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(54) Flexible container discharge apparatus and method

(57) Flexible container discharge apparatus (10) for a flexible bulk container (56) as hereinbefore defined, comprises a base structure (12), a movable container support element (14) for supporting the flexible bulk container (56) and hingably connected to the base structure (12) for movement relative thereto, and a plurality of pivotable urging elements (16) which project in a direction away from the support element (14) and which are directly or indirectly connected to the support element (14). With a flexible bulk container (56) positioned on the support element (14), as flowable material within the container is discharged, the urging elements (16) pivot towards each other, pressing the flowable material towards an outlet of the container. A method of discharging material from a flexible bulk container (56) is also provided.

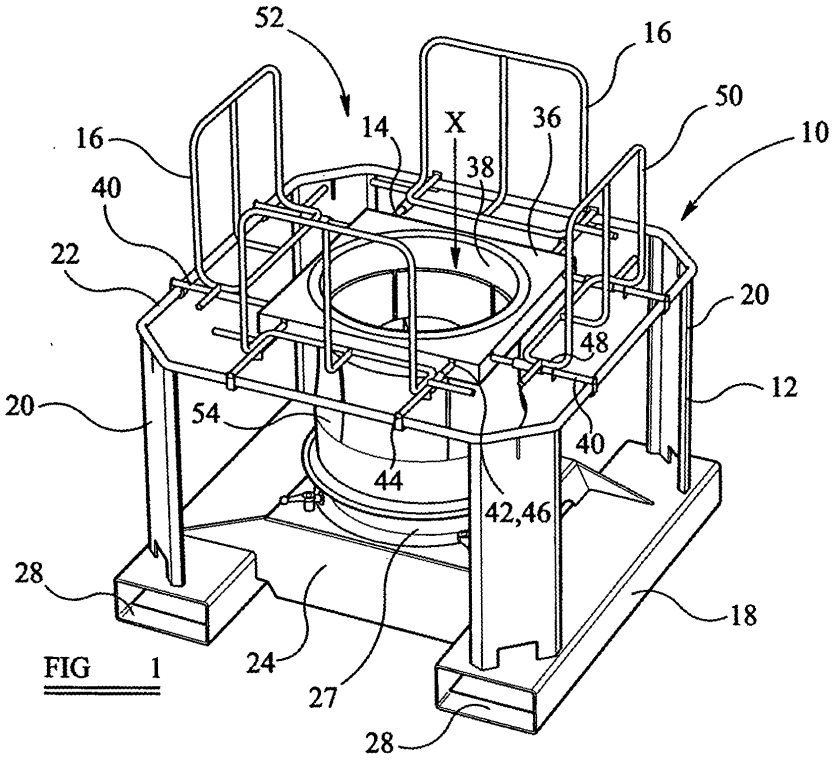

FIG 1

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Description

[0001] The present invention relates to a flexible container discharge apparatus for a flexible bulk container, and to a method of discharging material from such a flexible bulk container.

[0002] Flexible bulk containers are well known, and, by way of example, are commonly called Bulk Bags, Big Bags, Super Sacks, and Flexible Intermediate Bulk Containers (FIBC's). A flexible bulk container is formed from woven or non-woven material and essentially defines a large bag suitable for holding and transporting flowable particulate material, such as cement, flour, sugar, sand, powder, granular material, and pharmaceuticals. A capacity of a flexible bulk container can typically range from 250 litres to 2000 litres, and a lifting device, such as a hoist, forklift truck, or crane, is generally used to manoeuvre a full flexible bulk container.

[0003] However, it is envisaged that a flexible bulk container can have a capacity in the range of 5 litres to 100,000 litres.

[0004] Herein, therefore, a flexible bulk container is defined as a container formed from a woven or non-woven flexible material which has a capacity in the range of 5 litres to 100,000 litres, and more preferably 250 litres to 2000 litres, and which can hold for transportation flowable particulate material.

[0005] In order to discharge the material from such a flexible bulk container, due to the weights involved, specialised apparatus is required. Flexible container discharge apparatus is known from, for example, Spiroflow Limited of Clitheroe, Lancashire, United Kingdom. All such known apparatuses operate in fundamentally the same way. A rigid funnel-shaped hopper is provided in which the flexible bulk container can be placed. A valve is located below the hopper, and a discharge pipe or duct extends from the valve to the base of the hopper. A flexible discharge tube is typically incorporated in a base of the flexible bulk container, and this tube is connected to the discharge duct of the hopper, or simply runs down into its interior. If a flexible discharge tube is not provided, then the base of the flexible bulk container is cut or perforated to allow discharge.

[0006] A first problem which is associated with the present apparatus, is that a flexible bulk container with material therein adopts a substantially flat bottom or base. The flexible bulk container therefore does not seat correctly in the known hopper, until a significant amount of the material has been discharged. The material is therefore often difficult to initially discharge, due to compaction, accessibility to open the discharge tube of the container is difficult and often complex, and the stability of the apparatus is reduced, due to the higher centre of gravity.

[0007] A further significant problem is the connection of the discharge outlet of the flexible bulk container to the discharge duct of the apparatus, since the dimensions of the flexible tubular discharge pipes of the flexible bulk containers vary widely. If the apparatus is designed so that the discharge duct of the apparatus must be connected to the flexible discharge tube of the flexible bulk container, then adapters are necessary. Even so, with a flexible tubular discharge pipe having a length which is less than or equal to its diameter, connection to a discharge pipe of the known apparatus is often difficult or impossible. Consequently, complicated sealing arrangements are required. However, this in turn then leads to complications when trying to open the flexible tubular discharge pipe in order to initiate discharge.

[0008] Yet another problem occurs, since the known apparatus is integrally formed as a single device, and is too large to be portable. This frequently leads to cross-contamination, not only when using the apparatus for the discharge of various different materials, but also since the apparatus is generally located in a non-hygienic environment, leading to contamination from the environment during placement of the flexible bulk container, and connection of the flexible discharge tube.

[0009] The present invention therefore seeks to solve these problems.

[0010] According to a first aspect of the invention, there is provided flexible container discharge apparatus for a flexible bulk container, the apparatus comprising a base structure, a common movable container support element for supporting the flexible bulk container and hingably connected to the base structure for movement relative thereto, and a plurality of equi-angularly pivotable urging elements which project in a direction away from the common support element and which are directly or indirectly connected to the common support element, so that, as the common support element moves due to gravity, the urging elements equi-angularly pivot towards each other.

[0011] Preferably, the base structure includes one or more upstanding support members, and a rim on the or each support member, the movable container support element being hingably connected to the rim.

[0012] Advantageously, the movable container support element may include a plurality of spaced arms which are pivotably engaged with the base structure. In this case, each arm may preferably include a joint for articulated movement.

[0013] Preferably, the moveable container support element includes a plate having a material discharge aperture therethrough.

[0014] Furthermore, the urging elements may define a variable-volume enclosure for receiving the flexible bulk container.

[0015] Beneficially, one or more of the said urging elements is preferably a frame.

[0016] Preferably, a portion of one or more of the said urging elements forms part of the movable container support element.

[0017] More preferably, one or more of the said urging elements is slidable relative to the movable container support element.

[0018] The flexible container discharge apparatus may

further comprises releasable holding means for releasably holding the movable container support element in a first upper position. In this case, the releasable holding means preferably is or includes one or more magnetic elements.

[0019] Advantageously, the flexible container discharge apparatus may further comprise a base hopper which is supported by the base structure.

[0020] In this case, the base hopper may be releasably connectable to the base structure.

[0021] Furthermore, the flexible container discharge apparatus may further comprise a flexible discharge duct which is connected or connectable between the movable container support element and the base hopper, and through which material from the flexible bulk container passes during discharge. In this case, the flexible container discharge apparatus may further comprises a valve for closing a flow path through the flexible discharge duct. Furthermore, the valve may include a material dislodgement device which is movable in the flexible discharge duct for projection into an interior of the flexible bulk container.

[0022] Preferably, the valve includes a cutting device which is moveable in the flexible discharge duct for cutting a base of the flexible bulk container.

[0023] Preferably, the flexible container discharge apparatus may further comprise a biasing element for moving the support element and/or urging elements to promote material discharge. In this case, the biasing element is preferably a cage.

[0024] According to a second aspect of the invention, there is provided flexible container discharge apparatus as claimed in any one of the preceding claims, in combination with a flexible bulk container having a flowable material therein, the container being provided on the common movable container support element of the apparatus, and the pivotable urging elements forming a variable volume enclosure around the flexible bulk container, the urging elements equi-angularly pivoting towards each other as the material flows from the container whereby a base of the flexible bulk container forms a hopper-shape.

[0025] Preferably, the flexible bulk container has a flexible tubular outlet with a length which is less than or equal to its diameter.

[0026] Advantageously, the combination may further comprise a flexible elongate tie element for location around a flexible tubular outlet of the flexible bulk container, the tie element having a length adapted for access from the exterior of the discharge apparatus when the flexible bulk container is seated on the discharge apparatus.

[0027] According to a third aspect of the invention, there is provided A method of discharging material from a flexible bulk container as hereinbefore defined, the method comprising the steps of : a) providing flexible container discharge apparatus including a base structure, a common movable container support element which is hingably connected to the base structure, and a plurality of equi-angularly pivotable urging elements which are directly or indirectly connected to the common support element and which project away from the support element to define an enclosure for the flexible bulk container; b) locating the flexible bulk container on the common movable container support element, so that the weight of the container urges the common support element downwards, thus causing the urging elements to equi-angularly pivot inwards and press on the flexible bulk container; and c) opening the flexible bulk container so that material contained therein is discharged through its base.

[0028] Preferably, in step a), it is determined whether : i) the flexible bulk container to be emptied has a flexible discharge tube in its base which has a length which is greater than its diameter, ii) the flexible bulk container has a flexible discharge tube in its base which has a length which is less than or equal to its diameter, or iii) whether the base of the flexible bulk container must be punctured to enable discharge, in the case of option i), the flexible discharge tube is connected directly to a base hopper supported by the base structure in step b), in the case of options ii) and iii), a flexible discharge duct is provided between the base hopper and the movable container support element.

[0029] In this case, in option iii), the discharge apparatus may be provided with a cutting device for puncturing the base of the flexible bulk container.

[0030] Optionally, in step c), the angular displacement of the pivotable urging elements may automatically increase as the material flows out of the flexible bulk container, so that the urging elements continue to force the material in the flexible bulk container towards the opening.

[0031] Preferably, in step c), the base of the flexible bulk container automatically adopts a hopper-shape as the material flows out of the flexible bulk container. In this case, a slope of the hopper-shaped base may increase the more the material flows out of the flexible bulk container.

[0032] Preferably, step c) occurs prior to step b).

[0033] Preferably, the locating of the flexible bulk container on the apparatus in step b) occurs at a first location, and the apparatus and flexible bulk container are moved to a second location which is different from the first location for discharge of the material into a second container.

[0034] Beneficially, the flexible container discharge apparatus may be selected in step a) from amongst a plurality of flexible container discharge apparatuses.

[0035] Preferably, the base structure includes a or the base hopper, and the base hopper is selected in step a) based on a specific material contained within the flexible bulk container, so that cross-contamination is prevented or limited.

[0036] More preferably, the method further comprises a step d), subsequent to steps b) and c), of agitating the material within the flexible bulk container.

[0037] The method may further comprise a step e), subsequent to step a), of retying a flexible discharge tube of the flexible bulk container with an elongate flexible tie element having a length which is suitable for access from an exterior of the discharge apparatus when the flexible bulk container is positioned on the discharge apparatus.

[0038] Preferably, the flexible bulk container has a flexible discharge tube with a length which is less than or equal to its diameter.

[0039] More preferably, the flexible container discharge apparatus further comprises a biasing element, and a step f) is provided subsequent to step c) of imparting oscillation to the support element via the biasing element.

[0040] The present invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which :

Figure 1 shows a first embodiment of flexible container discharge apparatus, in accordance with the first aspect of the invention;

Figure 2 shows an enlarged view from above of the flexible container discharge apparatus;

Figure 3 shows the flexible container discharge apparatus with a flexible bulk container positioned thereon;

Figure 4 shows the flexible container discharge apparatus suspended above a discharge station to which can be suspended a secondary container;

Figure 5 shows the flexible container discharge apparatus seated on the discharge station;

Figure 6 shows an enlarged partially translucent view of the flexible bulk container seated on the discharge apparatus, and of a valve within a flexible discharge duct and in a first condition;

Figure 7 shows the discharge apparatus during discharge;

Figure 8 shows an enlarged view of the discharge apparatus during discharge;

Figure 9 shows an enlarged partially translucent view of the flexible bulk container seated on the discharge apparatus, and of the valve within the flexible discharge duct and in a second condition extending into the flexible bulk container;

Figure 10 shows a second embodiment of the flexible container discharge apparatus, in accordance with the first aspect of the invention;

Figure 11 is a side view showing the discharge apparatus suspended above a raising member;

Figure 12 shows the discharge apparatus incorporating the raising member, and a flexible bulk container seated thereon;

Figure 13 shows the raising member removed, and an elongate flexible discharge tube of the flexible bulk container being stretched;

Figure 14 is an enlarged view of part of a rim of a base hopper of the discharge apparatus;

Figure 15 is a partially translucent view of the base hopper shown in Figure 14, showing a clamping band which extends around the rim of the base hopper and by which the flexible discharge tube of the flexible bulk container is attached to the base hopper; and

Figure 16 shows a third embodiment of flexible container discharge apparatus, in accordance with the first aspect of the invention.

[0041] Referring firstly to Figures 1 to 9 of the drawings, there is shown a first embodiment of flexible container discharge apparatus 10 which comprises a base structure 12, a single common movable container support element 14 which is hingably connected to the base structure 12 for movement relative thereto, and a plurality of pivotable urging elements 16 which upstand from the common support element 14.

[0042] The base structure 12 includes a ground-contactable base member 18, four upstanding elongate support members 20 positioned at four corners of the base member 18, and an endless rim 22 which is fixed to and which extends between all four support members 20.

[0043] As shown in Figure 3, optional extended support members 23 can be provided on the elongate support members 20 for further stabilisation. The extended support members 23 include hooks 23a for connection with loops on a flexible bulk container. The extended support members 23 are shown removed in the other drawings for clarity purposes.

[0044] The base member 18 includes a central portion 24 with a discharge aperture 26 therethrough, a base hopper 27 provided in the discharge aperture 26 and releasably engaged with the central portion 24, and a fork receiving member 28 provided on two opposing sides of the central portion 24. The fork receiving members 28 are channels or tubes dimensioned to receive forks of a forklift truck.

[0045] As best seen in Figures 2, 6 and 9, a valve device 30 is provided for opening and closing a flow path (arrow X) through the base hopper 27 of the base member 18. Conveniently, the valve device 30 is that described in the applicant's European patent application EP1038802A1, although other kinds of valve devices can

of course be utilised.

[0046] Since a valve 32 of the valve device 30 is movable upwardly to open the valve device, it is convenient to provide a ring-shaped material dislodgement element 34 which is positioned above, and moves with, the valve 32. The material dislodgement element 34 is thus movable relative to the base structure 12 in an upwards and downwards direction.

[0047] Although ring-shaped or halo-like, the material dislodgement element can take any shape which results dislodgement of material.

[0048] In a modification, a cutting device (not shown), such as one or more blades, can additionally or alternatively be provided to project upwardly from the movable valve 32. This is required when a bottom of the flexible bulk container must be cut or punctured in order to discharge material. The cutting device is preferably removable, and simply attached when required.

[0049] The movable container support element 14 includes a single support plate 36 having a centrally positioned material discharge aperture 38 therethrough. The support plate 36 is centrally suspended from the rim 22 via a plurality of spaced articulated arms 40. Each arm 40 is positioned adjacent to a corner of the support plate 36, and includes a joint 42 at or adjacent thereto. A distal end 44 of each arm 40 furthest from the support plate 36 is pivotably and slidably engaged with the rim 22 at a position between upstanding elongate support members 20.

[0050] Although each arm 40 is pivotable about the rim 22, the rim itself or a portion of the rim can be rotatable, and thus, in this case, each arm can be angularly-displaceably fixed relative to the portion of the rim adjacent thereto.

[0051] To prevent the support plate 36 from sagging due to gravity and before any load is placed on the support plate 36, means are provided for releasably holding the joint 42 of each arm 40 in an unbent or rectilinear condition. The releasable holding means includes a pair of magnetic elements (generally referenced as 46 in Figures 1 and 8) provided within the joint 42 which contact when the arm 40 is straight.

[0052] However, it will be understood that other means for releasably holding the movable container support element 14 in an upper condition are entirely feasibly, such as a removable elongate brace which is wedgingly interposable between the base member 18 and a lower surface of the support plate 36.

[0053] Each urging element 16 is in the form of an L-shaped frame, with the urging element 16 being removable and releasably-slidably engagable at its foot-portion 48 to two respective arms 40 of the support element 14 and slightly spaced from the support plate 36 so as not to interfere with the joints 42 of the arms 40. In this way, the back-portions 50 of the L-shaped frames project perpendicularly or substantially perpendicularly away form the support element 14 and define a variable volume enclosure 52 for receiving flexible bulk containers of varying dimensions. Since the foot-portions 48 of the L-shaped frames are directed inwardly, they effectively form part of the support element 14.

[0054] Although the urging elements 16 are formed as frames, they can be solid plates. The urging elements 16 can also be permanently fixed relative to the support plate 36, if only one type of flexible bulk container is to be used. Alternatively, the urging elements 16 need not be removable, but can be slidably adjustable along the arms 40.

[0055] To contain material discharged from a flexible bulk container, and before the valve device 30 is opened, a flexible, typically elastic, discharge duct 54 of typically circular lateral cross-section is connected between the aperture 38 of the support plate 36 and the base hopper 27 of the base member 18, and around a movable cage 55. The flow path X is thus defined between the support plate aperture 38 and the base hopper 27. As best shown in Figures 2, 6 and 9, the cage 55 is connected to and moves with the movable container support element 14, but, upon initial opening of the valve device 30 at least, does not interfere with the valve device 30.

[0056] The flexible container discharge apparatus 10 can be formed integrally as part of a larger apparatus below, on or in which a further smaller or larger container can be provided into which material from the flexible bulk container is dispensed or metered. However, advantageously, the flexible container discharge apparatus 10 described above is portable, allowing removable placement on another container, such as a silo or intermediate bulk container (IBC), or apparatus which itself holds a smaller or larger flexible container. Consequently, the flexible container discharge apparatus 10 can be prepared and loaded with a flexible bulk container at a first location, before then being transported to a second location for discharge. Since the base of the flexible bulk container is seated and effectively sealed to the support plate 36, the possibility of cross-contamination at the second location is eliminated or significantly reduced.

[0057] When a flexible bulk container 56 having an integrally formed flexible discharge tube 58 in its base 60 is to be discharged, the flexible bulk container 56 is raised, for example by a forklift truck or hoist, and the urging elements 16 are removed or slidably adjusted to the width of the flexible bulk container. In this case, the length of the flexile discharge tube 58 is less than or equal to its diameter. A suitably long length, for example 2 metres, of a flexible elongate tie element 62, such as rope, cord or string, is releasably tied around the flexible discharge tube 58 of the container at a position below an existing tie (not shown). The existing tie 64, which is typically a very short piece of string or cord, can then be removed, so that the longer tie element 62 prevents discharge.

[0058] With the arms 40 of the common support element 14 held in the straight position, and thus the support plate 36 in its initial upper condition, the re-tied flexible bulk container 56 is seated on the support element 14 such that the flexible discharge tube 58 of the container

extends into the flexible discharge duct 54 of the apparatus. See Figures 6 and 9. Prior to fully lowering the flexible bulk container 56 onto the support element 14, the ends of the longer tie element 62 are positioned to be accessible from the exterior of the apparatus 10. If sufficiently long, the free end of the flexible discharge tube 58 is also positioned over the material dislodgement element 34 to prevent possible fouling.

[0059] The urging elements 16 are positioned to contact the sides of the flexible bulk container.

[0060] The container 56 is then fully seated on the support element 14. Due to the weight of the container 56 bearing on the support plate 36, the support plate 36 is urged vertically downwards. This releases the joints 42, and the articulated arms 40 of the support element 14 flex or articulate. Since the urging elements 16 are held in position on the articulated arms 40, each urging element 16 equi-angularly pivots inwardly as the arms 40 bend, thus pressing against and gripping the flexible bulk container 56. The flexible bulk container 56 is now securely and stably held by the discharge apparatus 10.

[0061] The longer tie element 62 can be released and pulled free by a user, simply by tugging on one of the accessible free ends. Flowable material within the flexible bulk container 56 thus discharges into the flexible discharge duct 54 of the discharge apparatus 10, but is prevented from exiting by the closed valve device 30 in the base hopper 27.

[0062] The loaded flexible container discharge apparatus 10 can now be moved to the discharge site at the second location by a suitable device, such as a forklift truck.

[0063] The discharge apparatus 10 with flexible bulk container 56 securely held thereon can then be placed on a suitable discharge station (shown in Figures 4 and 5), which is prepared for discharge into a suitable secondary container (not shown). Once positioned ready for discharge, the valve 32 of the valve device 30 in the flexible discharge duct 54 is moved upwards, thus opening, and the flowable material begins discharging. With the upward movement of the valve 32, the material dislodgement element 34 is forced into the interior of the flexible bulk container 56, dislodging and breaking up any compacted material. The valve 32 can include vibration, pulsation or oscillation means for imparting vibration, pulsation or oscillation to the material dislodgement element 34. This is disclosed in EP1038802A1, which is incorporated herein by reference. However, for the sake of clarity, the valve device 30 can include an inflatable and deflatable pneumatic actuator which pneumatically controls the movement of the valve 32. Control circuitry can thus impart pulsation, vibration or oscillation to the material dislodgement element via the actuator.

[0064] If flow of the material stops, due to for example bridging or cohesion within the flexible bulk container, the actuator can be operated to lift the valve 32 higher. The valve 32 thus contacts and lifts the cage 55. The cage 55, acting as a biasing element, thus lifts the support plate which presses into the base of the flexible bulk container. In this condition, the valve 32 can be vibrated, pulsed, or oscillated by the actuator to impart movement to the contents of the flexible bulk container. This results in promotion of the flow of the material.

[0065] The raising of the cage 55 and thus the support plate inherently pivots the urging elements slightly outwards. Vibration, pulsation or oscillation thus causes the urging elements to massage the sides of the flexible bulk container, again promoting flow.

[0066] Obviously, other types of actuator are also possible for controlling the valve device 30 and any pulsation or vibration.

[0067] As the flowable material leaves the flexible bulk container 56 and as best understood from Figures 7 to 9, the urging elements 16 are able to pivot further inwards by equal degrees, decreasing the volume of the enclosure 52 defined thereby, and the support plate 36 vertically descends. This beneficially results in the automatic formation of the base 60 of the flexible bulk container 56 into a funnel-shaped hopper 65. As more material is discharged, the urging elements 16 pivot further towards each other, forcing more material towards the discharge opening. The slope of the hopper-shaped base 60 also continues to steepen as the support plate 36 lowers, again resulting in more flowable material moving towards the discharge opening.

[0068] A second embodiment of the flexible container discharge apparatus 10 is shown in Figures 10 to 15 of the drawings, and like references refer to like parts. In this embodiment, a flexible bulk container 156 having an elongate flexible discharge tube 158 in its base is provided. In this case, the flexible discharge tube 158 has a length which is greater than its diameter. Consequently, the flexible discharge duct 54 is removed.

[0069] The base hopper 27 is released from its engagement with the central portion 24 of the base member 18. A raising member 166, typically in the form of a cage, is provided, and the discharge apparatus 10 is raised and lowered onto the raising member 166 so that it is accommodated within the discharge aperture 26 of the central portion 24. This results in the raising member 166 raising the base hopper 27 up towards the movable container support element 14.

[0070] With the urging elements 16 adjusted to accommodate the flexible bulk container 156, the flexible bulk container 156 is lowered so that it is almost seated on the movable container support element 14. The flexible discharge tube 158 of the flexible bulk container 156 is then releasably clamped to the up-raised base hopper 27. As seen in Figures 14 and 15, the base hopper 27 is provided with a rim 168 around and over which is provided a circular elastic cover 170. As seen in Figure 15, a ring-shaped clamping band 172 is provided as a close-fit around the rim 168. With the cover 170 rolled downwards, the flexible discharge tube is fed inside the clamping band 172, out and back on itself to encompass the clamping band 172 therewithin. The elastic cover 170 is

then rolled back up and over the rim 168, thus releasably securing the clamping band 172, and consequently the flexible discharge tube 158, to the base hopper 27, as seen in Figures 13 and 14.

[0071] In this condition, the flexible bulk container 156 is fully seated on the movable container support element 14, and the raising member 166 is removed. With the raising member 166 removed, the base hopper 27 reseats in the discharge aperture 26, and is reengaged with the central portion 24. The flexible discharge tube 158 is thus stretched, and forms a duct between the movable container support element 14 and the base hopper 27.

[0072] Once the existing tie 164 is released from the flexible discharge tube, discharge can take place as described above.

[0073] In this embodiment, since the flexible discharge duct 54 is not needed, the longer tie element 62 is also dispensed with, since access to the flexible discharge tube of the flexible bulk container 156 is unhindered.

[0074] Referring now to Figure 16, a third embodiment of the flexible discharge apparatus 10 is shown, and like references again refer to like parts. In this embodiment, the only different from the discharge apparatus shown in Figure 1, is that urging elements 116 include a plate-like foot-portion 148. This enables the urging element to be independently pivotable relative to the respective supporting arms 40. The urging elements 116 can be releasably engaged to the arms 40.

[0075] This feature is beneficial, since it allows at least manual pivoting of the urging elements during discharge by a user in order to promote discharge. It is envisaged that the pivoting, alternatively or additionally to being manual, could be via a controllable actuator.

[0076] By providing ratchet-like teeth along the longitudinal extent or a portion of the arms, the plates can be removable from the apparatus and simply positioned on the arms relative to the flexible bulk container as necessity dictates.

[0077] The longer extended support members can replace the shorter upstanding support members. In this case, the rim is mounted on the extended support members.

[0078] The valve device of EP1038802A1 is particularly advantageous, since it can be readily closed and opened during discharge, without cross-contamination. This allows straightforward and simple accurate metering or dispensing of the material into one or more secondary containers.

[0079] The urging elements, due to their point contact with the sides of the flexible bulk container, break up compacted material and so-called 'rat holes' formed by the material dislodgement element.

[0080] Electric, hydraulic or pneumatic pulsators or vibrators can be provided to contact the flexible bulk container to further break up and dislodge material therewithin. Alternatively or additionally, an actuator can be utilised to vibrate or pulsate the support element and thus also the urging elements, or *vice versa.*

[0081] Although the support element includes a support plate, this can be replaced with a frame to which the flexible discharge duct is connected.

[0082] The flexible discharge duct, as an alternative, can be connected to the material dislodgment element, so that it is extended upwards to seal to the flexible bulk container or the support element as the valve is raised to open the valve device.

[0083] The discharge apparatus of the present invention can accommodate any type of flexible bulk container without the requirement for an adaptor. The discharge apparatus can accept a flexible bulk container with an elongate flexible discharge tube which is longer than its diameter, a flexible bulk container with a flexible discharge tube having a length which is less than or equal to its diameter, and also a flexible bulk container with not discharge tube. In this latter case, the cutting device must be provided to form a discharge outlet or opening in the base, and the flexible bulk container is typically disposed of following discharge.

[0084] Consequently, prior to discharge, the type of flexible bulk container must be determined, and the flexible discharge duct is then mounted on the apparatus or removed, dependent on necessity.

[0085] The main advantage of the above-described flexible container discharge apparatus is that it can operate solely under gravity, without reliance on electrical energisation of any kind. As the common support plate lowers, the urging elements are automatically moved or tilted inwards by equal amounts and the hopper-shaped base of the container automatically steepens. Both actions act to force material towards the outlet, thus promoting fast and effective discharge.

[0086] Since the discharge apparatus is portable, it is possible to provide a specific discharge apparatus for use only with a specific material. Consequently, the discharge apparatus can be selected from amongst a plurality of discharge apparatuses. This prevents or limits the possibility of cross-contamination.

[0087] Furthermore, by providing further parts which contact the flowable material, it is a straightforward matter to interchange parts base don the type of flowable material to be discharged. For example, the base hopper, valve device, and the flexible discharge duct are the only parts of the discharge apparatus to contact the material being discharged. Consequently, these parts can be designed for use with specific materials, and interchanged as necessity dictates. This further reduces the risk of cross-contamination.

[0088] There is no requirement for a stretcher arrangement, in order to stretch a base of the flexible bulk container to ensure complete discharge. The fact that the base of the flexible bulk container is automatically formed into a hopper-shape inherently stretches the base.

[0089] The flexible container discharge apparatus automatically accommodates for any change in material characteristics from free flowing to cohesive and sticky.

[0090] Additional stabilisation to support the flexible

container from above is not necessary, since the container is stably supported on the common support element and the equi-angularly movable urging elements.

[0091] The embodiments described above are given by way of examples only, and various other modifications will be apparent to persons skilled in the art without departing from the scope of the invention, as defined by the appended claims.

Claims

1. Flexible container discharge apparatus (10) for a flexible bulk container (56; 156), the apparatus (10) comprising a base structure (12), a common movable container support element (14) for supporting the flexible bulk container (56; 156) and hingably connected to the base structure (12) for movement relative thereto, and a plurality of equi-angularly pivotable urging elements (16; 116) which project in a direction away from the common support element (14) and which are directly or indirectly connected to the common support element (14), so that, as the common support element (14) moves due to gravity, the urging elements (16; 116) equi-angularly pivot towards each other.

2. Flexible container discharge apparatus (10) as claimed in claim 1, wherein the base structure (12) includes one or more upstanding support members (20), and a rim (22) on the or each support member (20), the movable container support element (14) being hingably connected to the rim (22).

3. Flexible container discharge apparatus (10) as claimed in claim 1 or claim 2, wherein the movable container support element (14) includes a plurality of spaced arms (40) which are pivotably engaged with the base structure (12).

4. Flexible container discharge apparatus (10) as claimed in claim 3, wherein each arm (40) includes a joint (42) for articulated movement.

5. Flexible container discharge apparatus (10) as claimed in any one of the preceding claims, wherein the moveable container support element (14) includes a plate (36) having a material discharge aperture (26) therethrough.

6. Flexible container discharge apparatus (10) as claimed in any one of the preceding claims, wherein one or more of the said urging elements (16; 116) is slidable relative to the movable container support element (14).

7. Flexible container discharge apparatus (10) as claimed in any one of the preceding claims, further comprising a base hopper (27) which is supported by the base structure (12).

8. Flexible container discharge apparatus (10) as claimed in claim 7, further comprising a flexible discharge duct (54) which is connected or connectable between the movable container support element (14) and the base hopper (27), and through which material from the flexible bulk container (56; 156) passes during discharge.

9. Flexible container discharge apparatus (10) as claimed in claim 8, further comprising a valve (32) for closing a flow path (X) through the flexible discharge duct (54), wherein the valve (32) includes a material dislodgement device (34) which is movable in the flexible discharge duct (54) for projection into an interior of the flexible bulk container (56; 156).

10. Flexible container discharge apparatus (10) as claimed in claim 9, wherein the valve (32) includes a cutting device which is moveable in the flexible discharge duct (54) for cutting a base (60) of the flexible bulk container (56; 156).

11. Flexible container discharge apparatus (10) as claimed in any one of the preceding claims, further comprising a biasing element (55) for moving the support element (14) and/or urging elements (16; 116) to promote material discharge.

12. Flexible container discharge apparatus (10) as claimed in claim 11, wherein the biasing element (55) is a cage.

13. Flexible container discharge apparatus (10) as claimed in any one of the preceding claims, in combination with a flexible bulk container (56; 156) having a flowable material therein, the container (56; 156) being provided on the common movable container support element (14) of the apparatus (10), and the pivotable urging elements (16; 116) forming a variable volume enclosure around the flexible bulk container (56; 156), the urging elements (16; 116) equi-angularly pivoting towards each other as the material flows from the container whereby a base of the flexible bulk container (56; 156) forms a hopper-shape.

14. A combination as claimed in claim 13, wherein the flexible bulk container (56; 156) has a flexible tubular outlet (58; 158) with a length which is less than or equal to its diameter.

15. A combination as claimed in claim 13 or claim 14, further comprising a flexible elongate tie element (62) for location around a flexible tubular outlet (58; 158) of the flexible bulk container (56; 156), the tie

element (62) having a length adapted for access from the exterior of the discharge apparatus (10) when the flexible bulk container (56; 156) is seated on the discharge apparatus (10).

16. A method of discharging material from a flexible bulk container (56; 156) as hereinbefore defined, the method comprising the steps of : a) providing flexible container discharge apparatus (10) including a base structure (12), a common movable container support element (14) which is hingably connected to the base structure (12), and a plurality of equi-angularly pivotable urging elements (16; 116) which are directly or indirectly connected to the common support element (14) and which project away from the support element (14) to define an enclosure for the flexible bulk container (56; 156); b) locating the flexible bulk container (56; 156) on the common movable container support element (14), so that the weight of the container urges the common support element (14) downwards, thus causing the urging elements (16; 116) to equi-angularly pivot inwards and press on the flexible bulk container (56; 156); and c) opening the flexible bulk container (56; 156) so that material contained therein is discharged through its base (60).

17. A method as claimed in claim 16, wherein, in step a), it is determined whether : i) the flexible bulk container (56; 156) to be emptied has a flexible discharge tube (58; 158) in its base (60) which has a length which is greater than its diameter, ii) the flexible bulk container (56; 156) has a flexible discharge tube in its base (60) which has a length which is less than or equal to its diameter, or iii) whether the base (60) of the flexible bulk container (56; 156) must be punctured to enable discharge, in the case of option i), the flexible discharge tube (58; 158) is connected directly to a base hopper (27) supported by the base structure (12) in step b), in the case of options ii) and iii), a flexible discharge duct (54) is provided between the base hopper (27) and the movable container support element (14).

18. A method as claimed in claim 17, wherein, in option iii), the discharge apparatus (10) is provided with a cutting device for puncturing the base (60) of the flexible bulk container (56; 156).

19. A method as claimed in any one of claims 16 to 18, wherein the locating of the flexible bulk container (56; 156) on the apparatus (10) in step b) occurs at a first location, and the apparatus (10) and flexible bulk container (56; 156) are moved to a second location which is different from the first location for discharge of the material into a second container.

20. A method as claimed in any one of claims 16 to 19, wherein the flexible container discharge apparatus (10) further comprises a biasing element (55), and a step f) is provided subsequent to step c) of imparting oscillation to the support element (14) via the biasing element (55).

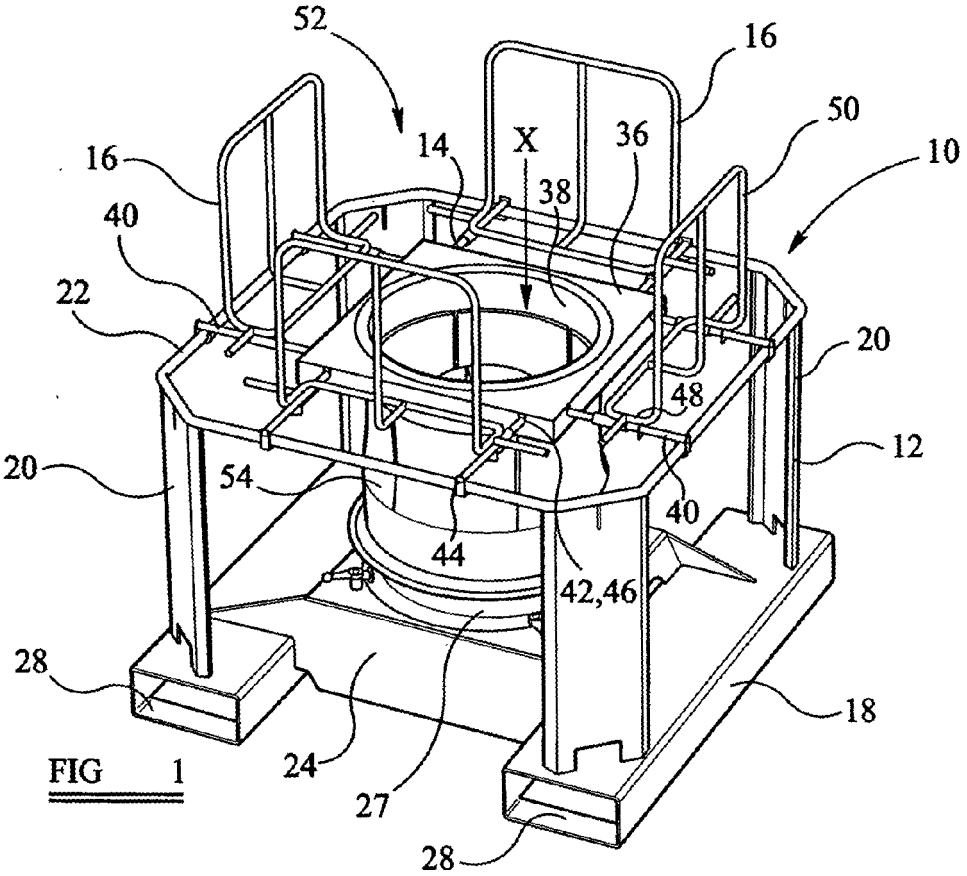
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FIG 1

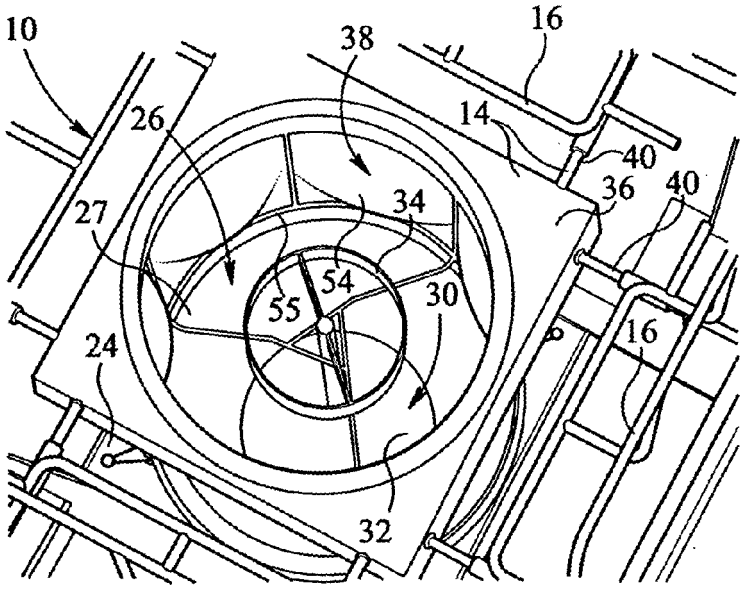
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FIG 2

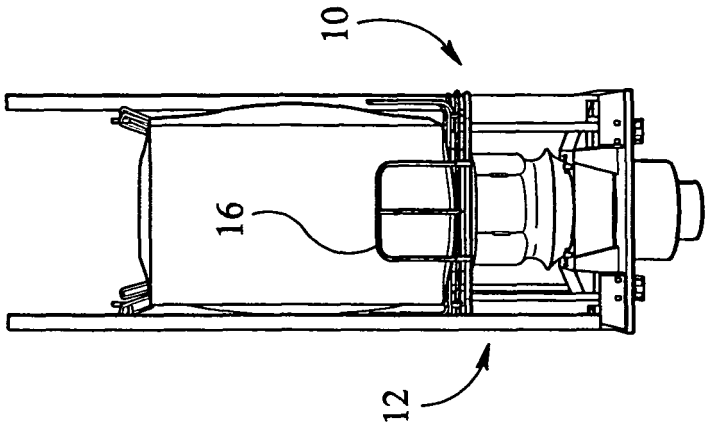


FIG 5

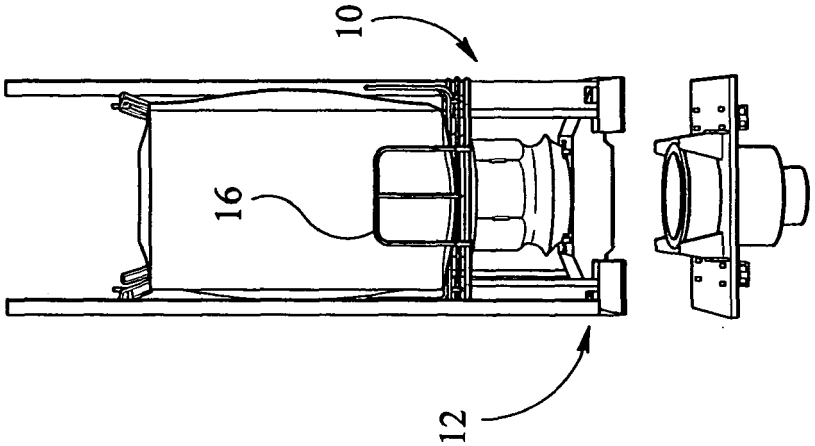


FIG 4

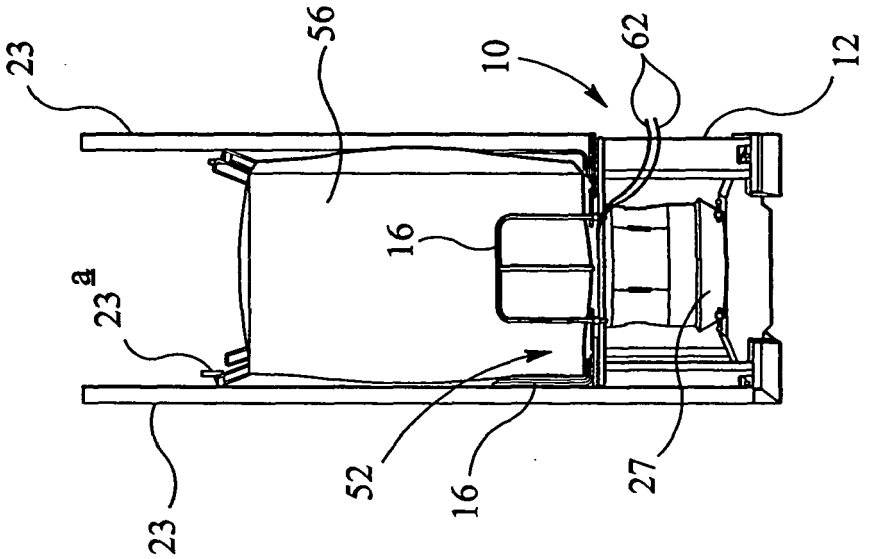


FIG 3

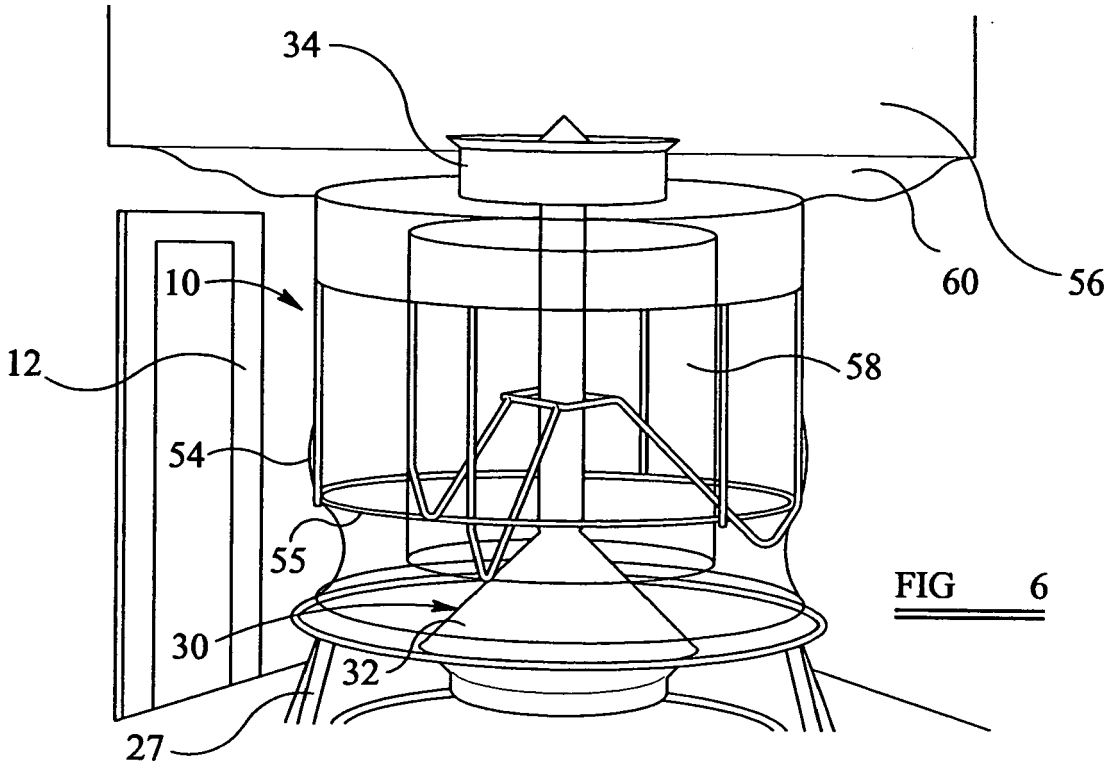


FIG 6

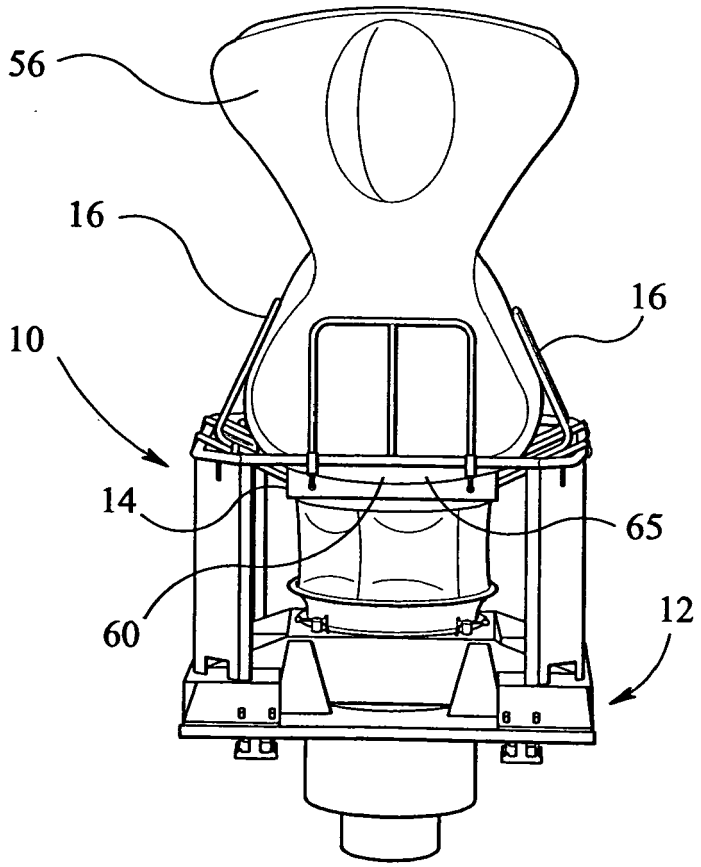
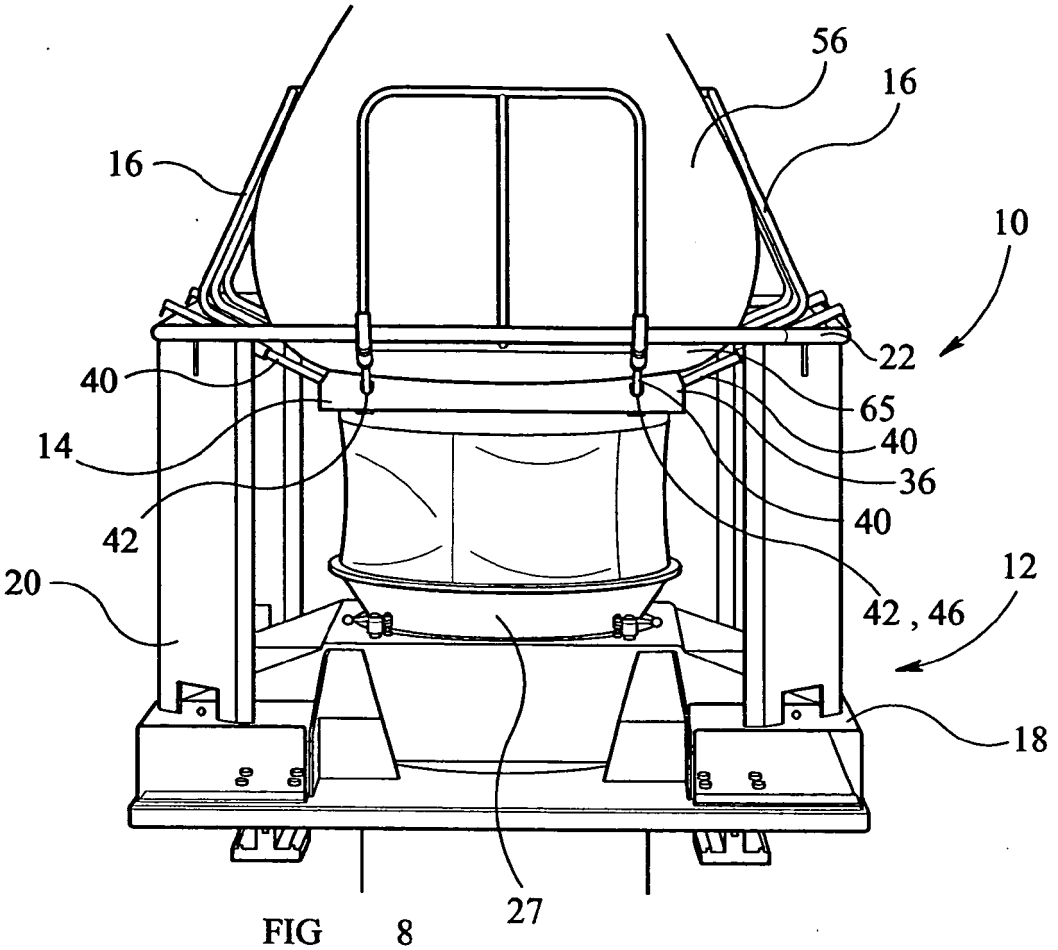


FIG 7


56
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16
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42 , 46
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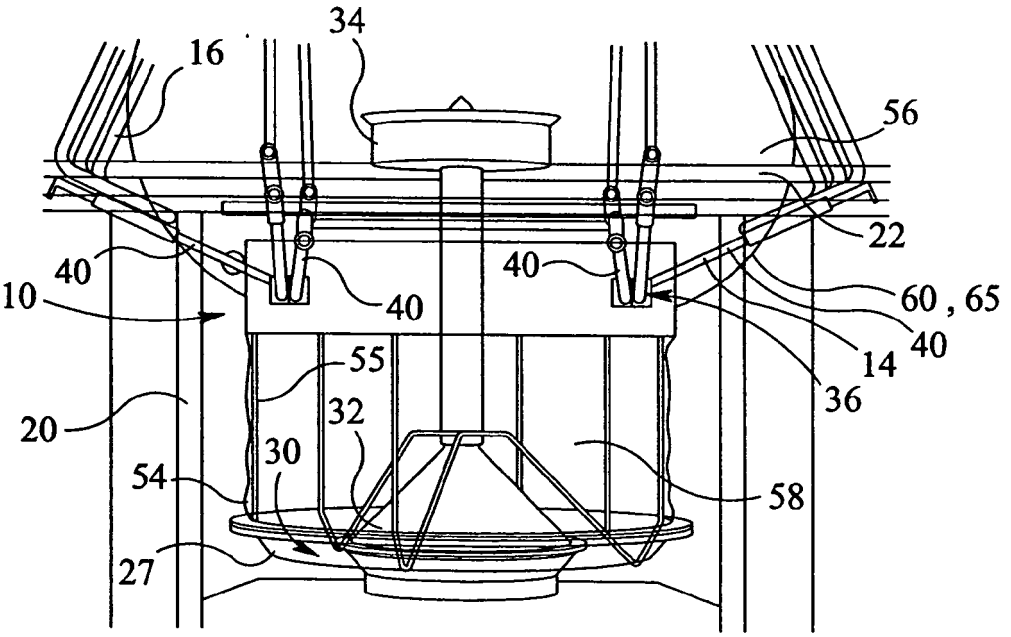
FIG 8


34
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60 , 65
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FIG 9

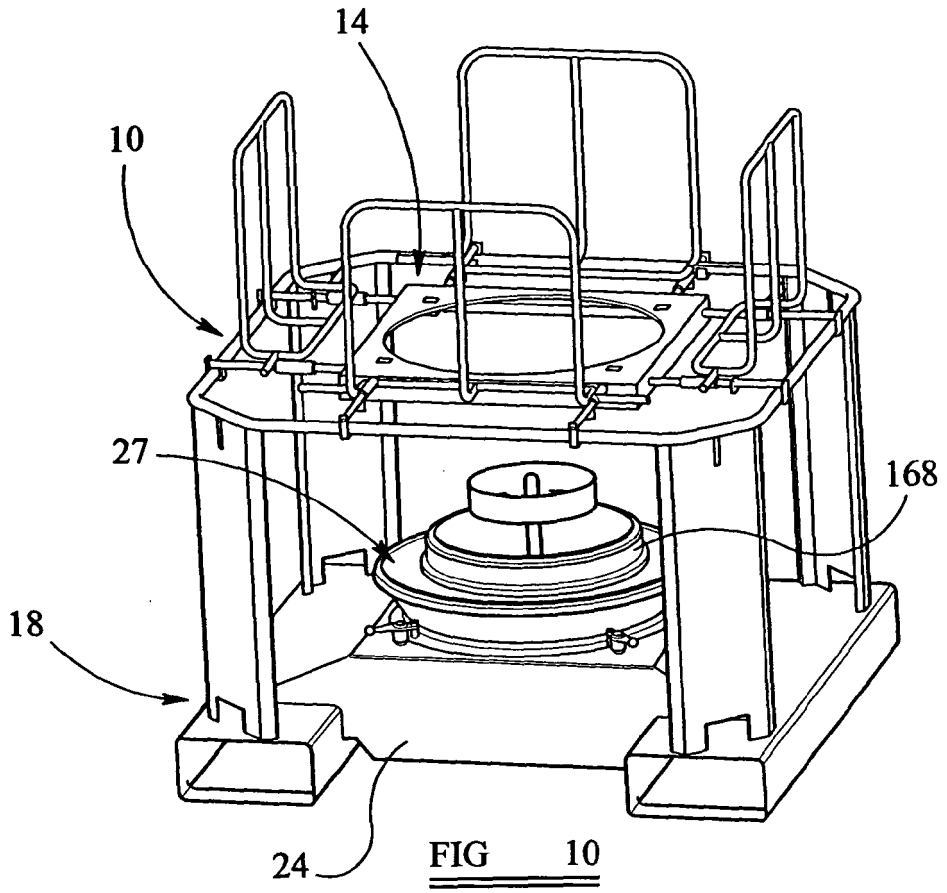

FIG 10

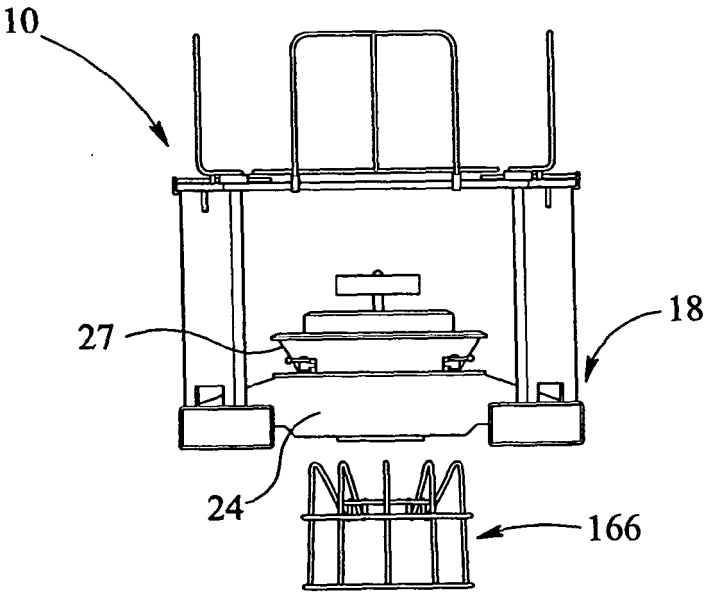

FIG 11

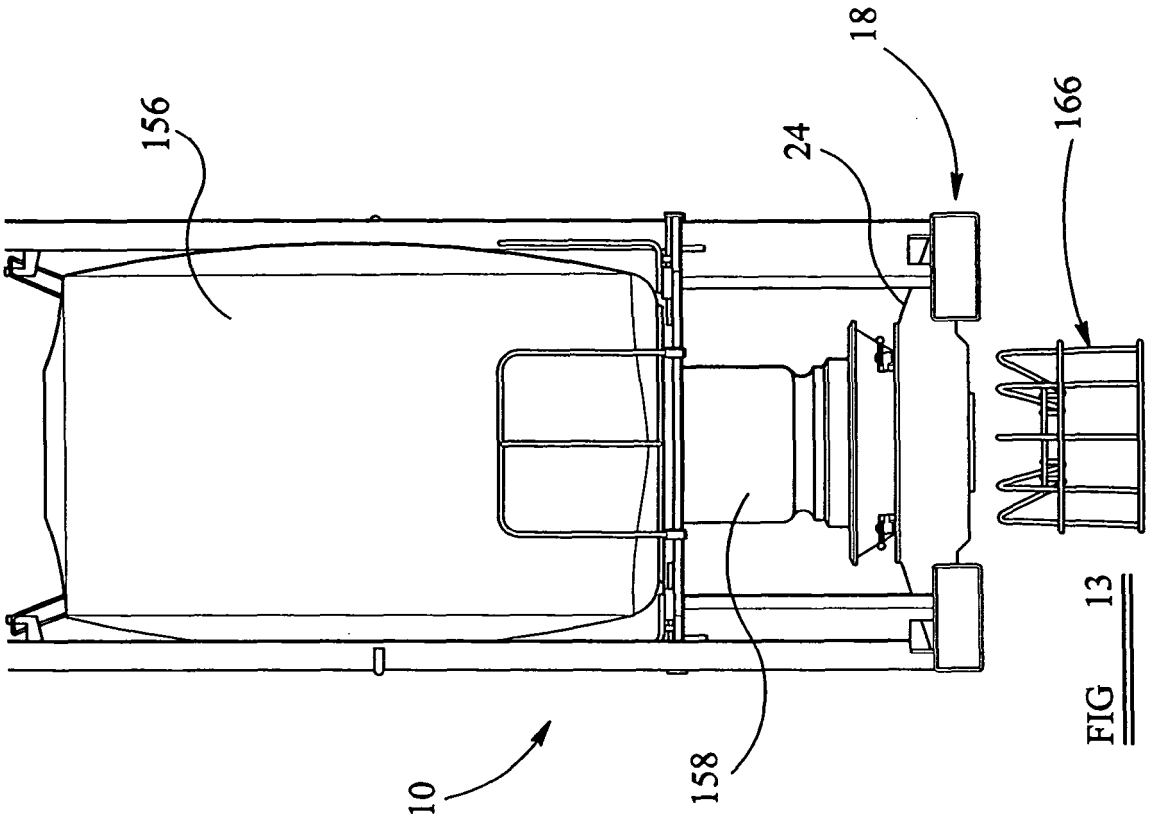

FIG 13

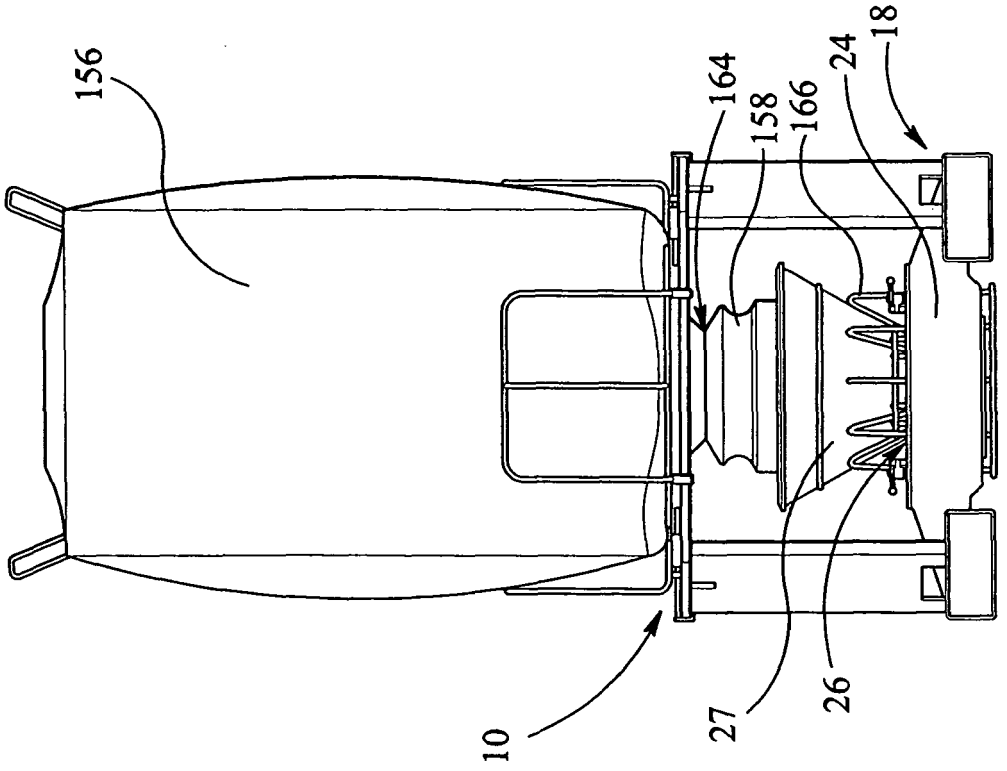

FIG 12

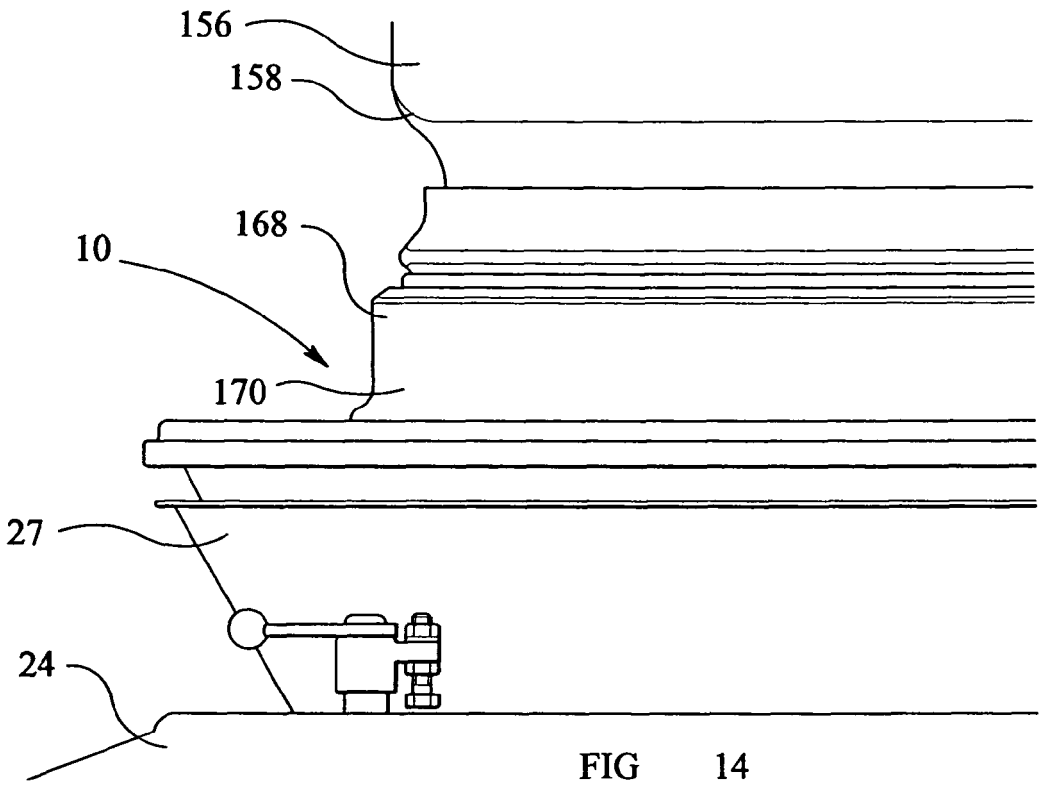

FIG 14

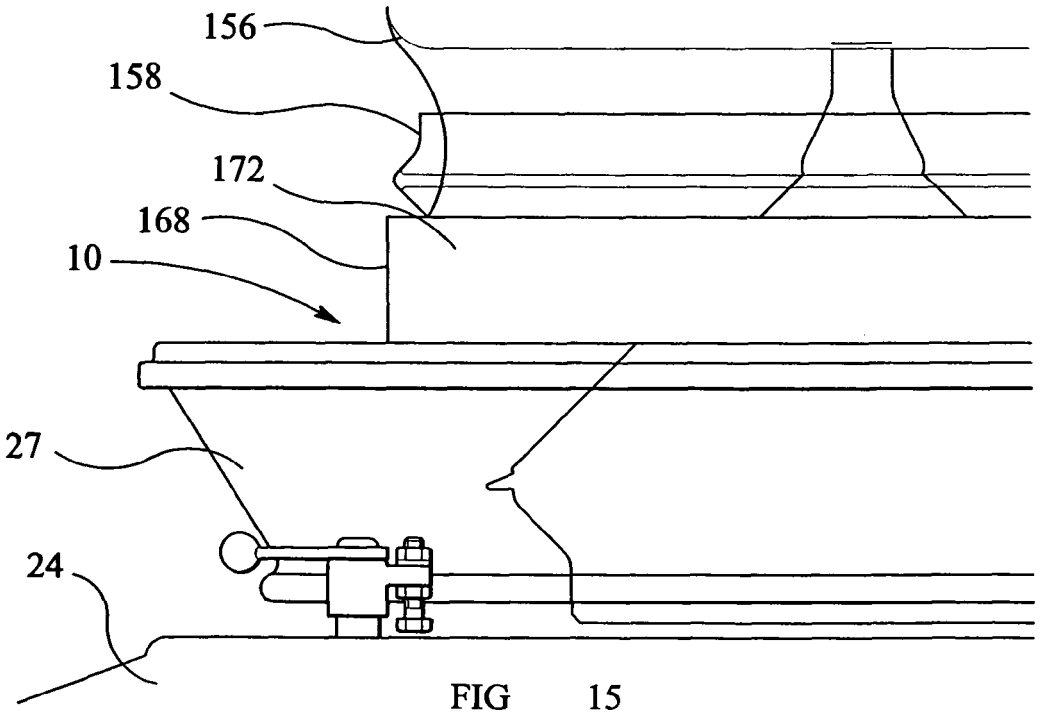

FIG 15

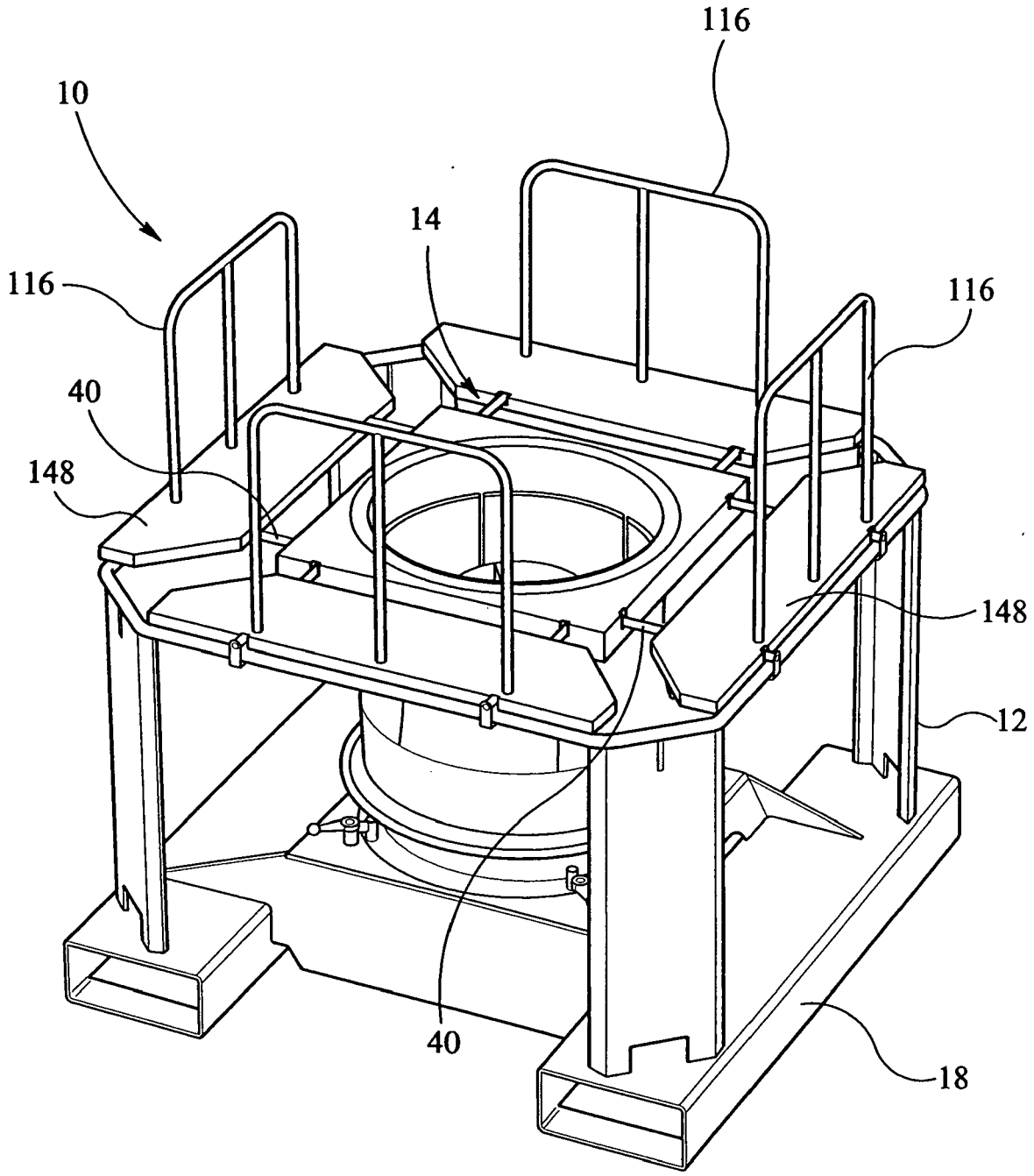

FIG 16

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 25 0216

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	SU 1 206 188 A1 (CHEREPOVETS METALL KOM [SU]) 23 January 1986 (1986-01-23) * figures 1,2 *	1,16	INV. B65B69/00
A	US 6 186 360 B1 (BECKER STEVEN L [US] ET AL) 13 February 2001 (2001-02-13) * the whole document *	1,16	
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A	US 5 788 449 A (RIEMERSMA KEITH A [US]) 4 August 1998 (1998-08-04) * column 3, line 64 - column 4, line 35; figures 1-3 *	1,16	
			TECHNICAL FIELDS SEARCHED (IPC) B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 April 2008	Grentzius, Wim

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EPO FORM 1503 03.82 (P04C01)

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22-04-2008

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