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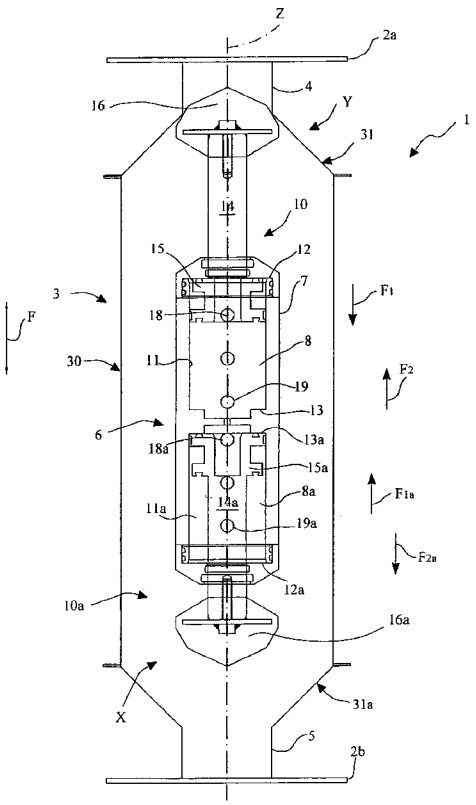

Fig. 2.a

(57) Abstract: An equipment for processing granular material, provided with, at least one valve (1, 1') for opening and/or closing said equipment, comprising a valve body (3) through which the material can pass when leaving and/or entering the equipment and a first and a second mouth (4, 5) forming the inlet and outlet for the material to and from the valve body (3). The at least one valve (1, 1') comprises a first and a second plug device (10, 10a) positioned to open and/or close the first and second mouth (4, 5) respectively to allow and/or prevent the passage of material from or towards said equipment and a movement system for moving the first and second plug devices (10, 10a) independently of each other.

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EQUIPMENT FOR PROCESSING GRANULAR MATERIALS, PROVIDED WITH VALVE HAVING TWO INDEPENDENTLY MOVABLE PLUG DEVICES

DESCRIPTION

Technical field

The invention relates to equipment for processing granular or powder material, provided with an improved valve and having the features stated in the preamble of the main claim.

More specifically, the invention relates to equipment for use in procedures of moulding and extruding plastics materials.

Prior art

At the present time, finished or semi-finished plastics articles are manufactured by many different production processes, including injection moulding.

The plastics material to be processed is usually in the form of granules, also known as pellets, which are formed into finished or semi-finished articles by heating, casting and moulding, or extrusion.

The forming process includes a melting stage in which the plastics material, initially in granular form, is melted in a heating chamber, and a subsequent injection stage in which the material is injected into suitable moulds for moulding to the desired shape.

However, many types of plastics materials used for moulding or extrusion are hygroscopic, and therefore easily absorb moisture, giving rise to serious problems, because water creates bubbles and voids in the liquefied plastics material during the forming process.

The granules must therefore be dried and dehumidified before being

subjected to the desired forming process, and the moisture content of the material must also be kept low during its subsequent storage.

A dehumidifying stage is therefore provided upstream of the moulding or injection stage, to extract the moisture from the granules.

When the dehumidifying stage is carried out under vacuum, the granular material is first placed in a heating chamber where it is heated to a desired temperature, preferably between about 80°C and about 200°C, resulting in a moderate dehumidification of the material, depending on the external temperature and humidity.

The hot granular material is then supplied to a vacuum dehumidifier, in which it is subjected to a pressure below atmospheric pressure to extract the moisture from the material.

The dehumidification efficiency of this procedure is not dependent on the external conditions, but on the operating conditions, temperature and pressure in the dehumidifier.

The dehumidifier comprises a sealed container into which the granular material is loaded, this container being provided with walls, externally covered with insulating material to limit heat losses towards the outside and to keep the material at the desired temperature.

The dehumidifier is provided with an upstream valve for connection to the heating chamber and a downstream valve for connection to subsequent forming machines.

The valves can be actuated to set them to an open position, in which a passage is provided through the valve for the flow of the plastics material, and a closed position, in which the aforesaid passage is closed, thus

preventing the flow of material through the valve and sealing the dehumidifier.

A drawback associated with the use of known dehumidifiers is that accumulations of material are frequently created at the valves, and particularly in the valve passages, thus impeding the correct operation of the valve.

The residues of material may partially obstruct the valve passages, thus preventing the optimal flow of the material entering and leaving the dehumidifier and consequently preventing the correct measured feed of the material.

The aforesaid residues may even prevent the correct closing of the valves and consequently prevent the sealing of the dehumidifier.

This downgrades the performance of the dehumidifier and causes problems in the subsequent processing of the plastics material.

The operators are therefore obliged to carry out frequent maintenance operations in order to remove the accumulations of plastics materials from the valves.

This leads to increased labour costs in respect of the maintenance work carried out by the operators.

It is also necessary to interrupt the production process during the maintenance operations, thus slowing down production.

Another drawback related to the use of known dehumidifiers, is the fact that they work properly only when operated in totally discontinuous manner (i.e. in batch), that is by loading the amount of material to be treated and, subsequently, discharging from the dehumidifier the whole

content of treated material.

Indeed, valves currently available in the market, do not allow, in the normal operating conditions, proper opening/closing operation, intercepting the flowing material and assuring, at the same time, tightly sealing of the dehumidifier.

Actually, typically used lubricants and gaskets, do not provide good performances at temperatures and vacuum levels reached in plastics material dehumidifiers.

These drawbacks are magnified by diameter sizes of material ducts, which usually are equal to or larger than 70 mm.

The discontinuous process of known vacuum dehumidifiers causes relevant disadvantages on downstream treatments, since dehumidified plastics material is subjected to significant temperature drops between the dehumidification and the subsequent treatment by press or extruder.

Indeed, after a certain amount of plastics material has been dehumidified, a part of it is transferred to the subsequent treatment, while the remaining part must be stored, waiting for the subsequent treatment.

During this waiting time, material is liable to cool down, so that in the subsequent treatment an additional energy amount is required to melt plastics material, or, as an alternative, during the waiting time plastics material must be heated so as to limit, or to avoid, cooling.

Anyway, the process energy consumption is very high.

Consequently there is a requirement to provide equipment for processing granular or powder materials with a new type of valve which can enable the above problems to be overcome.

In particular, the aforesaid valve must be designed in such a way that the dehumidifier is tightly sealed in the expected temperature and pressure conditions.

Description of the invention

One object of the invention is to provide equipment for processing granular or powder materials, provided with an improved valve which is reliable, requires little maintenance, and allows a good flow of material when open, while also being capable of tightly sealing the equipment.

Another object is to provide a valve which makes it possible to avoid the formation of accumulations or residues of material in a passage area of the valve.

Yet another object is to provide a valve designed in such a way as to provide a tight seal of the equipment to which it is fixed, under the temperature and pressure conditions present during operation.

Yet another object is to provide a valve designed in such a way as to allow loading and discharging of partial amounts of plastics material from a vacuum dehumidifier, while the same is working.

These and other objects are achieved by the invention by means of equipment for processing granular or powder materials, provided with improved valves and constructed in accordance with the appended claims.

Brief description of the drawings

The features and advantages of the invention will be made clearer by the following detailed description of a preferred example of embodiment thereof, illustrated, for the purposes of guidance and without restrictive intent, with reference to the attached drawings, in which:

- Figure 1 is a schematic view of a portion of an installation for processing plastics materials, comprising an equipment according to the present invention;
- Figure 2a is a schematic front view in partial section of a valve of the equipment of figure 1;
- Figure 2b is a side view of the valve of Figure 2a.

Figure 1 shows a portion of an installation 100 for forming plastics materials, positioned upstream of forming machines which are not shown.

Plastics material in granular or powder form is fed into a loading hopper 101 of the installation 100 as indicated by the arrow Fa, and then into a heating chamber 102.

This chamber is connected to a heating circuit 102a designed to introduce hot air into the heating chamber 102 in order to heat the plastics material to a desired temperature, usually comprised between approximately 80°C and approximately 200°C. The final temperature is function of the plastics material which is treated in the installation 100.

The heating of the material causes the evaporation of a fraction of the moisture present in the material, this fraction depending on the existing external conditions of temperature and humidity.

The plastics material 102 is then fed from the heating chamber into a dehumidifier 103, in which it is subjected to a dehumidification process under a vacuum and at a high temperature, in such a way that the residual moisture is extracted from the plastics material.

The plastics material is then fed from the dehumidifier 103, as indicated by the arrow Fb, into forming machines which are not shown.

A first valve 1 and a second valve 1' are positioned, respectively, between the dehumidifier 103 and the heating chamber 102 and between the dehumidifier and the subsequent forming machines, these valves alternately allowing and preventing the flow of material into and from the dehumidifier 103. The first and second valves 1 and 1' are also designed in such a way that, when they are open, the granular material passes through them to enter or leave the dehumidifier 103.

The dehumidifier 103 comprises a containing body 105 for collecting the plastics material which leaves the heating chamber 102 in order to be dehumidified.

The containing body 105 is delimited externally by a wall 106, preferably thermally insulated, which is connected by a pipe 107 to a vacuum pump 108 to create a desired pressure reduction in the containing body 105. The vacuum pump 108 is usually made to work in such a way as to generate a relative pressure of about -980 mbar within the containing body 105.

In the illustrated embodiment, the first and second valves 1 and 1' are substantially identical, and therefore the following description, which relates to the first valve 1 with reference to Figures 2a and 2b, is applicable to both valves, and corresponding parts are indicated by the same reference numerals.

The first valve 1 comprises two connecting portions 2a and 2b to connect the valve 1, respectively, to the heating chamber 102 and to the dehumidifier 103, a valve body 3, and a first and a second mouth 4 and 5, interposed between the valve body 3 and the two connecting portions 2a and 2b respectively.

The first and second mouths 4 and 5 are shaped in such a way as to act, respectively, as an inlet and an outlet for the material passing through the valve body 3, and have a smaller aperture than that of the valve body 3, preferably with a nominal diameter of about 70 mm.

The valve body 3 comprises a central cylindrical portion 30 and opposing linking portions 31 and 31a interposed between the cylindrical portions and the first and second mouths 4 and 5 respectively.

The linking portions 31 and 31a are provided with inner walls inclined in such a way that they diverge from the first and second mouth 4 and 5 respectively towards the cylindrical portion 30 of the valve body 3, thus facilitating the flow of material through the valve body 3 and the emptying of the latter.

This is because the granular material entering the valve body 3 after leaving the first mouth 4 is made to flow through a passage having a diverging cross section, formed by the first linking portion 31, and is distributed over a progressively increasing cross section. This prevents the formation of local obstructions or accumulations of material within the valve body 3.

Similarly, the granular material leaving the valve body 3 is progressively directed towards the second mouth 5 by the presence and shape of the second linking portion 31a, so that local accumulations of granular material within the valve body 3 are prevented in this case also.

Inside the valve body 3, in the cylindrical portion 30 and in a substantially central position within the latter, there is provided a closing device 6 comprising a shell 7 extending along a longitudinal axis Z of the valve 1, in

other words, in the illustrated version, in the direction in which the plastics material passes through the valve body 3.

Preferably, the shell 7 is positioned in such a way as to prevent the formation in the valve body 3 of passage areas having a particularly constricted cross section by comparison with other areas, in order to avoid local obstructions and make the passage of the material through the valve body 3 as uniform as possible.

The shell 7 is shaped internally to form a first and second cavity 8 and 8a, which are positioned in sequence along the longitudinal axis Z and are shaped symmetrically with respect to this longitudinal axis Z.

The first and second cavities 8 and 8a are positioned so that they partially house a first and a second plug device 10 and 10a for opening and/or closing the first and second mouths 4 and 5 respectively, to allow and/or prevent the passage of material through them.

In versions which are not shown, the shell and/or the first and second cavities can be shaped differently from those shown, according to the direction in which the granular material passes through the valve and the positions of the first and second mouths in the valve with respect to each other. Each cavity houses a corresponding plug device positioned to interact with one of the mouths with which the valve is provided.

In the illustrated version, the first and second plug device 10 and 10a are structurally identical, and the following description is therefore limited to one of them.

The first cavity 8 is formed by a lateral wall 11, a base wall 12 positioned nearer the first mouth 4, and an opposing end wall 13.

The first plug device 10 comprises a rod 14 carrying at its opposite ends a piston 15 which is slidable in a sealed way inside the first cavity 8, and a plug element 16 shaped to interact with inner walls of the first mouth 4 in order to open and/or close it.

The base wall 12 is positioned near the plug element 16 of the first plug device 10, and has a hole in which the rod 14 is slidably located to allow the movement of the first plug device 10.

Sealing gaskets are interposed between the piston 15 and the inner walls of the cavity 8 and between the hole in the base wall 12 and the rod 14.

The plug element 16 is preferably made from silicone or any other material providing a good seal in the required temperature and pressure conditions.

The plug element 16 is provided with convex outer walls which are shaped in such a way as to promote the flow of the material over them and to prevent local stoppages of material; for example, the outer walls may be sloping.

In the illustrated version, the outer walls of the plug element 16 comprise three wall portions designed to come into contact with the granular material at different and increasing inclinations with respect to the direction of flow of the granular material, in other words towards the direction of the longitudinal axis Z.

This further facilitates the flow of the granular material within the cylindrical portion 30 of the valve body 3.

Each plug device 10, 10a is movable along the longitudinal axis Z in both directions shown by the arrow F between an open position X, shown in Figures 2a and 2b with reference to the second plug device 10a, and a

closed position Y shown in Figures 2a and 2b with reference to the first plug device 10, and in the opposite direction.

In the open position X, the piston 15 bears against the end wall 13 of the first cavity 8, the rod 14 is almost completely inserted into the first cavity 8, and the plug element 16 is spaced away from the first mouth 4, thus allowing the material to pass through the latter.

In the closed position Y, the piston 15 bears against the base wall 12 of the first cavity 8, the rod 14 is moved almost completely out of the cavity 8, and the plug element 16 bears against the walls of the first mouth 4, thus closing it and preventing the plastics material from passing through it.

The first valve 1 is connected for operation to a movement system which is designed to move the first plug device 10 between the closed position X and the open position Y and vice versa.

The movement system comprises a source of compressed air, not shown in the drawings, which can supply air at a certain pressure, a pneumatic circuit 17 for guiding the generated compressed air towards the first valve 1 and the second valve 1', and a selection device, not shown in the drawings, designed to select the specific pipe or pipes of the pneumatic circuit 17 through which the compressed air is to flow.

In one version, it is possible to provide a single source of compressed air to actuate both the first and the second valve 1, 1', while in another version, each of the first and second valves 1, 1' can be provided with a dedicated source of compressed air.

In one version, a dedicated movement system can be provided for each valve, while in another version a single movement system can be provided

for both valves.

Similarly, a single pneumatic circuit can be provided to guide the generated compressed air to both valves, or a dedicated pneumatic circuit can be provided for each valve, regardless of whether a single source or two separate sources of compressed air are provided.

In all the above cases, the first and second valves 1 and 1' can be actuated separately.

The pneumatic circuit 17 comprises an opening pipe 18 which opens through a hole in the lateral wall 11 of the first cavity 8 near the base wall 12, a closing pipe 19 which opens through another hole in the lateral wall 11 of the first cavity 8 near the end wall 13, as well as a second opening pipe 18a and a second closing pipe 19a which open through corresponding holes of the second cavity 8a.

The pneumatic circuit 17 also comprises a pair of cleaning pipes 20, 20a which open into the valve body 3 through cleaning holes 3b, 3c which are preferably located near the inner wall of the cylindrical portion 30.

The selection device can be used to send compressed air selectively to one or more of the aforesaid pipes of the pneumatic circuit 17, in order to execute a series of operations described more fully below.

For example, if the opening pipe 18 is supplied with air, this generates a flow of air which passes into the first cavity 8, thus generating a pressure on the piston 15 which can move the piston towards the end wall 13 of the first cavity 8, as indicated by the arrow F1. This movement of the piston 15 causes the plug device 10 to be translated in the direction shown by the arrow F1, and consequently causes the plug element 16 to move away

from the first mouth 4.

Following this translation, which ceases when the piston 15 comes to bear against the end surface 13, the first mouth 4 is open.

However, if the closing pipe 19 is supplied with air, this generates a flow of air which passes into the first cavity 8 and thus generates a pressure on the piston 15 which moves it towards the base wall 12 of the first cavity 8, in the direction indicated by the arrow F2. This movement causes the plug device 10 to be translated towards the first mouth 4.

This movement ceases when the plug element 16 comes to bear against the first mouth 4 and the piston 15 comes to bear against the base wall 12, thus causing the first mouth 4 to be closed by the plug element 16.

The end wall 13 and the base wall 12 of the first cavity 8 act as limiting walls for the movement of the piston 15.

On the other hand, if the cleaning pipe 20 is supplied with air, this generates a flow of air which enters the valve body 3, thus generating a cyclonic movement inside the valve body 3 to remove any accumulated deposits of material, in the proximity of the first mouth 4 for example.

If necessary, in one version, the outlet portion of the cleaning pipes 20, 20a can be suitably shaped to direct the jet of compressed air more efficiently towards the mouths 4 and 5, thus improving the efficiency of the removal of the residues of material.

In a version which is not shown, the valve 1 can be provided with a pair of tubes extending from the cleaning holes 3b and 3c respectively towards the first and second mouths 4 and 5, to guide the compressed air flow into the proximity of the mouths 4 and 5 and thus improve the efficiency of the

removal of the residues of material.

The last-mentioned variant is especially useful if the material to be processed has a particularly fine particle size, as in the case of powder material, and/or if the material to be processed has electrostatic properties such that accumulations of material are more easily formed and/or such accumulations are more difficult to remove.

When the pipes of the pneumatic circuit 17 leading to the second plug device 10a are supplied with air, the second mouth 5 can be opened, closed or cleaned in an identical way to that described above with reference to the first plug device 10.

The first and second plug devices 10 and 10a can be moved independently of each other, as mentioned above, by selecting the pipe or pipes of the pneumatic circuit 17 through which the compressed air is to flow on each occasion.

Thus the first and second mouths 4 and 5 of the first valve 1 can be opened and closed independently.

The same considerations are applicable to the second valve 1'; in other words, the corresponding first and second mouths 4' and 5' can be opened and/or closed independently of each other, and the corresponding cleaning holes 3b' and 3c' can be used to clean the mouths 4' and 5' in order to restore the correct operation of the second valve 1', if necessary, by removing any residues of granular or powder material.

Additionally, the supply of compressed air to the cleaning pipes 20 and 20a is independent of the position of the corresponding plug device 10, 10a.

This means that the first and second mouths of each valve 1, 1' can be

cleaned during the normal operation of the dehumidifier 103 without the need to stop production.

For example, with reference to the first valve 1, the first mouth 4 can be cleaned when the first plug device 10 is in the open position X, but the second plug device 10a can also be in the closed position Y, thus keeping the dehumidifier 103 sealed by means of the plug element 16a of the second plug device 10a.

Thus the dehumidifier 103 can continue to operate even during the cleaning operations.

Similarly, the second mouth 5 can be cleaned while the first plug device 10 is in the closed position Y, thus preventing the material present in the heating chamber 102 from interfering with the cleaning operations.

This makes it unnecessary to empty the heating chamber 102 before the aforesaid cleaning operation is carried out.

Similar considerations are applicable to the second valve 1'.

Additionally, the first and second valves 1 and 1' operate independently of each other, thus making it possible to connect the dehumidifier 103 alternately to the heating chamber 102 and/or to the forming machines located downstream of the dehumidifier 103.

In operation, in order to feed the plastics material from the heating chamber 102 to the dehumidifier 103, both of the plug devices 10, 10a of the first valve 1 are opened and both of the plug devices 10', 10a' of the second valve 1' are closed, thus allowing the material to pass from the heating chamber 102 through the valve body 3 to the dehumidifier 103, while preventing the material from leaving the containing body 105 of the

dehumidifier 103.

In this way the containing body 105 of the dehumidifier 103 is filled with the desired quantity of plastics material.

The first plug device 10 of the first valve 1 is then closed, as described above, while the second plug device 10a is left open in order to make the plastics material present in the valve body 3 flow towards the dehumidifier 103 in such a way that the valve body 3 of the first valve 1 is emptied.

When the valve body 3 is empty, the second plug device 10a of the first valve 1 is also closed, thus sealing the dehumidifier 103.

At this point, the vacuum pump 108 can be actuated to create the desired pressure reduction in the dehumidifier 103 and eliminate any moisture that may be present on the plastics material.

The dehumidification procedure takes place for a desired period of time to provide the requisite degree of dehumidification.

At the end of the dehumidification process, both of the plug devices 10', 10a' of the second valve 1' are opened to allow the dehumidified plastics material to flow through the second valve 1' so that the containing body 105 of the dehumidifier 103 is completely or only partially emptied.

At the end of this operation, the first and second plug devices 10' and 10a' of the second valve 1' are closed to prevent any further outflow of material from the containing body 105 of the dehumidifier 103.

If necessary, the emptying of the valve body 3' of the second valve 1' can be completed by closing the first plug device 10' in the first place, and only closing the second plug device 10a' subsequently.

In a variant, not shown in the appended drawings, the containing body 105

of dehumidifier may be provided with an outer jacket connected, by means heating pipes to a hot air generator, in order to introduce hot air into the jacket to keep the material in the containing body at a desired temperature, or to heat it to the aforesaid desired temperature, if necessary.

Furthermore, a layer of insulating material is positioned outside the jacket to provide thermal insulation of the containing body of dehumidifier, thus limiting heat losses and consequently reducing the consumption of hot air for heating.

The valves described above have numerous advantages.

The plug devices of each valve can be moved independently of each other, thus enabling the valve body to be emptied completely, and making it possible to carry out any necessary cleaning operations without stopping the operation of the installation.

Each valve and each plug device of each valve can also be moved independently, providing similar advantages in terms of the operation of the installation.

Furthermore, each mouth of each valve can be cleaned independently, as stated above, without closing the installation; this feature evidently provides considerable benefits.

The cleaning operations are carried out by means of compressed air which is also used for the movement of the plug devices, making it possible to obtain the aforesaid advantages without excessively complicating the structure of the valves.

Moreover, the configuration of the movement system, particularly the

pneumatic circuit, makes this system particularly reliable.

This is because the opening and closing pipes of the pneumatic circuit open into cavities formed by the shell inside the valve body, in other words into areas where there is no flow of material.

This makes it possible to prevent the plastics material from coming into contact with movement members of the plug devices as it does in known valves, and to prevent any obstructions in the passages due to accumulations of plastics material, thus making the movement system reliable over a period of time.

On the other hand, the cleaning pipes open into the valve body, in order to remove any accumulations of material that may be formed in the valve body, particularly in the area of the mouths.

The plug elements are preferably made from silicone or other material capable of maintaining its properties even in the operating conditions of the valve, in other words at 200°C and -980 mbar.

Valves are without lubricants, which are unnecessary in view of the new configuration and the operating mode of the valves.

Moreover, gaskets are not subjected to particularly heavy working conditions and they are not intended for direct contact with plastics material.

Therefore, valves allow the equipment of the invention to load plastics material into the containing body in subsequent steps or to discharge only a part of plastics material present in the containing body, always keeping the equipment in operation.

Thus, it is no longer necessary to treat, for example to dehumidify, plastics material in a totally discontinuous manner.

Actually, this entail several advantages, heat loss, and consequently cooling of plastics material, is reduced or avoided, thus markedly reducing the energy consumption related to the subsequent working steps.

CLAIMS

1. Equipment (103) for processing granular material, provided with at least one valve (1, 1') for opening and/or closing said equipment (103), said valve comprising a valve body (3) through which said material can pass when leaving and/or entering said equipment (103) and a first and a second mouth (4, 5) forming the inlet and outlet for said material to and from said valve body (3), characterized in that said at least one valve (1, 1') comprises a first and a second plug device (10, 10a) positioned to open and/or close said first and said second mouth (4, 5) respectively to allow and/or prevent the passage of material from or towards said equipment (103), and a movement system for moving said first and said second plug devices (10, 10a) independently of each other.

2. Equipment according to Claim 1, additionally comprising a shell (7) positioned inside said valve body (3) and designed to house, at least partially, said first and/or said second plug device (10, 10a).

3. Equipment according to Claim 1, in which each of said first and said second plug devices (10, 10a) comprises a piston (15, 15a) which is slidable in a cavity (8, 8a) formed in said shell (7), a plug element (16, 16a) designed to interact with said first and/or said second mouth (4, 5), and a rod (14, 14a) interposed between said piston (15, 15a) and said plug element (16, 16a).

4. Equipment according to Claim 3, in which said plug element (16, 16a) is made from silicone.

5. Equipment according to any one of the preceding claims, in which

said movement system comprises a source of compressed air and a pneumatic circuit (17) for guiding said compressed air towards said first and/or said second plug device (10, 10a) in order to move said first and/or said second plug device (10, 10a) between an open position (X) and a closed position (Y) in order to open and/or close said first and said second mouth (4, 5).

6. Equipment according to the preceding claim, in which said pneumatic circuit (17) comprises a plurality of pipes and a selection device for sending compressed air selectively to one or more pipes of said plurality of pipes.

7. Equipment according to the preceding claim, in which said plurality of pipes comprises at least one opening pipe (18, 18a) for opening said first and said second plug device (10, 10a).

8. Equipment according to Claim 6 or 7, in which said plurality of pipes comprises at least one closing pipe (19, 19a) for closing said first and said second plug device (10, 10a).

9. Equipment according to any one of Claims 6 to 8, in which said plurality of pipes (17) comprises at least one cleaning pipe (20, 20a) opening into said valve body (3) in order to send air towards said first and/or said second mouth (4, 5) to remove residues of said material.

10. Equipment according to the preceding claim, additionally comprising at least one tube connected to said at least one cleaning pipe (20, 20a) and extending into said valve body (3) to guide said compressed air into the proximity of said first and/or said second

mouth (4, 5) to remove residues of said material.

11. Equipment according to any one of the preceding claims, additionally comprising a vacuum pump connected for operation to a body (105) of said equipment (103) to generate the vacuum in said body (105).

12. Equipment according to any one of the preceding claims, additionally comprising a heating device connected for operation to said equipment (103) and designed to heat said material in said equipment.

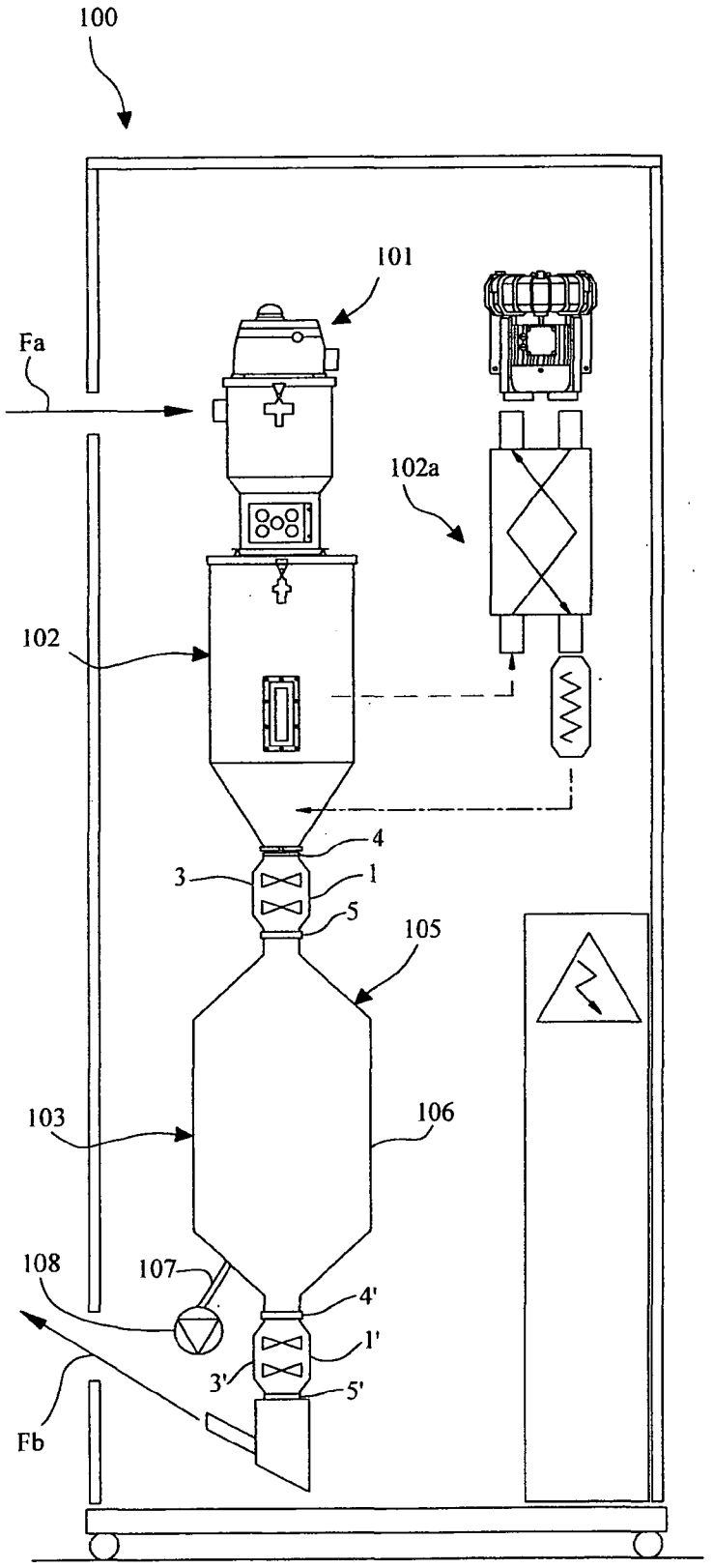
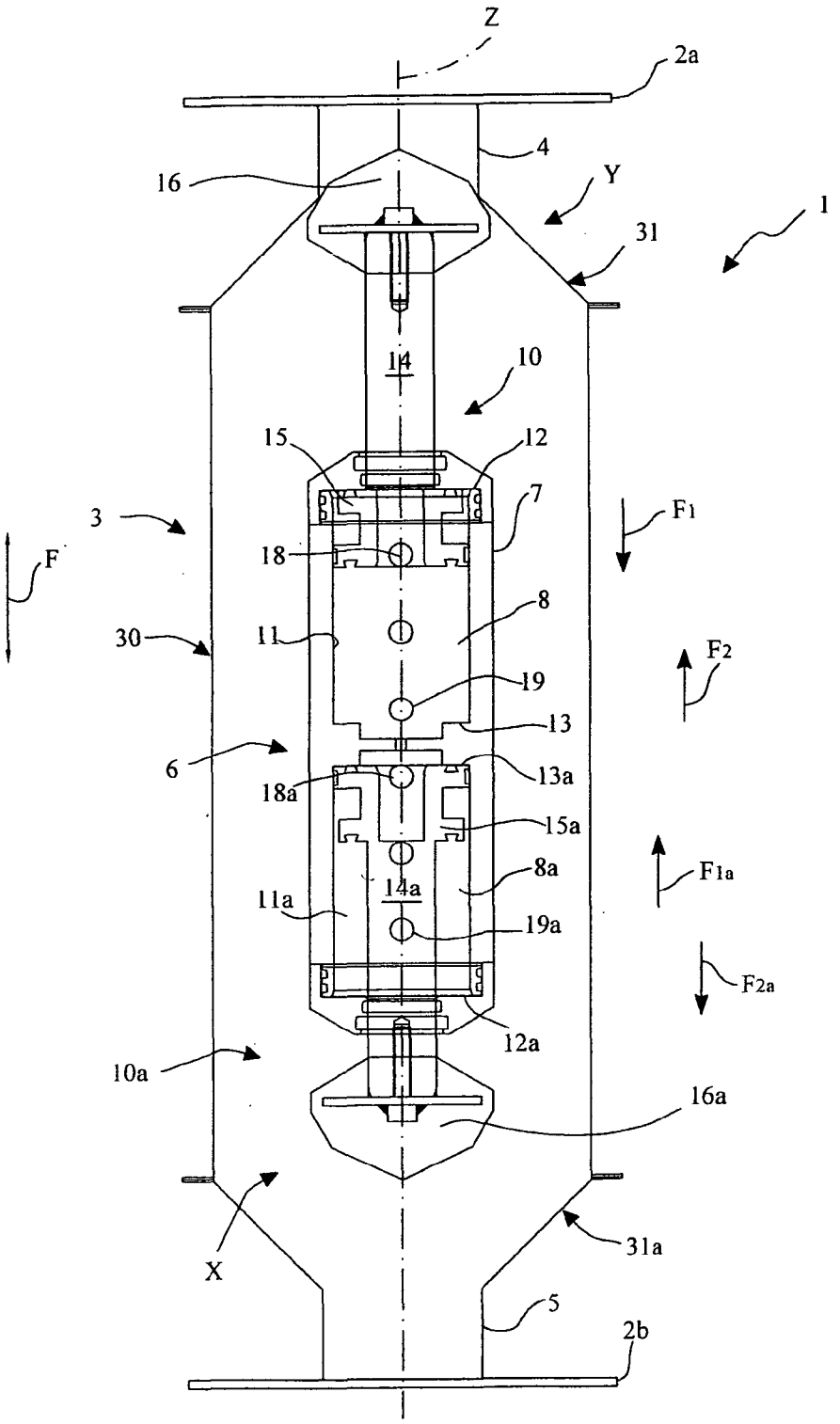


Fig. 1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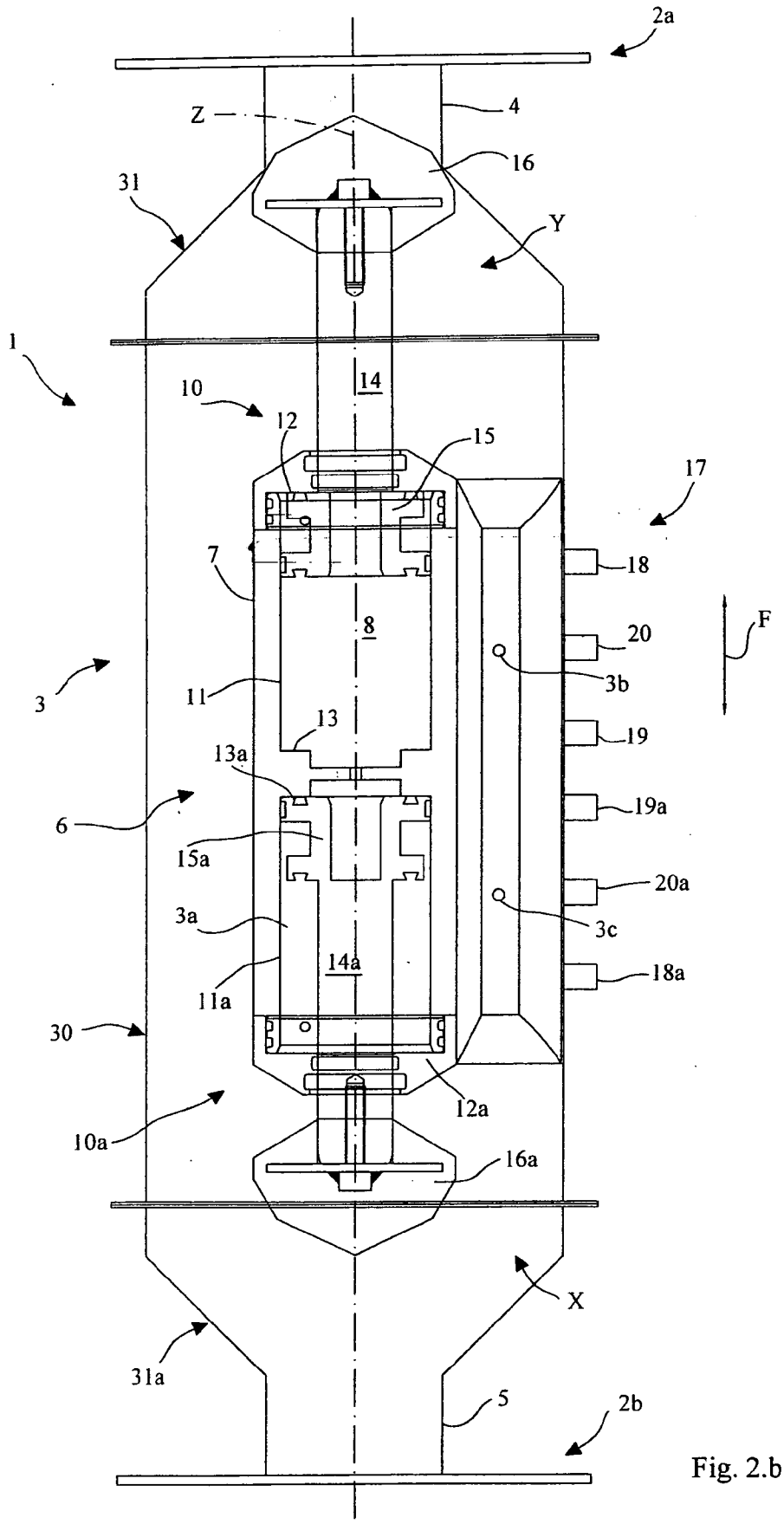
4
16
Y
1
31
14
10
15
12
3
7
F1
F
18
8
30
11
F2
19
13
6
13a
18a
15a
F1a
8a
14a
11a
19a
F2a
12a
10a
16a
X
31a
5
2b

Fig. 2.a


2a
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18
8
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F
3b
3
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13
19
13a
19a
6
15a
20a
3c
3a
14a
18a
11a
30
12a
10a
16a
X
31a
5
2b

Fig. 2.b

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/065102

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16K1/12 B29B13/02 B29B13/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16K B29B F26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2004/000069 A1 (GUROL I MACIT [US]) 1 January 2004 (2004-01-01) paragraph [0104] - paragraph [0120]; figures 11,16-22	1,2,11, 12 3-10
Y	US 4 197 873 A (BENNETT JOHN R [GB] ET AL) 15 April 1980 (1980-04-15) the whole document	3-10
X	US 2 602 498 A (OVERTON LYLE S) 8 July 1952 (1952-07-08) the whole document	1,2,11, 12
A	US 3 216 125 A (HEINZ DENNERT) 9 November 1965 (1965-11-09) the whole document	1,11,12

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 February 2009	05/03/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Lanel, François

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/065102

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2 592 474 A (OTTMAR SCHNYDER) 8 April 1952 (1952-04-08) figure 4	1,3,5-8
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