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(54) Device for packaging a flowable solid material

(57) The invention relates to a device (1) for packaging a flowable solid material, comprising a container (2) provided with a supply opening for supplying material to be packaged to the interior of the container and a discharge opening for discharging material that has been compacted in the interior of the container to a package (14), compacting means for compacting material in the interior of the container, said container comprising a circular, vertical, at least partially flexible wall (17), at least part of which can be moved towards the interior of the container and away from the interior of the container under the influence of the operation of moving means, wherein the moving means comprise at least one abutment element on the outer side of the vertical wall, at least the inner side of which can be moved radially inwards and outwards, as well as abutment means for exerting a force away from the interior of the container on the vertical wall so as to cause the vertical wall to abut with the outer side thereof against the inner side of said at least one abutment element.

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Description

[0001] The present invention relates to a device for packaging a flowable solid material, comprising a container provided with a supply opening for supplying material to be packaged to the interior of the container and a discharge opening for discharging material that has been compacted in the interior of the container to a package, compacting means for compacting material in the interior of the container, said container comprising a circular, vertical, at least partially flexible wall, at least part of which can be moved towards the interior of the container and away from the interior of the container under the influence of the operation of moving means.

[0002] Such a device is known from Dutch patent NL 1022560. The container that is described therein has a rectangular main shape, seen in horizontal cross-sectional view, and is provided with a cover at the upper side and a bottom at the lower side, which can both be swung away and which are capable of sealing the interior of the container airtight in closed condition. Flowable solid material to be packaged that is present in the container is subjected to a reduced pressure after the cover and the bottom have been closed, causing the material to be compacted. When subsequently the bottom is opened, there is a risk that the compacted material will stick to the wall of the container and that it can only be detached therefrom with a great deal of effort. To eliminate this risk, three of the four walls that define the rectangular main shape, seen in horizontal cross-sectional view, are double-walled. An intermediate space is present between the inner wall and the outer wall, the pressure within which space can be varied, whilst the inner wall is made up of two steel plates, between which a continuous rubber sheet is clamped, whose deformability makes it possible to move the inner wall both towards the interior of the container and away from the interior of the container by varying the pressure in the intermediate space.

[0003] An important limitation of the device described above is the fact that the operation principle in question is not suitable, or only if a very complex construction is used, for use with containers having a curved main shape, seen in horizontal cross-sectional view, such as a circular or an ellipsoidal cross-section.

[0004] European patent application EP-A1-417675 describes a vacuum sleeve system comprising a hollow, cylindrical container having an inner chamber and an outer chamber, which chambers are separated from each other by a wall. The chambers are in communication with each other via openings, as a result of which in principle the same pressure prevails in the two chambers. To facilitate the discharging of compacted powdery material from the container, it is proposed to use compressed air. An important drawback of this system is that it may lead to a considerable amount of dust formation.

[0005] The object of the invention is to provide a solution to the limitation described above whilst retaining the advantages as regards the discharging of compacted material from the container as described in NL 1022560. To achieve that object, the moving means comprise at least one abutment element on the outer side of the vertical wall, at least the inner side of which can be moved radially inwards and outwards, as well as abutment means for exerting a force away from the interior of the container on the vertical wall so as to cause the vertical wall to abut with the outer side thereof against the inner side of said at least one abutment element. These characteristic features ensure that there is no need to use an elevated pressure inside the container for discharging compacted material from the container, whilst in addition there is a greater freedom of design as regards the shape of the container.

[0006] A very important preferred embodiment is obtained if said at least one abutment element is made up of at least one flexible, hollow pressure element, with the moving means further comprising pressure means for varying the pressure inside the cavity of said at least one pressure element. Thus the shape of the container, seen in cross-sectional view, is mainly determined by the outer side(s) of said at least one flexible, hollow pressure element, against which the vertical wall abuts with the outer side thereof. By varying the pressure inside the cavity of said at least one pressure element, making use of the flexible nature of said at least one pressure element, said at least one pressure element can be compressed/flattened, for example upon reduction of the pressure inside the cavity thereof, by the outward force away from the interior of the container that is initially exerted on the vertical wall, and subsequently, because of the abutment between the vertical wall and said at least one flexible, hollow pressure element, on said at least one flexible, hollow pressure element by the abutment means.

[0007] To effect a deformation of said at least one flexible, hollow pressure element in an effective manner by having the pressure means vary the pressure inside the cavity of said at least one pressure element, it is preferable if a support member is provided at the outer side of said at least one flexible, hollow pressure element, against the inner side of which said at least one flexible, hollow pressure element abuts with the outer side thereof.

[0008] Such a supporting element is preferably formed by a circular, vertical outer wall, so that the device according to the present preferred embodiment is characterised in that a circular, vertical outer wall is provided at the outer side of said at least one flexible, hollow pressure element, against the inner side of which said at least one flexible, hollow pressure element abuts with the outer side thereof, an intermediate space being present between said outer wall and said wall, within which said at least one flexible, hollow pressure element is accommodated.

[0009] The use of an outer wall to support said at least one flexible, hollow pressure element at the outer side thereof has at least this major advantage that a large freedom of design is obtained as regards the position of

said at least one flexible, hollow pressure element.

[0010] According to a very practical preferred embodiment, said at least one flexible, hollow pressure element comprises at least one compressible hose. Such a hose might be like a garden hose, for example, which is made of such a material that it has a circular cross-section with a fixed diameter in externally unloaded condition, whilst it is also possible to compress the hose by exerting a specific force on the outer side thereof, so that a substantially ellipsoidal shape is obtained, the circumferential dimension of which is identical to the circumferential dimension of the circular shape of the hose in unloaded condition.

[0011] If said at least one compressible hose is spirally provided, the vertical wall may be surrounded by a single hose around the entire circumference thereof and, if desired, over the entire height thereof.

[0012] Alternatively it is also possible, however, for said at least one flexible, hollow pressure element to comprise a number of parallel, compressible hoses, so that the device according to the invention will be easier to fit.

[0013] For further reasons of constructional simplicity it is preferable in that connection if the hoses extend parallel to the vertical wall, seen in vertical cross-sectional view, along at least part of their length.

[0014] To vary the pressure inside the cavity of the various hoses, which is to be effected by the pressure means, it is preferable if the hoses are connected to a common pressure line.

[0015] Such a common pressure line further preferably extends annularly around the vertical wall. It is explicitly noted that within the framework of the present preferred embodiment the term annularly is not restricted to a circular shape but rather expresses that the pressure line surrounds the vertical wall, as a result of which the shape of the pressure line substantially corresponds to the circular shape of the vertical wall.

[0016] According to an advantageous alternative preferred embodiment, said at least one abutment element is made up of a number of at least substantially parallel, elongated abutment members, which abutment members can at least in part be moved radially inwards and radially outwards. An advantageous aspect of such a preferred embodiment is that it can in principle be designed to be low-maintenance and, in addition, easy to assemble without being liable to possible leakage.

[0017] The abutment members can be used the most efficiently if they extend at least substantially parallel to a central axis of the container.

[0018] To have the radially inward and outward movement of the abutment members take place in a constructionally simple manner, it is preferable if the abutment members are capable of reciprocating pivoting movement about respective pivot axes at upper ends of the abutment members, which pivot axes extend tangentially with respect to the part of the flexible wall of the container that abuts against the abutment member in question or at least parallel to that tangential direction.

[0019] It is furthermore preferable if at least one actuator is provided, which engages the abutment member for moving the abutment member radially inwards and outwards. It is noted in that connection that the term "engage" must not be interpreted so narrowly that the existence of a physical connection between said at least one actuator and the abutment member would be required. Alternatively, the actuator may push against the abutment members without being connected thereto.

[0020] A very simple embodiment can be obtained if said at least one actuator element comprises a bellows. Such a bellows may be provided for each abutment member individually or for a number of abutment members or even all abutment members together.

[0021] To have the flexible wall abut against said at least one abutment member in a simple yet reliable manner, it is preferable if the abutment means comprise vacuum means for creating a reduced pressure in an intermediate space between the vertical wall and a vertical outer wall outside said vertical wall, in which intermediate space said at least one abutment member is provided.

[0022] In addition to that, in another preferred embodiment, in which the abutment means comprise vacuum means for creating a reduced pressure in the intermediate space, the use of a circular, vertical outer wall that may be advantageously, but not necessarily, provided for supporting said at least one pressure element, offers this important advantage that the pressure at the outer side of the vertical wall can be influenced, more specifically reduced, thus making it possible to effect a continuous abutment of the outer side of the vertical wall against the inner side of said at least one flexible, hollow pressure element, irrespective of the pressure that prevails within said at least one flexible, hollow pressure element.

[0023] The device according to the present invention is advantageous in particular if closure means are provided for effecting an airtight seal of the interior of the container, with the compacting means comprising further vacuum means for reducing the pressure in the interior of the container while the container is being sealed airtight by the closure means.

[0024] An important advantage of the present invention is the fact that the vertical wall need not have a curved or inclined orientation to make it easier for compacted material to become detached therefrom. Consequently, further preferred embodiments are characterised in that the vertical wall extends in a straight line, seen in vertical cross-sectional view, and that the straight line of the vertical wall is vertically oriented, if desired, which has an advantageous effect as regards the constructional simplicity of the vertical wall.

[0025] The present invention further relates to a method for using a device according to the invention as described in the foregoing, which method comprises the steps of

A supplying flowable solid material to be packaged to the interior of the container via the supply opening,

B compacting the material in the interior of the container,
C moving at least part of at least the inner side of said at least one abutment member outwards for the purpose of enlarging interior dimensions of the container, and
D discharging compacted material from the container via the discharge opening.

[0026] When a flexible, hollow pressure element is used as the abutment member, it is advantageous if, within the framework of carrying out step C, the method according to the invention comprises the step of the pressure means reducing the pressure in the cavity of said at least one pressure element for the purpose of enlarging interior dimensions of the container.

[0027] If a device provided with closure means is used, wherein the compacting means comprise further vacuum means according to any one of the preferred embodiments of a device according to the invention as described above, the method preferably comprises the steps of

E the closure means effecting an airtight seal of the interior of the container between step A and step B, and
F the further vacuum means reducing the pressure in the interior of the container within the framework of carrying out step B.

[0028] The advantages of using such a method will already be apparent to those skilled in the art from the above description of (preferred embodiments of) the device according to the present invention.

[0029] The present invention will now be explained in more detail by means of a description of two preferred embodiments of a device according to the present invention, in which reference is made to the following figures:

Figure 1 is a schematic, vertical cross-sectional view of a first preferred embodiment of a packaging device according to the present invention;
Figure 2a is a sectional view along the line II-II, showing an inner wall having a diameter D;
Figure 2b is a sectional view along the line II-II in figure 1, showing an inner wall having a diameter D+;
Figure 2c shows the detail IIc of figure 2b;
Figure 3 shows the detail III of figure 1;
Figures 4a-4d show four successive conditions of the packaging device of figure 1 during the use thereof according to a first embodiment;
Figures 5a-5d show four successive conditions of the packaging device of figure 1 during the use thereof according to a second embodiment;
Figure 6 is a schematic, vertical cross-sectional view of a second preferred embodiment of a packaging device according to the invention;
Figure 7a is a cross-sectional view along the line VII-VII in figure 6, showing an inner wall having a diameter D;
Figure 7b is a cross-sectional view along the line VII-VII in figure 6, showing an inner wall having a diameter D+;
Figure 8 shows, combined in one figure, a third (on the left) and a fourth (on the right) preferred embodiment of the packaging device according to the invention;
Figures 9a and 9b are sectional views along the line IX-IX, showing the inner wall having a diameter D and the inner wall having a diameter D+, respectively;
Figure 10 shows, combined in one figure, a fifth (on the left) and a sixth (on the right) preferred embodiment of the packaging device according to the invention; and
Figures 11 a and 11b are sectional views comparable to the sectional views of figures 9a and 9b for a packaging device according to a seventh preferred embodiment, showing the inner wall having a diameter D and the inner wall having a diameter D+, respectively.

DESCRIPTION OF THE FIGURES

[0030] Figure 1 shows a packaging device 1 for flowable solid material, such as powders or granulates. The packaging device 1 comprises a filling tube 2 of circular cross-section (see also figures 2a and 2b). A valve 3 (schematically indicated) is provided at the upper side of the filling tube 2, whilst a screw valve 4 is present at the bottom side of the filling tube 2, which screw valve comprises a valve plate 5, which is pivotable about a pivot axis 6 between a closed position 5' and an open position 5". To effect said pivoting of the valve plate 5, a piston-cylinder assembly 7 is provided, which comprises a piston rod 8 that can move into and out of the cylinder 9 as indicated by the double arrow 15, to the free lower end of which piston rod an actuating arm 11 is pivotally connected about a pivot 10, which actuating arm is rigidly connected to the valve plate 5 at its opposite end.

[0031] A hopper 12 is disposed above the valve 3, from which material is metered into the interior of the filling tube 2 in the open position of the valve 3 and the closed position of the screw valve 4. Said material is compacted within the filling tube 2 in a manner yet to be described, after which the screw valve 4 opens, so that the compacted material falls into a packaging bag 14, the upper side of which is just visible in figure 1, via funnel means 13 under the influence of the force of gravity.

[0032] To compact material inside the filling tube 2, a reduced pressure is created in the interior of the filling tube 2 via the vacuum connection 6 after the valve 3 and the screw valve 4 have been closed, in which position the interior of the filling tube 2 is sealed airtight from its surrounding, which reduced pressure has a compacting effect on the material present in the filling tube. The reduced pressure can be generated by a vacuum pump,

for example, which communicates with the vacuum connection 16, but alternatively it may also be effected by using volume means as described in Dutch patent application NL 1025445.

[0033] As is also shown in figures 2a-3, the lower part of the filling tube 2 is double-walled, comprising a rubber inner jacket 17 and outside said jacket 17, spaced therefrom by some distance, an enveloping tube 18, so that a tubular space 19 is present between the jacket 17 and the tube 18. In said space 19, a number of parallel, vertically extending pressure hoses are provided, which have a closed bottom side and which are provided with a hose coupling 21 at the upper side for connection to a ring line 22, which is in turn connected, via a knee joint 23, to a compressed air source 24 that is capable of being throttled. A reduced pressure can be created in the space 19 via a vacuum connection 25, as a result of which the inner jacket is sucked against the outer sides of hoses 20. When the hoses 20 are pressurised as a result of the operation of the compressed air source 24, the hoses have a circular cross-section and the inner jacket 17 has a diameter D (figure 2a). When the compressed air source 24 is throttled or turned off, the pressure in the hoses 20 falls out or at least decreases, and as a result of the reduced pressure in the space 19 the hoses 20 are compressed against the inner side of the tube 18, with the abutment of the inner jacket 17 against the hoses 20 being retained, and the diameter of the inner jacket 17 consequently increases from D to D+ (figure 2b, 2c).

[0034] Figures 4a-4d show four successive stages of a first method for using a packaging device 1. Starting from an empty filling tube 2 with the valve plate 5 in the closed position, the valve 3 in the open position and the hoses 20 pressurised into a circular cross-section, so that the inner jacket 17 has taken on the diameter D, as shown in figure 2a (figure 4a), flowable solid material 25 is admitted into the filling tube 2 via the open valve 3, after which the valve 3 is closed (figure 4b). Then a reduced pressure is generated in the interior of the filling tube via the vacuum connection 16, causing the material 25 to be compacted. Because of this compacting effect there is a risk that an adhesion is created between the inner wall of the filling tube 2 and the material 25, such that, in spite of the force of gravity, the material 25 will not automatically fall out of the filling tube 2 when the valve plate 5 is opened. To overcome this problem in an efficient manner, the compressed air source 24 is throttled or turned off at the same time or shortly before the valve plate 5 is opened, as a result of which the inner jacket 17 takes on the diameter D+ and consequently the material 25 becomes fully detached from the inner jacket 17 and falls into a package 14 without impediment.

[0035] Figures 5a-5d show four successive stages of a second method of using a packaging device 1. In the starting situation that is shown in figure 5a, the filling tube 2 is already filled with material 25, and the diameter of the inner jacket 17 has been increased to D+ prior to the compacting of the material 25 by reducing the pressure in the hoses 20. Alternatively it is also possible to obtain this effect by reducing the pressure in the space 19 even further (figure 5a). Then the material is compacted in the known manner by reducing the pressure within the filling tube 2 via the vacuum connection 16 (figure 5b). Subsequently, the pressure within the hoses 20 and/or the pressure within the space 9 is reduced, thus creating some distance again between the compacted material 25 and the inner side of the inner jacket 17, so that the compacted material 25 can fall into the packaging bag 14 without impediment when the valve plate 5 (figure 5d) is opened.

[0036] Figures 6, 7a and 7b show an alternative embodiment of a packaging device according to the invention. In this embodiment the hoses 120 are provided in an annular, horizontal orientation, parallel to each other, in the space 119 between the outer tube 118 and the inner jacket 117 rather than being vertically oriented. All the individual, annular hoses 120 are connected to a vertical pressure line 122 for varying the pressure within the various hoses 120. Alternatively it is also conceivable to use only one hose, for example, which is spirally wound around the inner jacket 117 in the space 119.

[0037] Figures 8 and 9a and 9b relate to a third and a fourth preferred embodiment of a packaging device according to the invention. In these packaging devices a circular filling tube 131 provided with a rubber inner jacket 132 is used. The circular filling tube 131 is surrounded by an enveloping tube 133 along the lower part of its length, as a result of which a tubular space 134 is present between the inner jacket 132 and the enveloping tube 133, which space is sealed airtight from its surrounding, such as the interior of the inner jacket 132. The pressure within the tubular space 34 can be reduced by pressure means (not shown).

[0038] Disposed within the tubular space 134 are parallel, vertical, rigid slats, for example made of a metal, which are arranged in regularly spaced-apart relationship around the entire circumference of the inner jacket 132. In the third preferred embodiment, as shown on the left-hand side in figure 8, said slats 135 are pivotable about a pivot axis 136 at their upper ends, which pivot axes extend perpendicularly to the plane of drawing and which, for each slat, generally extend tangentially with respect to that part of the inner jacket 132 which, as will be explained in more detail yet, abuts against the slat 135 in question or at least parallel to that tangential direction.

[0039] A pneumatic cylinder 137 is provided for each slat 135, which cylinder functions to pivot the slats 135 about their respective pivot axes 136. The piston rod 138 of the cylinder 137 engages the outer side of the slat 135 via the tubular space 134 at a point located on the lower half of the length of said slats. The piston body 139 is connected to the outer side of the enveloping tube 133. It will be understood that passages for the piston rods 138 are provided in the enveloping tube 133. When the pneumatic cylinder 137 is suitably energized, this will cause the slats 135, which are provided along the entire circumference of the inner jacket 132, to pivot to and fro

about the respective pivot axes 136.

[0040] By reducing the pressure within the tubular space 134, the inner jacket 132 is made to abut against the slats 135 with the outer side thereof. It is precisely because of the reduced pressure within the tubular space 134 that the abutment of the inner jacket 132 is retained also when the slats 135 pivot outwards about their respective pivot axes 136 from the situation that is shown in figure 8. This causes the diameter of the filling tube to increase from the upper ends of the slats 135 to the lower ends of the slats 135, so that the inner tube slightly diverges towards the bottom, as a result of which powdery material that has been compacted in the filling tube 131 will become detached from the inner jacket 132 and fall from the filling tube 131 into the packaging bag (not shown) in the open position of the valve 140.

[0041] Now a fourth preferred embodiment of a packaging device according to the present invention will be described with reference to the right-hand side of figure 8, which embodiment can be regarded as a variant of the third preferred embodiment. The difference with the packaging device according to the third preferred embodiment is that the slats 141, which, like the slats 135, extend vertically and parallel to each other on the outer side of the inner jacket 132 within the tubular space 134, are not pivotable but translatable in radial direction, to which end a pneumatic cylinder 143 is provided at a point located on the upper half of the length of the slats 141 in addition to the pneumatic cylinder 142 that is present at a point located on the lower half of the slats 141. When the pneumatic cylinders 142, 143 are energized simultaneously, this enables the slats 141 to translate radially inwards and outwards for influencing the diameter of the inner jacket 132 in this manner. If the pneumatic cylinders 142, 143 are not energized to the same extent, it is furthermore conceivable that this will lead to the orientation of the slats 141 being changed, for example in order to simulate a pivoting movement, as with the slats 135, in this manner.

[0042] Figures 9a and 9b are sectional views along the line IX-IX in figure 8, showing a fourth preferred embodiment in, respectively, a filling position, in which the internal diameter of the inner jacket 132 has a diameter D, and a subsequent discharging position, in which the diameter has been increased to D+ to assist in the discharge of material that has been compacted in the filling tube 131. While the present embodiment employs pneumatic cylinders 137, 142, 143 as actuators, it is also conceivable within the framework of the present invention to use other types of actuators, for example hydraulic or electric actuators.

[0043] Further examples of the packaging device are formed by the fifth and the sixth preferred embodiment thereof, which are still further variants of the third preferred embodiment and the fourth preferred embodiment, respectively, which embodiments will be explained below in the description of figure 10, in which like elements will be indicated by the same numerals. In the fifth preferred embodiment of the packaging device (left-hand side of figure 10), the pivoting of the slats 135 about the associated pivot axes 136 is effected by means of a bellows 151 having a wall 152 rather than by the pneumatic cylinder 137. The wall 152 of the bellows is clamped against the inner side of the enveloping tube 133 by means of rings 153, 154. The bellows 151 extends around the inner jacket 132 at the outer side of the pivotable slats 135. The outer sides of the slats 135 abut against the wall 152 of the bellows on account of the reduced pressure that prevails within the tubular space 134. The pivoting of the slats 135 can be controlled by suitably controlling the pressure in the bellows 151 so as to have the slats 135 assume the most optimum orientation for filling, compacting and discharging, respectively, as already described above.

[0044] On the right-hand side of figure 10 the manner in which use is made of a bellows 155 having a wall 156 and clamping rings 157, 158 is shown. Like the bellows 151, the bellows 155 fully surrounds the inner jacket 132 at the outer side of the slats 141, but in this case also along (practically) the entire length of the slats 141. It is possible to control the radial position of the slats 141, and thus the diameter of the inner wall 132 at the location of the slats 141, by suitably controlling the pressure within the bellows 155 because of the reduced pressure within the tubular space 134, which ensures that the inner jacket 132 remains in abutment with the wall 156 of the bellows, so as to gear said position optimally to the filling, compacting and discharging operations. To give the bellows 155 a stable shape, it may be advantageous to use partitions in the interior of the bellows 155 (or possibly of the bellows 151), which define chambers being in communication with each other within the bellows.

[0045] Figures 11 a and 11 b show yet another variant of the sixth preferred embodiment (right-hand side of figure 10), in which hoses 161 are used for each slat 141 rather than a single bellows 155 or pneumatic cylinders, such as the pneumatic cylinders 142, 143 in figure 8. Said hoses are provided at the radial outer side of each slat 141, within the tubular space 34. The hoses 161, which are comparable to the hoses 20 in the embodiment that is shown in figure 1, can be compressed when a reduced pressure, or at least a pressure lower than the pressure in the tubular space 134, prevails within said hoses 161, as is shown in figure 11 b, causing the slats 141 to move outwards accordingly.

[0046] Although the hoses extend along the entire length of the slats 141 in the embodiment that is shown in figures 11 a and 11 b, it is alternatively also possible to use slats 135 that are pivotable about pivot axes 136, in which case the hoses that are used only extend at the outer side of a lower part of the slats 135, for example over the same height as the bellows 151.

Claims

1. A device for packaging a flowable solid material, comprising a container provided with a supply opening for supplying material to be packaged to the interior of the container and a discharge opening for discharging material that has been compacted in the interior of the container to a package, compacting means for compacting material in the interior of the container, said container comprising a circular, vertical, at least partially flexible wall, at least part of which can be moved towards the interior of the container and away from the interior of the container under the influence of the operation of moving means, **characterised in that** the moving means comprise at least one abutment element on the outer side of the vertical wall, at least the inner side of which can be moved radially inwards and outwards, as well as abutment means for exerting a force away from the interior of the container on the vertical wall so as to cause the vertical wall to abut with the outer side thereof against the inner side of said at least one abutment element.

2. A device according to claim 1, **characterised in that** said at least one abutment element is made up of at least one flexible, hollow pressure element, with the moving means further comprising pressure means for varying the pressure inside the cavity of said at least one pressure element.

3. A device according to claim 2, **characterised in that** a support member is provided at the outer side of said at least one flexible, hollow pressure element, against the inner side of which said at least one flexible, hollow pressure element abuts with the outer side thereof.

4. A device according to claim 2 or 3, **characterised in that** a circular, vertical outer wall is provided at the outer side of said at least one flexible, hollow pressure element, against the inner side of which said at least one flexible, hollow pressure element abuts with the outer side thereof, an intermediate space being present between said outer wall and said wall, within which said at least one flexible, hollow pressure element is accommodated.

5. A device according to any one of the claims 2, 3 or 4, **characterised in that** said at least one flexible, hollow pressure element comprises at least one compressible hose.

6. A device according to claim 5, **characterised in that** said at least one compressible hose is spirally provided.

7. A device according to claim 5, **characterised in that** said at least one flexible, hollow pressure element comprises a number of parallel, compressible hoses.

8. A device according to claim 7, **characterised in that** the hoses extend parallel to the vertical wall, seen in vertical cross-sectional view, over at least part of their length.

9. A device according to claim 7 or 8, **characterised in that** said hoses are connected to a common pressure line.

10. A device according to claim 9, **characterised in that** said common pressure line extends annularly around the vertical wall.

11. A device according to claim 1, **characterised in that** said at least one abutment element is made up of a number of at least substantially parallel, elongated abutment members, which abutment members can at least in part be moved radially inwards and radially outwards.

12. A device according to claim 11, **characterised in that** said abutment members extend at least substantially parallel to a central axis of the container.

13. A device according to claim 12, **characterised in that** said abutment members are capable of reciprocating pivoting movement about respective pivot axes at upper ends of the abutment members, which pivot axes extend tangentially with respect to the part of the flexible wall of the container that abuts against the abutment member in question or at least parallel to the tangential direction.

14. A device according to claim 11, 12 or 13, **characterised in that** at least one actuator is provided, which engages the abutment member for moving the abutment member radially inwards and outwards.

15. A device according to claim 14, **characterised in that** said at least one actuator element comprises a bellows.

16. A device according to any one of the preceding claims, **characterised in that** the abutment means comprise vacuum means for creating a reduced pressure in an intermediate space between the vertical wall and a vertical outer wall outside said vertical wall, in which intermediate space said at least one abutment member is provided.

17. A device according to any one of the preceding claims, **characterised in that** closure means are provided for effecting an airtight seal of the interior of the container, with the compacting means comprising further vacuum means for reducing the pres-

sure in the interior of the container while the container is being sealed airtight by the closure means.

18. A device according to any one of the preceding claims, **characterised in that** the vertical wall extends in a straight line, seen in vertical cross-sectional view.

19. A device according to claim 18, **characterised in that** the straight line of the vertical wall is vertically oriented.

20. A method for using a device according to any one of the preceding claims, comprising the steps of

A supplying flowable solid material to be packaged to the interior of the container via the supply opening,
B compacting the material in the interior of the container,
C moving at least part of at least the inner side of said at least one abutment member outwards for the purpose of enlarging interior dimensions of the container, and
D discharging compacted material from the container via the discharge opening.

21. A method according to claim 20 for using a device according to any one of the claims 2-10, comprising the step of the pressure means reducing the pressure in the cavity of said at least one pressure element for the purpose of enlarging interior dimensions of the container within the framework of carrying out step C.

22. A method according to claim 20 or 21 for using a device according to claim 16, comprising the steps of

E the closure means effecting an airtight seal of the interior of the container between step A and step B, and
F the further vacuum means reducing the pressure in the interior of the container within the framework of carrying out step B.

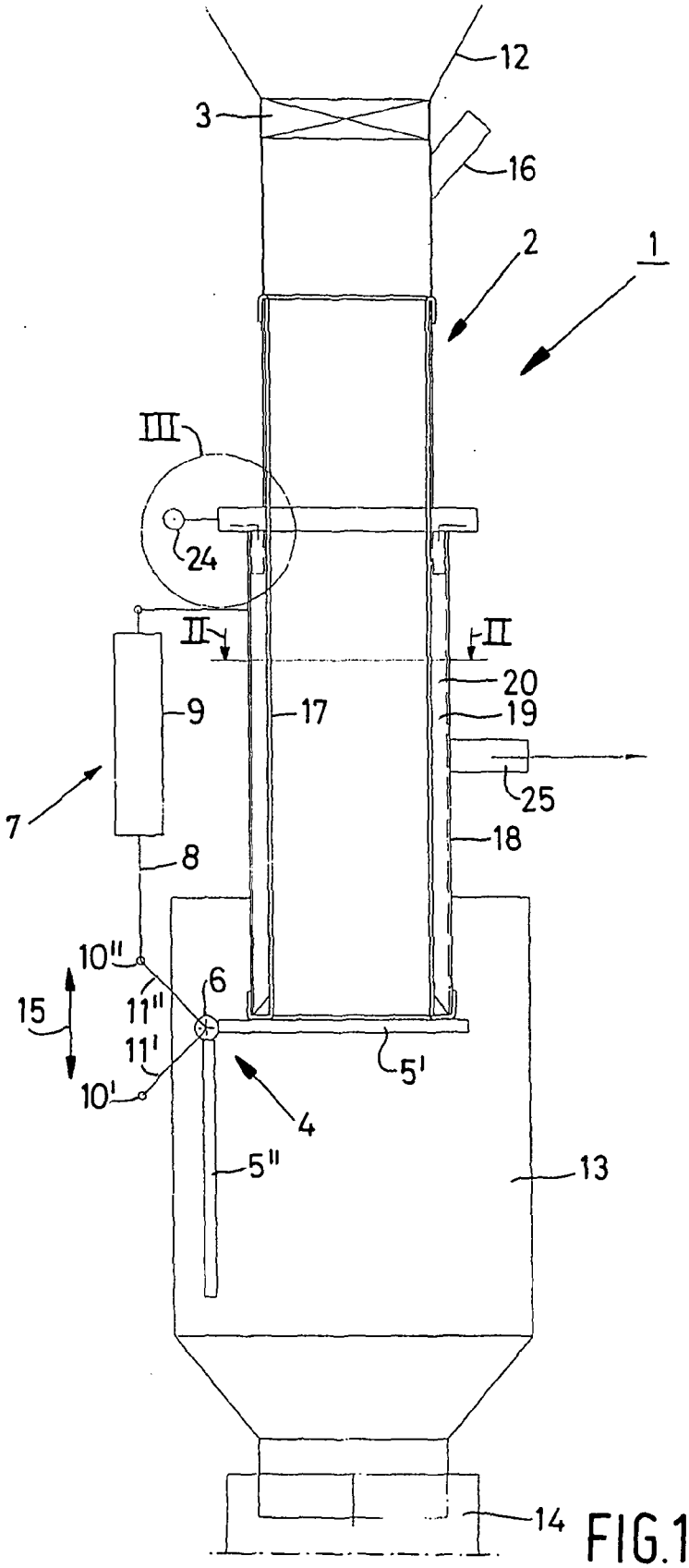

FIG.1

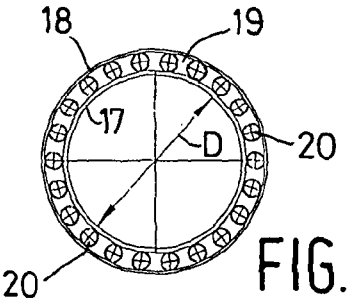

FIG.2a

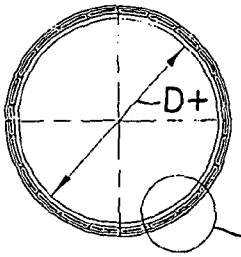

FIG.2b

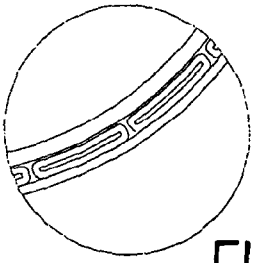

FIG.2c

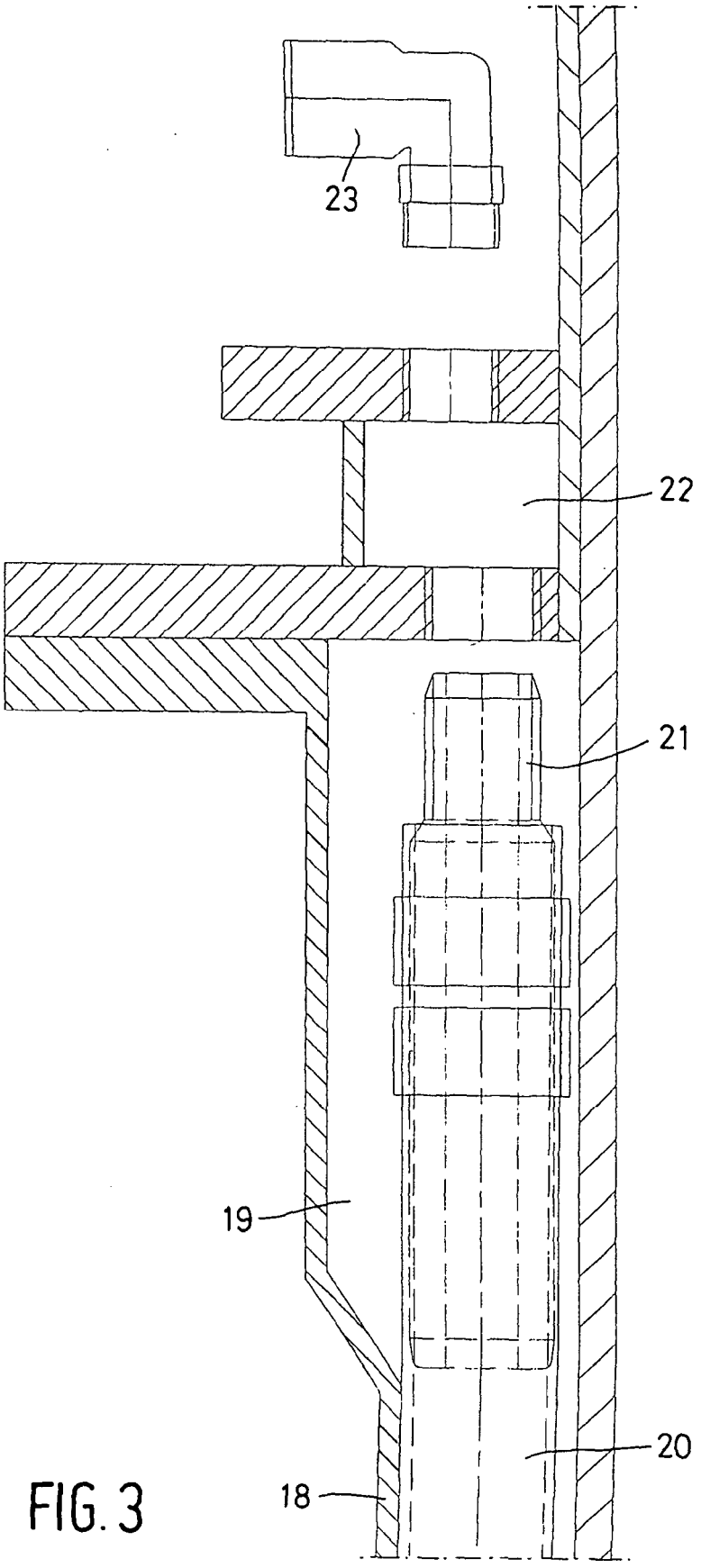

FIG. 3

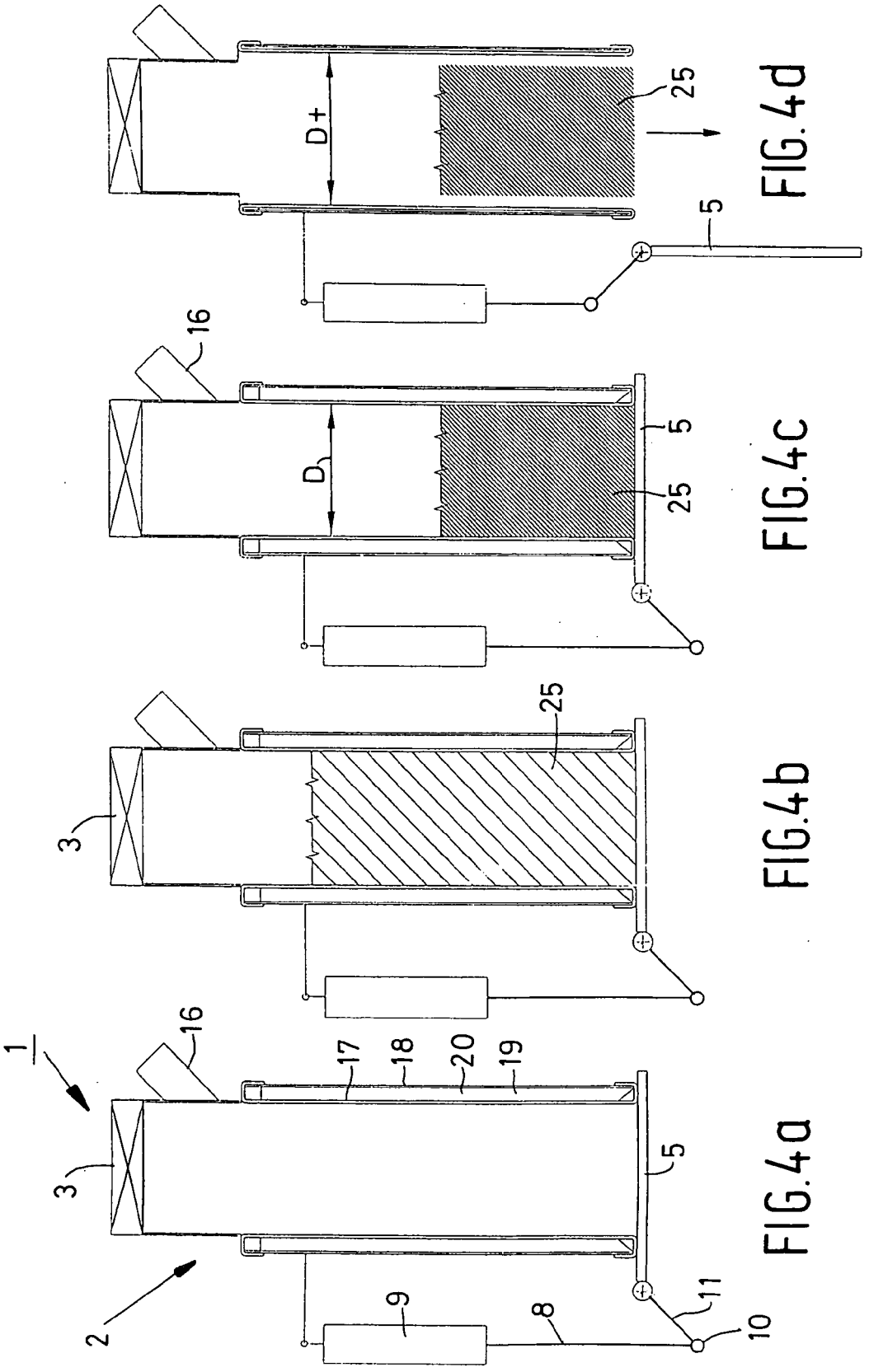

FIG.4a

FIG.4b

FIG.4c

FIG.4d

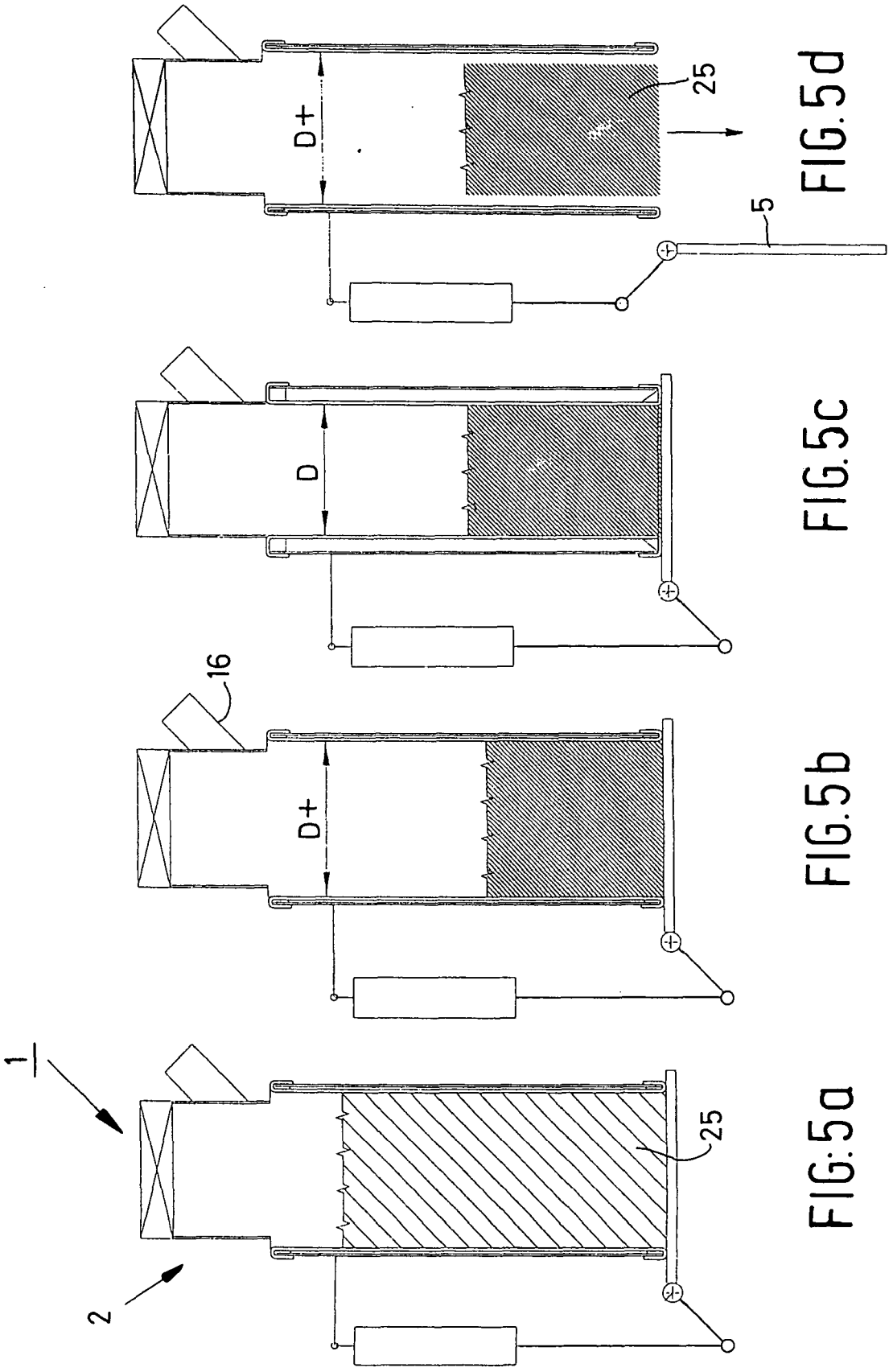

FIG.5a

FIG.5b

FIG.5c

FIG.5d

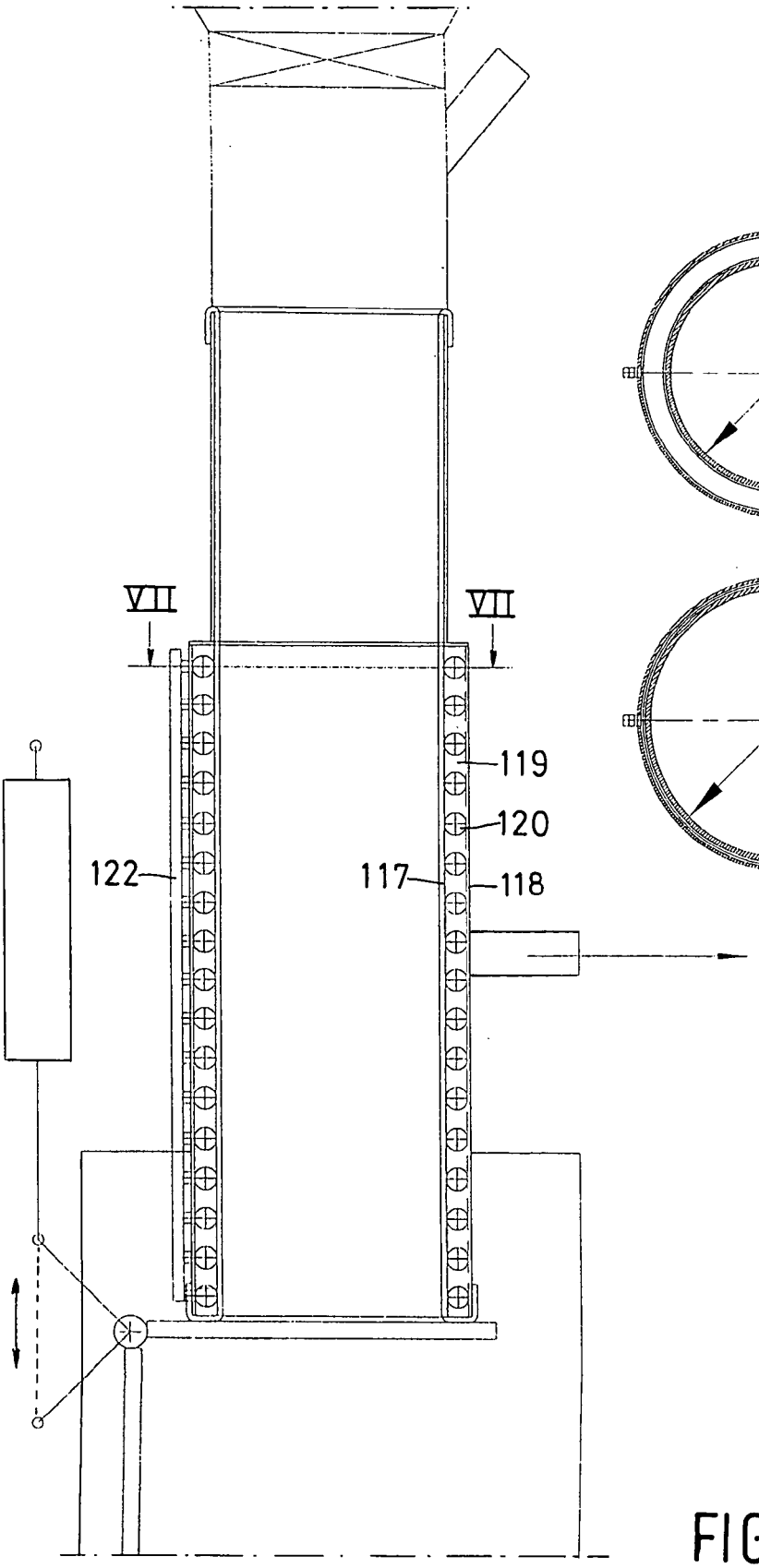

FIG.6

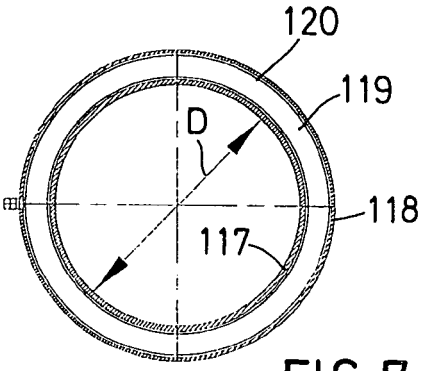

FIG.7a

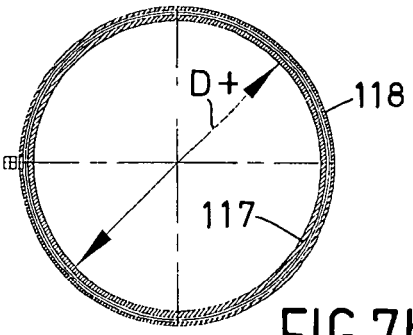

FIG.7b

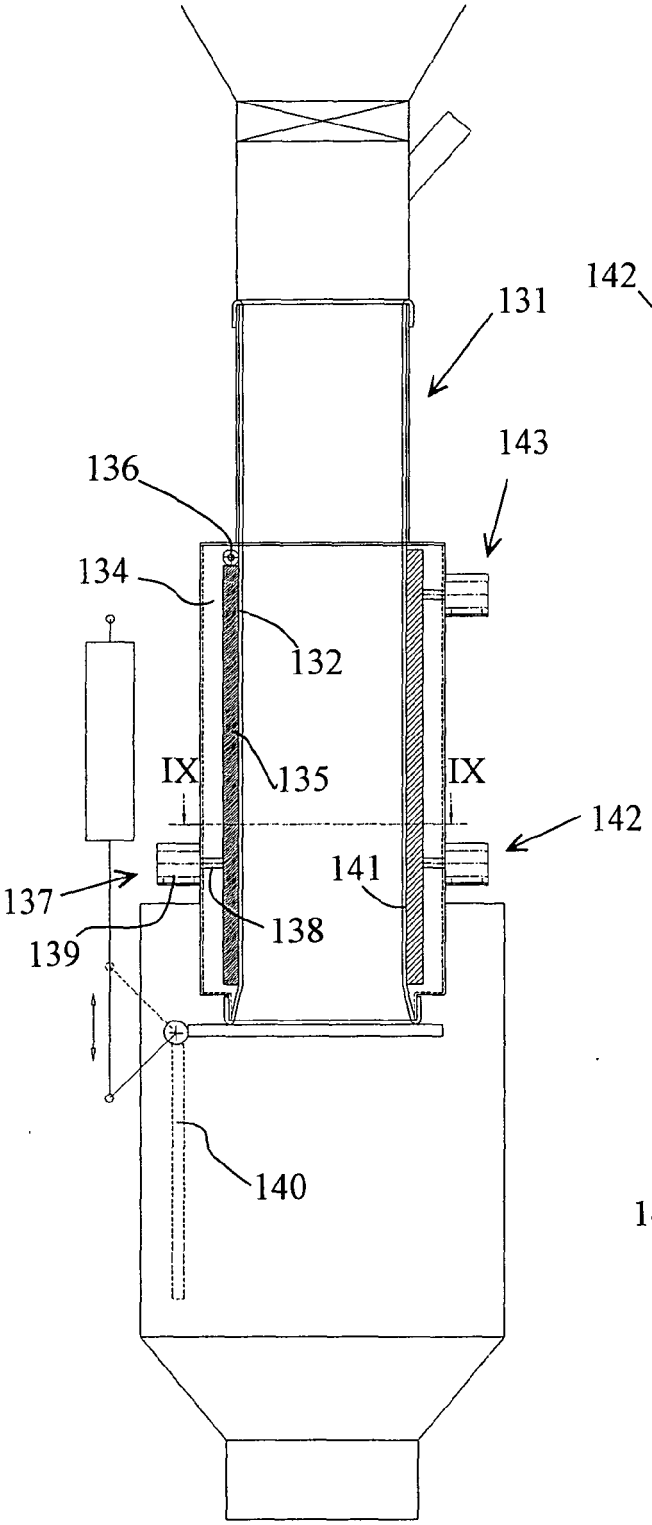

Fig. 8

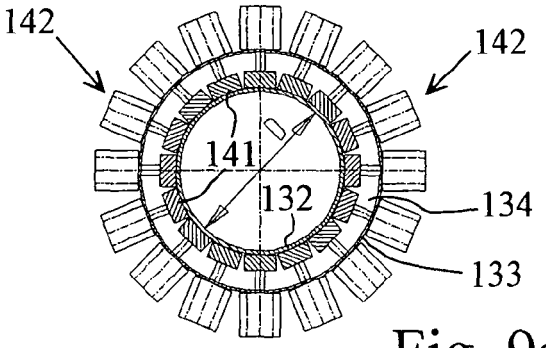

Fig. 9a

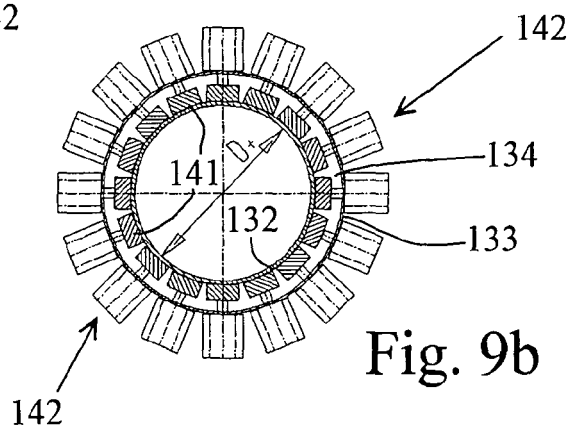

Fig. 9b

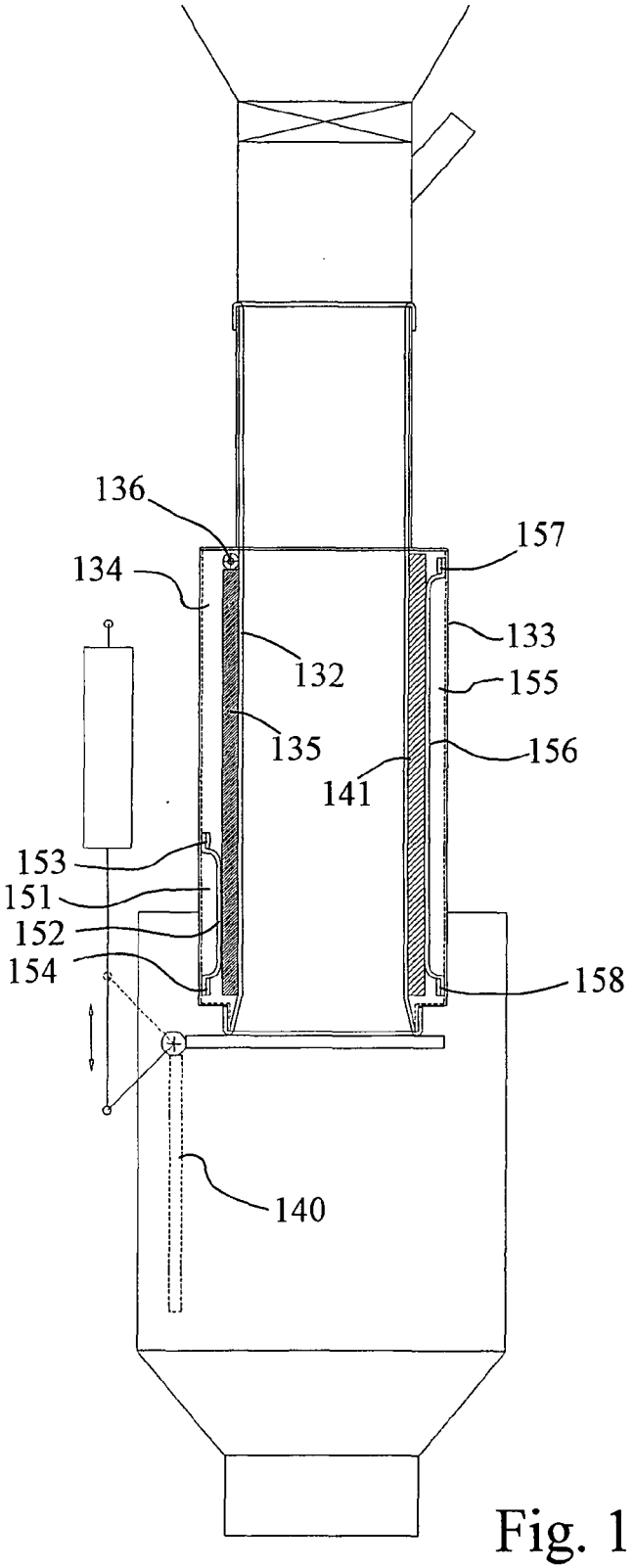

Fig. 10

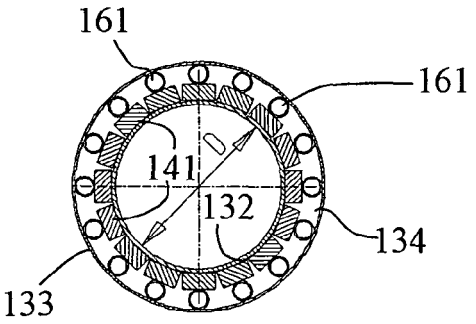

Fig. 11a

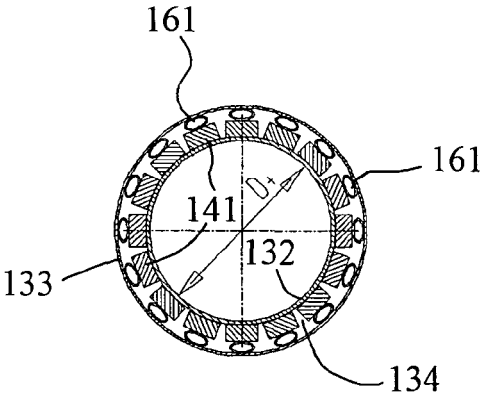

Fig. 11b

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 07 5709

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 July 2006	Jagusiak, A

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25-07-2006

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