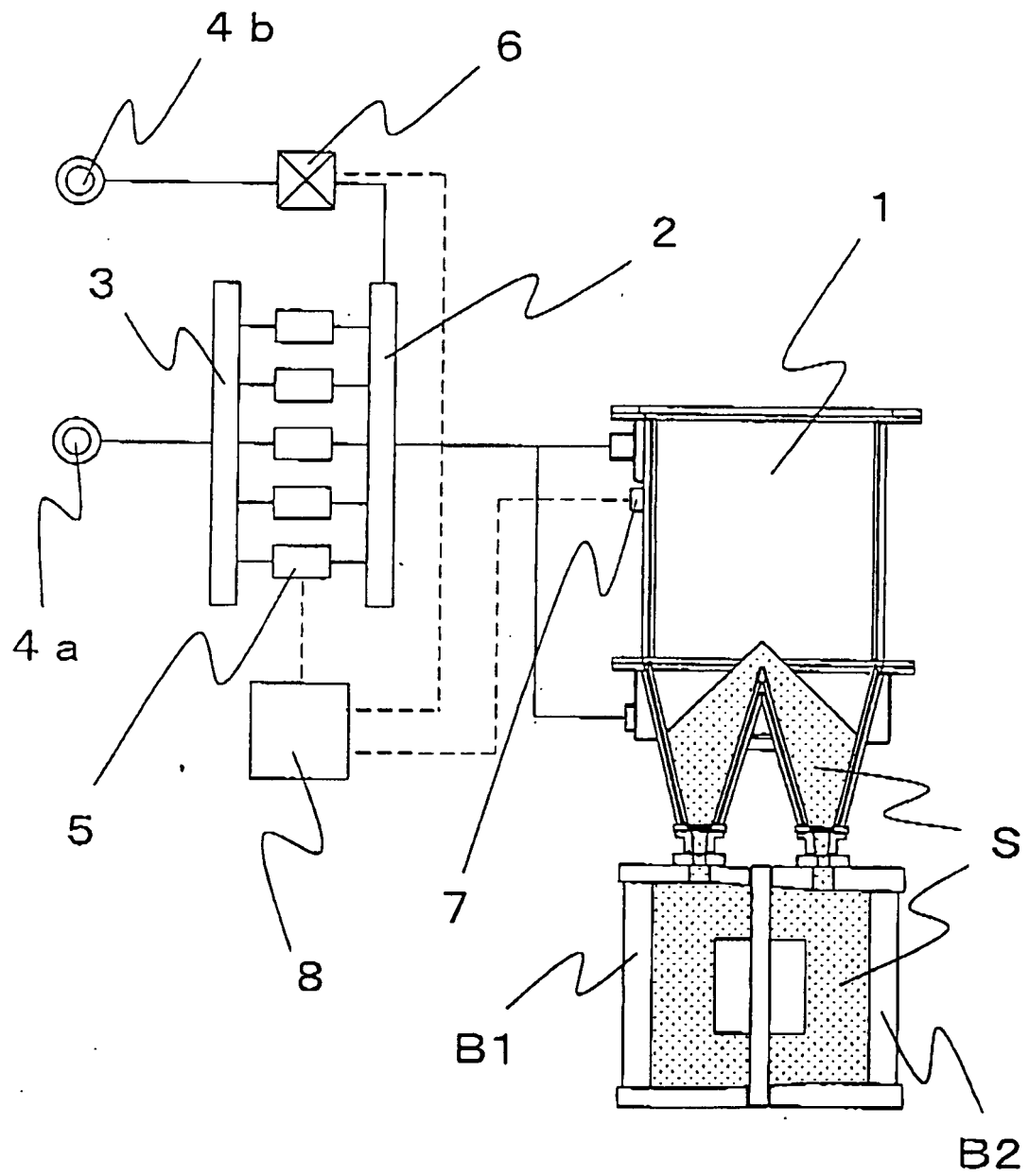


Fig. 4

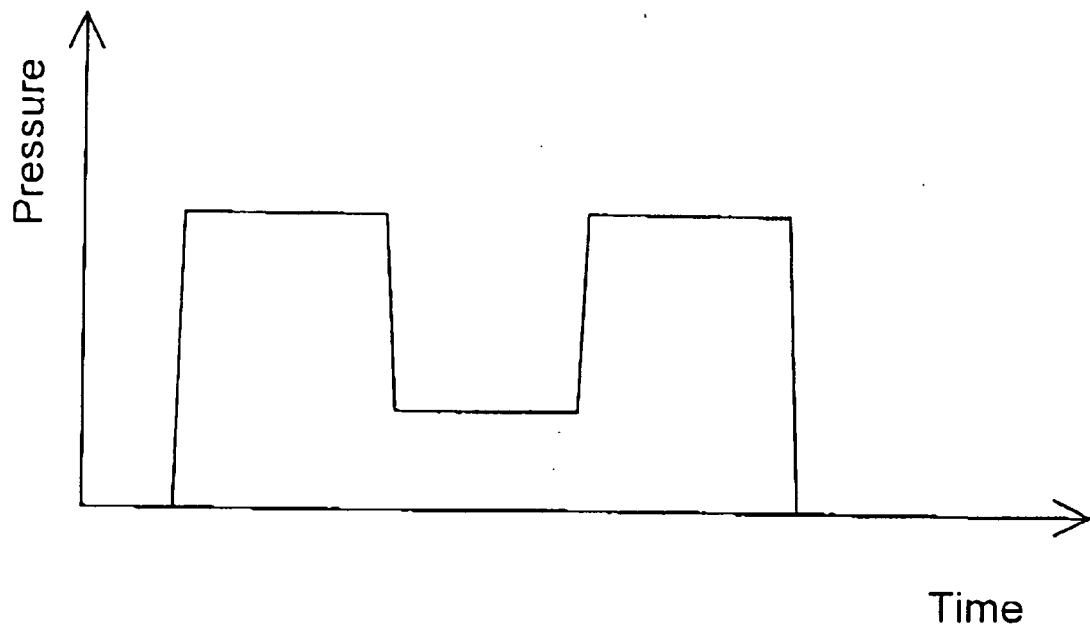


Fig. 5

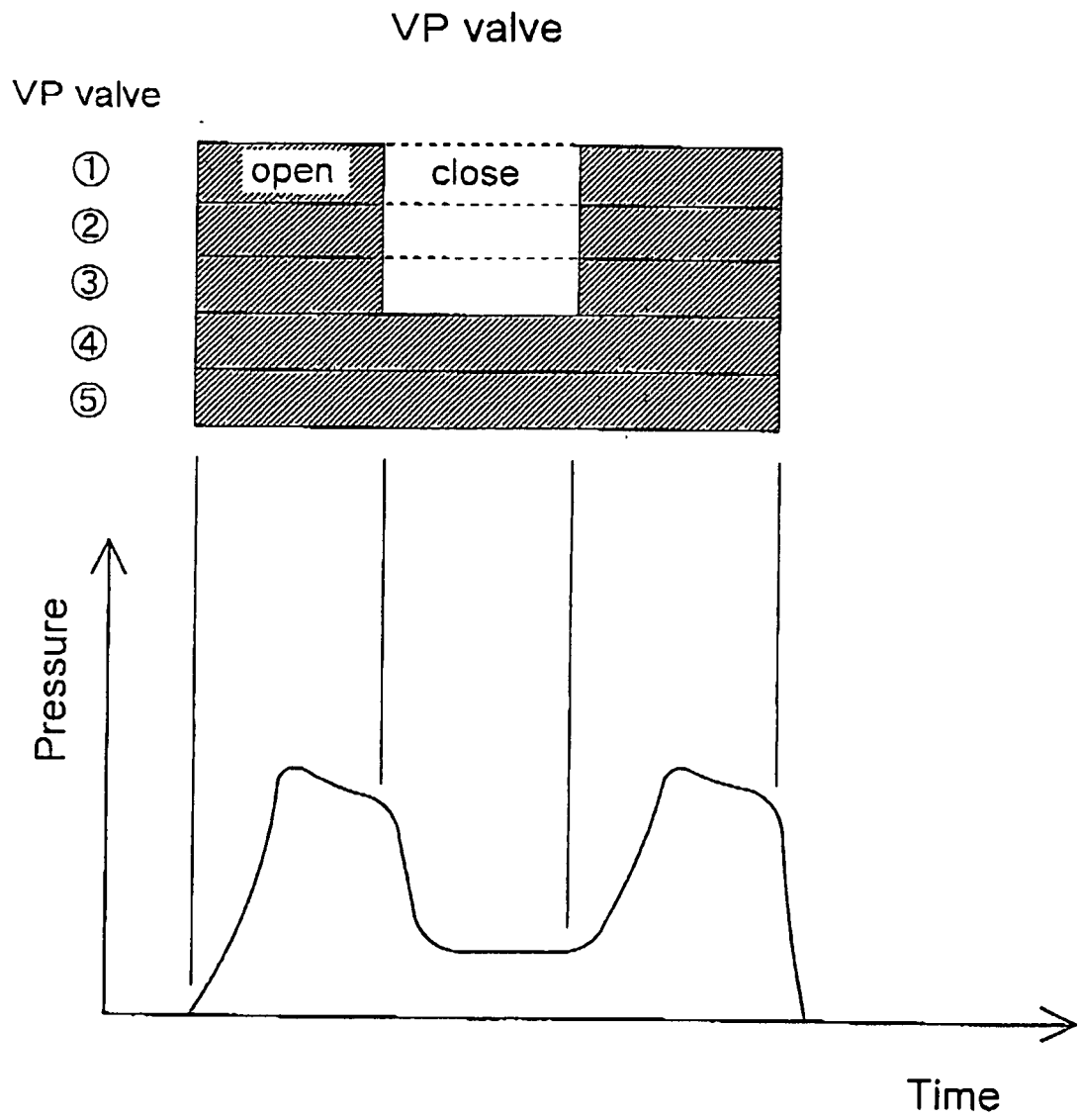


Fig. 6

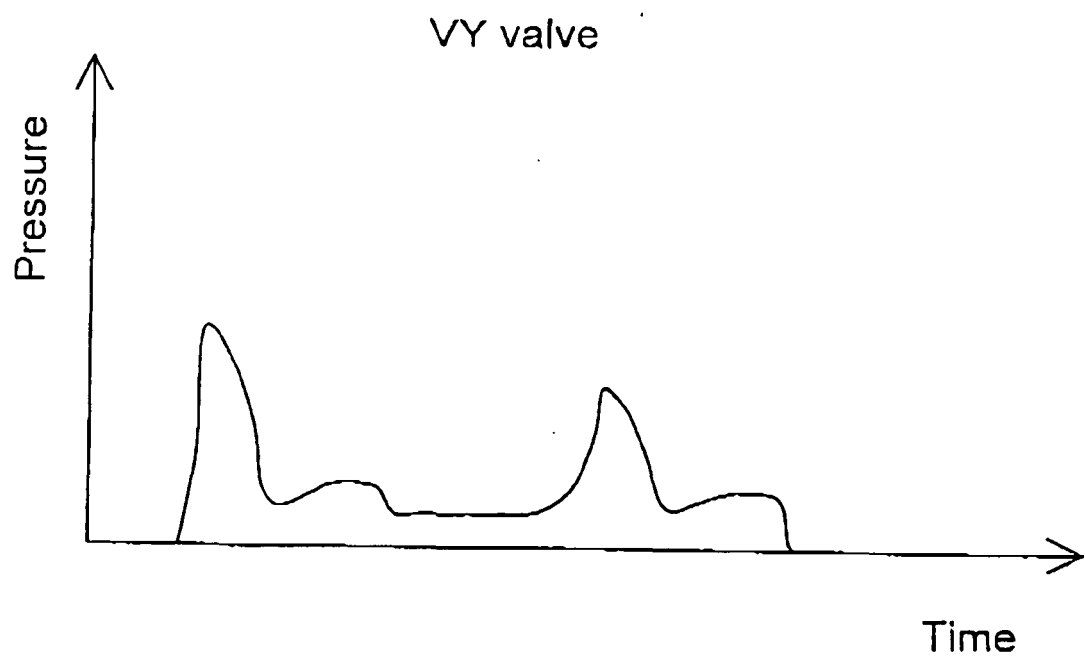


Fig. 7

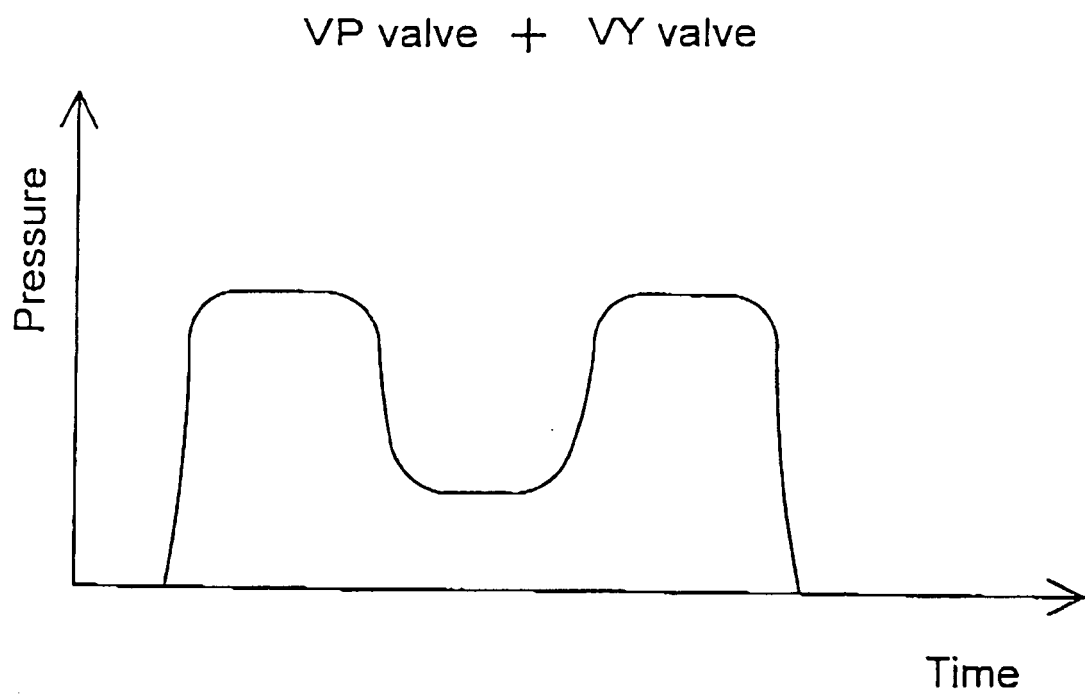


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H06277800 B [0002]