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A method for filling containers

The present invention relates to a method for the optimised loading of containers with fluid solids.

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For the transportation of solids, high requirements are necessary in respect of safety (e.g. loading safety, storage safety), quality and cost effectiveness.

For example, in the case of packing and transportation in conventional sack-like
10 packing drums, so-called Big Bags, the Big Bags exhibit insufficient stability and dimensional consistency. Consequently, additional measures are necessary during bagging, loading and load securing. The low dimensional consistency also increases the risk of the Big Bags becoming damaged during loading and transportation (safety risk) as a result of internal stresses or as a result of the bags "rubbing together" and the
15 risk of unusually high pressures in the case of pressure and/or friction-sensitive products. As a result of an increased amount of dust, the dust explosion risk in the case of dust-explosive materials is clearly increased or occurs only when the product escapes as a result of bursting or damage to the Big Bag. Insufficient dimensional consistency and stability of the Big Bags can also involve risks during storage of the
20 Big Bags. For example, a safety risk can arise as a result of a Big Bag falling over or falling down. Furthermore, the cost effectiveness of the storage is increased by optimised packing of the Big Bags.

Furthermore, in conventional loading of the Big Bags onto a pallet, the stacking
25 possibilities are limited. For example, in cases where bisphenyl-A prill is to be packed, in a conventional 20 foot box container (20' box container) (ISO 22GO ff.), it is not possible to stack Big Bags corresponding to the conventionally marketed units of weight, e.g. 1000 kg Big Bags, inclusive of pallets, and a large amount of load securing is required. Furthermore, a large proportion of the loading volume is unused.
30 Even in cases where a conventional 500 kg Big Bag, for example, corresponding to conventionally marketed units of weight, and a conventional 1000 kg Big Bag, for example, also corresponding to conventionally marketed units of weight, are stacked -



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above one another, a large amount of load securing is required. In addition, part of the loading volume is still unused.

5 The object of the present invention is therefore to provide a method for the optimised filling of containers with fluid solids, which does not have the disadvantages of the state of the art.

This object is attained by the use of packing drums according to claim 1.

10 The subject matter of the invention is a square, foldable packing drum made of high-strength fabric for fine-particle bulk materials with a filling socket and optionally an additional outlet socket, in which the packing drum comprises a reinforcement of the lateral edges by an internal, supportive fabric secured to the sides of the edges, characterised in that the base of the packing drum comprises an additional, high-
15 strength sliding surface.

The sliding surface is preferably made of reinforced fabric material, more particularly fabric on a base of polypropylene, polyethylene or PVC.

20 In a particularly preferred manner, the sliding surface projects beyond the outside of the packing drum in the form of a gripping edge on at least one side of the packing drum.

25 In a further preferred form of the packing drum, the gripping edge projects from the base at an angle to the base surface, more particularly by means of correspondingly fitted seams on the gripping edge, which allow the gripping edge to stand erect, or by means of plastics material inserts in the gripping edge.

Also preferred is a packing drum, in which the supportive fabric is fitted at an angle of $45^{\circ} \pm 5^{\circ}$ to the side walls.

5 In a particularly preferred manner, the supportive fabric comprises a plurality of superimposed openings for the bulk material, the openings in the lower region having an oval, horizontal cross section. This ensures uniform filling of the triangular cavity behind the supportive fabric.

10 A further subject matter of the invention is a packing drum stack of packing drums according to the invention containing bulk material.

The packing drum stack is preferably constructed in such a manner that two, more particularly slightly curved sliding plates made of plastics material, more particularly
15 polyethylene or polyvinyl chloride, are additionally fitted between superimposed packing drums of the stack in each case. In this manner, the construction and dismantling of the stack is further simplified.

In this respect, the upper sliding plate particularly preferably has a reverse curvature to
20 the lower sliding plate. In this manner, the engagement of forks of fork-lift trucks in the intermediate space between the sliding plates is facilitated.

A further subject matter of the invention is a container filled without interruption with
25 a packing drum stack according to the invention.

Also subject matter of the invention is a method for filling containers with fluid solids, characterised in that the fluid solids are packed in the above-mentioned packing drums according to the invention and the packing drums are stacked in the container.

30 Additional sliding plates with opposite, slight curvatures are preferably fitted between the superimposed packing drums.

An additional sliding plate is particularly preferably placed beneath the lowermost packing drum.

5 The fluid solids which are to be used according to the invention preferably have bulk densities of 300 to 900 kg/m³, particularly preferably 400 to 800 kg/m³ and especially preferably 500 to 700 kg/m³.

10 The packing drums according to the invention (also called Big Bags in the following) are sack-like packing drums. They can be made of any type of textile fabric. They are preferably made of synthetic fibre fabric.

15 The method according to the invention and the packing drums have numerous advantages. They are characterised by a high level of safety, for example good loading safety and a high degree of storage safety. In addition, they are highly cost-effective, since very dense packing of the fluid solids is possible (so-called Dense Pack System).

20 The fluid solids which are to be packed according to the invention can be, for example, pulverulent (e.g. flour or product dust), gritty (e.g. gravel, wheat), perloid (e.g. prill made of bisphenyls, for example), flake-shaped (e.g. flakes of bisphenyls, for example) or granular. In this respect, the granulates can be cuboid, lenticular, spherical or cylindrical. Examples of granulates of this type are, for example, synthetic granulates, such as granulates made of polycarbonate, acrylonitrile/styrene polymers, ABS, polyamides, polyolefins and other synthetic materials.

25 Preferred fluid solids which can be used according to the invention are those made of bis(4-hydroxyaryl)alkanes (bisphenyls). Particularly interesting in this respect is the industrially important example bisphenyl A (BPA). The preferred form of the BPA solid to be packed is BPA prill. Prill is understood to be spherical or approximately spherical solid particles. The diameter of the spheres is typically 0.1 mm to 1 cm.

For loading and unloading as well as for storage, combined systems of Big Bags and a transportation support, e.g. a pallet, are usually used. However, this has the disadvantage that valuable loading volume is lost owing to the use of pallets.

- 5 Furthermore, there is a risk of the Big Bags sliding upon or sliding off the transportation support. If transportation supports with low or very low heights are used, then it is possible to make use of increasing loading volumes. However, the risk of the Big Bags sliding upon or off the transportation support remains.

- 10 It was also found that the provision of integrated gripping and handling devices (gripping edge) on the Big Bag makes it possible to combine the advantage of optimal loading volume with the prevention of sliding of the Big Bags upon or off the transportation support.

- 15 More particularly, the integrated gripping and handling device (gripping edge) is a solid, preferably slidable layer, which is securely connected, for example sewn, to the base of the Big Bag and which projects beyond said base at least at one edge to such a degree that it can be grasped by means of specially designed devices, so that in this manner the Big Bag can be pulled onto or off an industrial vehicle, for example. The
20 integrated gripping and handling device can also be a plastics material plate, for example.

- The integrated gripping and handling device can be manufactured from various materials. For example, it can be manufactured from the same material as the actual
25 Big Bag. In addition, coated fabrics can be used, e.g. glass fibre or synthetic fabrics, which are coated with a non-stick material, e.g. Teflon. Also suitable are plastics materials, for example reinforced plastics material film.

- 30 The integrated gripping edge is preferably connected to the Big Bag in such a manner that even in the event of incorrect handling, e.g. tearing off or open of the gripping edge, the actual Big Bag is not damaged. In this manner, the risk of accidents or safety risks as a result of product leakage can be markedly reduced. This is attained, for

example, in that the integrated gripping edge is only connected to the Big Bag, e.g. by sewing, at the edges of the Big Bag base.

5 As a result of the combination of the packing drum according to the invention having excellent stability and dimensional consistency and the integrated gripping and handling device on the packing drum, an optimal and compact filling of the container is possible (Dense Pack System), so that inherent loading safety is attained, and the safety risk is reduced. Furthermore, as a result of the compact closure and optimal packing of the container, the contamination of the product by environmental
10 influences, e.g. oxygen and moisture, is reduced, since the specific surface area (over the Big Bag walls) relative to the surroundings is clearly reduced. Reduced contamination results in improved storage and product stability. Furthermore, the cost-effectiveness of transportation is improved as a result of the optimised use of the loading volume.

15 Particularly preferred therefore is a method for filling a conventional 20'-box container (ISO 22GO ff.) with filled packing drums having a total weight of 20 t, characterised in that the bulk material is filled and loaded into Big Bags according to the invention preferably corresponding to conventionally marketed units of weight, e.g. 500 and
20 1000 kg.

In the case of 1000 kg Big Bags, the following measurements apply, for example:

outer length: 1060 mm (+/- 10 mm)
25 outer width: 1060 mm (+/- 10 mm)
outer height: 1170 mm (+/- 20 mm).

The Big Bags according to the invention are characterised in that the stability and dimensional consistency of the Big Bag are improved as a result of the additional,
30 inner supportive fabric.

The Big Bags are more particularly characterised in that the additional, inner supportive fabric is provided with preferably elliptical openings, preferably a circular opening as the uppermost opening of the inner supportive fabric, which are in turn preferably uniformly distributed. These openings are used, for example, for the rapid and uniform filling of the Big Bags. The longitudinal axis of the elliptical openings is preferably parallel to the Big Bag base.

The integrated gripping and handling device on the packing drum can be safely and economically used by special designs of the industrial vehicles which transport the Big Bags. Non-integrated gripping and handling devices on the Big Bag, e.g. a combination of the Big Bag and suitable gripping and handling devices, can also be used by the special designs of the industrial vehicles.

Conventional industrial vehicles are characterised by a projection, which offers maximum stability for the Big Bag/transportation support system. The required broad design of the projection has the disadvantage that damage to an adjacent Big Bag can occur in the Dense Pack System (DPS). There is also a risk, particularly during unloading, of two Big Bags being grasped, which means an increased risk of damage to one or both Big Bags, for example as a result of the Big Bags falling over or falling down.

Also found was a suitable device for industrial vehicles for the handling of Big Bags with a preferably integrated gripping edge. This device is also suitable for corresponding gripping and handling devices which are not integrated into the Big Bag, e.g. a combined system of Big Bag and a transportation support.

The suitable device for industrial vehicles is characterised by its optimised geometry, which allows for safe handling during loading and unloading. In this respect, the geometry and dimensions are selected in such a manner that, on the one hand, damage to an adjacent Big Bag is prevented in the Dense Pack System (DPS), and the risk of two Big Bags being grasped, particularly during unloading, which means an increased risk of damage to one or both Big Bags, for example as a result of the Big Bags falling

over or falling down, is clearly reduced, and on the other hand the bearing surface for the Big Bag on the industrial vehicle is designed in such a manner that safe and cost-effective loading and unloading is possible. In addition, the device of the industrial vehicles is characterised by low frictional resistance, so that the newly developed Big Bag with its preferably integrated gripping and handling device can be safely and rapidly pulled onto the industrial vehicle device or off the industrial vehicle device. Low frictional resistances are attained, for example, by polished surfaces or additional auxiliary means, e.g. poly(tetrafluorethylene) spray. In addition, the suitable device for industrial vehicles is characterised by a moving gripping device, which allows for safe and rapid uptake onto the industrial vehicle device or removal from the industrial vehicle device. This gripping device can be hydraulically controlled by the operator, for example.

By way of example, the following procedure for pulling the Big Bag with preferably integrated gripping and handling device onto the industrial vehicle equipped according to the invention can be used.

A movable industrial vehicle device with gripping claws is driven up to the edge of the loading surface of the industrial vehicle, pulled by the edge of the Big Bag with preferably integrated gripping and handling device onto the bearing surface. The gripping claws grasp the gripping edge. The Big Bag together with the integrated gripping edge is then pulled onto the bearing surface of the industrial vehicle. In order to convey the Big Bag thus disposed on the bearing surface from the industrial vehicle into a container, for example, the movable industrial vehicle device with the gripping claws pushes the Big Bag together with the integrated gripping edge off the bearing surface.

Of course, other large containers, preferably containers, can be filled using this technique, for example 40'-box containers (ISO 42GO ff.).

The present invention will be explained by way of example in the following with the aid of four drawings, without being restricted to the drawings.

Example

Fig. 1 shows, in a plan view in the direction of the base of the Big Bag, a square Big Bag having a square base area. Sewn into the Big Bag are webs of additional, inner supportive fabric (1). In this manner, the said webs divide a central cavity from four small cavities, which are disposed over the edges of the Big Bag.

Fig. 2 is a perspective view of the Big Bag from Fig. 1. The viewing direction is from the interior of the Big Bag towards one of the four webs of additional, inner supportive fabric and the edge of the Big Bag lying behind said web. Recognisable are two side walls of the Big Bag (2), a web of additional, inner supportive fabric (1), in which a circular hole as the uppermost opening and elliptical holes (3, 4, 5, 5a) are disposed. In addition, a holding loop (6) is fitted to the edge of the Big Bag at the top.

Fig. 3 shows an arrangement possibility for the optimal filling of a container (7) with the Big Bags (8) according to the invention. The container is shown open at the top. Recognisable are two superimposed layers of the Big Bags according to the invention. For the sake of clarity, the covered Big Bags and the covered lines of the Big Bags are not shown.

Fig. 4 shows the preferred embodiment of the Big Bag (9) according to the invention with holding loops (6) and four webs of additional, inner supportive fabric (1) with holes (3) disposed therein. The characterising feature of the preferred embodiment of the Big Bag is the slidable, thin plastics material plate (20), which is securely sewn to the base of the Big Bag.

Claims

1. A square, foldable packing drum of high-strength fabric for fine-particle bulk materials with a filling socket and optionally an additional outlet socket, in
5 which the packing drum comprises a reinforcement of the lateral edges by an internal, supportive fabric secured to the sides of the edges, characterised in that the base of the packing drum comprises an additional, high-strength sliding surface.
- 10 2. A packing drum according to claim 1, characterised in that the sliding surface is made of reinforced fabric material, more particularly fabric on a basis of polypropylene, polyethylene or PVC.
- 15 3. A packing drum according to claim 1 or 2, characterised in that the sliding surface projects beyond the outside of the packing drum in the form of a gripping edge on at least one side of the packing drum.
- 20 4. A packing drum according to claim 3, characterised in that the gripping edge projects from the base at an angle to the base surface, more particularly by means of correspondingly fitted seams on the gripping edge or plastics material inserts in the gripping edge.
- 25 5. A packing drum according to one of claims 1 to 4, characterised in that the supportive fabric is fitted at an angle of $45^{\circ} \pm 5^{\circ}$ to the side walls.
- 30 6. A packing drum according to one of claims 1 to 5, characterised in that the supportive fabric comprises a plurality of superimposed openings for the bulk material, the openings in the lower section having an oval, horizontal cross section.
7. A packing drum stack of packing drums containing bulk material according to one of claims 1 to 6.

8. A packing drum stack according to claim 7, characterised in that two, more particularly slightly curved sliding plates made of plastics material, more particularly polyethylene or polyvinyl chloride are additionally fitted between superimposed packing drums of the stack in each case.
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9. A packing drum stack according to claim 8, characterised in that the upper sliding plate has a reverse curvature to the lower sliding plate.
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10. A container filled without interruption with a packing drum stack according to one of claims 7 to 9.
11. A method for filling containers with fluid solids, characterised in that the fluid solids are packed in packing drums according to one of claims 1 to 7 and the packing drums are stacked in the container.
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12. A method according to claim 11, characterised in that additional sliding plates with opposite, slight curvatures are fitted between the superimposed packing drums.
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13. A method according to one of claims 11 or 12, characterised in that an additional sliding plate is placed beneath the lowermost packing drum.