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(54) **A powdered material flow control device to fill a bag and corresponding bag filling machine and process**

(57) A powdered material flow control device for filling a bag (100) comprising a first screw conveyor (2) for transporting the material. The device (1) also comprises a second screw conveyor (4) adjacent the first screw conveyor (2). Both screw conveyors (2, 4) are vertically arranged, and, inside a housing (6) defining an inlet port (8), a outlet port (10) for the material and a common inner chamber (12). The screw conveyors (2, 4) have dimensions such that the housing (6) is externally snugly adapted to the cross section of the bag (100), said first and second screw conveyors (2, 4) rotating at a synchronized speed. The invention also proposes a machine including the device, as well as a filling process that uses the device.

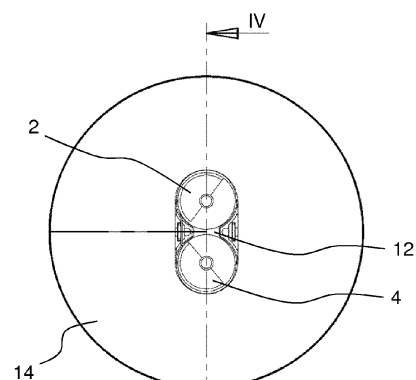


FIG. 3

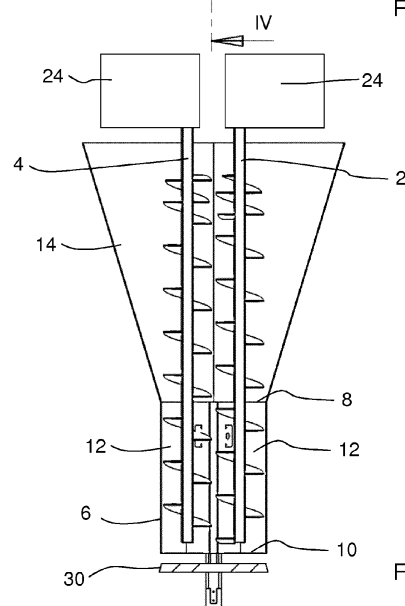


FIG. 4

Description

Field of the invention

[0001] The invention relates to a powdered material flow control device for filling a bag comprising a first screw conveyor for transporting said material.

[0002] Likewise, the invention also relates to a machine including said flow control device, as well as a process for filling bags using said device.

State of the art

[0003] Devices for filling bags with powdered material are known both in preformed bag filling machines and in forming, filling and sealing machines, which form their own bag and are known in the art as FFS (form, fill and seal) machines. The usual thing when filling bags is to take advantage of the effect of gravity so that the material falls under its own weight centered in the bag. To determine the amount by weight of material which has been placed in the bag, three different ways of measuring are regularly used: measurement of the net weight, of the gross weight and of the weight loss.

[0004] Net weight measuring consists of providing a load sensor in the hopper for filling the bag. The hopper is filled, for example, by means of a conveyor belt. In this way the weight of material with which it is desired to fill the bag is determined from the hopper and when the metered amount is ready, the hopper is opened and it is allowed to fall into the bag.

[0005] For gross weight measurement, a conveyor belt allows the powdered material to fall and the end weight measurement is performed on the bag itself.

[0006] Finally in the weight loss method, the weight sensor is provided in the hopper containing all the powdered material, starting out from a known amount of material. Thus, pouring of the material through the hopper mouth is started and the weight loss in the hopper is monitored. When the desired filling weight is attained, a cover closes the hopper mouth.

[0007] In all the filling and weight control methods discussed above, it is hard to control how the material falls into the bag. It is also complicated accurately to know how much material is in transit in the space comprised between the point of supply and the bag and thus accuracy in the bag filling is lost.

[0008] An additional problem is that the effect known as fluidization of the material appears during the filling operation. Fluidization of a powdered material consists on aeration or the incorporation of air experimented by the material due to its own movement and having as a consequence an increase in the volume thereof and it behaving similarly to a fluid. This leads to the material occupying a greater volume within the bag than would be desirable. In this context, the bags to be filled with powdered material usually have a three-dimensional form such that once they are filled it is close to an ortho-

hedron having a rectangular cross section twice as wide as it is deep. This shape is particularly appropriate for palletizing full bags. Then, if the material is highly fluidized, the bag loses volume with the passage of time and becomes emptier, whereby it loses its approximately orthohedron shape and is thus harder to palletize, since it easily deforms.

[0009] Finally, another problem inherent in the filling of bags by free fall of a highly fluidized material consists of there usually being an increase in the amount of material dust generated when hitting the bottom of the bag or the material already placed on this bottom. This dust dirties the bag inner walls and can hinder its closing.

[0010] To solve these interrelated problems, solutions such as the one disclosed in document EP 1819596 A1 have been suggested. This document discloses an FFS machine in which the bag is filled through a screw conveyor and the bag can move vertically to reduce the height over which the powdered material falls. Thus, initially, the bag is close to the outlet port from the screw conveyor and as it is filled, it moves away so that the distance between the port and the surface on which the material falls is kept approximately constant. Nevertheless, this system requires additional control members to coordinate the separation movement of the bag relative to the screw conveyor to guarantee the downward movement of the bag. Consequently, both the machine and the metering device are relatively complicated.

[0011] Document US 2008/0115462 A1 shows an FFS machine having a metering and weighing system for pasty materials containing water, such as for example mixtures of plaster and water ready for use. In this machine there is used a first coarse filling screw conveyor and a second smaller diameter screw conveyor for the fine filling, both being vertically arranged. Both screw conveyors can rotate simultaneously to fill the bag more quickly, but the final filling is carried out by the fine filling screw conveyor. This causes irregularity in the flow falling in the bag. Furthermore, a sensor is provided in this system which weights the bag to determine the gross weight.

[0012] Finally, document CN 2795035 U shows a device for filling bags with powdered material in which two screw conveyors are provided for the simultaneous horizontal filling of two bags. To this end, the screw conveyors share a single material supply hopper which is separated into two independent chambers, one for each bag.

Summary of the invention

[0013] It is an object of the invention to provide a flow control device for a powdered material for filling a bag of the type indicated at the beginning, allowing the fluidization of the material to be reduced as far as possible in a simple manner.

[0014] This purpose is achieved by a flow control device of the type indicated at the beginning, characterized in that it comprises a second screw conveyor adjacent said first screw conveyor, with said first and second screw

conveyors being arranged vertically, and at least in part, inside a housing defining an inlet port, a outlet port for said material and a common inner chamber, and in that said first and second screw conveyors have dimensions such that said housing is externally snugly adaptable to the cross section of the bag, said first and second screw conveyors rotating at a synchronized speed.

[0015] Thanks to this arrangement, several objectives are attained simultaneously. In the first place, the flow can be controlled since the entrained volume of powdered material is known at all times and is regular and foreseeable at all times due to the synchronization of both screw conveyors. On the other hand, from the hopper containing all the powdered material to the outlet port compacting takes place which helps to reduce the aeration of the material and therefore precludes fluidization. Finally, the fact that the housing is adapted to the shape of the bag mouth is the cause that, with the powdered material falling under its own weight in a relatively compacted form, the bag is uniformly filled across the whole width thereof, considerably reducing any possible aeration, which improves the compacted filling of the bag in a simple way. This leads to the filling producing a substantially parallelepipedic bag, thereby facilitating palletizing.

[0016] The invention further includes a number of preferred features that are object of the dependent claims and the utility of which will be highlighted hereinafter in the detailed description of an embodiment of the invention.

[0017] Preferably in the area where said first and second screw conveyors are adjacent one another, said housing defines at least one longitudinal channel separate from said inner chamber for the passage of handling mechanisms extending up to said outlet port. In this way a much more compact device is achieved.

[0018] It may also be of interest to achieve maximum compacting prior to discharge of the product through the outlet port. To this end, the pitch of said screw conveyors decreases towards said outlet port.

[0019] Optionally, said first and second screw conveyors have the same spirals and directions of rotation and alternatively said first and second screw conveyors have opposite spirals and directions of rotation.

[0020] In certain cases, it may be desirable to achieve maximum compacting of the powdered material after it has already been discharged into the bag. To this end, said handling mechanisms comprise at least one of an air suction device at the top end of the bag, or a vacuum generator device within mass of the bagged powdered material.

[0021] In an especially preferable way said housing has a cross section twice as wide as it is deep.

[0022] The invention also relates to a bag filling machine comprising between said metering device and said bag it comprises a powdered material flow control device according to the invention.

[0023] Finally, the invention relates to a process for

filling bags with a powdered material solving the problem of fluidization in a simple way. To this end, the process comprises following steps: [a] determining a metered amount of powdered material with which it is desired to fill a bag, [b] pouring said metered amount into the hopper of a powdered material flow control device comprising adjacent first and second screw conveyors, said first and second screw conveyors being arranged vertically, and at least in part, inside a housing defining an inlet port, a outlet port for said material and a common inner chamber, and said first and second screw conveyors having dimensions such that said housing is externally snugly adaptable to the cross section of the bag, and [c] rotating said first and second screw conveyors synchronously to discharge said powdered material through said outlet port.

[0024] In an especially preferable way, in the procedure according to the invention said housing has a cross section twice as wide as it is deep.

[0025] Likewise, the invention also includes other features of detail illustrated in the detailed description of an embodiment of the invention and in the accompanying figures.

Brief description of the drawings

[0026] Further advantages and features of the invention will become apparent from the following description, in which, without any limiting character, preferred embodiments of the invention are disclosed, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a first embodiment of a powdered material flow control device according to the invention.

Figure 2 is a side view of the device of Figure 1.

Figure 3 is a top plan view of the device of Figure 1.

Figure 4 is a front view of the device of Figure 1 in section along the line IV-IV of Figure 3.

Figure 5 is a cross section view along the line III-III of Figure 2.

Figure 6 is a schematic view of a first embodiment of a machine according to the invention.

Figure 7 is a schematic view of a second embodiment of a machine according to the invention.

Figure 8 is a perspective view of a second embodiment of a powdered material flow control device according to the invention.

Figure 9 is a side view of the device of Figure 8.

Figure 10 is a top plan view of the device of Figure 8.

Figure 11 is a cross section view along the line XI-XI of Figure 9.

Detailed description of embodiments of the invention

[0027] Figures 1 to 5 show a first embodiment of the powdered material flow control device 1 according to the invention. This device 1 may be mounted both in FFS machines and in machines for preformed bags.

[0028] As may be seen in the Figures, the device 1 has an upper hopper 14 containing the powdered material in bulk, in spite of the material not being shown in the Figures. The hopper 14 contains the premeasured amount with which the flow is regulated to fill the bag 100. At the bottom end of the hopper 14 there extends vertically downward a tubular housing 6 enveloping a first and second screw conveyors 2, 4 which are arranged one adjacent the other. The first and second screw conveyors 2, 4 are only partly arranged in the housing 6, since they are partly inside the hopper 14 to be able to start the entrainment of powdered material downwards. The housing 6 has an inlet port 8, and an outlet port 10 delimiting a common inner chamber 12 through which the powdered material is caused to descend.

[0029] Thus, in the invention, the first and second screw conveyors 2, 4 are dimensioned such that the housing 6 enveloping them is snugly adapted to the generally rectangular cross section of the bag 100. As may be seen in Figure 5, the bags 100 usually have a bellows shape on their shorter sides 104, which substantially improves filling, since the material forces the bag to take on a parallelepipedic shape facilitating palletizing thereof. In the first place, the fact that the housing 6 is adapted to the cross section of the bag 100 substantially reduces the entry of air. Nevertheless, it is not essential for the invention for the bag 100 to be completely open, forming a rectangular inlet mouth. Thus, for example, in the case of FFS machines in which the bag 100 is often held by two lateral grippers at the height of the lateral bellows at the sides 104. In any case, it is an object of the invention to reduce as far as possible the spaces between the housing 6 and the mouth 102 of the bag 100 to make it as difficult as possible for air to enter during the filling process of the bag 100.

[0030] Additionally, the first and second screw conveyors 2, 4 rotate at synchronized speeds thanks to corresponding servo motors 24 schematically shown in Figure 2, which allows the flow to be uniformly controlled. Alternatively, the first and second screw conveyors may share one same servo motor. On the other hand, thanks to the flow control, the material cannot fall irregularly or in spurts, which would facilitate its entraining air.

[0031] Finally, the outlet port 10 substantially fills the whole width and depth of the cross section of the bag 100. When the powdered material falls by gravity, it falls spreading itself over practically the whole of the bag 100 bottom. This prevents the formation of a single central heap, like the one that forms in the state of the art machines having a single central screw conveyor. Also, in comparison with the gravity filling machines, the fall of the material is fully controlled.

[0032] As may also be seen in the Figures, the housing 6 snugly envelops the first and second screw conveyors 2, 4. Thus, in the area where both screw conveyors are adjacent, the housing 6 follows a wedge form with the side walls 28 thereof following the profile of the screw conveyors. Thanks to a second wall 26 as a second en-

velope a longitudinal channel 16 separate from the inner chamber 12 is formed for the passage of handling mechanisms extending to said outlet port 10. Since it is isolated from the inner chamber 12, this channel 16 allows mechanisms which conventionally are separate to be integrated in the housing and therewith a very compact device 1 is achieved.

[0033] Among the devices that may be guided through this channel there is for example a suction device 18 for the air gathering at the top end of the bag 100. The purpose of this device consists of removing the air gathering at the top of the bag, above the powdered material, before closing, thereby to reduce the total volume of the closed bag and improve palletizing.

[0034] Another possible device is a vacuum generating device 20. This conduit-like device is provided with a filter. In a first embodiment it may project from the housing 6 and extend downwardly into the mass of the bagged powdered material. Then, the device 20 sucks within the powdered material to cause a vacuum in the interior thereof and again improve the palletizing of the product. Thanks to the filter, there is avoided the loss of material inside the vacuum generating device 20. Alternatively, the vacuum generating device 20 may operate at the level of the outlet port of the housing 6, to produce the vacuum before the material falls into the bag 100.

[0035] In a preferred embodiment not shown in the figures, the pitch of the screw conveyors 2, 4 decreases towards said outlet port.

[0036] It may also be seen in the Figures that the first and second screw conveyors 2, 4 have the same spiral and direction of rotation but, nevertheless, these first and second screw conveyors 2, 4 can have opposite spirals and directions of rotation.

[0037] Finally, it may also be seen in this first embodiment that activatable rods 22 have been caused to extend through the channels 16 and are provided at the lower end thereof with a cover 30 for closing the outlet port 10 of the housing 6 to interrupt the fall of material when, for example, the hopper 14 is refilled with a new metered amount for filling the bag 100.

[0038] The invention also relates to a machine in which the flow metering device of the invention is applied. In the first place, Figure 6 schematically shows a first embodiment of a bagging machine according to the invention. Therein there is to be seen at the top portion a conveyor belt 110 for supplying the powdered material 112 to a metering device 106. In this case the machine has a net weight system. To this end, the metering device 106 has a weight sensor 108 for determining the amount with which the bag 100 is to be filled. Once the amount has been correctly determined, the gates 114 of the metering device are opened and the material falls under its own weight into the hopper 14.

[0039] Thereafter, the measured amount inside the hopper 14 is caused to feed through the adjacent first and second screw conveyors 2, 4 vertically downwards thanks to a step in which the first and second screw con-

veyors 2, 4 are rotated at a synchronized speed to discharge the powdered material through said outlet port 10. Obviously, the process may also comprise the steps of sucking the air from the top of the bag 100 before closure, or the step of generating a vacuum in the powdered material, either before leaving the outlet port 10 or once inside the bag 100.

[0040] Figure 7 shows a second embodiment in the case of a bagging machine with weight determination by weight loss. Here, the machine has a silo 116 containing a large amount of powdered material. The weight sensor 108 is associated with the silo 116. Thus, to fill the hopper 14 of the control device, the gates 114 are opened and the material is allowed to fall by gravity. The sensor 108 determines the drop in weight in the silo 116 and closes the gates as soon as the desired measured amount has been reached. From here on the flow control is carried out in the same way as in the embodiment of Figure 6.

[0041] Finally, Figures 8 to 11 show a second embodiment of the flow control device of the invention. In this case, the only substantial difference relative to the embodiment of Figures 1 to 5 is that instead of a cover 30 for blocking the outlet port 10 having a longitudinal movement, it has two tilting semi covers 32, hinged to the housing 6 to block the port 10. As far as the rest is concerned, the device 1 has the same features as those described above.

Claims

1. A powdered material flow control device for filling a bag (100) comprising a first screw conveyor (2) for transporting said material, **characterized in that** it comprises a second screw conveyor (4) adjacent said first screw conveyor (2), with said first and second screw conveyors (2, 4) being arranged vertically, and at least in part, inside a housing (6) defining an inlet port (8), a outlet port (10) for said material and a common inner chamber (12), and **in that** said first and second screw conveyors (2, 4) have dimensions such that said housing (6) is externally snugly adaptable to the cross section of the bag (100), said first and second screw conveyors (2, 4) rotating at a synchronized speed.
2. The device according to claim 1, **characterized in that** in the area where said first and second screw conveyors (2, 4) are adjacent one another, said housing (6) defines at least one longitudinal channel (16) separate from said inner chamber (12) for the passage of handling mechanisms extending up to said outlet port (10).
3. The device according to claim 1 or 2, **characterized in that** the pitch of said screw conveyors decreases towards said outlet port.
4. The device according to any one of claims 1 to 3, **characterized in that** said first and second screw conveyors (2, 4) have the same spirals and directions of rotation.
5. The device according to any one of claims 1 to 3, **characterized in that** said first and second screw conveyors (2, 4) have opposite spirals and directions of rotation.
6. The device according to any one of claims 2 to 5, **characterized in that** said handling mechanisms comprise at least one of an air suction device (18) at the top end of the bag, or a vacuum generator device (20) within mass of the bagged powdered material.
7. The device according to any one of claims 1 to 6, **characterized in that** said housing (6) has a cross section twice as wide as it is deep.
8. A machine for filling bags (100) comprising a metering device (106) for metering a measured amount of powdered material **characterized in that** between said metering device (106) and said bag (100) it comprises a powdered material flow control device (1) according to any one of claims 1 to 7.
9. A process for filling bags with a powdered material, **characterized in that** is comprises the following steps:
 - [a] determining a metered amount of powdered material with which it is desired to fill a bag (100),
 - [b] pouring said metered amount into the hopper (14) of a powdered material flow control device (1) comprising adjacent first and second screw conveyors (2, 4), said first and second screw conveyors (2, 4) being arranged vertically, and at least in part, inside a housing (6) defining an inlet port (8), a outlet port (10) for said material and a common inner chamber (12), and said first and second screw conveyors (2, 4) having dimensions such that said housing (6) is externally snugly adaptable to a cross section of the bag (100), and
 - [c] rotating said first and second screw conveyors (2, 4) synchronously to discharge said powdered material through said outlet port (10).
10. A process according to claim 9, **characterized in that** said housing (6) has a cross section twice as wide as it is deep.

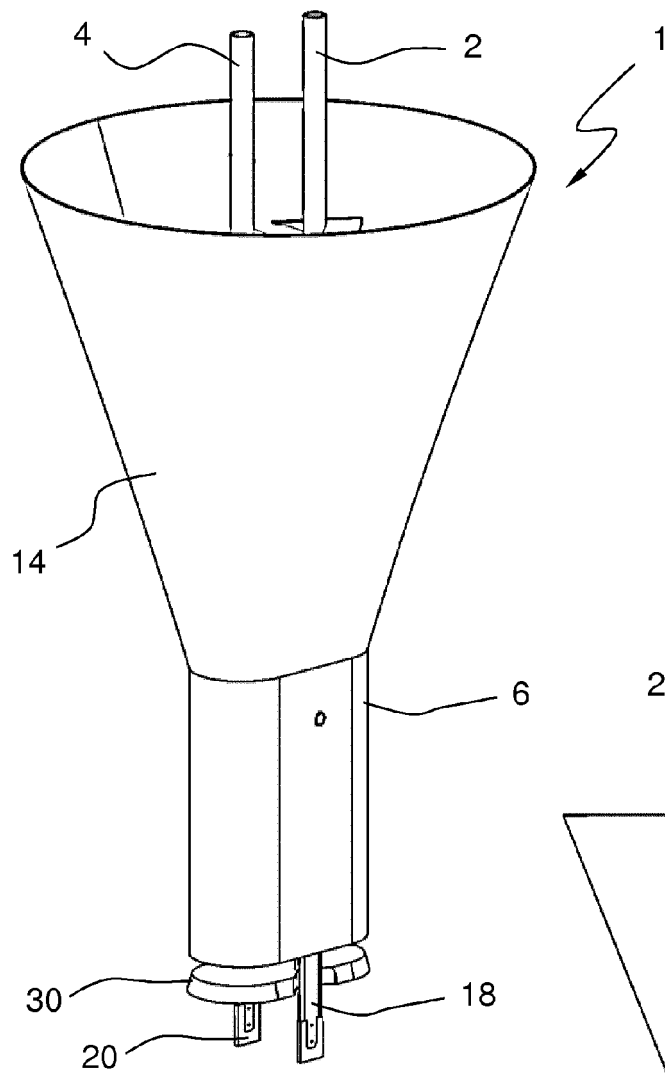


FIG. 1

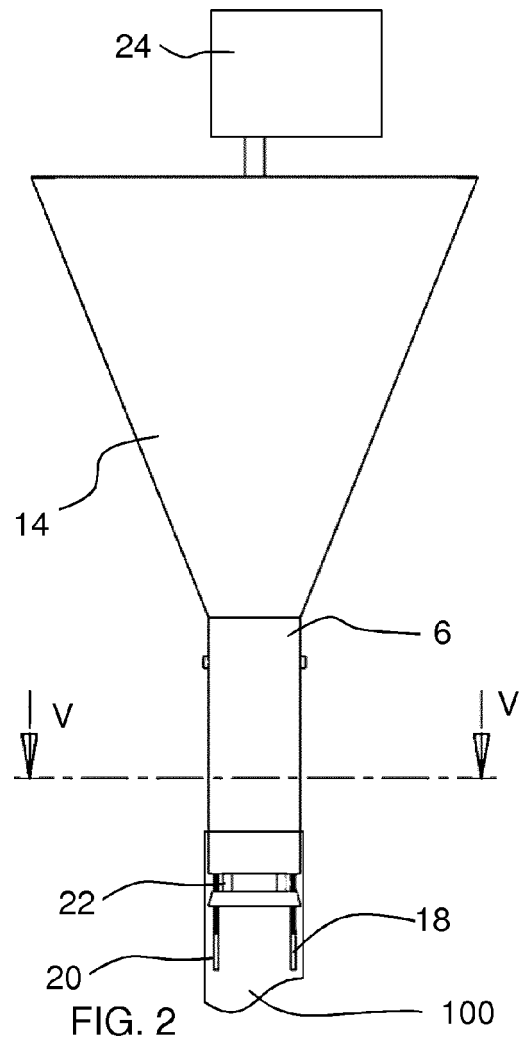


FIG. 2

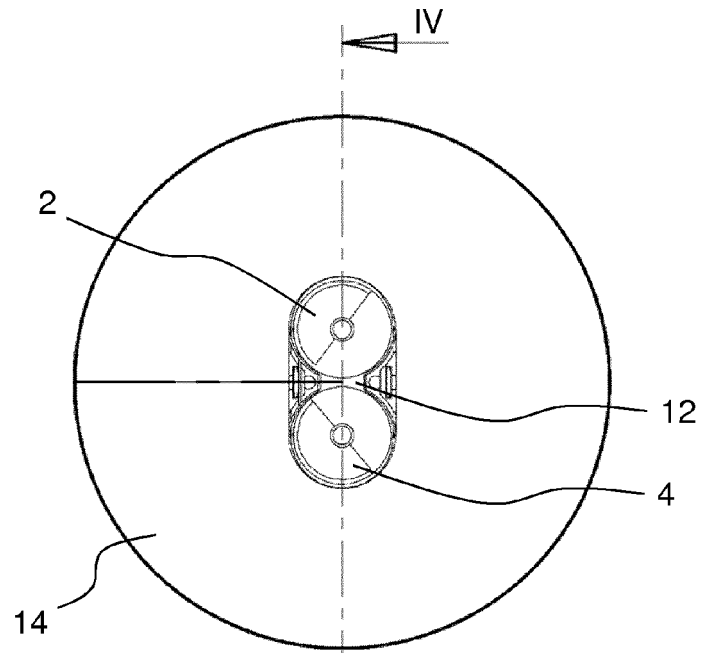


FIG. 3

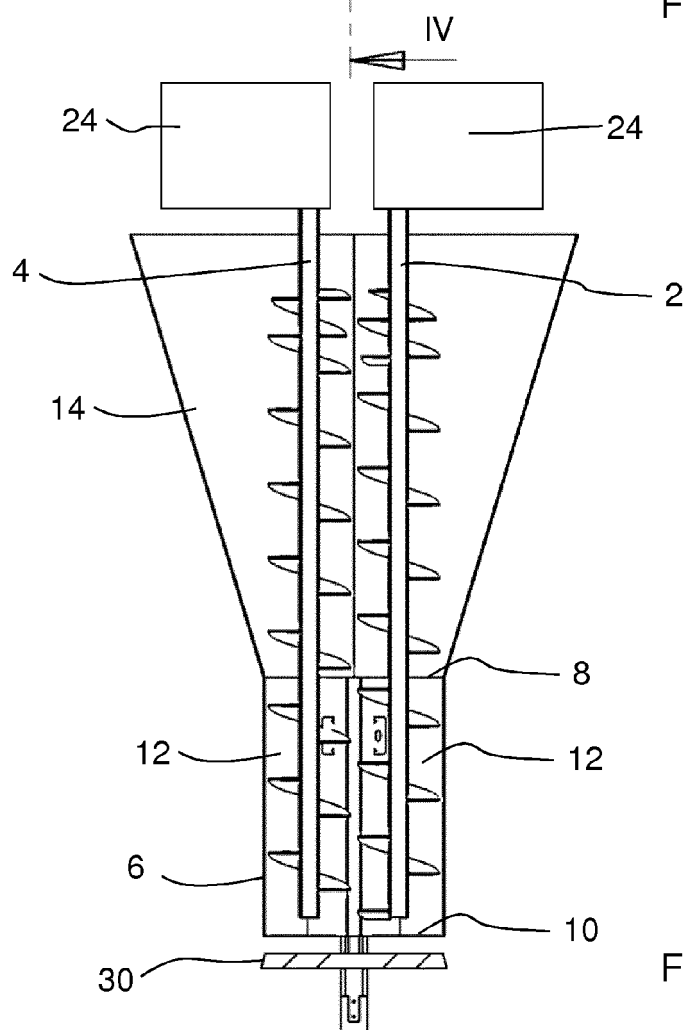
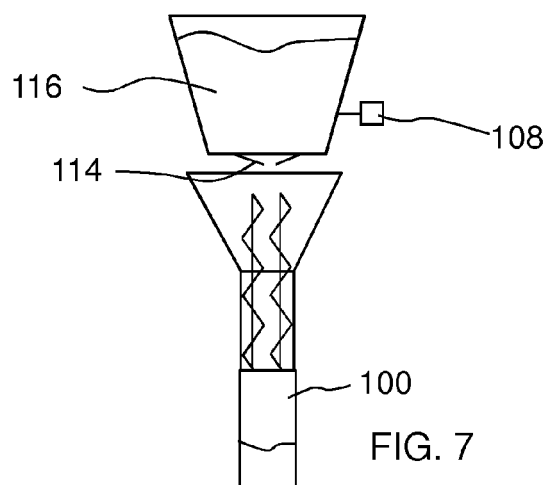
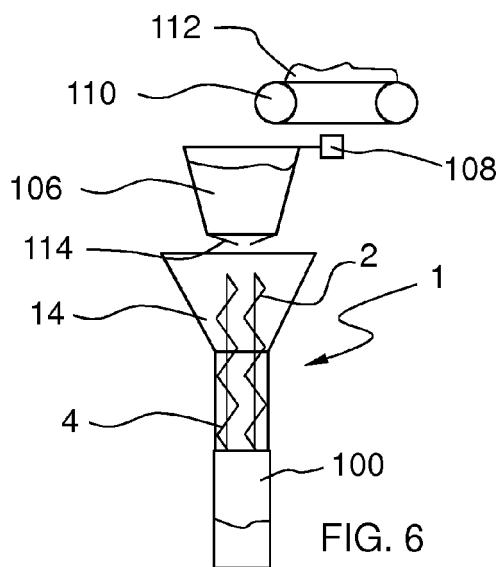
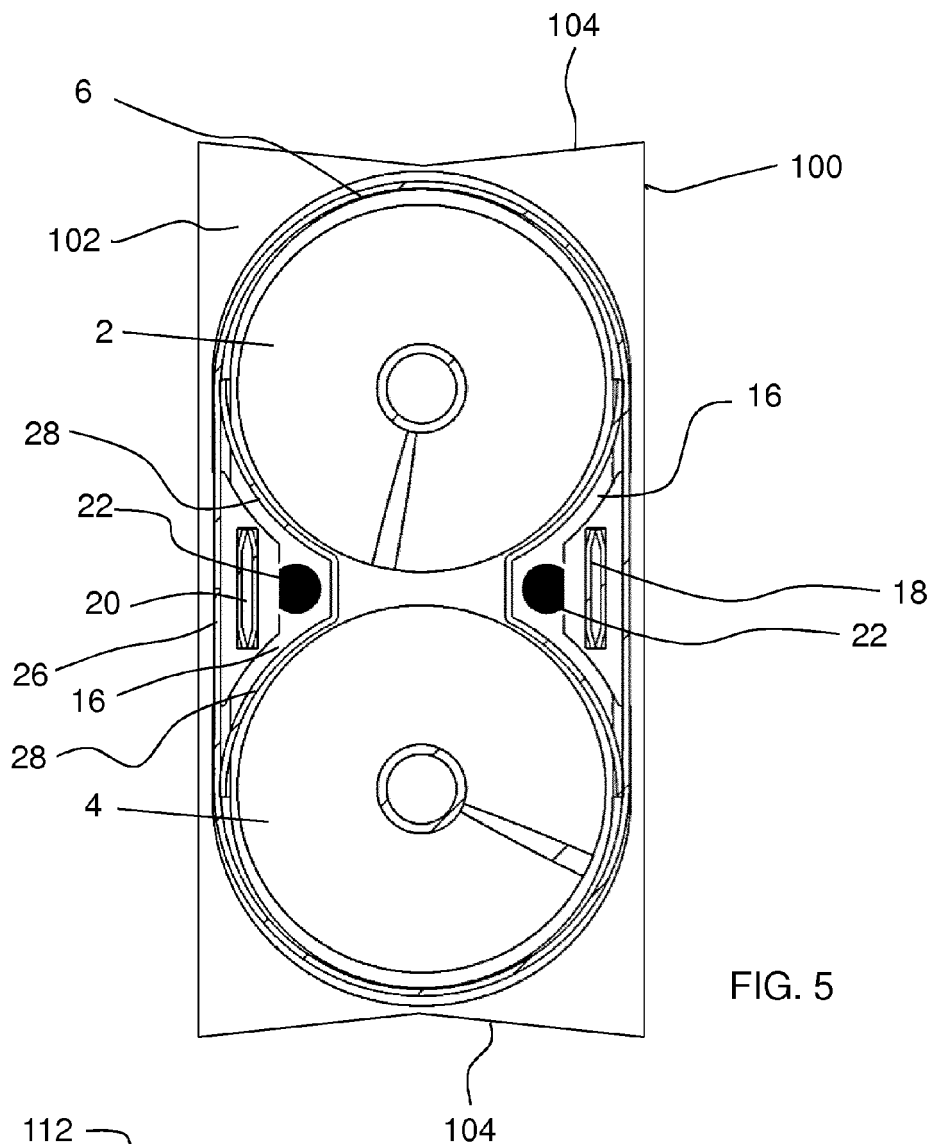


FIG. 4



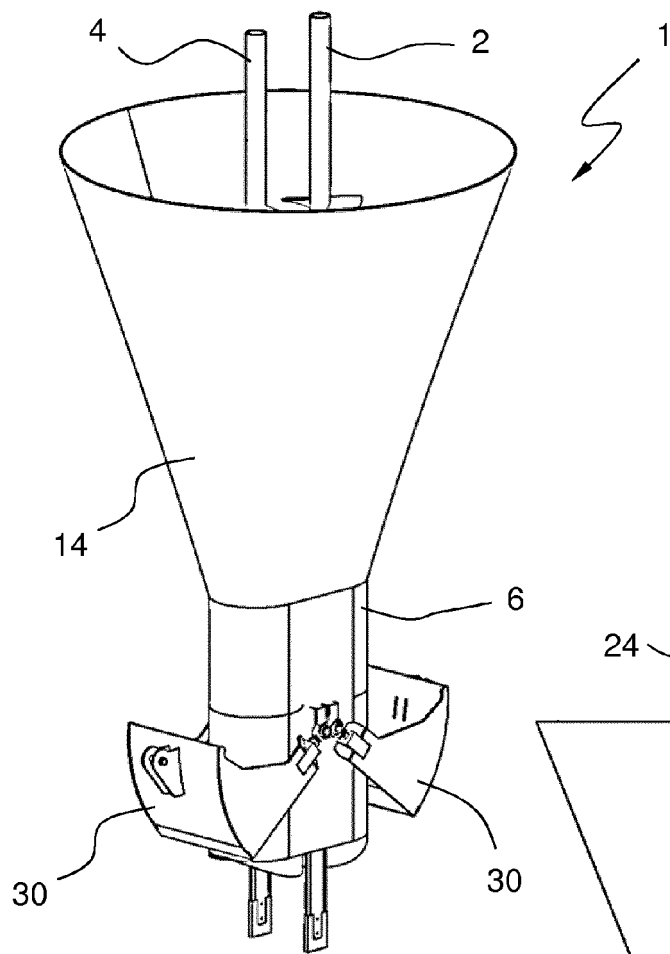


FIG. 8

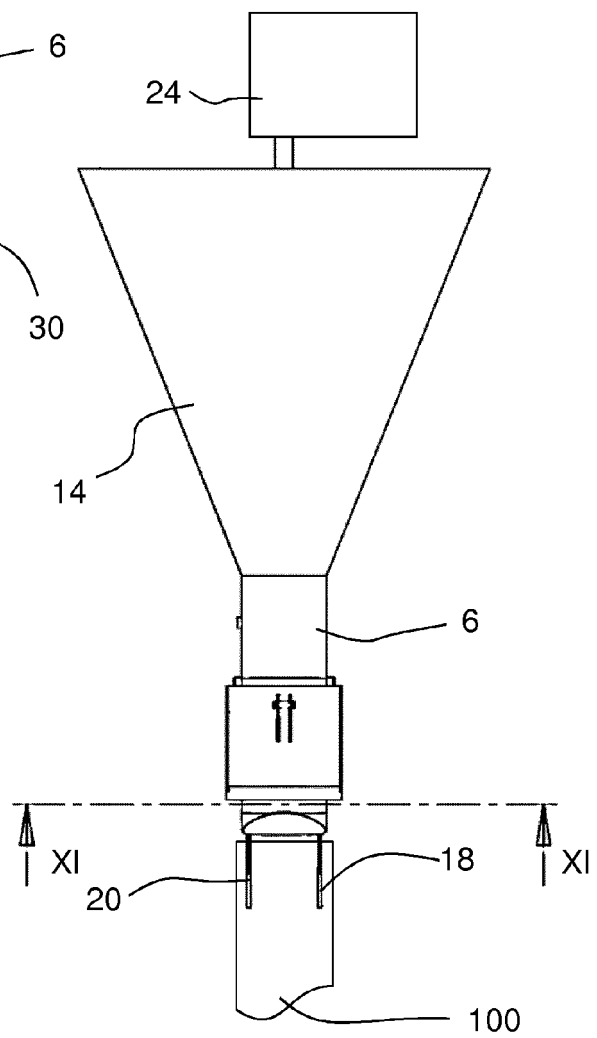
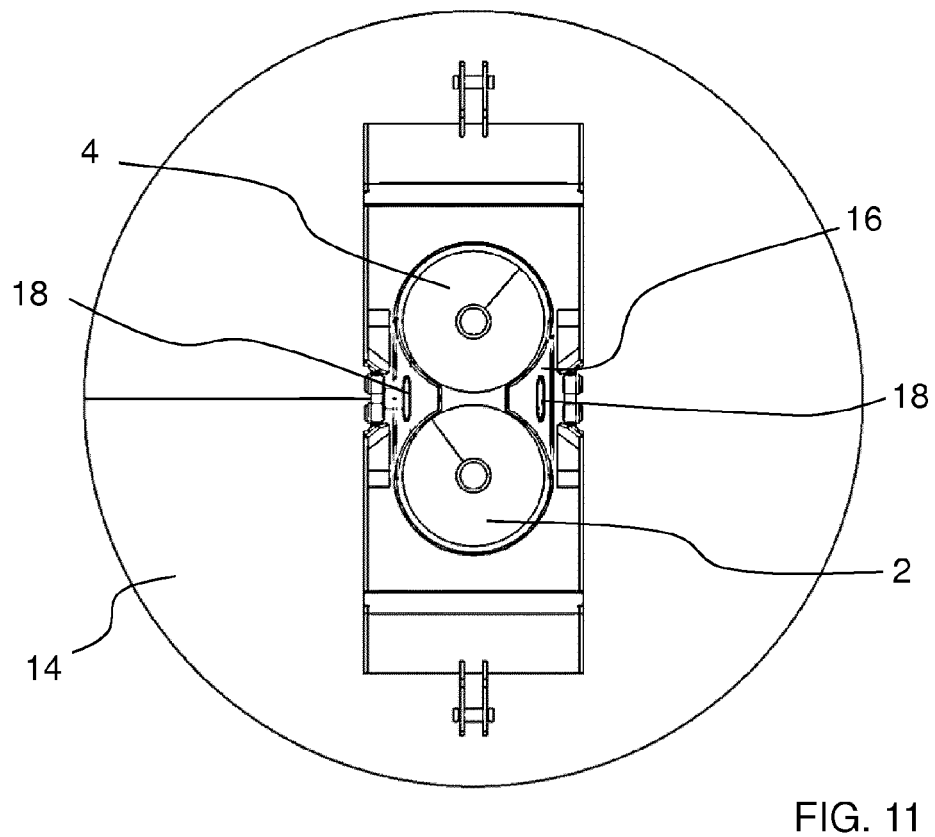
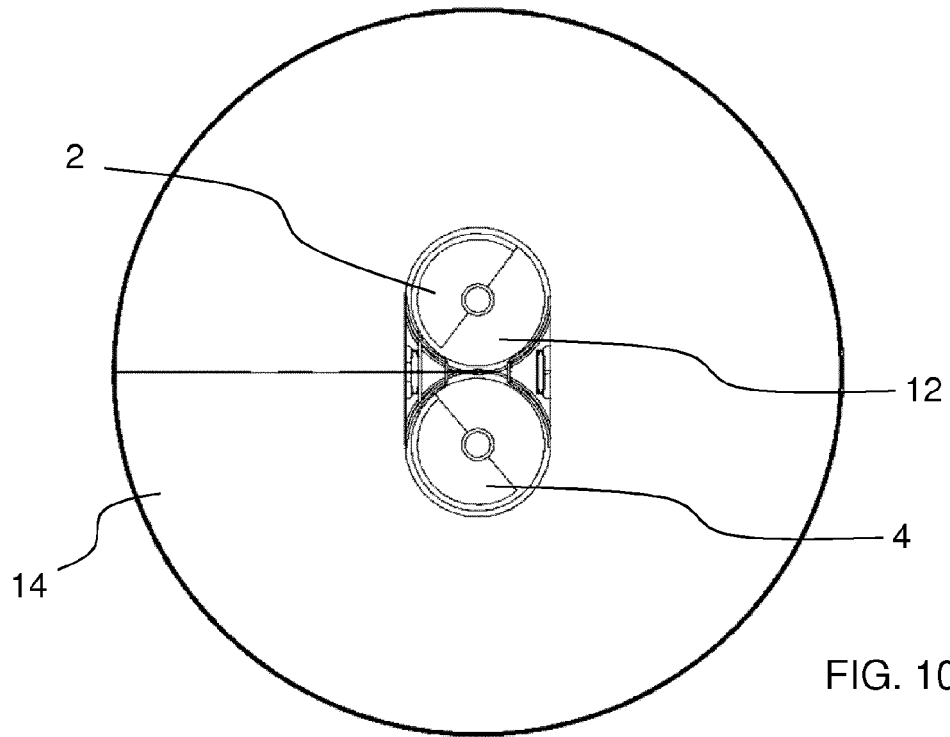


FIG. 9





EUROPEAN SEARCH REPORT

 Application Number
EP 14 15 4615

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 413 214 A (GERH AREHNS MEK VERKST AB) 12 July 1934 (1934-07-12)	1,2,4,7	INV. B65B1/12 B65B1/28 B65B1/32
Y	* page 1, line 9 - line 17; figures 1, 2, 3, 4 * * page 2, line 87 - line 91 * * page 1, line 63 - line 68 * * page 2, line 32 - line 43 *	3,5,6, 8-10	
Y	DE 25 55 347 A1 (CELCOMMERZ RETTENMAIER FELIX [DE]) 30 June 1977 (1977-06-30) * claim 5; figure 1 *	3	
Y	EP 1 994 817 A1 (AIMO KORTTEEN KONEPAJA OY [FI]) 26 November 2008 (2008-11-26) * claim 3; figure 1 *	5	
Y	WO 2007/007155 A1 (FR DI FERRUZZI RAFFAELE [IT]; FERRUZZI RAFFAELE [IT]) 18 January 2007 (2007-01-18) * figure 1 *	6,8-10	
A	US 7 004 210 B1 (WEGMAN PAUL M [US] ET AL) 28 February 2006 (2006-02-28) * figures 1-4 *	6	TECHNICAL FIELDS SEARCHED (IPC) B65B
A	GB 129 633 A (LEUMANN RICHARD [CH]) 4 October 1920 (1920-10-04) * figure 1 *	3	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 July 2014	Examiner Vassoille, Philippe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ON EUROPEAN PATENT APPLICATION NO.**

EP 14 15 4615

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16-07-2014

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 413214	A	12-07-1934	NONE
DE 2555347	A1	30-06-1977	NONE
EP 1994817	A1	26-11-2008	EP 1994817 A1 26-11-2008 FI 7785 U1 29-02-2008
WO 2007007155	A1	18-01-2007	NONE
US 7004210	B1	28-02-2006	NONE
GB 129633	A	04-10-1920	NONE

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1819596 A1 [0010]
- US 20080115462 A1 [0011]
- CN 2795035 U [0012]