METHOD FOR FILLING BAGS WITH GRANULES

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The invention relates to an apparatus and a method for filling bags (34) with granules. The invention also relates to a support element (1) for supporting a bag (34, 36) during filling, the support element (1) being in the form of a pitched roof, and means (24) for fastening to a transporting belt (10) being arranged on the underside of the support element (1).
FIG. 2
FIG. 4
METHOD FOR FILLING BAGS WITH GRANULES

[0001] The invention relates to a method for filling bags with granules by way of a filling plant, and also to an apparatus for filling bags with granules, wherein a bag is supported by support elements during filling.

PRIOR ART

[0002] Bulk materials generally have to be filled into containers and packaged for transport. Bulk materials are, for example, sand, powder and granules of various materials. In the present description, the general term granules is used for all of these bulk materials.

[0003] For transport, granules are packaged in particular into silo trucks, big bags, corrugated board octagonal containers and bags. With a silo truck, very large quantities of bulk material can be transported at once. However, the bulk materials are increasingly being requested in smaller units. Big bags and corrugated board octagonal containers provide disposable and reusable containers having a large capacity, typically between 500 and 2000 liters. However, the bulk materials are increasingly being requested in smaller units, and as a result the proportion of granules that are delivered packed in big bags has increased greatly in recent years. The bags have a typical width of between 20 cm and 50 cm with a length of between 40 cm and 1 m and a depth of from 2 cm to 20 cm. Typical filling weights are in the range between 1 kg and 100 kg. Preferably, the weight of the bags is selected such that a bag can be moved by a single worker, for example from 5 kg to 50 kg.

[0004] Documents DE 30 06 129, DE 43 14 711, DE 1 948 228 and DE 31 18 866 relate to apparatuses for filling bags with granules. DE 2 317 671 discloses a combination of a conveyor belt with a connecting device for accessory parts. One of the disclosed accessory parts is in this case in the form of a pitched roof and is fastened to a conveyor belt by way of a connecting member.

[0005] DE 2 311 252 relates to a method for packaging a compressible and elastic article which is packaged into a bag, the bag being pressurized before being sealed.

[0006] Automated plants which operate for example on the FFS (form, fill, seal) principle are available for filling bags with granules. The material for the bags is often delivered on an endless roll and formed into a bag in a first step. If the bag material is delivered for example in the form of a side-gusset tubular film on a roll, to this end the bottom end of the bag is fused, the bag is cut to the required length (for example 80 cm) and opened for example via suction bars and moved into the filling position.

[0007] In the next step, a particular quantity of granules is filled into the bag. The quantity can be determined for example via the weight or via the volume. Depending on the embodiment of the filling apparatus, the bag can be shaken in order to compact the filled granules.

[0008] For the next step, the granule-filled bag is transported to a sealing station, for example by way of a pair of tongs and/or with the aid of a transporting belt. The upper seam region of the bag is cleaned if required and welded in order to be sealed. During sealing, excess air can be removed from the interior of the bag by way of a vacuum pump. After the bag has been sealed, it is transported onward and usually prepared, by way of a palletizing device, for transport on a carrier, for example a Eurolaggable.

[0009] A disadvantage of this method is that the bags filled in this way deviate considerably from the optimum cuboid shape and as a result the stacking property of the bags is impaired. For reasons of stability, the bags can be stacked on a pallet only about 4 to 6 layers. Furthermore, space is not utilized optimally, since unused hollow spaces remain to a relatively great extent between the bags. This problem is illustrated in FIG. 1. Noticeable hollow spaces (35) remain between the bags and further layers can no longer be stacked safely (31) on the pallet (32).

[0010] It is an object of the invention to provide a method and an associated apparatus, by way of which the format of bags, which have been filled for example on the FFS principle, can be configured in a virtually cuboidal form. There is proposed a support element for supporting a bag during filling, the support element preferably being in the form of a pitched roof, and means for fastening to a transporting belt being arranged on the bottom side of the support element.

[0011] The support elements are preferably attached to the transporting belt of an apparatus for filling granules such that the gable ends of the support element are directed perpendicularly to the transporting direction of the transporting belt and a shape in which a bag can be received is formed between two flanks of two support elements.

[0012] In one embodiment of the support element, the means for fastening to a transporting belt are configured as a clamp which encloses a cleated conveyor belt foot of a transporting belt configured as a cleated conveyor belt. As a result, the support element according to the invention can be fastened easily to a cleated conveyor belt, which is usually used in an apparatus for filling bags with granules. It is not generally necessary to carry out further modifications of the apparatus or to replace the transporting belt.

[0013] Preferably, an angle of 20° to 45° is enclosed between the flanks of the support element and the vertical. The flanks of two adjacent support elements form a shape that narrows downwardly, i.e. in the direction of the transporting belt. As a result, the bag is supported during filling and excessive widening of the bag in the bottom region ("formation of a foot") is prevented. The angle of the flanks can be adapted to the bag size used.

[0014] In one embodiment of the support element according to the invention, the two flanks of the support element in the form of a pitched roof are at the same angle to the vertical.

[0015] In a further embodiment of the support element, the two flanks of the support element are at different angles. Thus, a different angle can be set for example for the flank that is directed in the transporting direction than for the flank that is directed in the opposite direction. As a result, the behavior of the transporting belt when the filled and sealed bag is discharged, i.e. when the bag is transferred from the apparatus for filling the bags with granules to a downstream palletizing device, can be optimized. Similarly, the support element can be adapted to the filling plant used by the angle of the flanks being set.

[0016] In one embodiment, the edges of the support element according to the invention are rounded. As a result of the rounding of the pointed edge of the support element in the form of a pitched roof, and also of the edges, directed in the direction of the transporting belt, of the two flanks, sharp points which could mechanically damage the material of the bags are avoided.
The support element according to the invention is produced from a suitable material, such as plastics material (in particular polypropylene, polyethylene or polyvinyl chloride) or a metal, for example.

The support element should be produced from a material which does not chemically attack the bag material. Together with the rounding of the edges of the support element, this has the effect that undesired damage to the bags during filling, sealing and transport is avoided.

A further aspect of the invention is the provision of an apparatus for filling bags with granules, comprising a filling plant and a transporting belt, support elements according to the invention being fastened to the transporting belt, adjacent support elements on the transporting belt forming a downward narrow shape.

While a bag is being filled, the bag is received and supported in the shape formed by two adjacent support elements. The downwardly narrowing shape counteracts excessive widening of the bag in the bottom region.

In one embodiment of the apparatus, the transporting belt is configured as a cleated conveyor belt and the support elements are fastened to the cleated conveyor belt feet of the cleated conveyor belt.

The flanks of the shape formed by two adjacent support elements on the transporting belt enclose an angle of between 20 and 40 degrees in one embodiment of the invention. In a further embodiment of the invention, the two flanks of the shape are at different angles.

The height of the support elements arranged on the transporting belt of the apparatus according to the invention is selected such that the running of the transporting belt with the supporting elements fitted is not impeded. This selection of the height of the support elements ensures that the support elements can be fitted without problems on a cleated conveyor belt of an apparatus for filling bags with granules, without further modifications or alterations to the plant being necessary.

A further aspect of the invention is the provision of a method for filling bags with granules by way of a filling plant as has just been described, the bags being conveyed at least partially on a transporting belt, having the following method steps:

- filling a bag with the granules,
- evacuating and sealing the bag,

the bag being supported in a narrowing shape during filling and being pressed into its ultimate format after being sealed.

In the first step of the method, a bag is filled with granules. Without additional supporting of the bag, the bag would assume its greatest thickness in the bottom region and would become increasingly narrow toward the top end. The supporting of the bag in a downwardly narrowing shape counteracts this effect. The bag is narrower in the bottom region and now has its greatest thickness approximately in the middle. In the next method step, the granule bag is transported to a sealing station. In the sealing station, the bag is sealed by welding.

Simultaneously or almost simultaneously, the bag is “evacuated”, in that excess air is removed from the interior of the bag via a vacuum pump. In order that the bag is simultaneously stable, airtight and easily weldable, a composite material composed, for example, of at least one plastics layer and/or of at least one metal layer is preferred as bag material. Subsequently, the sealed and evacuated bag is transported onward and in the process is discharged onto a further transporting belt from the transporting belt of the apparatus for filling granules. The bag is conveyed to a press and pressed thereby to its ultimate format. As a result of the pressing, granules are pushed from the middle of the bag into the adjoining regions. Since the greatest thickness of the bag is in the middle prior to pressing, a bag with a virtually cuboidal format is produced after pressing.

In one embodiment of the method, the bag is oriented with its longest side upward during filling.

On account of the supporting of the bag during filling, a bag oriented with its longest side upward has a smaller thickness both at the bottom end and at the top end than in its middle after filling.

In one embodiment of the method, a filled bag lies on its largest surface during pressing and has an approximately cuboidal shape after pressing.

The method is suitable for bags of various sizes and makes it possible to set the length of the bag freely.

On account of the support element according to the invention, an apparatus for filling bags with granules can be improved such that the filled bags can be brought into an approximately cuboidal format by pressing. Thus, better space utilization is achieved in palletizing downstream of the filling of the bags and the stackability of the filled granule bags is improved. As a result, it is possible to accommodate the bags on a pallet in more layers than has hitherto been possible. The number of pallets required for transport is reduced, thereby lowering expenditure and costs of logistics.

The advantageous configuration of the support element according to the invention with a holding apparatus makes it possible to fasten the support element to a cleated conveyor belt, as is usually used in apparatuses for filling bags with granules. On account of the selection according to the invention of the maximum height of the support elements, no further alterations or modifications to the apparatus for filling bags with granules have to be carried out apart from the fitting of the support elements.

The angles of the flanks of the shape formed by the support elements are matched to the size of the bags to be filled and set for optimal supporting of the bag during filling and for defect-free discharging of the bag.

The method can be adapted to different sizes of bags, so that the great flexibility of filling on the FFS principle is retained.

BRIEF DESCRIPTION OF THE FIGURES

The invention is described in more detail in the following text with reference to the drawings, in which:

FIG. 1a shows a palletized stack of granule bags filled according to the prior art,
FIG. 1b shows a palletized stack of granule bags filled by way of the method according to the invention,
FIG. 2 shows a schematic illustration of the apparatus according to the invention for filling granule bags,
FIG. 3 shows the completion of formatting of a granule bag by pressing,
FIG. 4 shows a filled granule bag supported by the support elements according to the invention,
FIG. 5 shows an embodiment of a support element according to the invention.
VARIANT EMBODIMENTS

[0044] FIG. 1a shows a palletized stack of granule bags which have been filled by a method according to the prior art.

[0045] FIG. 1a shows granule bags 31 which have been filled by a method according to the prior art. The granule bags 31 are stacked in six layers on a pallet 32. Located on this stack is a further pallet 32 having a further six layers of granule bags 31. Unused hollow spaces 35 between the bags 31 are clearly noticeable. Furthermore, the format of each individual bag 31 varies greatly and there are to some extent considerable deviations from the ideal cuboidal format. Further layers of bags 31 can no longer be deposited safely on the stack.

[0046] FIG. 1b shows a palletized stack of bags which have been filled and formatted by the method according to the invention.

[0047] FIG. 1b illustrates six layers of bags 30 on a pallet 32. Placed on top of this stack is a further pallet 32, on which likewise six layers of bags 30 are arranged. On account of the virtually cuboidal format of the bags 30, fewer or only small hollow spaces 35 arise between the bags 30. Furthermore, the top side of the stack of bags is suitable for adding further layers of bags 30 to the stack.

[0048] FIG. 2 shows a schematic illustration of the apparatus according to the invention for filling bags with granules.

[0049] FIG. 2 illustrates a cleated conveyor belt 10, on which a multiplicity of cleated conveyor belt feet 12 are arranged. Fastened to the cleated conveyor belt 10 are support elements 1, which have a pitched roof-like shape. The material necessary for producing the bags is delivered wound up on an endless roll 60. The material wound up on the roll 60 is configured for example as an endless tube or as an endless side-gusset tubular film.

[0050] Simple films, composite films, paper and composite materials composed of at least one film layer and at least one further layer are used as bag material. Examples of bag materials that are used are polyethylene, polypropylene, composite material composed of aluminum and polyethylene and composite material composed of paper and polyethylene.

[0051] The endless material 61 is conveyed through a sealing and cutting apparatus 64 via a plurality of deflecting rolls 62 and a pair of driven rolls 66. With the sealing and cutting apparatus 64, first of all the bottom end of the bag is fused. Then, the bag material 61 is unrolled further until the desired length of the bag has been reached, and is subsequently cut off by the sealing and cutting apparatus 64. This produces a bag which is still folded together and is closed at one end by fusion. The subsequent side walls of the bag are already closed, since the bag material 61 is configured in the form of a tube or of a side-gusset tube. The bag, which is still folded together, is grasped by a holding and transporting apparatus 46 and moved into the region of the cleated conveyor belt 10, where the bottom end of the bag 34 is introduced onto the cleated conveyor belt 10 between two support elements 1, which form a shape 2 that narrows in the direction of the transporting belt 10.

[0052] The top end of the bag 34 is opened by the holding and transporting apparatus 46 so that a filling apparatus 40 can engage in the opened bag 34. A quantity, defined for example by weighing or measuring the volume, of material or granules to be introduced can then be introduced via the filling apparatus 40. During the filling operation, the bag 34 continues to be held by the holding and transporting apparatus 46. The holding and transporting apparatus 46 can be configured for example as a suction bar, which retains the bag with the aid of negative pressure.

[0053] Once the bag 34 has been filled, it is released by the holding and transporting apparatus 46. As a result of the filling with granules, the bag stands on its own. On account of the bag 34 being supported by way of the support elements 1 on the cleated conveyor belt 10, the granule bag 34 has a smaller thickness in the bottom region 39 than in the middle. The filled, but not yet sealed granule bag 34 is transported by the cleated conveyor belt 10 to a sealing apparatus 42. There, the top side 38 of the bag is grasped and the bag is sealed by fusion. At the same time, the sealing apparatus 42 sucks excess air out of the granule bag via a connection to a vacuum pump 44.

[0054] After sealing, the sealed granule bag 36 is transported onward by the cleated conveyor belt 10 to a bag discharge 13. At the bag discharge 13, the sealed granule bag 36 drops from the cleated conveyor belt 10 onto a transporting belt 14. In the process, the orientation of the granule bag 36 changes. On the cleated conveyor belt 10, the granule bag 36 is oriented with its longest side upward. On the transporting belt 14, the granule bag 36 lies on its side, such that its largest surface is directed downward. The transporting belt 14 transports the granule bag 36 to a press, by way of which the granule bag 36 obtains its virtually cuboidal formatting.

[0055] On account of the possibility of processing air- and water-impermeable composite materials such as an endless tubular film 61 composed of polyethylene and aluminum, granules of hygroscopic materials can also be filled into bags in conjunction with the evacuation of the bags 34. Examples of hygroscopic materials packed into bags are plastics granules such as ABS (acrylonitrile butadiene styrene), PA (polyamides), PC (polycarbonates), PET (polyethylene terephthalate), PU (polyurethanes), PVC (polyvinyl chloride) and basic chemicals such as caprolactam (crystalline), adipic acid (crystalline) and hexamethylenediamine adipate (crystalline salt).

[0056] In one embodiment of the apparatus, the opened granule bag 34 is shaken after being filled with granules, in order to compact the filled granules.

[0057] FIG. 3 illustrates a granule bag immediately before and also after pressing. FIG. 3 shows a filled and sealed, but not yet pressed granule bag 36. The granule bag 36 is lying on its side with its largest side surface downward in a press 50. The thickness of the bag is largest in the middle 37 and decreases both toward the bottom side 39 and toward the top side 38. By way of the press 50, pressure is exerted on the granule bag 36 in the direction of the arrow designated by the reference sign 52. As a result, granules from the middle region 37 of the granule bag 36 are pushed in the direction of the top side 38 and the bottom side 39.

[0058] Furthermore, an illustration of a pressed granule bag 30 which is still located in a press 50 can be found in FIG. 3. On account of the pressure during pressing, the bag 30 has assumed approximately cuboidal formatting, in which the thickness of the bag 30 is virtually identical both in the region of the middle 37 and in the region of the top side 38 and the bottom side 39.

[0059] FIG. 4 illustrates a filled, but not yet pressed granule bag on a cleated conveyor belt having the support elements according to the invention.

[0060] FIG. 4 illustrates an already filled and sealed, but not yet pressed granule bag 36. The granule bag 36 is located on a cleated conveyor belt 10 and is supported by two support
elements 1 in the region of its bottom side 39. On account of the support elements 1, the bag 36 assumes a shape in which it has its greatest thickness in the region of its middle 37. In the region of the bottom side 39 and the top side 38, the granule bag 36 assumes in each case a smaller thickness. The support elements 1 according to the invention comprise a part 20 in the form of a pitched roof and a fastening means 24. By way of the fastening means 24, the part 20 of the support element 1 in the form of a pitched roof is fastened to a cleated conveyor belt foot 12 of the cleated conveyor belt 10.

[0061] A shape 2 that narrows downwardly, i.e., toward the cleated conveyor belt 10, is formed on the cleated conveyor belt 10 by in case two adjacent support elements 1. The size of the support elements 1, in particular the height thereof, is selected such that the support elements 1 can circulate together with the cleated conveyor belt 10 in the apparatus for filling bags with granules without impeding the cleated conveyor belt 10.

[0062] FIG. 5 illustrates an embodiment of the support element according to the invention. FIG. 5 shows a support element 1 on the cleated conveyor belt 10. The support element 1 comprises a part 20 in the form of a pitched roof and a holder 24. The part 20 in the form of a pitched roof is rounded both at the top at the pointed edge and at the edges facing the cleated conveyor belt 10. This avoids the bag material being mechanically damaged during transport on the cleated conveyor belt 10. The holder 24 comprises a holding plate 23 which is connected to the part 20 in the form of a pitched roof, a clamping bracket 25, a clamping bracket plate 26 and a plurality of screws 27 and nuts 28. By way of the clamping bracket 25, the clamping bracket plate 26 and at least two screws 27, the holder 24 is fastened to a cleated conveyor belt foot 12 of the cleated conveyor belt 10. In this case, the screws 27 engage in threads 29 in the clamping bracket 25. The clamping bracket 25 is connected to the holding plate 23 via at least one screw 27. The connection is fixed by a plurality of nuts 28.

[0063] Depending on the configuration of the cleated conveyor belt foot 12 and optionally further requirements placed on the support elements, such as the possibility of being able to remove the support elements 1 on the cleated conveyor belt 10, for example, it is also possible to fit the support elements 1 on the cleated conveyor belt 10 with means other than those just mentioned. If it is no longer required for the support elements 1 to be removed from the cleated conveyor belt 10, it is for example conceivable to connect the support element 1 to a cleated conveyor belt foot 12 by welding or adhesive bonding. For an easily releasable connection, the holder 24 can also be configured with other means for fastening, such as a direct screw connection into the cleated conveyor belt foot 12, for example.

[0064] The part 20 in the form of a pitched roof has two flanks 21, 22. The flank 21 that faces in the running direction of the cleated conveyor belt 10 encloses an angle α with the vertical. That flank 22 of the part 20 in the form of a pitched roof that faces counter to the running direction of the cleated conveyor belt 10 encloses an angle β with the vertical. In the embodiment shown in FIG. 5, the angle α of the flank 21 is smaller than the angle β of the flank 22, i.e., the flank 21 that faces in the transporting direction is steeper than the flank 22 that faces counter to the transporting direction. As a result, the behavior of the transporting belt or cleated conveyor belt 10 at the bag discharge 13 is optimized.

1-16. (canceled)

17. A support element (1) for supporting a bag (34, 36) during filling, wherein the support element (1) is in the form of a pitched roof having two flanks (21, 22) and three edges (18, 19) and wherein a clamp (25, 26) for fastening (24) to a transporting belt (10) is arranged on the bottom side of the support element (1), the clamp (25, 26) being set up to enclose a cleated conveyor belt foot (12) of a transporting belt (10) configured as a cleated conveyor belt.

18. The support element (1) according to claim 17, wherein an angle (α, β) of 20° to 45° is enclosed between the flanks (21, 22) of the support element (1) and the vertical.

19. The support element (1) according to claim 17, wherein the two flanks (21, 22) of the support element (1) are at different angles (α, β).

20. The support element (1) according to claim 17, wherein the edges (18, 19) of the support element (1) are rounded.

21. The support element (1) according to claim 17, wherein the support element (1) is produced from a plastics material or a metal, in particular from polypropylene, polyethylene or polyvinyl chloride.

22. An apparatus for filling bags (30, 34, 36) with granules, comprising a filling apparatus (40) and a transporting belt (10), wherein support elements (1) are fastened to the transporting belt (10), two adjacent support elements (1) on the transporting belt (10) forming a downwardly narrowing
shape (2) and the support elements (1) being in the form of a pitched roof having two flanks (21, 22) and three edges (18, 19) and a clamp (25, 26) being set up to enclose a cleated conveyor belt foot (12) of a transporting belt (10) configured as a cleated conveyor belt.

23. The apparatus according to claim 22, wherein the flanks (21, 22) enclose an angle (α, β) of between 20° and 45° with the vertical.

24. The apparatus according to claim 22, wherein the two flanks (21, 22) of the shape (2) formed by two support elements (1) and the transporting belt (10) are at different angles (α, β).

25. The apparatus according to claim 22, wherein the height of the support elements (1) is selected such that the running of the transporting belt (10) with the support elements (1) fitted is not impeded.

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