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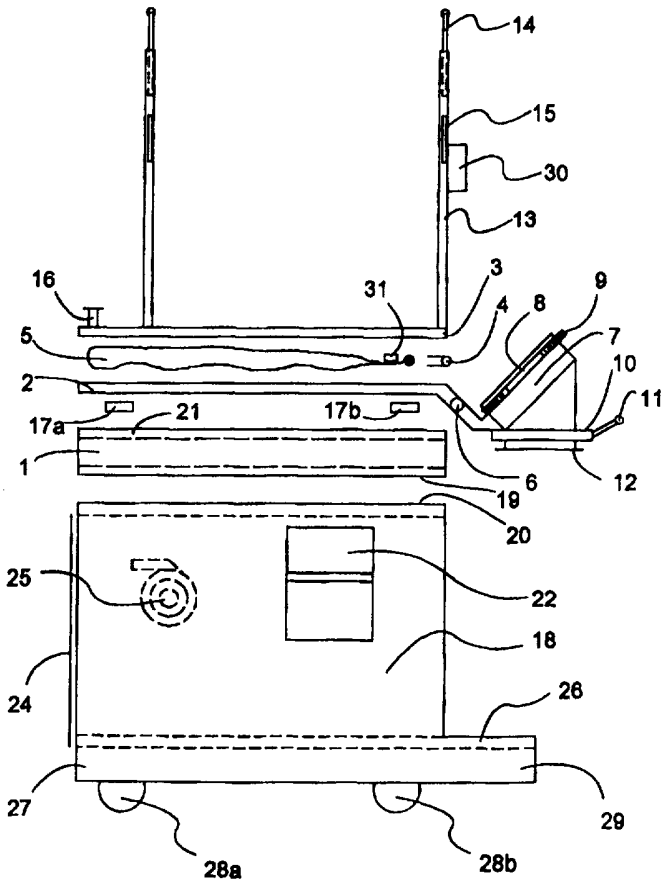
(54) Title: IMPROVED UNLOADER FOR BULK BAGS

(57) Abstract

A portable unloader for bulk bags adapted for storing and handling ingredients of batch processes. The unloader has a rigid top frame (3) for supporting the bulk bag and bottom frame (2) connected by a hinge (4), with an inflatable membrane (5) disposed between the frames (2, 3). When the membrane (5) is inflated by a blower (25), the top frame (3) pivots and material flows to a hopper (7) having a metering valve (10).



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IMPROVED UNLOADER FOR BULK BAGS

BACKGROUND

1. Field of the Invention.

The invention relates to an apparatus for unloading process materials from bulk bags.

2. Description of the Related Art.

Many industries process bulk materials in large batches. Such industries include, but are not limited to, agriculture, pharmaceuticals, and plastics. Typically, one bulk material is the major ingredient, which is then processed in batches with discrete quantities of minor ingredients. Minor ingredients may be flavorings, preservatives, or other substances that are added to the major ingredient during processing.

The major ingredient is often purchased and handled in very large bulk containers, like railroad cars and silos. They may also be purchased and handled in bulk bags. The minor ingredients, however, are typically handled in smaller containers, like fiber drums, steel drums, and 50 pound (23 kilogram) bags.

Handling minor ingredients by these means has several disadvantages. Drums and bags are typically only used once. Therefore, their use is a waste of resources, they are costly, and effort must be made to dispose of them.

Bags and drums are also difficult to move around. Moving takes a great deal of manual labor, which is also costly. Personnel who handle bags and drums are more likely to suffer painful back injuries, which increases costs to bulk material processors.

Another disadvantage is that using only part of a bag or a drum necessarily exposes the entire contents of the container to air. Exposure to air causes many materials to deteriorate much more rapidly than when sealed.

One solution has been to employ a bottom discharge bag that is lifted and conveyed from its top straps by a fork truck. This solution has several disadvantages. First, the structure, such as the forks, needed to support the bag would be at a high elevation relative to the center of gravity of the fork truck. Driving a fork truck that is supporting a high load is very dangerous because the truck could tip over very easily.

Second, someone would have to go underneath the bag at some point to attach the bottom discharge spout to another apparatus. This is also very dangerous, because it is difficult for the truck driver to see the person underneath the bag, and the bag could slip off of the forks and onto the bag operator. Also, a strap or bag seam could break, causing injury, contamination, and other damage.

Third, the bottom discharge spout would get dirty from being transported near the ground. Dirt would be more likely to get into the batch, thus contaminating the process.

Another solution is to employ a side mounted discharge bag and tilting unloading apparatus, such as that disclosed in U.S. Patent No. 5,344,048, by Bonerb, which is not admitted

to be prior art with respect to the present invention by its mention in this Background section. While suitably adapted to be an alternative means of storing and handling bulk materials, the use of those apparatuses does not solve the problem of metering out minor ingredients or transporting the unloader to the place where it is needed.

For the foregoing reasons, there is a need for a portable unloader that can meter out discrete quantities of materials, that is easy and safe to operate in a variety of configurations, that is capable of maintaining the cleanliness of the discharge spout, and can be easily handled using an ordinary fork truck or other light transportation means.

SUMMARY

The present invention is directed to an apparatus that satisfies these needs. An improved unloader for bulk bags having features of the present invention comprises a base frame, connected by a hinge to a top frame upon which a flexible bulk bag is secured, with an inflatable membrane disposed between the base frame and top frame that tilts the top frame when inflated. Instead of an inflatable membrane, at least one hydraulic or pneumatic cylinder could be provided to tilt the top frame in relation to the base. Alternatively, bulk bags with an inflatable liner discharge means may be employed instead of tilting a hinged top frame. The base frame has a top and bottom that is adapted to receive the forks of a fork truck on the top and bottom to prevent the unloader and bag from tipping over off of the forks during unloading. A hopper is connected to the top frame that is adapted to fit the discharge spout of the bulk bag. A metering valve is connected to the hopper for measuring out discrete quantities of materials.

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description and accompanying drawings.

DRAWINGS

Fig. 1 is an exploded side view of an improved unloader for bulk bags for which a raised platform, load cells, and pivoting hopper are provided.

Fig. 2 shows an improved unloader with a hood extension over the hopper, agitator inside the hopper, and screw feeder options.

Fig. 3 shows an improved unloader that can be rolled on rails with, a scissor lift feature.

Fig. 4 shows an improved unloader with a powered wheels and a scissor lift feature.

Fig. 5 shows an improved unloader carried by a fork truck, and used with an inflatable bulk bag instead of having a tilt feature.

Fig. 6 shows an improved unloader that can be rolled on rails and having a tilt feature.

Fig. 7 shows an improved unloader with a tilt feature provided with a screw conveyor system.

Fig. 8 shows an improved unloader version adapted to unload three bulk bags at a time unto a screw conveyor.

Fig. 9 shows an improved unloader provided with an inflatable bulk bag and a platform of adjustable height.

Fig. 10 shows an improved unloader capable of being mounted directly on a floor.

Fig. 11 shows an improved unloader having a sifter attached to a bag spout.

Fig. 12 is an isometric view of a bulk bag with one side completely open instead of a spout.

Fig. 13 is a side view of the bulk bag of Fig. 12 showing the lacing assembly in greater detail.

Fig. 14 is a side view of the bulk bag of Fig. 12 with the side closed and the lacing assembly laced.

Fig. 15 is an isometric view of the bulk bag of Fig. 12 showing the opening closed and laced.

Fig. 16 is a front view showing an improved unloader having a double deck arrangement.

Fig. 17 is a side view of the version shown in Fig. 16.

Fig. 18 is a side view of a rigid portable bin system.

Fig. 19 is a front view of the rigid portable bin system shown in Fig. 18.

Fig. 20 is a side view of the rigid portable bin system of Fig. 18 showing a flexible side discharge bag stowed inside.

Fig. 21 shows the bag in bin system of Fig. 20 being connected to a process inlet, while still not discharging.

Fig. 22 shows the bin system of Fig. 21 in operation, discharging material.

Fig. 23 shows a version of the bin system of Fig. 18 wherein the rigid bin is corrugated material like cardboard, and may use a disposable or reusable liner.

DESCRIPTION

Turning to the drawings, all the components described are substantially rigid, and preferably made of steel, except for an inflatable membrane 5 and bag 34. The options shown in a particular drawing are not limited to being used with only with those other options shown in the drawing. The options in one drawing may be used with options of other drawings to adapt the invention to a variety of situations. Also, drawing items that are not in the description of the drawing are to be construed as the same or equivalent to like numbered items in previous drawings. The best modes known are disclosed herein.

Turning to Fig. 1, a bottom frame 2 is attached with a hinge 4 to a top frame 3. An inflatable membrane 5 is disposed between the bottom frame 2 and top frame 3. A clamp 31, or other fastening mechanism, is secured to the inflatable membrane 5 to prevent it from sliding out of position when in use.

Bag support posts 13 are attached to the top frame 3. Extensions 14 are slideably attached to the support posts 13 that can be adjusted up or down to match the size of a bulk bag being

discharged and setting on top frame 3. The extensions 14 are optional features, as are hand holds 15 that may help an operator climb onto the unloader.

A bag retention strap post 16 is secured onto the top frame 3 to secure a bulk bag when the top frame 3 is tilted. A front support bar 30 is movably secured to the front bag support posts 13 to hold the bulk bag in place when top frame 3 is tilted. The front support bar 30 can be adjusted upwards or downwards.

A hopper 7 is attached to the bottom frame 2 by a frame extension 6. The frame extension 6 may be fixed, hinged, or removable to facilitate storage of the unloader when not in use. The inlet of the hopper 7 is sized to receive the discharge spout of a bulk bag, which is held in place by a clamp ring 8. A flange ring that is attached on top of the valve may also be used to receive the discharge spout of the bag. If no valve is used, the spout may be attached to the frame extension 6. A fastener 9 on the bag clamp ring 8 permits an operator to open and close the clamp ring 8 to permit securing or removing the discharge spout of the bulk bag.

A flow control valve 10 is positioned at the outlet of the hopper 7 to meter the amount of material flowing out. The valve 10 may be an iris valve, slide gate valve, butterfly valve, or other valve known to those skilled in the art. The preferred embodiment uses the iris valve, because of its ability to easily control the amount of material flowing through. The iris valve is also very durable, and keeps the material very clean. A valve controller 11 may be a handle, or other manual or automatic means known to those skilled in the art. A clamp ring 12 at the bottom of the hopper 7 permits connection to another apparatus for handling bulk material at a bulk processing facility.

The bottom frame 2 is secured to a base frame 1. The base frame 1 has a top plate 21 and a bottom plate 19, which together are adapted to receive the forks of a fork truck therebetween. They may be plates or bars that are substantially rigid and can take the load of the unloader and bulk material. The top plate 21 supports the unloader when it is being transported.

During unloading, the center of gravity may shift and tend to cause the unloader to tip over. At that point, the bottom plate 19 contacts the forks of the fork truck and prevents the unloader from tipping over.

One version of the present invention provides one or more load cells 17a and 17b. The load cells 17a and 17b can be placed between base frame 1 and bottom frame 2 so that as an operator dispenses material, the load cells 17a and 17b provide information to a readout apparatus well known in the art to show the change in weight. Another version may have two additional load cells 17c and 17d, placed on a side opposite that shown in Fig. 1, but are not shown in this view. As an alternative, the unloader can be placed on floor scales to determine the weight.

Another version of the present invention is to provide a platform 18, having a top plate 20. The bottom plate 19 of the base frame 1 is removably secured, for example by bolting, to the top part of the platform 18. The platform 18 has a bottom plate 26 that forms the top part of an area adapted to receive the forks of a fork truck 27, like in the base frame 1. The platform 18 may be of any height.

Another version of the present invention provides a step 22, that is secured to the platform 18, which helps an operator climb onto the unloader.

Another version of the present invention provides an end plate 24 secured to a side opposite the hinged 4 side of the unloader. By using an unloader provided with an end plate 24, a fork truck operator approaching the unloader would clearly see that the forks can safely be placed only in areas 27 and 1, and thus prevent damage or unsafe handling of the unloader.

An outrigger portion 29 may be provided on the platform 18. When the top frame 3 is tilted during unloading, the center of gravity of the unloader may shift and cause the unloader to tip. The outrigger 29 prevents the unloader from tipping over.

Another version of the present invention provides wheels 28a and 28b. The wheels 28a and 28b permit an operator to roll the unloader in a safe manner to where it is needed. Preferably four wheels would be provided. Wheels 28c and 28d are not shown in this side view.

A blower 25 is provided to inflate the inflatable membrane 5, and is shown attached to the platform 18. If the platform 18 is not provided, the blower 25 may alternatively be secured to the bag support post 13 or frame extension 6. The blower 25 can be used to both inflate the inflatable membrane 5, and to inflate the bulk bag, if the bag is of the inflatable type.

The version shown in Fig. 2 is preferable when the material to be unloaded comprises cheese curds or fibers, or other non-dusty material. The spout 37 of the bag 34 used is large, compared to the size of spout used for other materials. To contain the material flowing out of the bag 34, a substantially rigid hood extension is provided, which is secured to the hopper 7. An inflatable bag 34 is used in this version, and a bag air inlet 39 must be provided to inflate its inflatable liner. Therefore, in this version, the top frame 3 need not tilt to discharge the contents of the bag 34, but can be provided. The top frame 3 can be made to incline backwards, tilt downwards, or upwards.

The bag 34 sits on a pallet 36, that has been placed on top frame 3. The frame 3 is attached to platform 18.

The bag is held upright by bag support posts 13. The posts nearest the viewer are 13a and 13b, but two other posts 13c and 13d would typically be provided for the side opposite the viewer.

An agitator 32 is provided to help break up material inside the hopper 7. A screw feeder 33 conveys material from the hopper 7 and out a conveyor discharge spout 38. The same motor that powers the agitator 32 can be the same motor that powers the screw feeder 33.

Fig. 3 shows what may be the typical arrangement for most process plants. Prior to the present invention, a pallet of boxes or 50 pound (23 kilogram) bags of material would be placed on a raised platform 43 near a stop 47. An operator would stand between a mixer 40 and the bagged or boxed materials placed on the platform 43. The operator had to lift the bagged or boxed materials, turn around, open the container, and dump the material in the mixer 40 through the mixer fill opening 41. This method is very labor-intensive. In addition, requiring a person to turn around while carrying a heavy load is a dangerous operation.

In the present invention, the operator merely has to roll the unloader from its position at the stop 47 towards the hopper and connect the spout 37 of the bag 34 to the mixer 40 at the mixer fill opening 41 and operate the unloader. As shown, a bulk bag 34 is provided with an inflatable liner which is filled at the bag air inlet 39 to discharge the material. Other discharge means, like tilting, may also be used.

The unloader in Fig. 3 is provided with rails 45 placed on the platform 43. The bag 34 is placed on a pallet 36, which has been placed on the unloader top frame 3. In this version the unloader is also provided with a lifting mechanism 46, which is shown as a scissor lift. The lifting mechanism could also use cables, hydraulic or pneumatic actuators, or equivalent means known to those skilled in the art. The lifting means are attached to a bottom frame 2, to which is attached two sets of wheels 28a and 28b, which are adapted to roll the unloader along the rails 45. The lifting means 46 permit the bag 34 to be loaded on the unloader at a low height, thus avoiding overhead obstructions 42 like piping, which are very common in process plants.

Other embodiments may include stairs 44 to help the operator reach the mixer fill opening 41 to secure the spout 37. Also, the rails 45 may be inclined toward the mixer 40 with respect to the platform 43, assuring that the unloader will not roll off of the platform. A version may also be provided with a brake or other wheel locking system to prevent the unloader from rolling during unloading.

The version in Fig. 4 is preferable when maximum portability is required. As shown, the bag 34 on the pallet 36 can be loaded onto the top frame 3 when very low to the ground, and then raised with a lifting means 46. A scissor lift is shown in Fig. 4, but other means known to those skilled in the art may also be used. The lifting means 46 is attached to the bottom frame 2, to which two sets of wheels 28a and 28b are attached. A drive motor 63 may be attached to the base frame 2 to power either set of wheels 28, or the lifting means 46. A platform outrigger 29 may be provided, which extends beyond the set of wheels closest to the hopper 7 to prevent the unloader from tipping.

In this version, the bag 34 is provided with a small spout 37, which is preferable for free-flowing materials. The hopper 7 is stationary, and does not pivot up and down like in other versions. The hopper 7 does not have to keep the spout 37 taut. The bag clamp ring 8 secures the spout 37 to the hopper 7. The hopper 7 is attached to the top frame 3 by a frame extension 6.

Another version may be provided in which the top frame 3 is attached to a motorized pallet truck or an electric pallet jack as the lifting means.

The version shown in Fig. 5 is provided with an unloader base frame 1 through which forks 49 of a fork truck 48, pallet truck, or stacker, may be inserted. The bag 34 is on a skid 36, and is held upright by bag support posts 13a and 13b. The bag support posts 13a and 13b have an "L" shape at the top, which are adapted to receive the straps of the bag 34.

The dumping means shown is a bag 34 with an inflatable liner. To dump, a blower 25 inflated the bag liner through the bag air inlet 39. The blower 25 is shown to be secured by the

base frame 1 by a blower frame 23. However, the blower 25 may be mounted anywhere on the unloader.

The bag spout 37 is secured to a bag connection flange 62 using a bag clamp ring 8. The flange 62 is a part of the flow control valve 10, which is secured to the base frame 1 by the frame extension 6. The frame extension 6 may be attached to the base frame 1 with a hinge 6a. The hinge 6a may be equipped with stops to position and lock the valve flow control 10 in an angled or full upright position. The hinge 6a allows the operator to move the valve flow control 10 close to the bag to connect the spout 37 if desired. A valve handle 11 controls the flow out of the flow control valve 10.

A valve clamp ring 12 may be provided to connect the unloader to a process inlet. As shown in Fig. 5, the unloader dumps into a drum 50, which is placed on a scale 51. Load cells may be used in place of scales. In use, an operator would move the valve handle 11 to open the flow control valve 10, and close the valve when the desired weight of material has been unloaded, and indicated by the scales.

The version shown in Fig. 6 is similar to the version shown in Fig. 3, except that it is preferable in situations where there are no overhead obstructions. The version in Fig. 6 is provided with rails 45 secured to a pre-existing platform 43. A platform 18 is provided with two sets of wheels 28a and 28b which permit the unloader to roll along the rails 45.

Instead of unloading by use of a bag 34 with an inflatable liner, this version is provided with a frame 3 that pivots upward on a hinge 4 when an hydraulic or pneumatic cylinder 52 pushes up off of the frame 18. Because this version tilts to unload, the bag 34 is held in place when tilted by a bag retention loop 53 on the unloader that secures a bag retention strap 16 secured to the bag 34. A front support bar 30, secured to the front bag support posts 13a, is also provided to prevent the bag from falling forward. Free flowing materials would employ a small spout 37, which is connected to a mixer 40 through a mixer fill opening 41.

The version shown in Fig. 7 is provided with an inclined conveyor 55 for unloading materials to a level higher than the unloader. A bag 34 is placed on a pallet 36, and is held upright by two sets of bag support posts 13a and 13b. The pallet 36 is placed on a top frame 3. The bag 34 is prevented from sliding while tilted by a bag retention loop 53, fastened to the bag 34, and secured to a bag retention strap 16, which is fastened to the top frame 3.

A platform 18 is provided, having an outrigger 29 to prevent the unloader from tipping while unloading. A blower 25 secured to platform 18 for inflating a membrane 5 is disposed between the top frame 3 and the platform 18. The blower 25 preferably supplies low pressure air at about 1 to 10 psi (.07 to .7 bars), through a hose 64 to the membrane 5.

When inflated the membrane 5 causes the top frame 3 to pivot on a hinge 4 secured to both the platform 18 and the top frame 3. A stop 54 mounted near the hinge side of the top platform 3 prevent the pallet 36 from sliding off during unloading. The stop 54 is preferably provided with any version having a tilting feature.

A bag spout 37 of the bag 34 is attached to a hopper 7 using a bag clamp ring 8. The hopper 7 is attached to the platform 18 by a frame extension 6. As material flows through the hopper 7 and the inclined conveyor 55, it passes through a rigid or flexible transition chute 57.

As a part of the incline conveyor 55, a clean up or wash out door 56 is provided to permit the inclined conveyor 55 to be washed out easily, and to provide access. Discharged material conveyed up the conveyor 55 by a screw, bucket, belt, or equivalent means, and is discharged through a conveyor discharge spout 38.

Fig. 8 shows a version of the unloader having three unloading stations, although any number of stations may be employed in this configuration. The three bags 34a, 34b, and 34c, are sitting on pallets 36a, 36b, and 36c. Although any number may be unloaded at one time, Fig. 8 shows as an example only two bags 34a and 34b being unloaded. Their spouts 37a and 37b are attached bag connection flanges 62a and 62b using bag clamp rings 8a and 8b. In this example, the third station connection flange 62c and clamp ring 8c are not being used.

The bags 34 are held upright by front and back sets of support posts 13. As shown, the support posts at each end 13a and 13d are "L" shaped so that they are adapted to be inserted into bag straps at the top of the bags 34. The two sets of support posts in the middle 13b and 13c are "T" shaped so that each post can support more than one bag.

The bag connection flanges 62 are mounted on a large hopper 7, which is emptied by a screw conveyor 33. Material is then discharged out a conveyor discharge spout 38. This version is preferable where bulk bags are loaded on an upper floor, and a mixer or other vessel on a lower floor need to be filled.

The version shown in Fig. 9 is a preferable embodiment for filling a surge bin or hopper 59 that extends downward part way through a floor 69. An unloader base 18 is equipped with adjustable sets of legs 65a and 65b. To provide a means for adjustment, holes are provided in the legs 65 which are adapted to match up with holes 61 provided in leg extensions 60 that will secure the platform 18 at a desired height when a pin is inserted through the set of matched holes.

As provided in this version, the discharge means is inflating the liner of an inflatable bulk bag 34 using the bag air inlet 39, which pushes the material out of a spout 37 into a hopper. The spout 37 is attached to a bag connection flange 62 using a bag clamp ring 8.

The bag 34 is held upright by its straps using two sets of "L" shaped support posts 13a and 13b secured to a top frame 3, which is secured to the platform 18. The bag 34 on its pallet 36 has been placed onto the top platform 3.

The version provided in Fig. 10 is an unloader mounted directly on the floor 69. A pallet 36 holding a bag 34 can be transported over a top side 66 of the top frame 3. A bottom frame 2 of the unloader is secured to the floor 69. The bottom frame 2 can be an ordinary plate of steel. An inflatable membrane 5 is disposed between the top frame 3, and bottom frame 2. The top frame 3 and bottom frame 2 are connected at an edge closest to a bin 59 by a hinge 4 so that the top frame 3 tilts at hinge 4 when the membrane 5 is inflated. Other tilting means, like hydraulic or pneumatic cylinders and linear actuators, may be used instead of an inflatable membrane 5. However, other

means must be mounted to the side of the unloader. Therefore, use of the membrane 5 is preferable in this version.

When tilted, material flows out of the bag 34 through the spout 37 to a bag connection flange 62. A clamp ring 8 secures the spout 37 to the connection flange 62. The connection flange 62 is secured to the floor 69. Material passes through the connection flange 62 and floor 69 through a transition chute 57 and into a bin 59, which can be any type of vessel.

As in other tilting versions, a bag retention strap 16 is attached to the top frame 3 of the unloader near a side opposite the hinge 4. The strap 16 secures a bag retention loop 53, which has been secured to the bag 34. The bag retention strap 16 and loop 53 prevent the bag 34 from sliding in the direction of the hinge 4 when the unloader is tilted.

In any version provided with tilting means, the bag support posts 13 shown in Fig. 10 are the preferred means of supporting the bag. During storage and handling, a flexible bag 34 holding material may become rounded, and extend over the preferred standard 40 inch (102 centimeter) width of the unloader and bag 34. If the extension posts 13 are secured to the middle of the top frame 3, a rounded bag 34 cannot easily be placed on the unloader. Experience has shown that bags 34 can expand out to 50 inches (127 centimeters) in width. Therefore, the preferred placement is to secure the support posts 13 at the end of the top frame 3 closest to the hinge 4 as shown in Fig. 10.

Also preferable in any version provided with tilting means is to provide "L" shaped support post extensions 14 slideably adjustable up and down in relation to support posts 13. Bag loop supports 67a and 67b are secured to the extensions 14, which are adapted to be inserted into bag loops at the top of the bag 34. To further facilitate loading bags 34 that have become rounded, the support posts 13 may be provided with a pivot hinge 68 to enable the posts to pivot away from the top frame 3. Using this method, the support posts 13 and extensions 14 can be pivoted away from the top frame 3 while a rounded bag 34 is being loaded. Then the posts 13 and extensions 14 can be pivoted back to their original position, and the bag loops secured with the bag loop supports 67a and 67b.

The version in Fig. 11 is the preferable embodiment for unloading flour or other similar materials, and is suitable for use in places like bakeries and supermarkets. A sifter 70 is mounted on an extension frame 6, which is attached at a front end of a platform 18. The sifter 70 preferably operates in a linear manner, having a sifting mechanism that spins on a shaft. An inlet of the sifter 70 may be on the side visible in Fig. 11, and an outlet may be on the opposite side, for example.

To measure out the desired amount of material, the sifter 70 is operated until a desired amount of flour is discharged through a flow control valve 10. One example shown in Fig. 11 discharges material from the valve 10, through a valve clamp ring 12 and into a receptacle 50. The receptacle 50 may be a drum, bin, bag, or other type of vessel. Under the receptacle 50 is a floor scale 51. Other weighing means, such as load cells, may be used. The flow control valve 10 may have manual or automatic shut-off controls for when a desired amount of material has been unloaded, as indicated by the floor scale 51 or other weighing means.

In the version shown in Fig. 11, a fork truck 48 lifts a bag 34, which has been placed on a pallet 36. The pallet 36 has been placed on a platform 18, which is adapted to be lifted by a fork truck 48. Bag support posts 13 are hingedly secured to the front of the platform 18 by a pivot hinge 68. Support posts 14 are slideably secured to the bag support posts 13. As in the other versions, bag loop supports 67a and 67b are secured to the support posts 14 for supporting the bag 34 from its top loops.

A blower 25 is mounted on the platform 18, but can be mounted on any surface. The blower 25 provides low pressure air to a bag air inlet 39, which inflates an inflatable liner within the bag 34.

As the bag liner inside of the bag 34 inflates, material is pushed toward a bag spout 37, which has been secured to a bag connection flange 62 by a bag clamp ring 8 for substantially dust free operation.

In use, when minor ingredients are needed for a process batch, a fork truck operator would approach the area where one or more unloaders are stored, possibly on racks. Bulk bags are already secured to the unloader, by being hooked by the bag retention strap post 16, and extensions 14, and the weight of the bag is supported by the top frame 3. Preferably, a flexible, side mounted discharge bag is provided. The bag is secured to the hopper 7 with the clamp ring 8.

Bottom discharge bags may also be used. A vibratory pipe or screw conveyor would be provided with the unloader to convey the discharged material to the hopper 7.

If a platform 18 is provided, the forks are placed in area 27. If a platform 18 is not provided, the forks are placed in area 1. The plate 24 prevents the operator from placing the forks in an area that cannot support the unloader. In each case, the unloader is approached from the side opposite the hopper 7.

The operator transports the unloader and bag while supporting the weight of the bag from underneath. This is an advantage over transporting a bottom discharge bag by securing the bag to the forks from the top of the bag. Approximately the same force is supported by the forks in both instances. However, in the present invention, the load is placed much lower. This greatly reduces the moment, or the tendency to tip over.

When the unloader has been transported to the input area of a bulk process, the operator first measures the weight using the load cells 17 and a readout device. The bulk process input is connected to the hopper 7 output by clamp ring 12. The blower 25 is activated, which inflates membrane 5. Inflation of the membrane 5 causes the top frame 3 to pivot forward on hinge 4. Material in the bulk bag flows into the hopper 7. The operator controls the valve 10 with the controller 11 to control the flow of material flowing out.

If during unloading, the center of gravity of the unloader shifts, it will tend to tip forward. The unloader will not tip over, because the bottom plate 19 holds the unloader securely on the forks.

When the desired amount of material has been dispensed, as determined by weight using the load cells 17, the valve controller 11 is operated, closing the valve 10. The membrane 5 is deflated, and the top frame 3 returns to its original position. The clamp ring 12 is disconnected from the bulk process input. The unloader is then returned to storage.

No operator has to handle unwieldy bags or drums. The discharge spout remains clean, and is easily inspected because it is on the side of the unloader. Because flexible bags are preferably used, no air enters the bag during discharge, so unloading does not induce deterioration of the material. No operator had to reach underneath the load in an unsafe manner. No lifting and turning by an operator is required. Minor ingredients for batch processes may be stored and dispensed safely, cleanly, and economically.

New Bag Design

In Figs. 12 through 15, an improved version of the bag 34 is provided that is preferable in applications where dust and contamination of the material are not problems, such as with certain applications using cheese. Essentially, four side panels 72 of the bag 34 open up to form a large spout 71 about the same size as the opposite side of the bag.

Fig. 12 shows the side panels 72 of the bag 34 extended in its discharge configuration in an isometric view, and not folded and laced to the side of the bag 34.

Fig. 13 shows from the side where a lacing assembly 73 is secured to a side panel 72. The lacing assembly 73 is preferably made of a heavy woven fabric, folded along its longest length. The unfolded side is secured, preferably by sewing, to the side panel 72 in a chevron formation. Squares are cut out of the folded side of the lacing assembly 73, thus forming loops through which a lacing can be passed. Fig. 13 is a side view of Fig. 12.

Fig. 14 is a side view of the bag 34 with the side panels 72 laced and tied. A bag closure tie 75 gathers material to make an enclosure of bag 34, making it suitable to hold bulk material.

Fig. 15 is an isometric view of the enclosure made in Fig. 14. In detail, a lacing 74 has been pulled through each lacing assembly on panels 72a, 72b, 72c, and 72d, and has been pulled tight to keep the bag 34 square. The lacing assemblies 73 of Figs. 12 and 13 on each panel 72 interlock to form a substantially flat side. The laces 74 are fastened at the center by a lacing fastener 76. This improved bag is suitably adapted for use with the large hopper described in Fig. 2.

Fig. 16 is a front view showing a pallet rack frame system 77 that has a double deck arrangement having a lower horizontal frame base 82 and an upper horizontal frame base 81. For most applications, the frame system 77 may be only one bag high. The version shown is two decks high, however, versions may be provided having more than two decks.

The bag 34 on the pallet 36 may be placed on the frame system 77 on the horizontal frame base 82. Once in place, top bag support straps 83a and 83b are attached to the bag loop supports 67a and 67b.

Once the bag's top support straps 83a and 83b are secured in place, the spout 37 of the bag 34 is removed from its stowage pouch, and the bag's opening 84 is connected to the bag connection flange 62. The bag connection flange 62 is located on the frame extension 6, which is attached to the horizontal frame base 82. Attached to the frame extension 6 is a flow control valve 10. With the flow control valve closed, the pleated area of the bag may be opened, allowing the spout 37 of the bag 34 to fill with material. The flow control valve 10 can be opened and closed according to how much material is to be discharged.

Once material reaches its angle of repose inside the bag 34 and stops flowing out by gravity, inflatable liner 85 (not shown) is expanded to push material to the spout 37 of the bag 34 to continue discharge of material through the flow control valve 10. If the double decker or multiple decks are used, an extension tube 80 may be used to convey material from the bag 34a to a lower ground level location.

Fig. 17 is a side view of the frame system 77. Because the back side 88 of the frame system 77 may be positioned close to or against a wall, making loading access impossible, the frame extension 6 may pivot up or down on joint 78. With the frame extension 6 folded down or up and next to the front side 89 of the frame system 77, a fork truck can easily place a bag 34 on the pallet 36 in the proper position. Once in position, frame extension 6 can be repositioned to its horizontal and operating position and locked into place.

The bag 34b shows the inflatable liner 85 in an expanded position, discharging material out of the bag 34b after material has stopped flowing by gravity.

A blower 86, which may be provided with a cabinet and controller, supplies lower pressure air to an air inlet tube 39 on the bag 34a through a hose 64. Load cells may be provided to weigh the contents of each bag. A dump platform may also be used on the frame system instead of the inflatable version of the bag.

Fig. 18 shows a version of the invention with rigid walls 90 that can be described as a rigid portable bin system unloader. The bin system has four sides, and is adapted to receive a flexible side mounted discharge bag. The bin comprises four rigid bin walls 90 and a base, under which bin legs 95a and 95b are secured. The top 97 may be open. Alternatively, a substantially rigid cover 99 may be provided, to which a fill spout flange 98 is secured.

One side of the bin has a double door assembly, both of which swing outward from the bottom of the bin. The interior door 92 and exterior door 93 pivot on hinge 93, and with the bottom of the bin form a space 104. A door lock assembly 100 is provided to hold one or both doors in an "up" position. A bag air inlet 39 is provided on a side opposite the doors 91 and 92 for inflating an inflatable liner 85, which is secured at its side attachment location 94. Before a bag is discharged, the inflatable liner is stored in its stored position 85a. When inflated for discharge, the liner expands to its expanded position 85b.

Fig. 19 is a front view of the rigid portable bin system of Fig. 18. The exterior discharge door is connected to the door hinge assembly 93. The door lock assembly 100 is adapted to secure the doors in an "up" position. The preferred embodiment of the door lock assembly 100 is

a short bar capable of pivoting on a stem, such that when the bar swings down by gravity, its position allows it to secure a door in position. The side attachment location 94b of the inflatable liner is near the top of 97 of the bin system, to enable the liner to push material out of the bag.

Fig. 20 is a side view of the portable bin system of Fig. 18 having bulk material inside a reusable or disposable liner 101 or bag. The liner 85 is not yet inflated. A liner discharge spout 102 has been placed between the interior door 92 and the exterior door 91.

Fig. 21 shows the portable bin system of Fig. 20 where the exterior door 91 has been opened and secured using the door lock assembly 100. The liner discharge spout 102 of the liner 101 has been removed from its stored position, and secured to a bag connection flange 62.

Fig. 22 shows the portable bin system of Fig. 21 where the interior door 92 has also been opened and secured using the door lock assembly 100. Material can flow out of the side discharge by gravity until the material has reached an angle of repose. At that point, air may be supplied through inlet 39 to inflate the inflatable liner 85, which pushes the remaining material out of the liner 101 through its spout 102.

A perforated vacuum tube 96 may be provided to deflate the inflatable liner 85 after a discharge operation. Likewise, vacuum tubes 103a and 103b may be provided to conform the sides of the liner 101 to the sides of the bin system and the inflatable liner 85 before and after discharge operations.

Fig. 23 is a side view of a version of the rigid bin system of Fig. 18 in which the rigid bin is a Gaylord container 105, which may be made of a corrugated material like cardboard. A reusable or disposable liner 101 is placed inside the container 105, and the liner discharge spout 102 is placed in front of a substantially rigid insert 106. The container 105 is shown placed on a pallet 36. The insert 106 may also be made of cardboard. The liner 101 is set inside the Gaylord container 105 such that the spout 102 and insert 106 face an opening 107 at the bottom of one side of the container 105. The opening 107 may be an opening provided in the container 105, or may be provided as a marked or perforated area on the container that may be cut or perforated when the material is to be discharged.

CLAIMS

What is claimed is:

1. A portable unloader for bulk material bags characterized in that at least one support post adapted to secure a bulk material bag is fastened to a base frame.

2. The unloader of claim 1 wherein the base frame is further characterized by top and bottom support guides adapted to receive the forks of a lifting mechanism to prevent the unloader from tipping over when unloading.

3. The unloader of claim 1 further characterized by a hopper having an inlet adapted to receive a discharge spout of a bulk bag, and having an outlet, said hopper secured to one edge of the frame by a frame extension.

4. The unloader of claim 3 wherein the frame extension is hingedly secured with a hinge to the platform.

5. The unloader of claim 3 further characterized by a flow control valve positioned at the outlet of the hopper to meter the amount of material flowing out of the bulk material bag when unloading.

6. The unloader of claim 5 wherein the hinge comprises a plurality of stops suitably adapted to hold the valve a plurality of positions.

7. The unloader of claim 1 characterized in that the bulk material bag comprises an inflatable liner having an inlet, and the unloader is provided with a blower pneumatically connected to the liner inlet for inflating the liner and propelling bulk material out of the bag and effecting its unloading.

8. The unloader of claim 1 characterized in that the support posts are fastened to a top frame, said top frame hingedly secured at one edge by a hinge to the base frame.

9. The unloader of claim 8 further characterized by an inflatable membrane, said membrane having an inlet, disposed between the top frame and base frame, and a blower secured to the base frame and pneumatically connected to the inlet, so that the top frame tilts relative to base frame when the membrane is inflated, thereby propelling material bulk material out of the bag and effecting its unloading.

10. The unloader of claim 8 further characterized by at least one load cell disposed between the top frame and the base frame for determining the weight of the material as it is unloaded from the bag.

11. The unloader of claim 1 further characterized by at least one frame extension slideably attached to each support post for adjusting the support to match the size of the bag.

12. The unloader of claim 8 further characterized by a platform suitably adapted to support and elevate the base frame.

13. The unloader of claims 1, 8, or 12, further characterized by a plurality of wheels secured to the unloader adapted to permit an operator to roll the unloader to a desired location in a safe manner.

14. The unloader of claim 1 further characterized by a lifting mechanism attached to the frame for elevating the frame to a desired position.

15. The unloader of claim 14 wherein the lifting mechanism is a scissor lift.

16. The unloader of claim 12 further characterized by sets of legs adjustably secured to the platform.

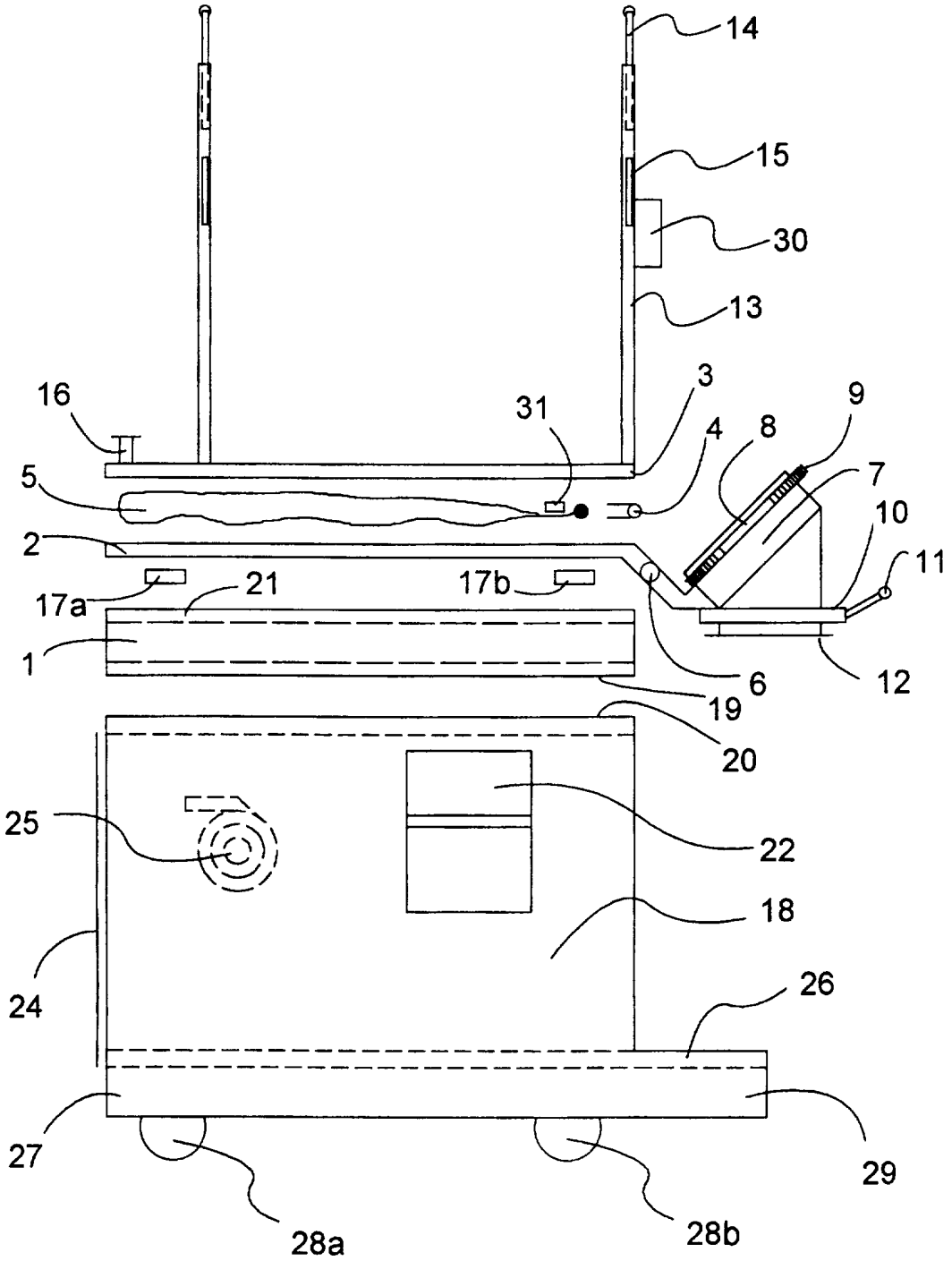
17. The unloader of claim 4 wherein the unloader is not portable.

18. An unloading system for bulk material bags characterized by a pallet rack frame system comprising a plurality of unloaders defined by at least one support post adapted to secure a bulk material bag fastened to a base frame.

19. A bulk material bag characterized by a container formed by four adjacent side panels having an outside, a closed end, an open end opposite the closed end, and a plurality of lacing assemblies secured in a chevron formation on the outside of two opposite side panels near the open end, said lacing assembly comprising an elongated material folded and secured at an edge opposite a folded edge, and squares cut out of the folded edge and suitably adapted on one side panel to interlock with the lacing assembly on the other side panel, and suitably adapted to gathered by lacing when folded, thereby forming a bag.

20. A bulk bag and container system characterized by a flexible bulk material bag having a side-mounted discharge spout, and a substantially rigid container comprising substantially rigid sides and a bottom, suitably adapted to receive the bag, said container further comprising an inside door and an outside door hingedly secured in series on one side of the container, such that the discharge spout of the bag is folded between the doors before it is loaded with a bulk material, and that when unloading, the outside door is opened, the spout is connected to a process inlet, and no material is discharged until the inside door is also opened.

21. A bulk bag and container system characterized by a flexible bulk material bag having a side-mounted discharge spout, and a corrugated container comprising substantially rigid sides and a bottom, suitably adapted to receive the bag, said container also provided with a corrugated insert disposed between the spout and the bag before loading, such that after loading the side of the container nearest the insert can be cut and the spout attached to a process inlet without material being discharged until the insert is removed from the container.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2
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17a
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17b
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28a
28b

Fig. 1

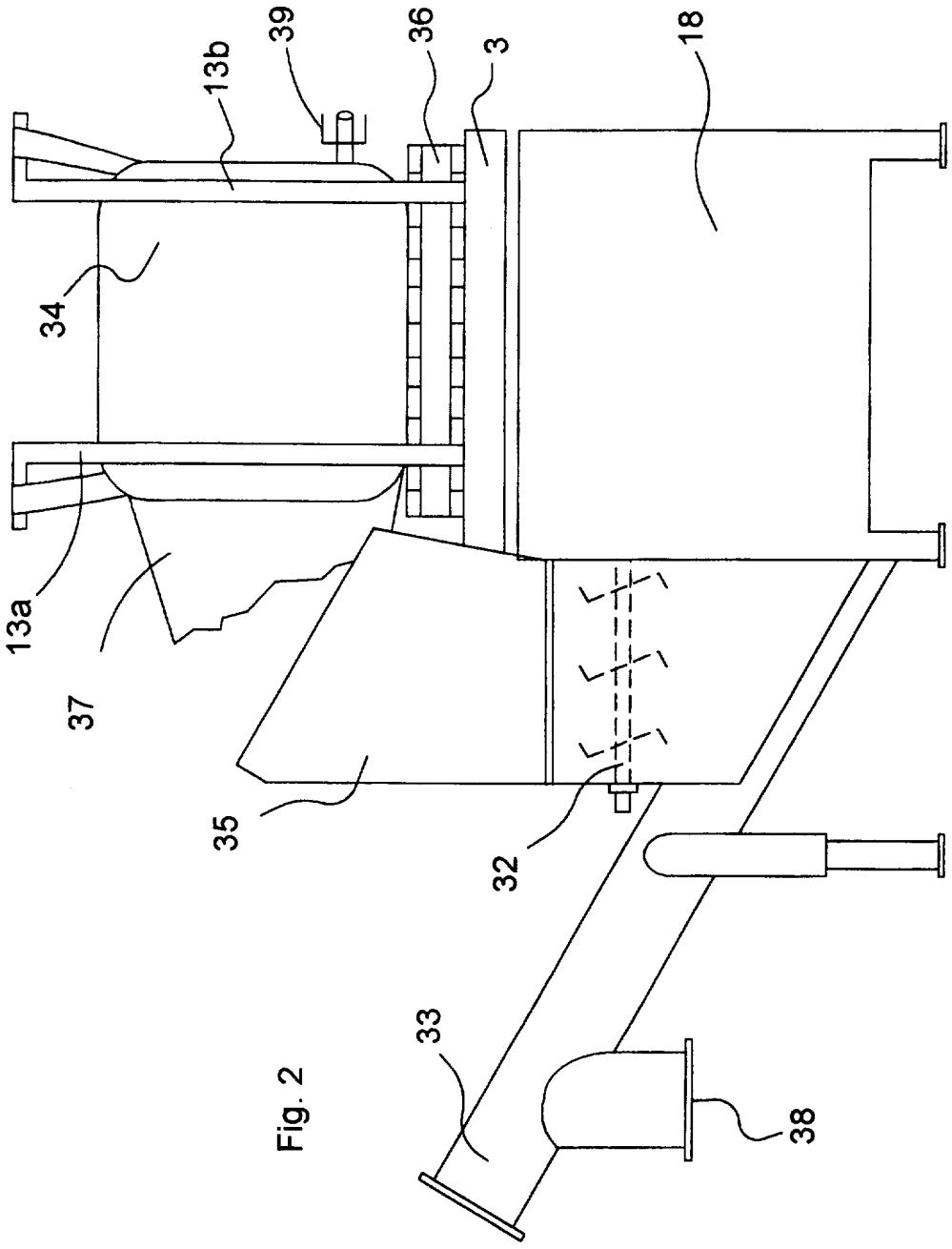


Fig. 2

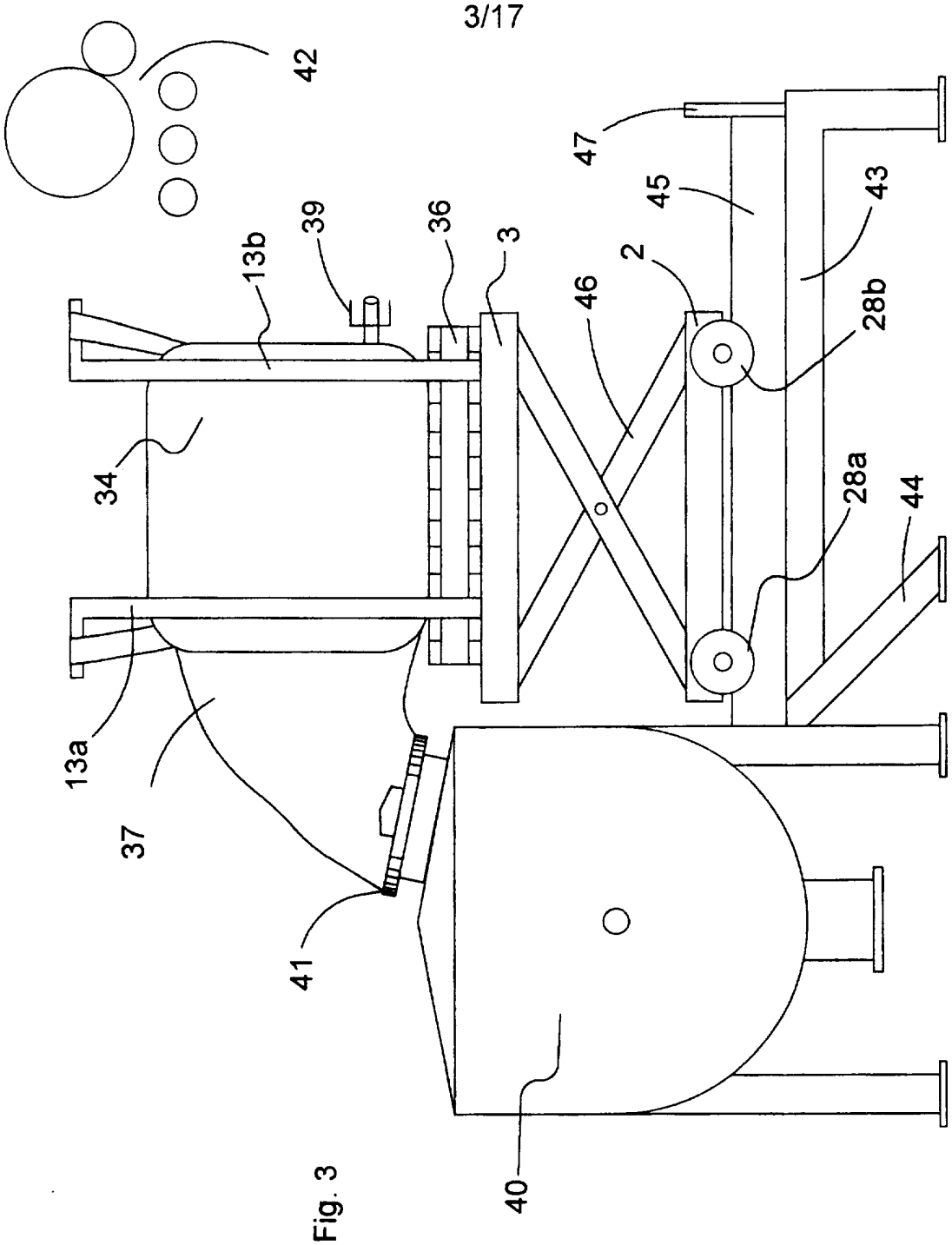


Fig. 3

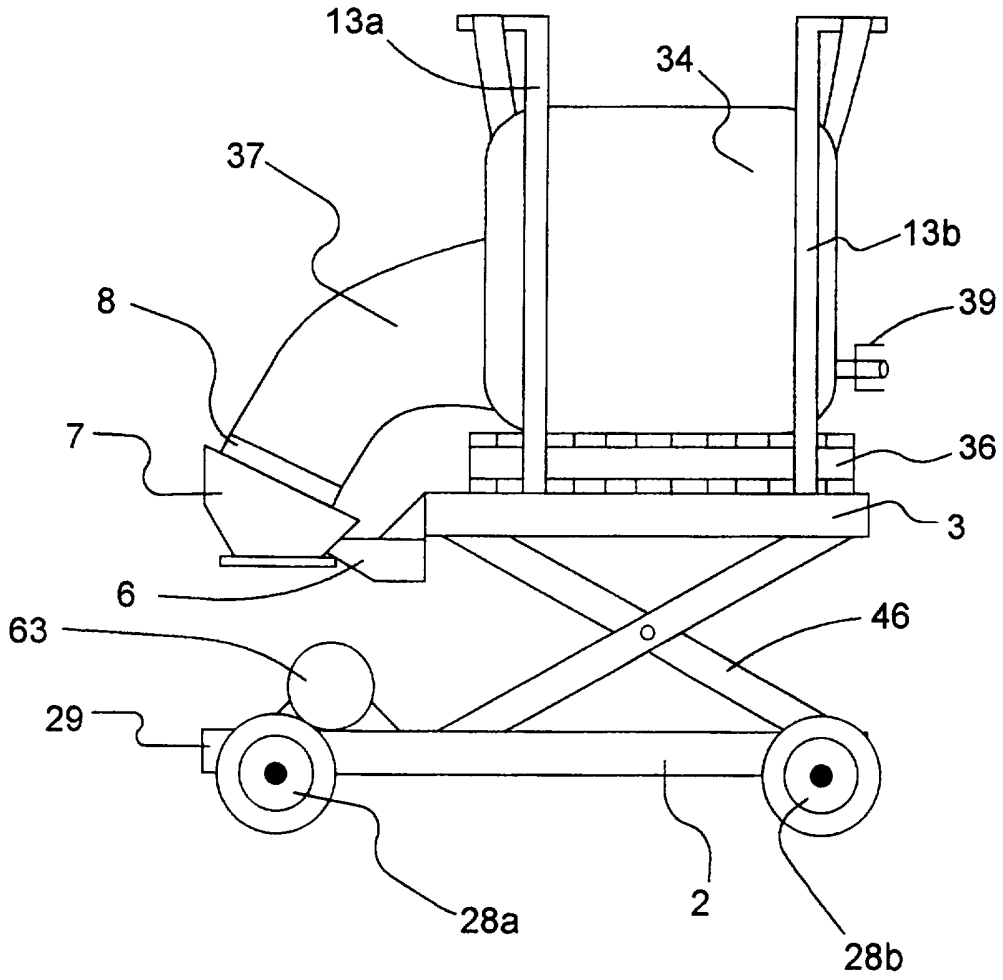


Fig. 4

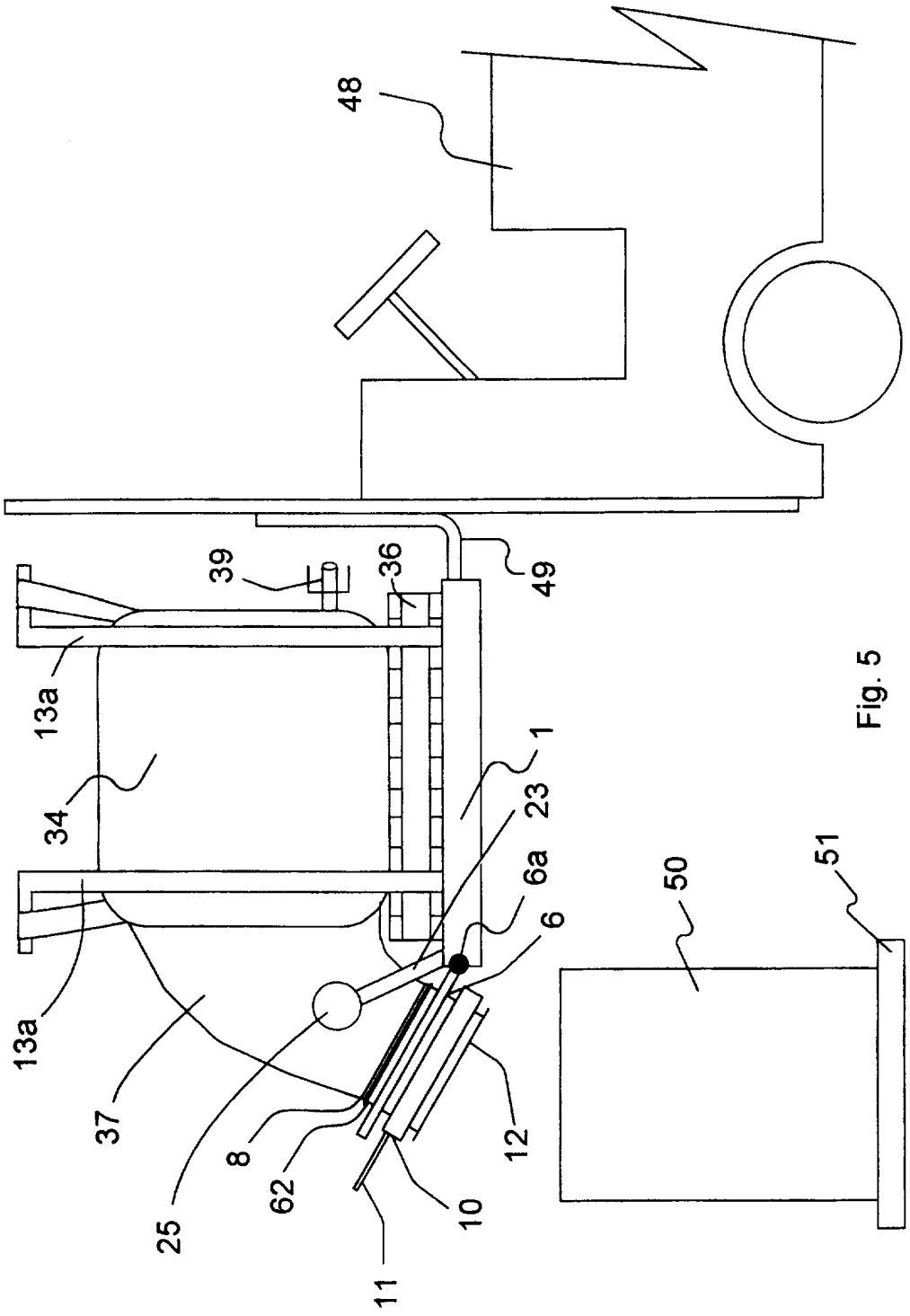


Fig. 5

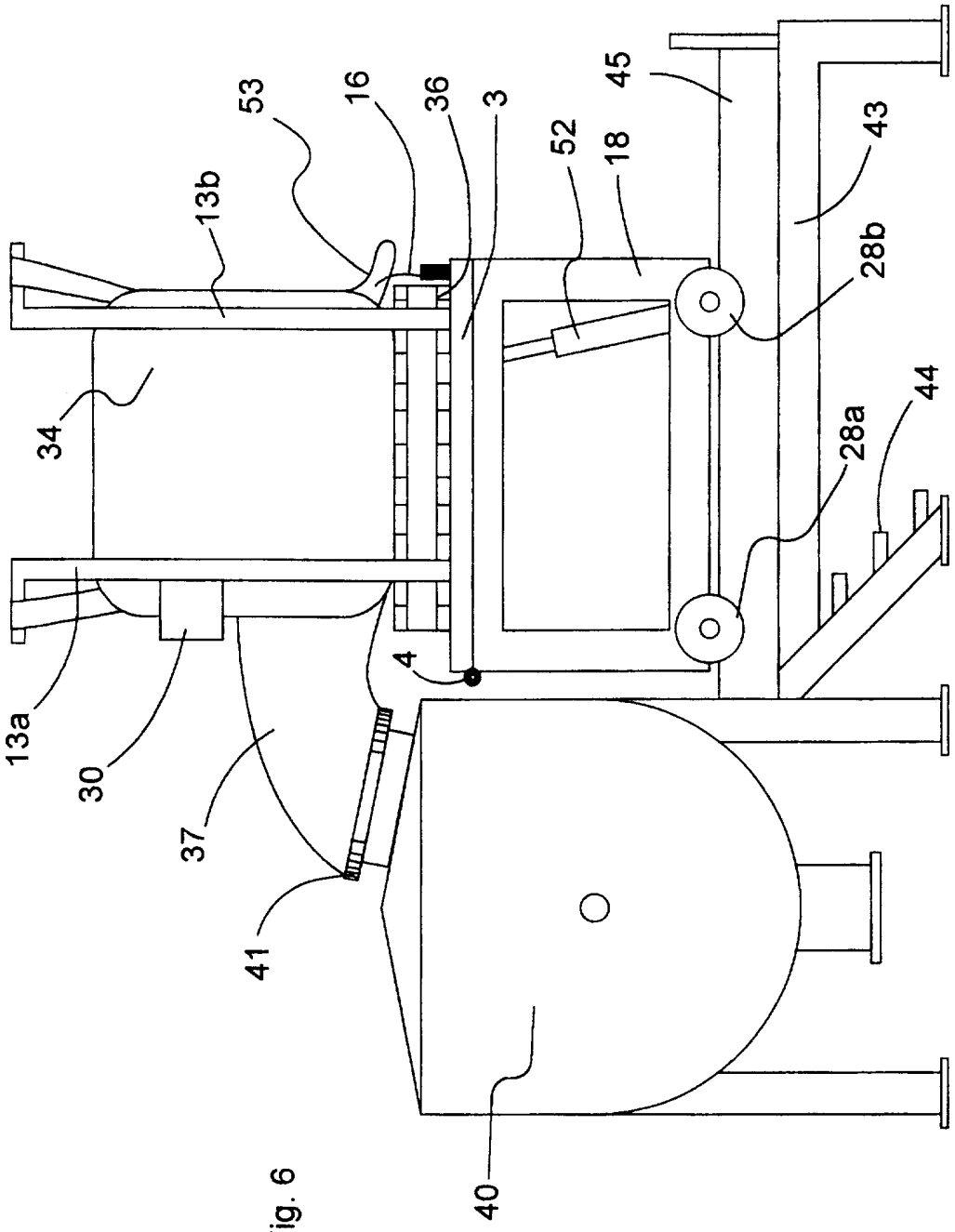


Fig. 6

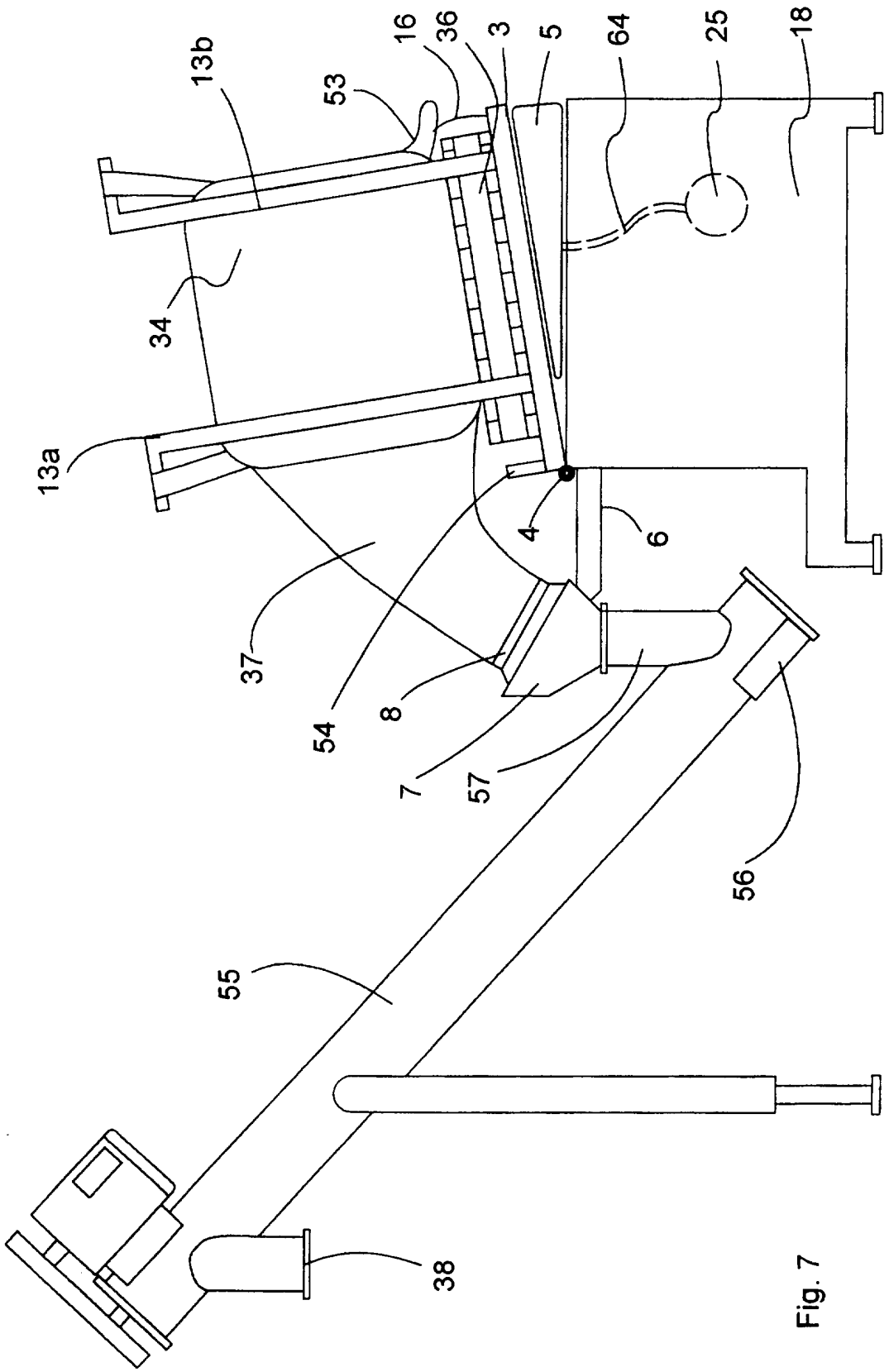
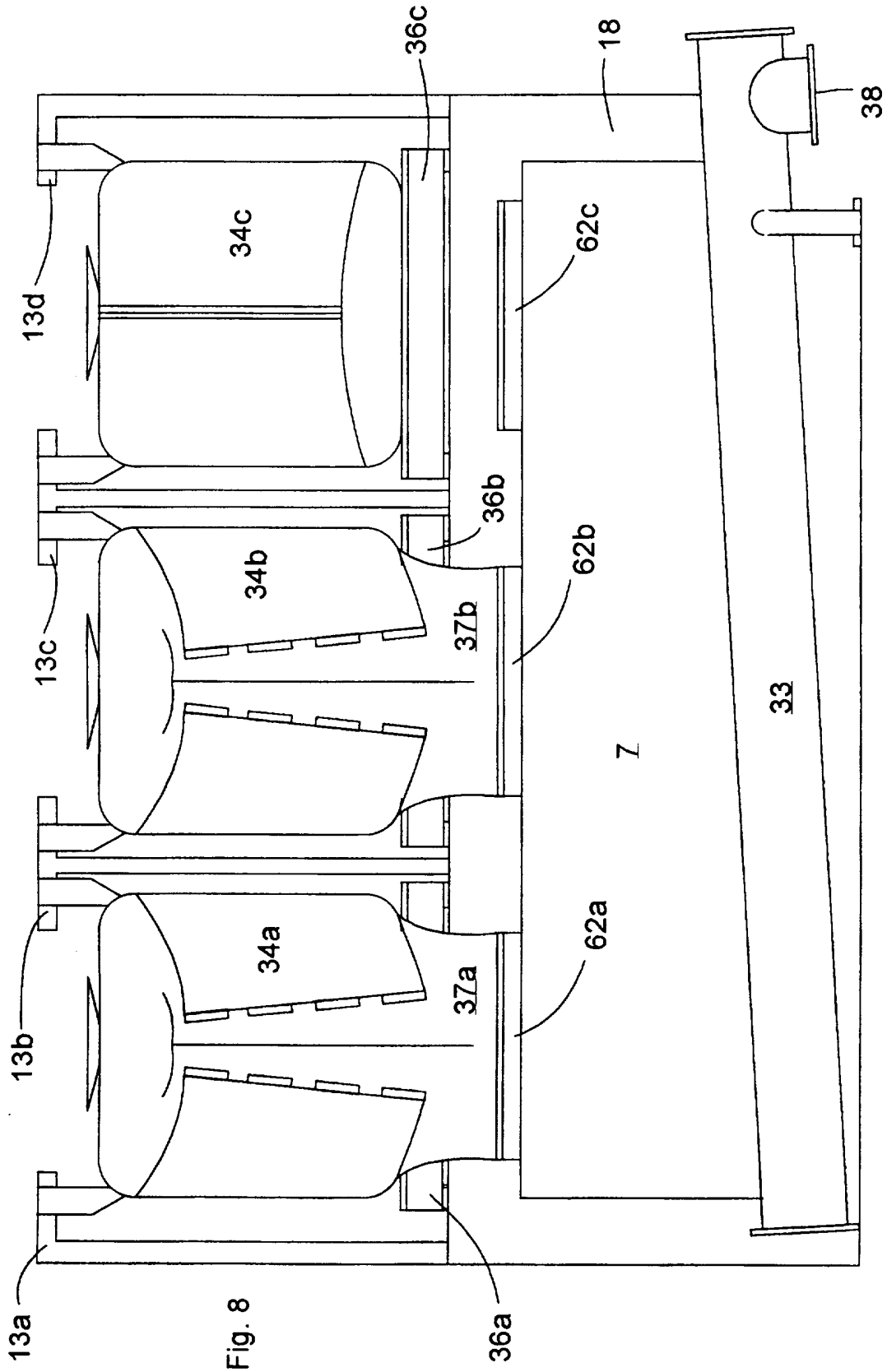


Fig. 7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18
38
34c
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13d
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Fig. 8

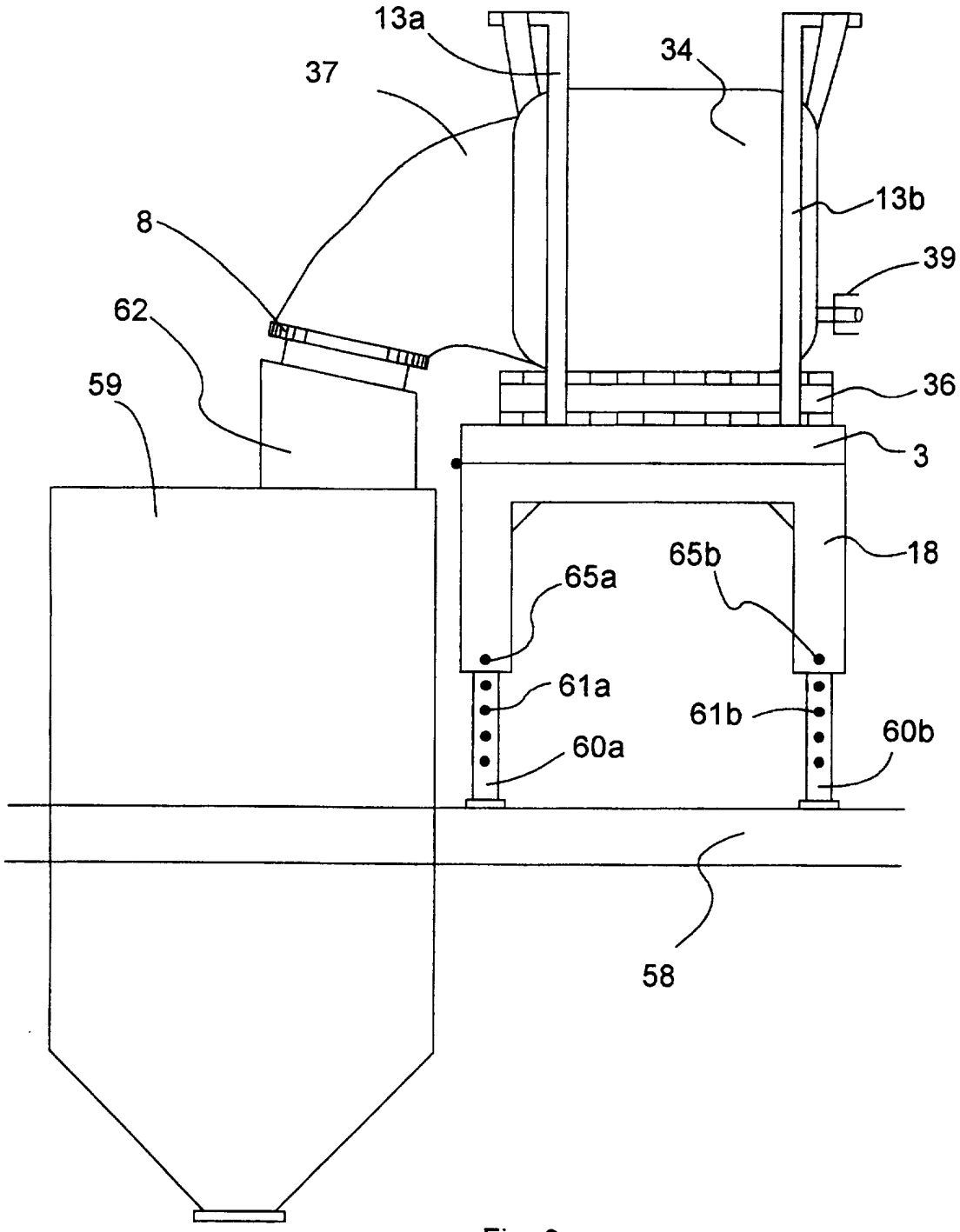


Fig. 9

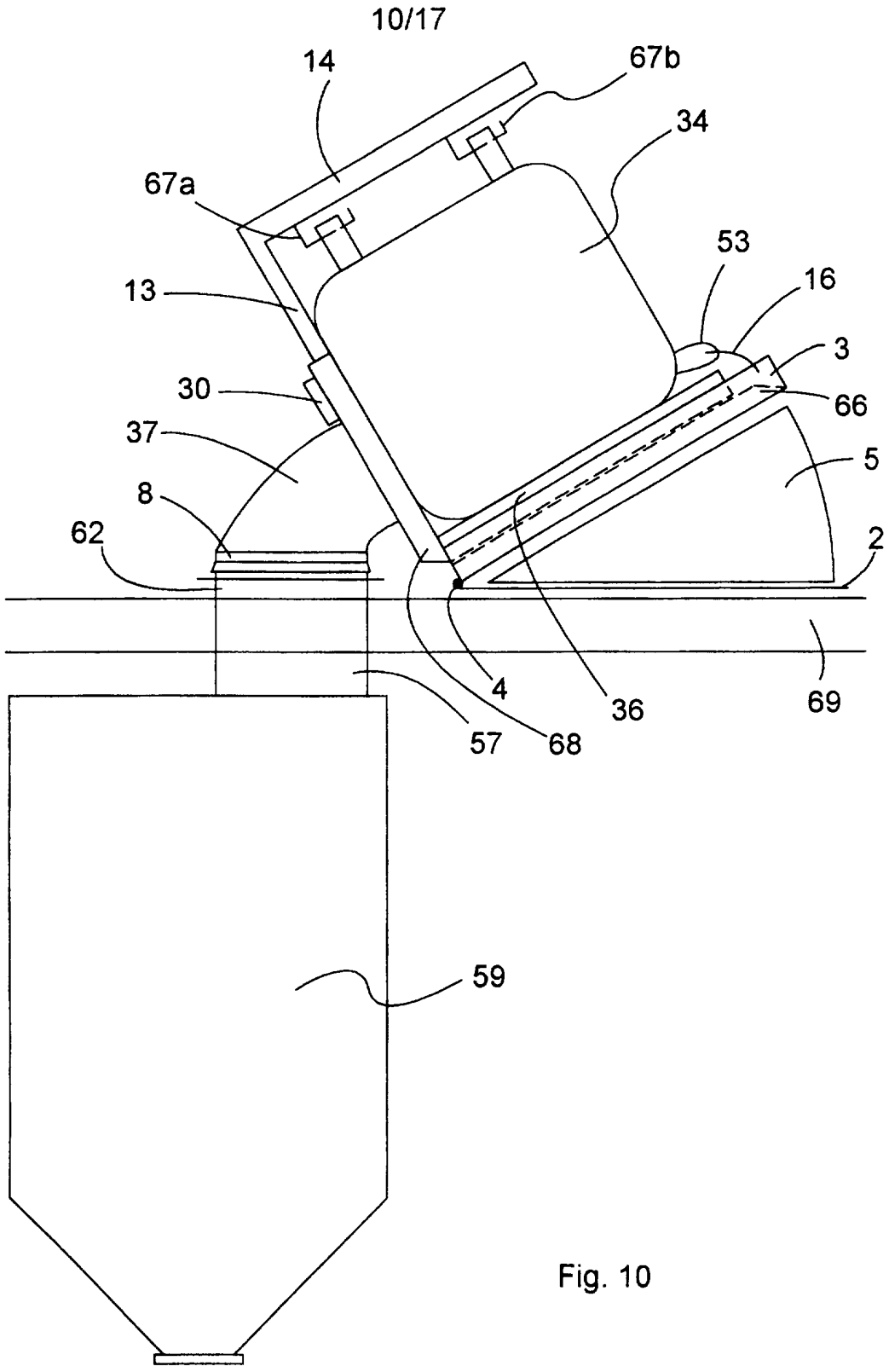


Fig. 10

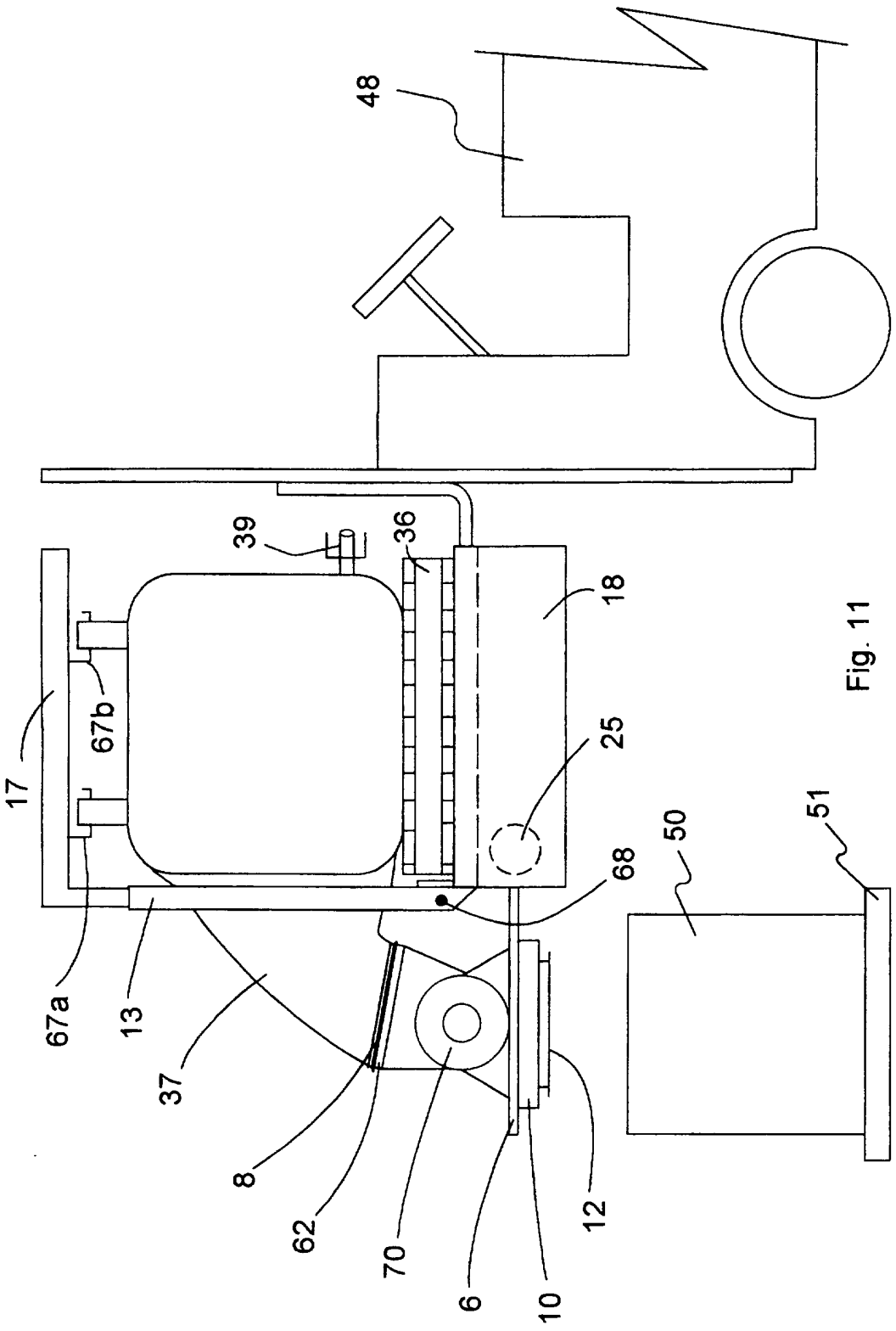


Fig. 11

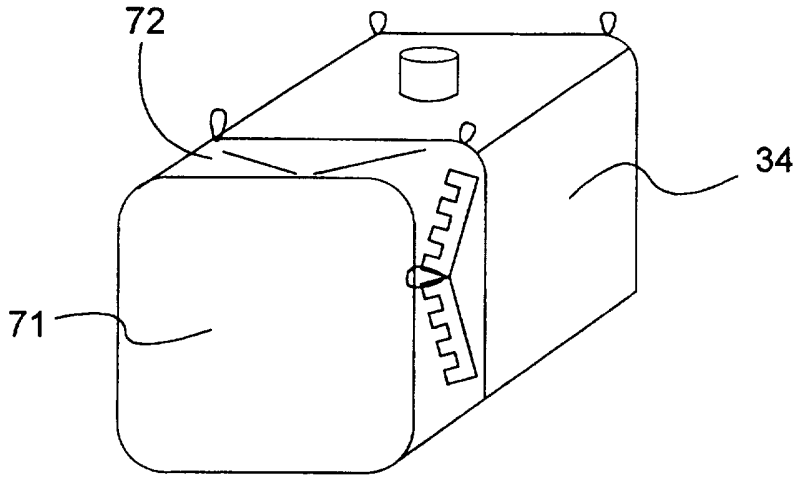


Fig. 12

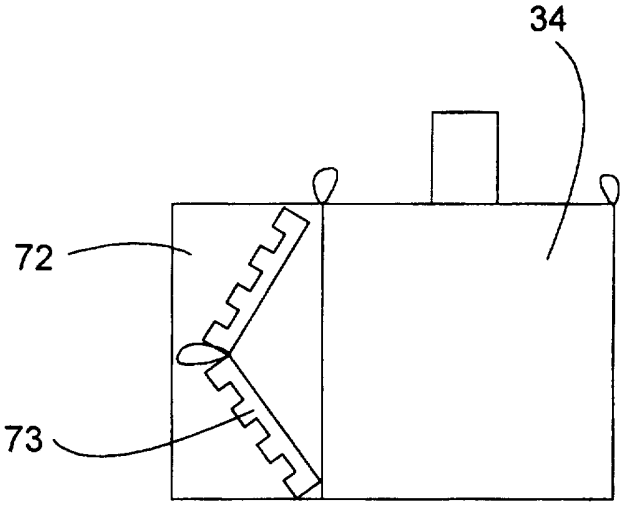


Fig. 13

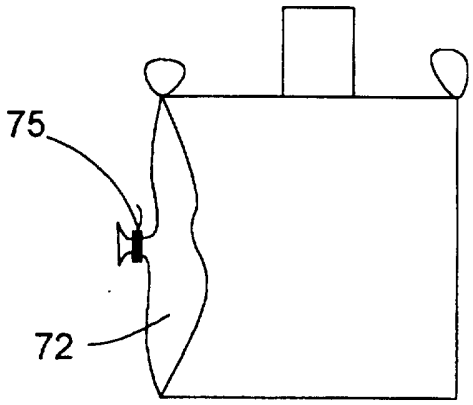


Fig. 14

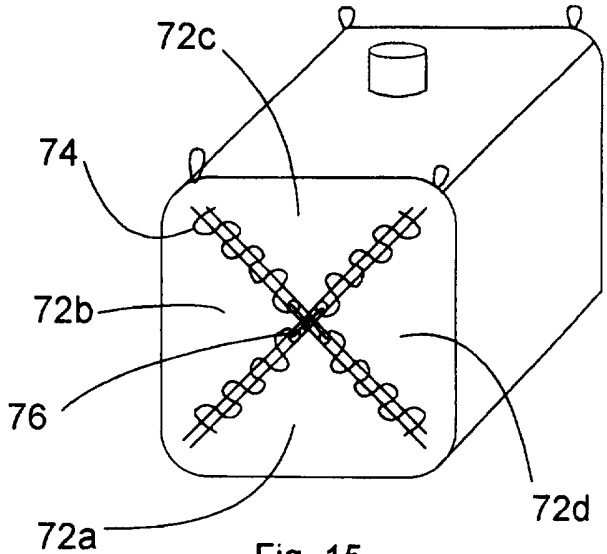
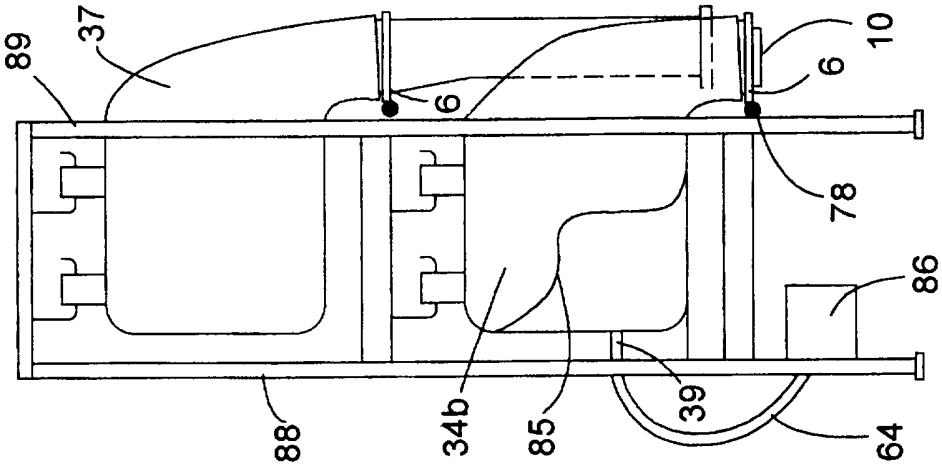


Fig. 15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34b
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Fig. 17

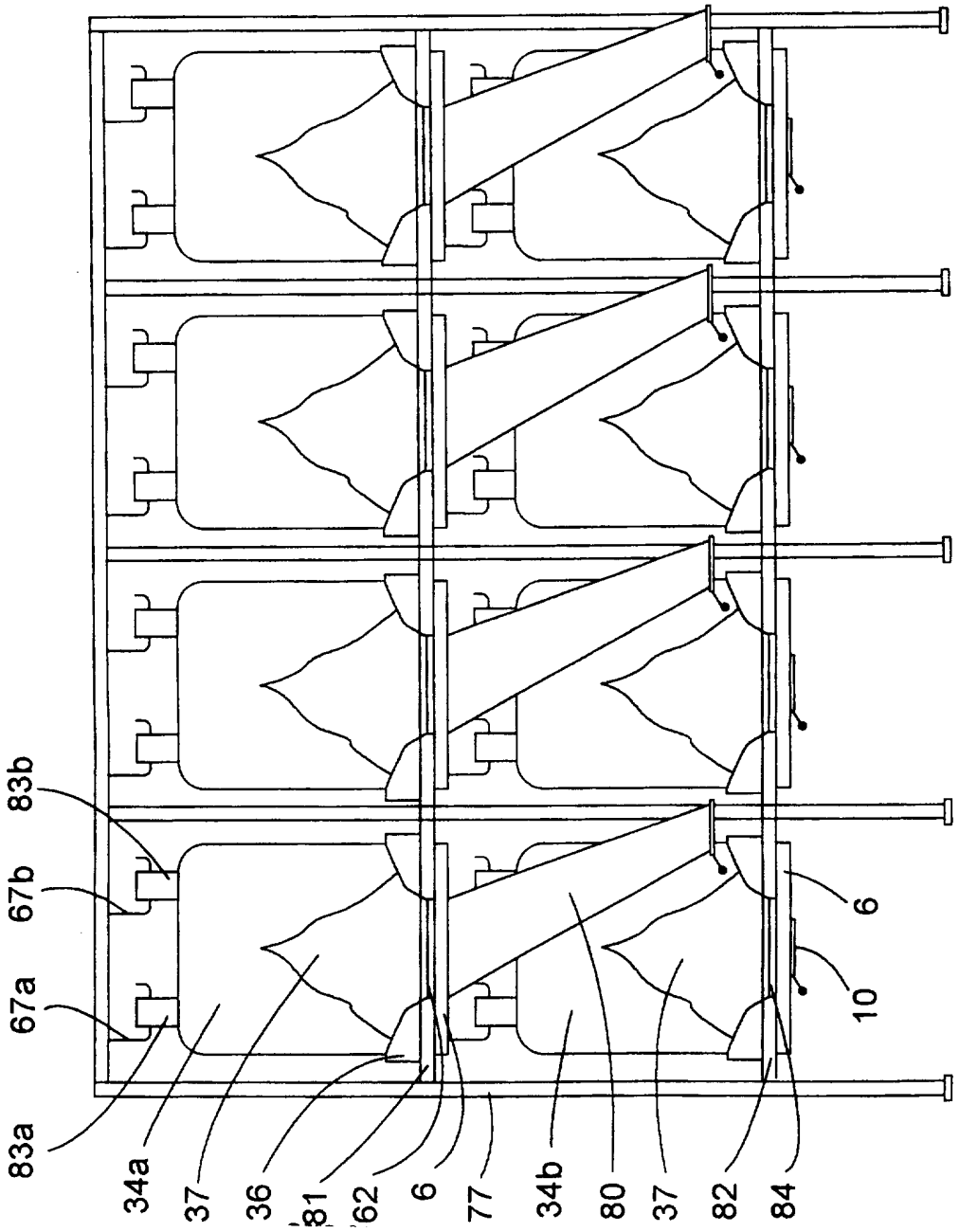
83b
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Fig. 16

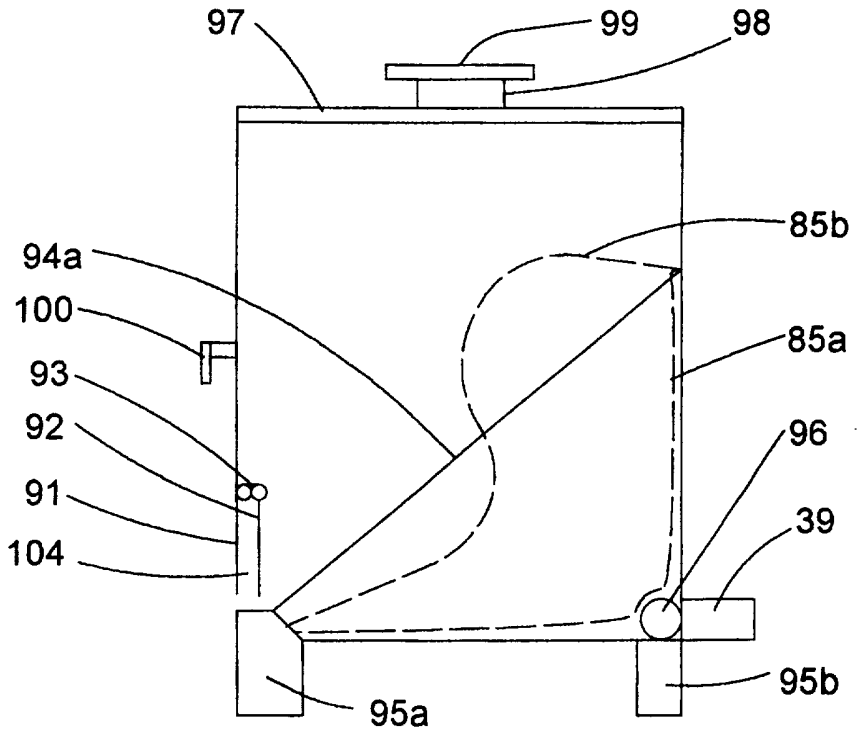

Fig. 18

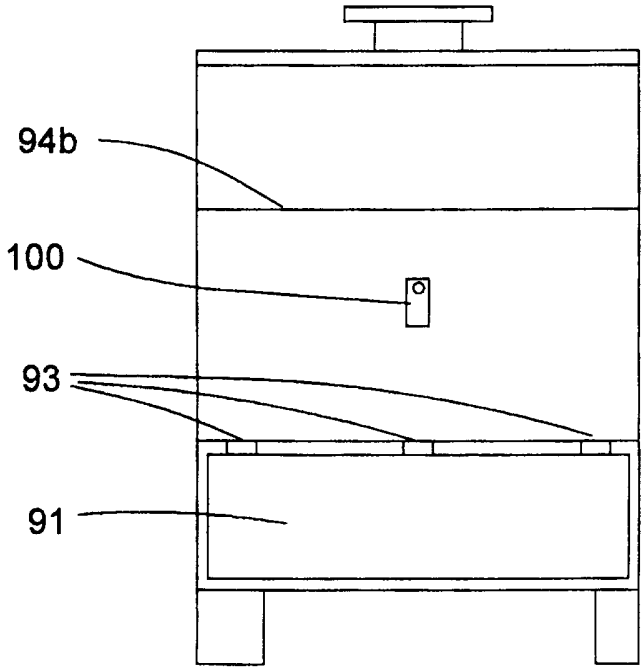

Fig. 19

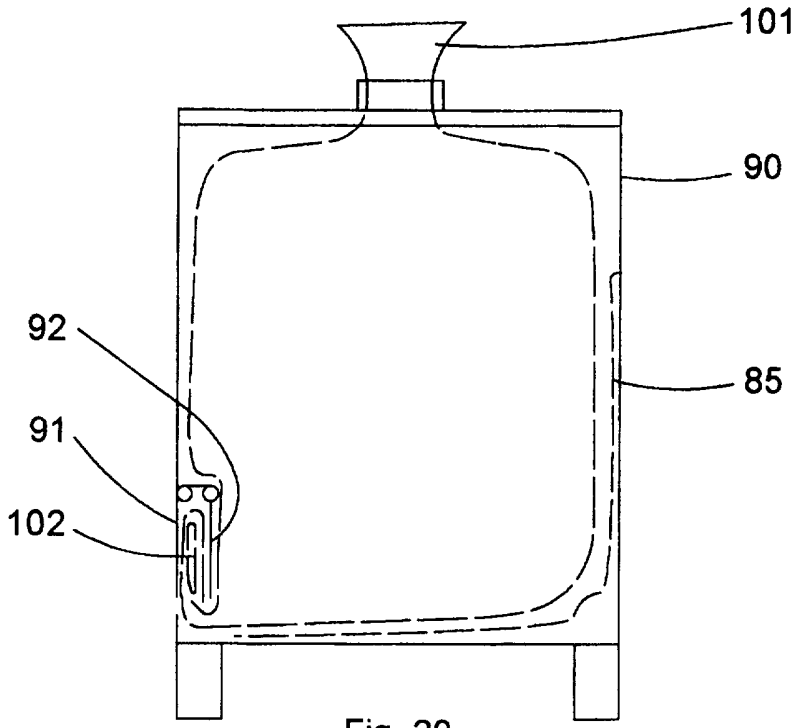

Fig. 20

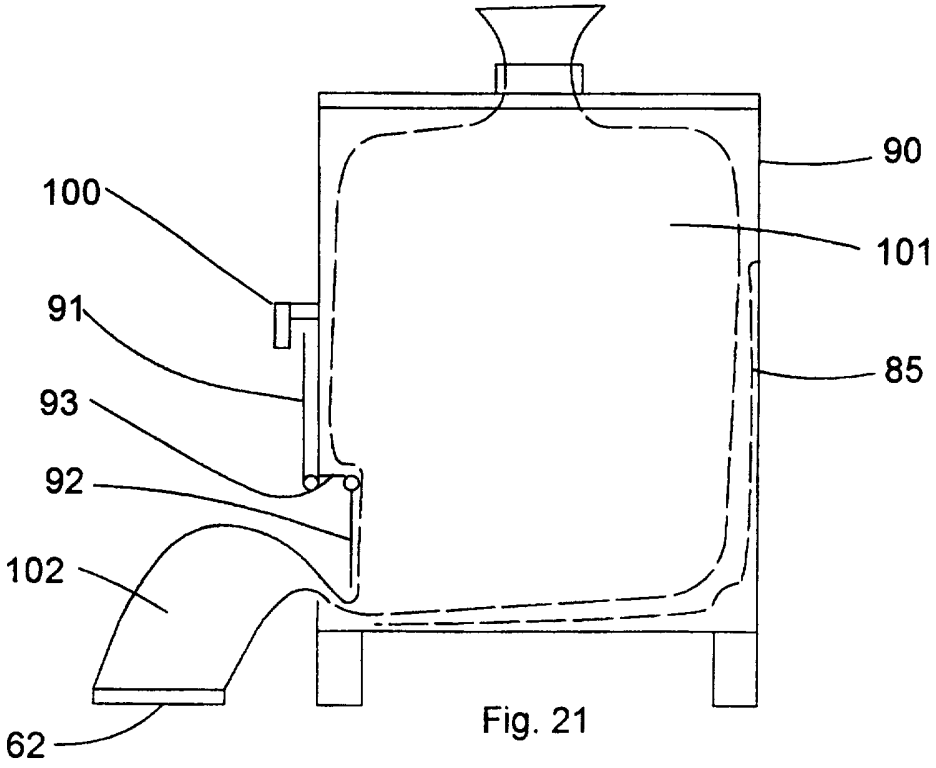

Fig. 21

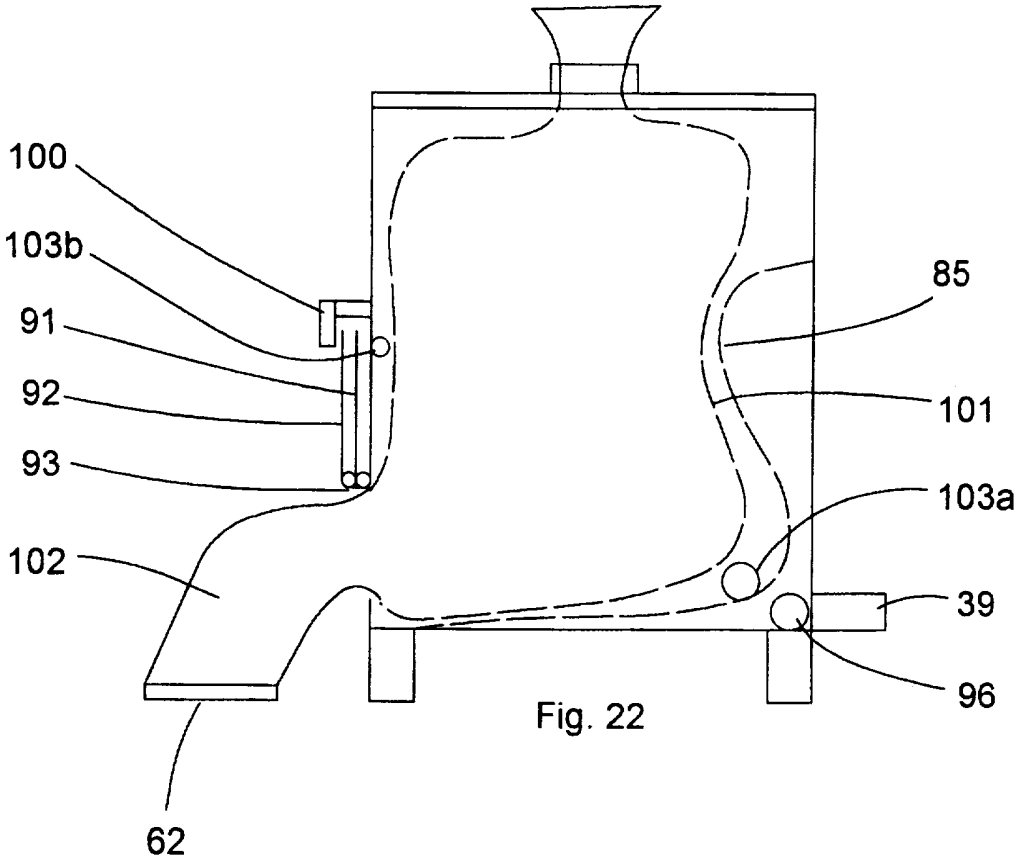

Fig. 22

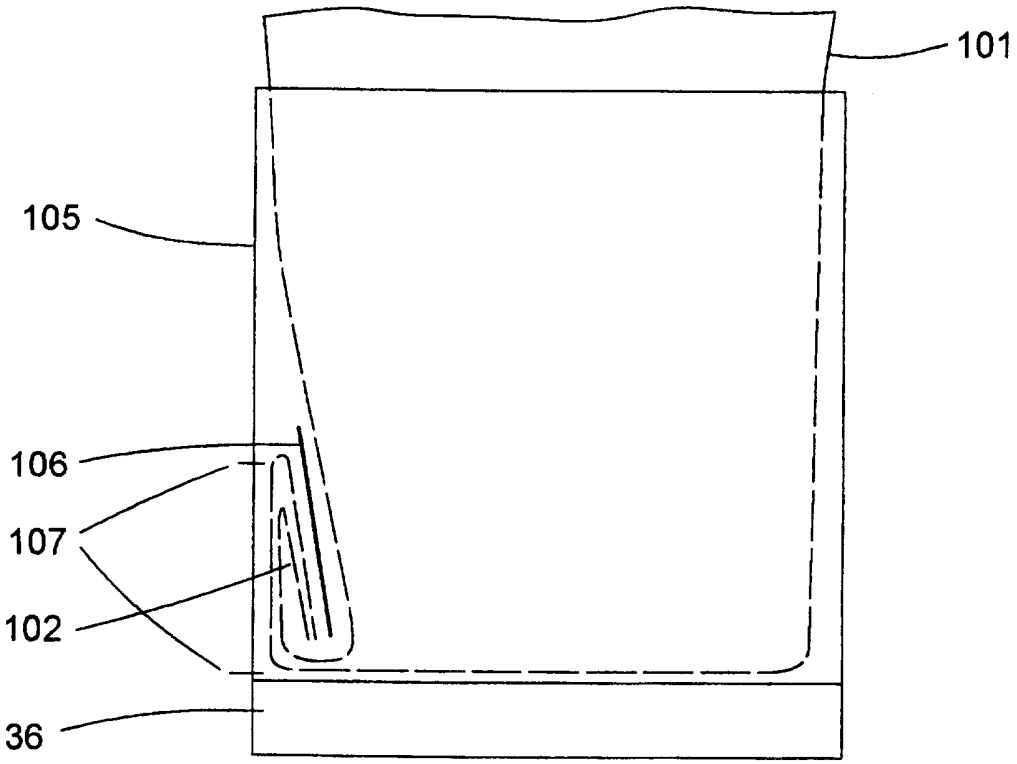

Fig. 23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/07581

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65B 1/04, 3/04
US CL :141/65,114,313; 222/181.3; 414/404
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 141/65,65,114,272,279,284,313-315,317; 222/181.3,181.2; 414/404,408

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,415,323 A (Fenelon) 16 May 1995, see entire document.	1,3,5,6,13,17 --- 4,7,11
X --- Y	US 5,257,725 A (Volk, Jr. et al.) 02 November 1993, see entire document.	1-3,17 --- 7,11,18
Y	US 4,563,864 A (Eschmann) 14 January 1986, see entire document.	4
Y	US 4,182,386 A (Alack) 08 January 1980, see entire document.	7
Y	US 4,966,311 A (Taylor) 30 October 1990, see entire document.	11

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 23 JULY 1997	Date of mailing of the international search report 27 AUG 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer STEVEN O. DOUGLAS Telephone No. (703) 308-0891

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/07581

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,184,759 A (Gill et al.) 09 February 1993, see entire document.	1-21
A	US 5,494,189 A (De Crane) 27 February 1996, see entire document.	1-21