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(54) Device and method for packaging a flowable solid material

(57) The invention relates to a device and a method for packaging a flowable solid material, such as a powder or a granulate. The device comprises first supplying means (20) for supplying a metered material fraction from a stock of the material to the interior of a container (14), compacting means (17) for compacting the metered material fraction in the interior of the container, second supplying means (15) for supplying the compacted material fraction to a package (9), and first sealing means (51) for sealing the package filled with the compacted material fraction.

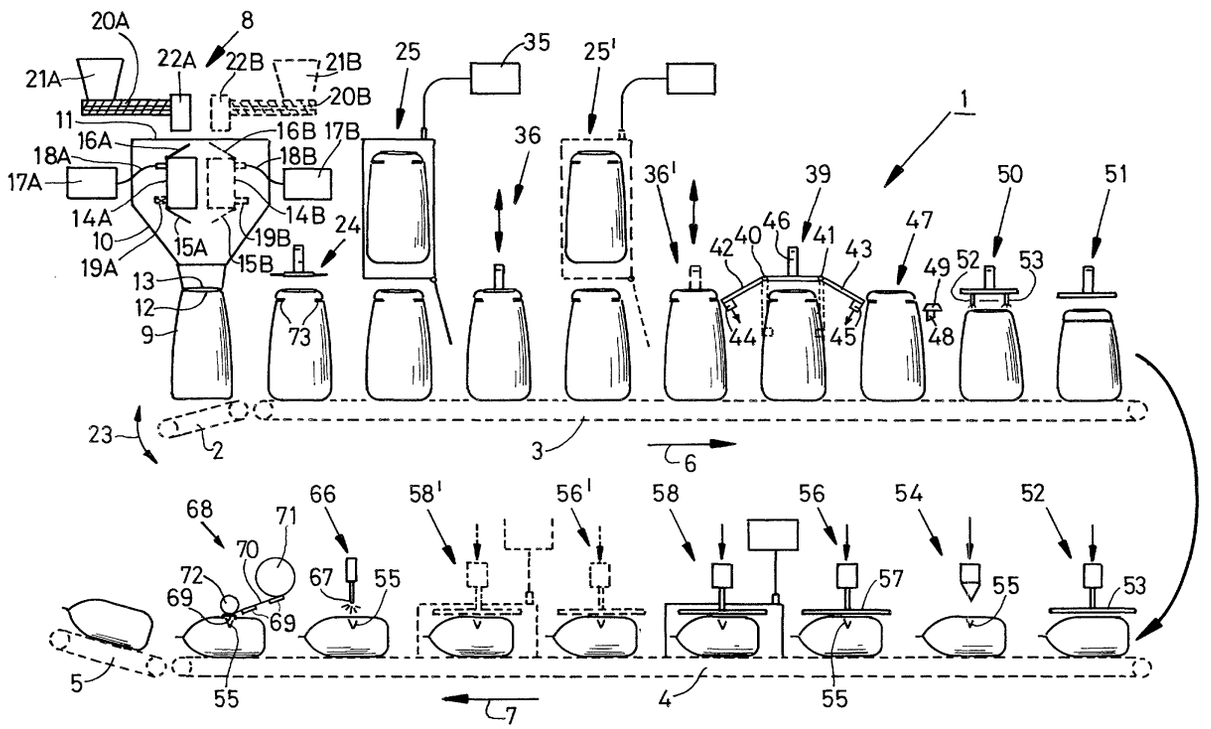


FIG.1

EP 1 312 547 A1

Description

[0001] The invention relates to a device as well as to a method for packaging a flowable solid material, such as a powder or a granulate, chemical powders, such as PVC powder, flour or cement. Various aspects play a role when packing such a material in a package, such as a bag. In the first place it is important that the correct amount is filled into the bag before it is sealed. In addition to that it is advantageous if the flowable material takes up as little volume as possible in the final sealed package, so that a minimum amount of space will be occupied during transport and storage, to which end the flowable material can generally be compacted. For reasons connected with storage and transport, it is furthermore very advantageous if the packages can be stacked in a stable position. For hygroscopic materials, such as cement, it is finally very advantageous if the package in question is impermeable to liquid, so that the hygroscopic material is prevented from coming into contact with moisture, for example from rainfall. Such contact would lead to premature curing of the cement, which would render it useless.

[0002] The object of the invention is to make a positive contribution as regards the above aspects, whether or not in preferred embodiments of the invention, and in order to accomplish that objective, the device according to the invention first of all comprises first supplying means for supplying a metered material fraction from a stock of the material to the interior of a container, compacting means for compacting the metered material fraction in the interior of the container, second supplying means for supplying the compacted material fraction to a package, and first sealing means for sealing the package filled with the compacted material fraction. Such a device is very advantageous on account of the specific sequence of the operating steps it embodies. Said specific sequence implies that the compacting of the material fraction takes place between the metering thereof and the supplying of the material fraction to the package. A major advantage of this sequence is that on the one hand said metering, which can be done by means of screw conveyors, for example, can take place in a relatively simple and reliable manner, because the material fraction has not been compacted yet when metering takes place, so that the material fraction will be flowable and homogeneous, which enables better metering. On the other hand, the fact that said compacting takes place before the material fraction is filled into the package has this major advantage that the package does not interfere with the compacting process, which would indeed be the case if the compacting step would be carried out after the step of introducing the material fraction into the package. Moreover, this makes it possible to use smaller packages.

[0003] A very advantageous embodiment of the device according to the invention is obtained if the compacting means comprise first closing means for providing a gastight seal of the interior of the container and first vacuum means for reducing the pressure in the interior of the container, which is filled with the material fraction and which has been closed by the first closing means. Reduction of the pressure in the sealed container, with suitable sub-atmospheric pressures ranging between 0.4 bar and 0.9 bar, will reduce the amount of pores between the particles of the flowable solid material as well as their size, as a result of which a compacting effect is obtained.

[0004] In order to achieve accurate metering, the device preferably includes weighing means for continuously determining the weight of the material fraction during the operation of the first supplying means, so that the supply of the material fraction by the first supplying means is stopped as soon as a desired weight has been determined by the weighing means.

[0005] To this end, the weighing means are preferably arranged for determining the weight of the container with the material fraction present therein. On the other hand, it is quite possible within the framework of the invention to meter the material fraction in a buffer container and subsequently supply it from said buffer container to the container, in the interior of which the material fraction is compacted by the compacting means. Such an embodiment could be advantageous, for example, if the device in question operates in steps and the sum of the processing times required for, respectively, metering and compacting the material fraction is larger than the desired processing step time, which would make it possible to reduce the cycle period.

[0006] A very simple and above all practical embodiment is obtained if the container comprises an inlet opening for the material fraction on the upper side and an outlet opening for the material fraction at the bottom side. Via said inlet opening, the metered supply of the material fraction to the interior of the container can take place, whilst the material fraction, which has been compacted in the meantime, can be passed through the outlet opening so as to be filled into the package in question.

[0007] Preferably, the inlet opening and the outlet opening can be closed by the first closing means. In that case it is advantageous if the first closing means, in the closed position thereof, form a bottom for the material fraction in the container at the outlet opening.

[0008] A very simple embodiment is obtained if the first closing means comprise at least one pivoted cover.

[0009] In order to increase the filling capacity, the device advantageously includes conveying means comprising a conveyor for conveying the package filled with the material fraction. Such conveying means can be driven both in steps and continuously, although driving in steps will be preferred in many cases because of the fact that the various processing machines, which will be described yet hereinafter, need not be designed for moving along with the conveyor in that case.

[0010] In order to increase the compacting capacity

of the device, the device preferably includes a first chamber, which can be sealed gastight by second closing means, for receiving the package, which is not sealed yet, with the compacted material fraction present therein, and second vacuum means for reducing the pressure in the first chamber, which has been sealed gastight. In said first chamber, further compacting of the material fraction takes place, during which process the package will come into close contact with the material fraction. A suitable sub-atmospheric pressure ranges between 0.4 bar and 0.9 bar. It should furthermore be realised that the effect achieved by the compacting means is usually undone to a certain extent as soon as the compacted material fraction is supplied to the package, during which the material fraction is generally subjected to shock loads, as a result of which the material is shaken up and its compactness is partially lost. This loss can also be compensated by the second vacuum means, therefore.

[0011] A very advantageous embodiment is obtained if a passage which can be closed by the second closing means is present at the bottom side of the first chamber for the relative passage of the package, which has not been sealed yet, with the compacted material fraction present therein. The second closing means preferably comprise a pivoted cover, just like the first closing means, which cover, upon being closed, provides a gastight seal of the interior of the first chamber.

[0012] In combination with a conveyor which the device comprises according to the preferred embodiment thereof, the first chamber is preferably fixedly disposed above the conveyor, and first moving means are provided for moving the package filled with the compacted material fraction via the passage between a position on the conveyor and a position in the first chamber. Thus, the package with the compacted material fraction present therein can be moved upwards from the conveyor via the passage in the first chamber, after which the first chamber can close as a result of the operation of the second closing means. As soon as a gastight seal has been effected, a sub-atmospheric pressure can be generated inside the first chamber by the operation of the second vacuum means.

[0013] Preferably, said first moving means comprise first driving means on the outside of the first chamber in order to limit the necessary volume of the first chamber as much as possible.

[0014] In particular for packaging hygroscopic, flowable types of material it is very advantageous if the first sealing means are arranged for liquid-tight sealing of the package filled with the compacted material fraction. It will be understood that in order to achieve this, also the material of the package itself must not allow liquid to permeate. Polyethylene, for example, could be a suitable material in this regard, whilst also other plastics, which are known to those skilled in the art, can be used for this purpose.

[0015] In order to enable stacking of the sealed packages, one preferred embodiment of the device comprises shaping means for shaping the sealed package in such a manner that two opposed, substantially flat and parallel sides are formed. This can be realised by means of a conveyor, for example, by placing the package flat on the conveyor and compressing the package from above with a flat plate or the like, so that a substantially flat and parallel side is formed both at the bottom side and at the upper side of the package.

[0016] A very advantageous preferred embodiment of the device is obtained if opening means are provided for forming an opening in the sealed package. Such a preferred embodiment provides major benefits also if the device does not comprise any compacting means for compacting the metered material fraction in the interior of the container. The benefits become manifest in particular when gastight packaging materials are used. The fact is that after the package has been sealed by the first sealing means, there is a risk of gas or air being trapped in the package, which gives the package a balloon-like appearance, as a result of which it is not possible, or at least not to a sufficient extent, to form two opposed flat and parallel sides. Air that is trapped in the package in this manner can now exit the package through the opening that has been formed by the opening means, for example under the influence of the press-down force on the package or under the influence of a sub-atmospheric pressure being generated.

[0017] Accordingly, a preferred embodiment is first of all characterized by second moving means comprising pressure means for compressing the sealed package, in which an opening is present, with a moving element.

[0018] On the other hand, an alternative preferred embodiment is characterized by third vacuum means and a second chamber for receiving the sealed package with the opening present therein, which second chamber can be sealed gastight by third closing means. Thus it is possible to subject both the sealed package with the opening present therein and the direct environment of said sealed package to a reduced pressure, for example a sub-atmospheric pressure ranging between 0.4 bar and 0.9 bar, as a result of which any gas, such as air, which may still be present in the package after sealing thereof can be removed therefrom. It is also possible within the framework of the invention to place a suction nozzle on the opening. It is noted, however, that such a situation involves the risk of material being sucked out of the package.

[0019] A practical situation is effected if the second chamber comprises a second passage at its bottom side for the relative passage therethrough of the package with the opening present therein, which passage can be closed by the third closing means. In this connection, the words "relative passage" are understood to mean that it is possible for the package with the opening present therein to move in an absolute sense in order to pass through the passage whilst it is also possible for the second chamber to move in an absolute sense, and

it is even possible to use a combination of such movements.

[0020] If a combination of a moving element and a second chamber is used, as described above, it is preferable to have the moving element compress the package with the opening present therein inside the second chamber. Thus, a very advantageous situation is created, in which gas that is present inside the package is removed from said package both as a result of the compression by the moving element and as a result of the action of the third vacuum means, whilst simultaneously excessive creasing of the package is prevented and furthermore desired flat and parallel sides can be formed on the package or be maintained thereon for the purpose of stacking the packages.

[0021] In order to keep the volume of the second chamber as small as possible, it is preferred, however, for the second moving means to comprise second driving means on the outside of the second chamber.

[0022] If a conveyor is used, it may be very advantageous, especially if the sealed package with the opening present therein is present on the conveyor in a lying position, if the second chamber is movably disposed above the conveyor, and third moving means are provided for moving the third chamber between a position above the conveyor and a position on the conveyor. If the conveyor is made of a gastight material, such as a rubber, said conveyor will effect the closing of the second passage at the bottom side of the second chamber, and consequently said conveyor forms part of the third closing means. As soon as the second chamber is positioned on the conveyor with its bottom edges surrounding the second passage, generation of the sub-atmospheric pressure can take place.

[0023] In particular when packaging hygroscopic materials in combination with a liquid-tight packaging material it is very advantageous if the device comprises second sealing means for liquid-tight sealing of the opening. Thus, liquid from outside the package is preventing from coming into contact yet with the hygroscopic material that is present in the package.

[0024] An extraordinarily simple and practical embodiment of the second sealing means is obtained if said sealing means comprise means for affixing a self-adhesive cover over the opening. Stickers may be used for that purpose.

[0025] The method according to the invention comprises the steps of

- supplying a metered material fraction from a stock of material to the interior of a container,
- sealing the container gastight,
- reducing the pressure in the interior of the container for the purpose of compacting the material fraction,
- opening the container,
- supplying the compacted material fraction to a package,
- sealing the package.

[0026] Preferably, said method is characterized by the additional steps of

- forming an opening in the sealed, liquid-tight package,
- sealing the opening liquid-tight.

[0027] Preferably, the contents of the package with the opening present therein is subjected to a reduced pressure after the opening is formed and before the opening is sealed, in order to eliminate bulging of the package caused by excess gas that is present inside the package, so that reliable stacking of the packages becomes possible.

[0028] Also in connection therewith, it is advantageous if the package with the opening present therein is shaped in such a manner after the opening is formed and before the opening is sealed that two opposite, substantially flat and parallel sides are formed.

[0029] The advantages of such embodiments of the method are in particular significant if the package is made of a liquid-tight material. It is noted that generally such materials are gastight as well.

[0030] The invention will be explained in more detail hereafter by means of a preferred embodiment of the invention, with reference to the drawings, with reference being made to the Figs. 1 - 4, which are all schematic representations.

[0031] Fig. 1 shows the preferred embodiment of a complete packaging device.

[0032] Fig. 2 shows (the operation of) processing unit 25 of the packaging device of Fig. 1.

[0033] Fig. 3 shows (the operation of) processing unit 36 of Fig. 1.

[0034] Fig. 4 shows (the operation of) processing unit 58 of Fig. 1.

[0035] Fig. 1 shows a preferred embodiment of a packaging device 1 according to the invention. The packaging device 1 comprises a conveying system with endless conveyor belts 2, 3, 4, 5 joining one another, which convey packaging bags 9 in the direction indicated by arrows 6, 7. Various processing units are positioned above said conveyor belts 2, 3, 4, 5, which units all carry out a specific processing step during the packaging process. The conveyor belts 2, 3, 4, 5 are driven in steps, with step times of about 4 seconds. Since the conveyor belts 2, 3, 4, 5 are driven in steps, there is no need for the various processing units to move along with the conveyor belt while carrying out the process step in question, although such a situation is quite possible within the framework of the invention.

[0036] Processing unit 8 on the one hand functions to supply the correct amount of flowable material, such as cement, to a packaging bag 9. To this end, the processing unit 8 comprises a funnel 10 having an open upper side 11 and an open bottom side 12. The inlet opening 13 closely surrounds the open bottom side 12 of the funnel 10, and the packaging bag 9 is connected to the fun-

nel 10 at that location. Accordingly, material which passes the open bottom side 12 of the funnel 10 under the influence of the force of gravity will be received in the packaging bag 9. Two weighing reservoirs 14A, 14B are present within the relatively wide upper side of the funnel 10. The weighing reservoirs 14A, 14B are open at their bottom sides as well as at their upper sides, but they can be closed by means of covers 15A, 15B and 16A, 16, respectively, at those locations. Covers 15A, 15B, 16A, 16B are circumferentially provided with a sealing strip, as a result of which the interior of the weighing reservoirs is sealed gastight from their environment after said covers have been closed.

[0037] A vacuum pump 17A, 17B is provided for each weighing reservoir 14A, 14B, which vacuum pump is connected to the associated weighing reservoir via connecting hoses 18A, 18B. After the covers 15A, 15B, 16A, 16B have been closed, a reduced pressure can be generated in the interior of the weighing reservoirs by activating the vacuum pumps 17A, 17B. Such reduced pressures typically range between 0.65 bar and 0.75 bar.

[0038] The weighing reservoirs 14A, 14B are each separately suspended from weighing cells 19A, 19B, by means of which weighing cells the weight of the weighing reservoirs 14A, 14B including their respective contents can be determined. Screw conveyors 20A, 20B are provided for supplying the cement to each weighing reservoir 14A, 14B, which screw conveyors supply cement from a storage container 21A, 21B to an outlet opening 22A, 22B. Said outlet openings 22A, 22b are located above the weighing reservoirs 14A, 14B. If cover 16A, 16B is open whilst cover 15A, 15B is closed, the reservoirs 14A, 14B can be filled with cement from storage containers 21A, 21B through rotation of the screw conveyors 20A, 20B. As soon as it has been established by means of the weighing cells 19A, 19B that a certain desired weight of cement has been supplied to weighing reservoirs 14A, 14B, the rotation of the screw conveyors 20A, 20B is stopped by a control system (not shown), and the covers 16A, 16B close. Although the screw conveyors 20A, 20B of Fig. 1 are single screw conveyors, it is quite conceivable in practice to use 2-stage metering, in which a distinction is made between coarse metering and fine metering, the latter taking place as soon as the desired weight is nearly reached. After the covers 16A, 16B have closed, the vacuum pumps 17A, 17B are activated, as a result of which air that is present in the pores in the cement that is present in the weighing reservoirs 14A, 14B is removed and the cement that is present in the weighing reservoirs 14A, 14B will set to a certain extent. After this compacting process has proceeded to a particular extent, air is admitted to the interior of the weighing reservoirs 14A, 14B again, after which the covers 15A, 15B at the bottom side of the weighing reservoirs 14A, 14B are opened, whereupon the compacted material will fall into the packaging bag 9 via the open bottom side 12 of the funnel 10. A major advantage of this arrangement is that the cement is already compacted before it is filled into the packaging bag 9, whilst on the other hand this compacted condition did not exist at the time of the metering of the cement, so that also said metering could take place without any difficulty.

[0039] The packaging bag 9 is made of polyethylene foil, which is airtight as well as liquid-tight. The packaging bag 9 is freely suspended during filling thereof as a result of conveyor belt 2 being tilted downwards. After the packaging bag 9 has been filled in the desired manner, said packaging bag 9 is detached from funnel 10 and the conveyor belt 2 is tilted upwards as indicated by double arrow 23, as a result of which the bottom side of packaging bag 9 comes into contact with the conveyor belt 2 and the packaging bag is transferred to conveyor 3.

[0040] Although the processing unit 8 has been described above in relation to a situation in which the metering of the cement, or in general of a flowable material, and the compacting of said metered material takes place in the same weighing reservoirs 14A, 14B, it is also possible within the framework of the invention for comparable compacting reservoirs to be disposed under the weighing reservoirs 14A, 14B, inside which the reduced pressure can be generated, so that this need not take place in the weighing reservoirs 14A, 14B. This may be desirable precisely because of the fact that otherwise the stopping time would be undesirably long if both metering and compacting must take place within one step time. In this case, a double processing unit 8 is used already so as to limit said step time, which is not necessary within the framework of the invention.

[0041] Disposed at the front of the conveyor belt 3 is processing unit 24, where V-shaped folds are formed at two opposed positions at the upper side of the bag, which folds are fixated by means of seals 73. Such a processing unit is known to those skilled in the art and requires no further explanation.

[0042] Processing unit 25 is shown in more detail in Fig. 2, which illustrates three stages I, II, III during the operation of the processing unit. The processing unit 25 comprises a vacuum chamber 26, which is open at its bottom side, but which can be closed by means of a cover 28 which pivots about a pivot 27. Disposed above chamber 26 is a double-acting pneumatic cylinder 29 with a single-sided piston rod 30. It is possible to move the piston rod 30 to and fro by means of the cylinder 29 between a lower position (stage I, III) and an upper position (stage II). Present at the bottom side of the piston rod 30 is a gripping unit 31 comprising two gripping jaws 32 which are capable of engaging the packaging bag 9 at its upper edge, near the V-shaped folds and the seals 73. After having engaged the packaging bag, the piston rod 30 moves upwards with the packaging bag 9 and the cover 28 will close. At the same time, the gripping jaws 32 move together, so that an opening 33 is formed at the upper side of the packaging bag 9. For the rest,

the packaging bag 9 largely retains its shape while this happens. Connected to the chamber 26, via a vacuum hose 34, is a vacuum pump 35, which, upon being activated, generates a sub-atmospheric pressure of about 0.6 bar inside the vacuum chamber 26. As a result, further compacting of the cement in packaging bag 9 will take place. In addition, the packaging bag 9 itself will come into closer contact with its contents. Once the sub-atmospheric pressure is released, the gripping jaws will move apart again, cover 28 will be opened and the piston rod 30 will move downwards, after which the gripping jaws 32 will open and the packaging bag 9 will be present on the conveyor belt 3 again for further transport.

[0043] The next processing unit 36 is a station for vertical shaking of the packaging bag 9, so that the cement, or another flowable material that is present in the packaging bag 9, of course, is homogeneously distributed. In Fig. 3, said shaking process is represented in the form of the stages I - IV thereof. To enable said shaking, the processing unit 36 comprises a gripping unit 37 which can be moved up and down more or less jerkily by moving means (not shown). The gripping unit 37 comprises two opposed strip-shaped clamping jaws 38, between which the upper side of the packaging bag 9 can be clamped.

[0044] Fig. 1 shows the processing units 25' and 36', which are similar to the processing units 25 and 36 and which are intended to further enhance the effect that is achieved by said processing units. The use of double versions of particular processing units in this manner makes it possible to keep the step times of the entire process that is carried out by the packaging device 1 relatively short, so that all processing units are optimally utilized.

[0045] In the next processing unit 39, the V-shaped fold that has been formed at the upper side is extended in downward direction. It should be realised that the action of the processing units 25 and 36, and possibly of the processing units 25' and 36', has caused the cement in the packaging bag 9 to settle, as a result of which no cement is present at the upper side of the packaging bag 9 any more. Beating arms 42, 43, which are pivotable about pivots 40, 41 and which are provided with V-shaped beating blocks 44, 45 at their lower ends, are present on either side of the packaging bag 9 for extending the V-shaped fold in downward direction. Dotted lines show the situation in which the beating blocks 44, 45 have just fallen into the packaging bag 9. In order to prevent the beating arms 42, 43 from blocking the transport of the packaging bags 9, said arms 42, 43 can either be pivoted through 90° about vertical axis 46 or be moved upwards.

[0046] In processing unit 47, the upper, superfluous part of the packaging bag 9, including the seals 73 provided in processing unit 24, are cut off the remaining part of the packaging bag 9 by means of two rotary knives 48, 49.

[0047] Subsequently, the upper side of the thus shortened packaging bag 9 is blown clear and thus made dust-free in preparation of a final sealing step in processing unit 51, in which the contents of the packaging bag are sealed airtight and liquid-tight from the environment of the packaging bag 9. The processing unit 50 is fitted with blowing nozzles 52, 53 for cleaning the upper side of the packaging bag, which blowing nozzles can be moved to and fro in horizontal direction along the upper side.

[0048] After completion of the sealing step in processing unit 51, the packaging bag 9 is pushed over by guide means (not shown) and simultaneously transferred to conveyor belt 4, which may extend perpendicularly to conveyor belt 3, for example. When the packaging bag 9 is pushed over, its orientation changes from a vertical position to a horizontal position.

[0049] The first processing unit 52 above the conveyor belt 4 presses the lying packaging bag down on the conveyor belt 4 by means of a plate-shaped pressure element 53, as a result of which parallel flat sides are formed at the upper side and the lower side of the packaging bag 9, or this situation is at least approximated.

[0050] In processing unit 54, an opening in the form of a cut 55 is formed in the flat upper side of the packaging bag 9. Such a cut 55 can be made with a stationary or a rotary knife, for example, which is capable of up-and-down movement.

[0051] Then the packaging bag 9 is compressed once again in the next processing unit 56, in the same manner as in processing unit 52, as a result of which part of the air, or in general of the gases, which will inevitably remain behind in the packaging bag 9 after the sealing process in processing unit 51, are forced out via cut 55. In that situation it is important, of course, that the pressure element 57 of processing unit 56 does not shut off the opening formed by the cut 55, to which end the pressure element may be provided with a hole at the location of said cut 55.

[0052] The next processing unit 58 is shown in more detail in Fig. 4, during stages 1 - V of its operation. The processing unit 58 is similar to the processing unit 25 to a certain extent. A vacuum chamber 59 having an open bottom side 60 is provided. The vacuum chamber can be moved downwards from the position above the packaging bag 9 to a position on the conveyor belt 4, in which position the vacuum chamber 59 encloses the packaging bag 9 entirely. In that situation, the vacuum chamber 59 and the conveyor belt 4, which is made of a particular type of rubber, together define a gastight space, within which the packaging bag 9 is present. The vacuum chamber 59 is connected to a vacuum pump 62 via a vacuum hose 61, which pump provides a sub-atmospheric pressure of about 0.6 bar during stages II and III in the space that is defined by the vacuum chamber 59 and the conveyor belt 4. Thus, the cement in packaging bag 9 is further compacted because the reduced pressure will also prevail at the location of the cement, owing

to the presence of cut 55. Present on top of the vacuum chamber 59 is a double-acting cylinder 63, the piston rod 64 of which extends into vacuum chamber 59. At its bottom end, the piston rod 64 is fitted with a pressure plate 65, which presses down on the upper side of the packaging bag 9 during the reduced pressure in stages II and III, as a result of which excessive creasing of the packaging bag 9 itself on account of the reduced pressure is prevented. After the reduced pressure has been increased to atmospheric pressure again, the vacuum chamber 59 is moved up, whilst the piston rod 64 with the pressure plate attached thereto is at the same time pressed down with increased force, as a result of which the packaging bag 9 becomes flatter (stage IV). Then the vacuum chamber 59 and the cylinder 63 are moved further upwards, as a result of which the packaging bag 9 can be transported further by conveyor belt 4.

[0053] The processing units 56' and 58' correspond to processing units 56 and 58, respectively, and need no further explanation, therefore, except that they effect a further intensification of the processing steps in question, of course.

[0054] At processing unit 66, the area surrounding the cut 55 is blown clear by means of a blowing nozzle 67.

[0055] This makes it possible to affix a sticker 69 to the cut 55 in a reliable manner at processing unit 68, thus effecting an airtight and liquid-tight seal of cut 55, as a result of which also the packaging bag 9 as a whole is sealed airtight and watertight. The stickers 69 are present on a carrier 70, a roll 71 of which is unwound along cut 55, where the sticker 69 is affixed to the packaging bag 9 by means of a pressure roller.

[0056] After processing unit 68, the packaging bag 9, which is now airtight and liquid-tight again, is taken over by conveyor belt 5, after which storage and transport of the packaging bags 9 can take place. It is noted that the packaging bags thus obtained take up a relatively small amount of volume, due to the various compacting steps that have been carried out. In addition, the packaging bag 9 has two parallel flat sides, so that they can readily be stacked. In the case of hygroscopic materials there is furthermore no need to be afraid that said hygroscopic material may come into contact with liquid, for example from natural rain fall, as long as the packaging bag 9 remains sealed, provided of course that the packaging bag is made of a liquid-tight material.

[0057] Furthermore it is noted that the inventive concept of forming an opening in the packaging bag yet after sealing of the bag has taken place and sealing said opening again after further compacting and shaping of the packaging bag can excellently be applied independently of the concept of compacting the flowable material to be packaged at processing unit 8 before said material is filled into the packaging bag 9, but after said flowable material has been metered by means of a metering system. In order to increase the capacity of the packaging device 1, it is also possible within the framework of the invention to use double parallel versions of those processing units that require a relatively long step time, such as processing the units 25 and 28, as a result of which the step time for that specific processing step can be doubled. It stands to reason that the flow of packaging bags must be split up in that case.

[0058] By way of illustration it is furthermore noted that it is possible when using a packaging device 1 as described above to produce about 800 liquid-tight bags having two flat sides, each containing 25 kg of cement, from which the air has been removed practically completely.

Claims

1. A device for packaging a flowable solid material, such as a powder or a granulate, comprising first supplying means for supplying a metered material fraction from a stock of the material to the interior of a container, compacting means for compacting the metered material fraction in the interior of the container, second supplying means for supplying the compacted material fraction to a package, and first sealing means for sealing the package filled with the compacted material fraction.

2. A device according to claim 1, **characterized in that** the compacting meas comprise first closing means for providing a gastight seal of the interior of the container and first vacuum means for reducing the pressure in the interior of the container, which is filled with the material fraction and which has been closed by the first closing means.

3. A device according to claim 1 or 2, **characterized by** weighing means for continuously determining the weight of the material fraction during the operation of the first supplying means, so that the supply of the material fraction by the first supplying means is stopped as soon as a desired weight has been determined by the weighing means.

4. A device according to claim 3, **characterized in that** said weighing means are arranged for determining the weight of the container with the material fraction present therein.

5. A device according to claim 1, 2, 3 or 4, **characterized in that** the container comprises an inlet opening for the material fraction on the upper side and an outlet opening for the material fraction at the bottom side.

6. A device according to claims 2 and 5, **characterized in that** the inlet opening and the outlet opening can be closed by the first closing means.

7. A device according to any one of the claims 2 - 6,

characterized in that the first closing means comprise at least one pivoted cover.

8. A device according to any one of the preceding claims, **characterized by** conveying means comprising a conveyor for conveying the package filled with the material fraction.

9. A device according to any one of the preceding claims, **characterized by** a first chamber, which can be sealed gastight by second closing means, for receiving the package, which is not sealed yet, with the compacted material fraction present therein, and second vacuum means for reducing the pressure in the first chamber, which has been sealed gastight.

10. A device according to claim 9, **characterized in that** a passage which can be closed by the second closing means is present at the bottom side of the first chamber for the relative passage of the package, which has not been sealed yet, with the compacted material fraction present therein.

11. A device according to claim 8 and claim 9 or 10, **characterized in that** the first chamber is fixedly disposed above the conveyor, and first moving means are provided for moving the package filled with the compacted material fraction via the passage between a position on the conveyor and a position in the first chamber.

12. A device according to claim 11, **characterized in that** said first moving means comprise first driving means on the outside of the first chamber.

13. A device according to any one of the preceding claims, **characterized in that** the first sealing means are arranged for liquid-tight sealing of the package filled with the compacted material fraction.

14. A device according to any one of the preceding claims, **characterized by** shaping means for shaping the sealed package in such a manner that two opposed, substantially flat and parallel sides are formed.

15. A device according to any one of the preceding claims, **characterized by** opening means for forming an opening in the sealed package.

16. A device according to claim 15, **characterized in that** said opening means comprise cutting means for forming a cut in the sealed package.

17. A device according to claim 15 or 16, **characterized by** second moving means comprising pressure means for compressing the sealed package, in which an opening is present, with a moving element.

18. A device according to claim 15, 16 or 17, **characterized by** third vacuum means and a second chamber for receiving the sealed package with the opening present therein, which second chamber can be sealed gastight by third closing means.

19. A device according to claim 18, **characterized in that** the second chamber comprises a second passage at its bottom side for the relative passage therethrough of the package with the opening present therein, which passage can be closed by the third closing means.

20. A device according to claim 17 and claim 18 or 19, **characterized in that** said moving element compresses the package with the opening present therein inside the second chamber.

21. A device according to claim 20, **characterized in that** the moving element compresses the package with the opening present therein inside the second chamber.

22. A device according to claim 8 and claim 19, 20 or 21, **characterized in that** the second chamber is movably disposed above the conveyor, and third moving means are provided for moving the third chamber between a position above the conveyor and a position on the conveyor.

23. A device according to any one of the claims 15 - 22, **characterized by** second sealing means for liquid-tight sealing of the opening.

24. A device according to claim 23, **characterized in that** said second sealing means comprise means for affixing a self-adhesive cover over the opening.

25. A method for packaging a flowable solid material, such as a powder or a granulate, comprising the steps of

- supplying a metered material fraction from a stock of material to the interior of a container,
- sealing the container gastight,
- reducing the pressure in the interior of the container for the purpose of compacting the material fraction,
- opening the container,
- supplying the compacted material fraction to a package,
- sealing the package.

26. A method according to claim 25, **characterized by** the additional steps of

- forming an opening in the sealed, liquid-tight package,
- sealing the opening liquid-tight.

27. A method according to claim 26, **characterized by** subjecting the contents of the package with the opening present therein to a reduced pressure after the opening is formed and before the opening is sealed.

28. A method according to claim 26 or 27, **characterized by** shaping the package with the opening present therein after the opening is formed and before the opening is sealed, in such a manner that two opposite, substantially flat and parallel sides are formed.

29. A method according to claim 25, 26, 27 or 28, **characterized in that** the package is made of a liquid-tight material.

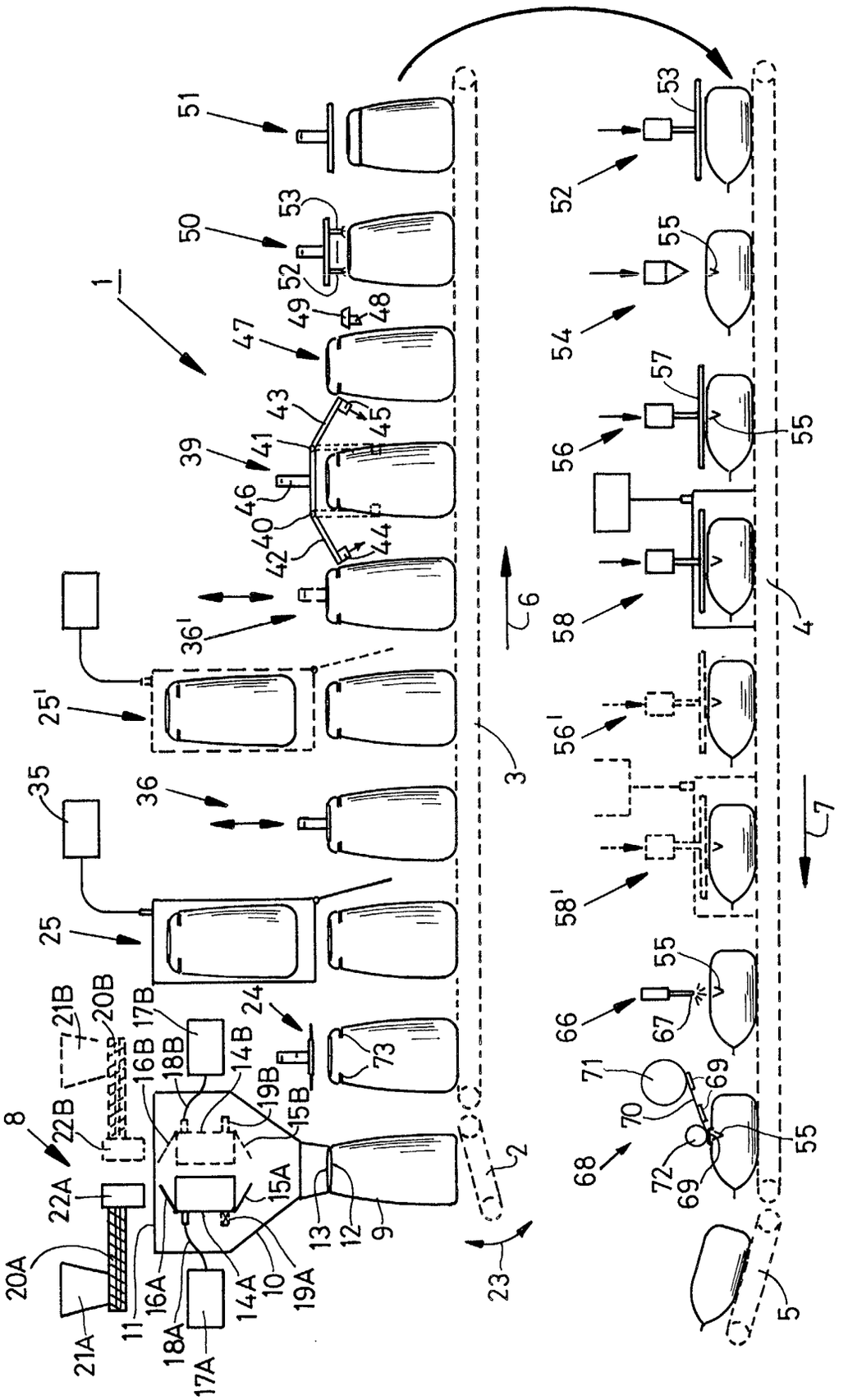

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FIG. 1

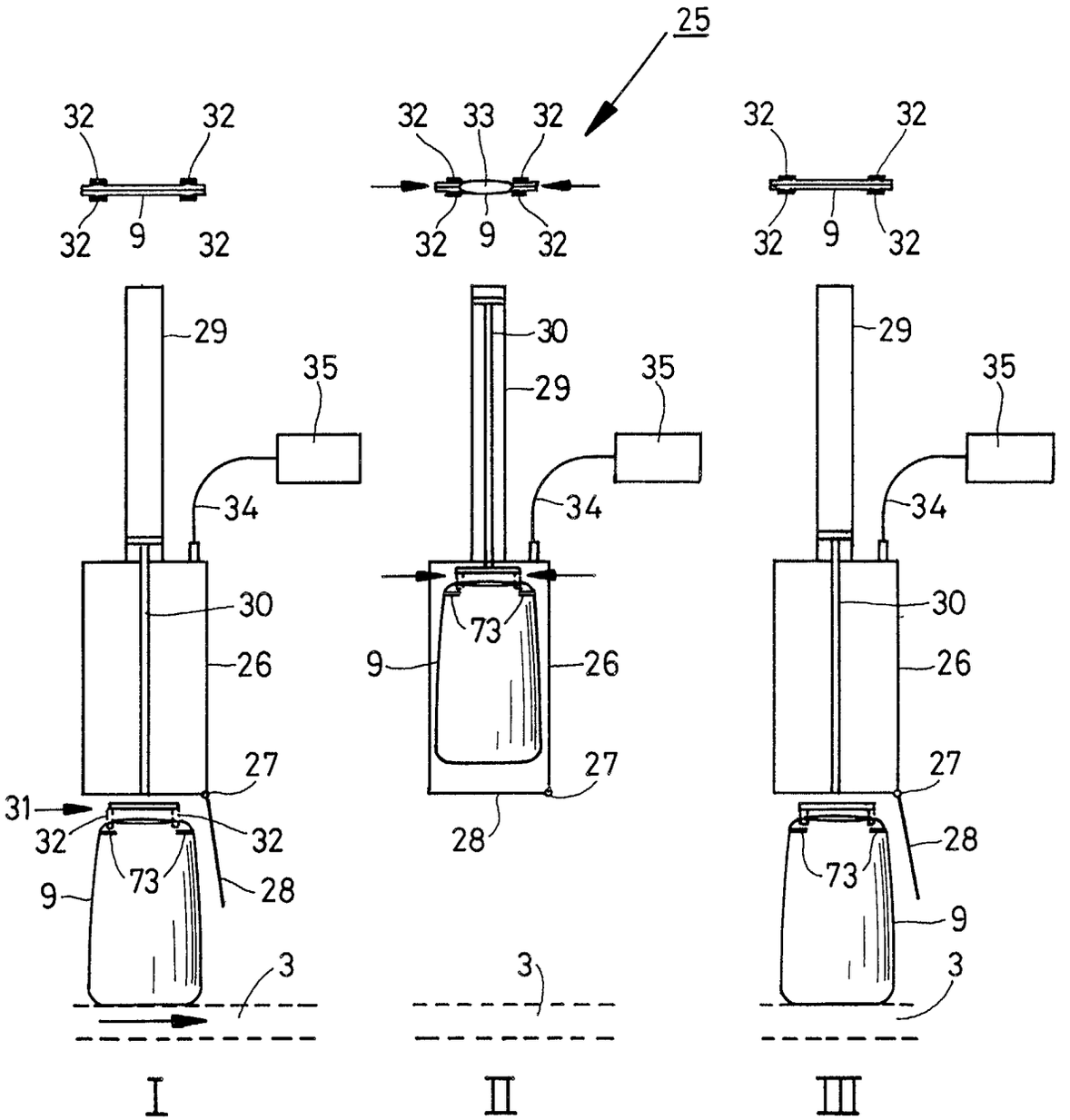


FIG. 2

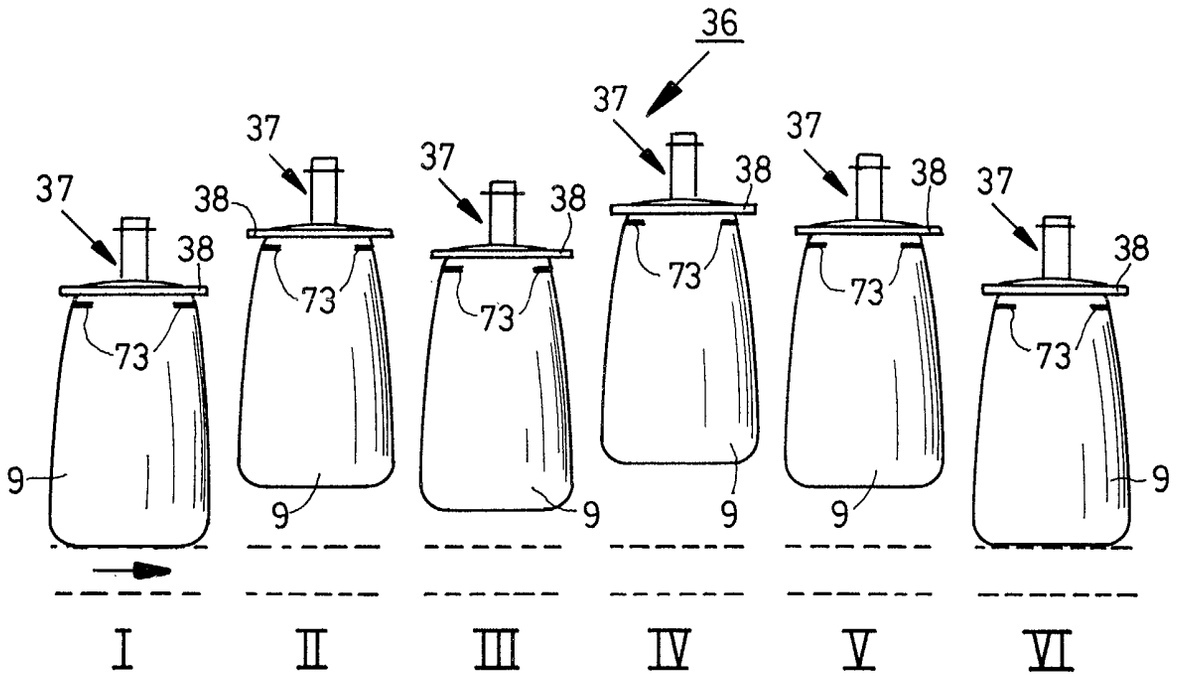


FIG. 3

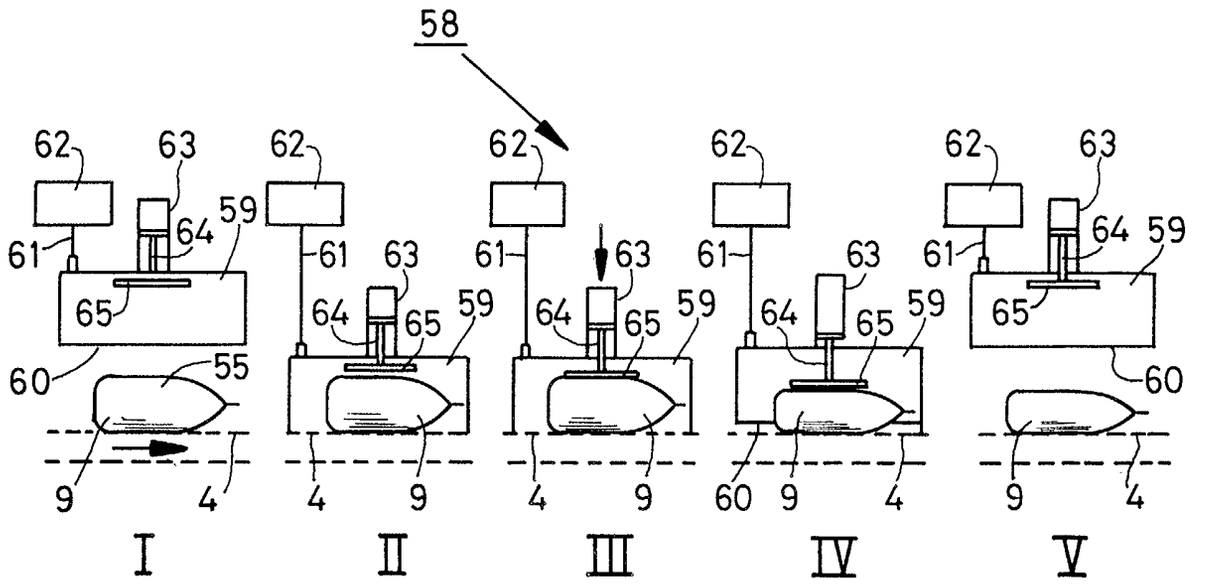


FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 20 4373

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Place of search	Date of completion of the search	Examiner
THE HAGUE	4 April 2002	Grentzius, W

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