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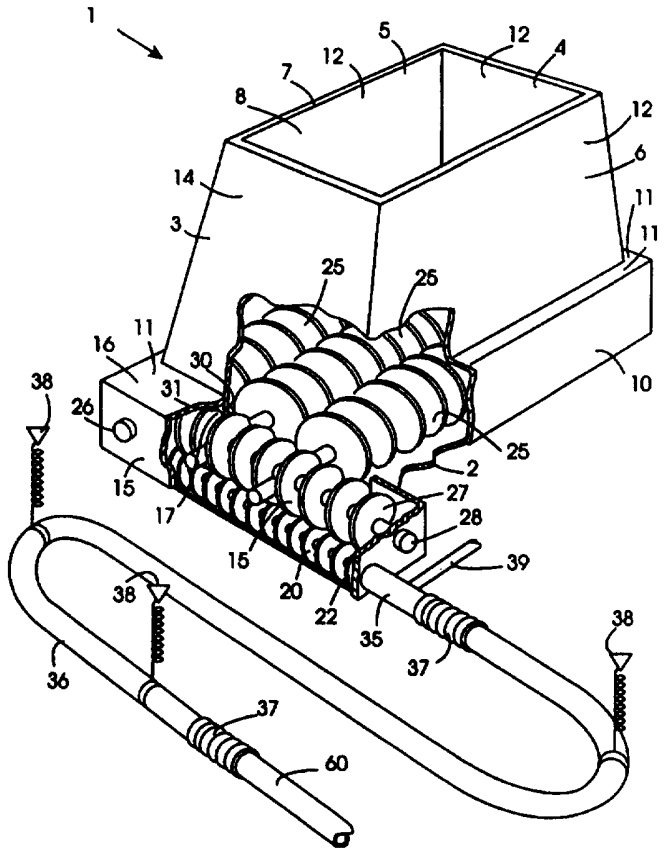
(54) Title: DISPENSING APPARATUS

(57) Abstract

A dispensing apparatus comprising a dispensing hopper (1, 50), a main delivery auger (20, 56, 84) for delivery material from the dispensing hopper (1, 50) through a dispensing outlet (22, 58, 85), an auger extension (63) extending from the main delivery auger (20, 56, 84) adjacent the dispensing outlet (22, 58, 85), the auger extension (63) extending into the bore of a dispensing pipe (35, 59) which extends from the dispensing outlet (22, 58, 85), the dispensing pipe (35, 59) being adapted for connection to a conveying conduit (36, 60) for delivering material from the hopper (1, 50) into the conveying conduit (36, 60), the conveying conduit (36, 60) being of the type through which material is conveyed by a fluid conveying medium, the auger extension (63), the dispensing pipe (35, 59) and the material being cooperable with each other for minimising backflow of conveying medium through the dispensing pipe (35, 59).



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"Dispensing apparatus"

The present invention relates to dispensing apparatus, and in particular, though not limited to a dispensing apparatus for dispensing ice either continuously or in batches.

Ice may be in any particulate form, such as, for example, ice lumps which are commonly referred to as ice cubes, particle ice, crushed ice, slush ice, flake ice, chip ice and the like. Hereinafter the term ice is used to encompass all such forms of ice.

The physical characteristics of particulate materials, in particular ice, result in problems with the storage and dispensing of the material. A typical problem associated with ice dispensing apparatus in which air is used to convey ice from the apparatus is that air can backflow from a dispensing pipe into the storage compartment or body of the apparatus. Heretofore, it has been common practice to use valves including rotary air locks to prevent such backflow and to ensure discharge is uninterrupted. However, the use of such valves adds extra expense and can be cumbersome. This can be particularly cumbersome where a continuous discharge is required.

Particulate ice has a tendency to fuse or form larger aggregates or particles when stored. Large particles or aggregates of ice, when formed, can be difficult or impossible to dispense or can cause blockages in dispensing hoppers either in the hopper proper or in hoppers having discharge tubes of a defined diameter through which the ice is discharged - large aggregates or large particulates of ice being unable to pass through the discharge tube.

Moreover, ice hoppers can accelerate fusion due to ice being compressed during storage in a hopper.

Fused or compressed ice in a hopper can result in "bridging" where the fused ice can cause the ice to form an ice bridge over the discharge opening or discharge means.

An object of the invention is to exploit the characteristics of ice to provide a dispensing apparatus which does not require the aforementioned valve arrangements.

A further object of the invention is to provide a dispensing apparatus for particulate materials having improved discharge characteristics.

A yet further object of the invention is to provide a dispensing apparatus having reduced instances of blockage in use.

Surprisingly, we have found that the discharge auger can itself prevent backflow without recourse to an independently operable valve.

According to the invention there is provided a dispensing apparatus, the dispensing apparatus comprising a dispensing hopper, a main delivery auger for delivering material from the dispensing hopper through a dispensing outlet, an auger extension extending from the main delivery auger adjacent the dispensing outlet, the auger extension extending into the bore of a dispensing pipe which extends from the dispensing outlet, the dispensing pipe being adapted for connection to a conveying conduit for delivering material from the hopper into the conveying conduit, the conveying conduit being of the type through which material is conveyed by a fluid conveying medium, the auger extension, the dispensing pipe and the material being cooperable with each other for minimising backflow of conveying medium through the dispensing pipe. Suitably, a material cooperating means is located within the dispensing pipe for minimising backflow of conveying medium through the dispensing pipe.

Advantageously, the diameter of the bore of the dispensing pipe substantially defines the outer diameter of the flight of the auger extension.

In one embodiment of the invention the material cooperating means comprises at least one ridge, or at least one groove extending generally longitudinally along the bore of the dispensing pipe for engaging material. Preferably, a plurality of ridges and/or grooves are provided extending generally longitudinally in the dispensing pipe bore. Advantageously, the internal diameter of the ridges extending longitudinally inwardly into the bore of the dispensing pipe substantially define the outer diameter of the auger extension, and preferably the ridges and grooves in the dispensing pipe bore define a plurality of longitudinally extending internal splines.

The material cooperating means cooperates with the material in the dispensing pipe to prevent backflow of material through the auger extension in the dispensing pipe.

In another embodiment of the invention the material cooperating means comprises an abutment projection extending axially from a flight of the auger extension for engaging the material. Preferably, the abutment projection extends radially across the auger flight. In one aspect of the invention one side of the abutment projection is ramped in a circumferential direction for facilitating easy passage of the material across the abutment projection for facilitating axial flow of the material along the auger extension in a downstream direction, the abutment projection being further provided with an abutment face disposed in an axially downstream direction to abut material moving in the upstream direction.

Advantageously, the main delivery auger extends into the dispensing pipe for a distance of at least 20mm, preferably, a distance of at least 50mm, more preferably a distance of at least

100mm and advantageously a distance of at least 200mm. Most preferably, the main delivery auger extends into the dispensing pipe for a distance of at least 250mm.

Advantageously, a fluid conveying medium inlet pipe communicates with the dispensing pipe. Preferably, the fluid conveying medium comprises pressurised air. More preferably, the air inlet is located at a bend in the dispensing pipe adjacent the auger extension.

Suitably, the conveying conduit comprises a valve means to restrict back flow of the fluid conveying medium to the dispensing hopper. Preferably, the valve means comprises a flap. More preferably, the flap comprises a flexible material. Most preferably, the flap is mounted on a hinge and is moveable between a first substantially closed position in which the flap forms a sealing relationship with the dispensing pipe and a second open position which allows for the passage of both the conveying fluid medium and the material from the dispensing pipe past the valve. Advantageously, the flap is maintained in the second open position by the material being conveyed in the dispensing pipe. Suitably, the valve means further comprises a sensor to detect the rate of discharge of material from the dispensing hopper.

The invention also provides a dispensing apparatus comprising a dispensing hopper, a dispensing outlet in the dispensing hopper, a conveying conduit in communication with the dispensing outlet, delivery means for delivering material from the hopper, through the outlet into the conduit, and a fluid conveying medium source in communication with the conduit to provide conveying medium to convey material in the conduit, the conveying conduit being provided with a valve means to restrict backflow of conveying medium from the conveying medium source to the hopper.

Suitably, the valve means comprises a flap.

Preferably, the flap comprises a flexible material. More preferably, the valve means is mounted on a hinge and is moveable between a first substantially closed position in which the flap forms a sealing relationship with the conveying conduit and a second open position. Most preferably, the flap is maintained in the second open position by the material being conveyed in the dispensing pipe.

Advantageously, the valve means further comprises a sensor to detect the rate of discharge of material from the dispensing hopper.

The invention also provides dispensing apparatus comprising a dispensing hopper, the dispensing hopper comprising a base, an upstanding side wall extending upwardly from the base, the base and side wall defining a hollow interior region, a main delivery auger extending along one side of the base for delivering material from the hollow interior region through a dispensing outlet from the hopper, a plurality of secondary delivery augers arranged side by side in the hollow interior region above the base and extending transversely of and towards the main delivery auger for urging material in the hopper to the main delivery auger, and an anti-jamming means co-operable with the main delivery auger for preventing jamming of the main delivery auger and of the secondary delivery augers by material being delivered to the main delivery auger by the secondary delivery augers.

The arrangement of augers and the anti-jamming means substantially reduces incidents of jamming and bridging in the dispensing apparatus.

In one aspect of the invention the anti-jamming means is an anti-jamming auger located adjacent and above and extending parallel to the main delivery auger.

The anti-jamming auger cooperates with the main delivery auger to

convey material to prevent jamming of the augers.

In another aspect of the invention the main delivery auger is of diameter less than the diameter of the anti-jamming auger, and preferably, significantly less than the diameter of the anti-jamming auger. Preferably, the diameter of the main delivery auger is substantially half the diameter of the anti-jamming auger.

A main delivery auger diameter which is less than the diameter of the anti-jamming auger results in enhanced reduced bridging and/or jamming.

In another aspect of the invention the secondary delivery augers are each of diameter greater than the diameter of the anti-jamming auger, and preferably, the diameter of each of the secondary delivery augers is greater than the diameter of the main delivery auger, and preferably, is significantly greater than the diameter of the main delivery auger.

These relative dimensions of the secondary delivery augers and the anti-jamming auger result in an apparatus with fewer secondary augers.

In another aspect of the invention the diameter of each secondary delivery auger is substantially similar to the sum of the diameters of the main delivery auger and the anti-jamming auger.

Preferably, the speed of rotation of the anti-jamming auger is greater than that of the main delivery auger.

It has been found that the incidents of jamming and bridging is further reduced where the augers are dimensioned according these constraints.

In another aspect of the invention an elongate dispensing

compartment extends longitudinally along one side edge of the dispensing hopper, and the main delivery auger is located in the dispensing compartment, the main delivery auger extending parallel within the dispensing compartment. Preferably, the anti-jamming auger is located within the dispensing compartment.

In another aspect of the invention the side wall defines with the base an elongate dispensing slot through which the dispensing compartment communicates with the hollow interior region of the dispensing hopper, and the dispensing compartment extends sidewardly outwardly from the side wall and the base and longitudinally along the side edge of the base.

In a further embodiment of the invention the hopper comprises four side walls extending upwardly from the base, one of the side walls defining the dispensing slot through which the dispensing compartment communicates with the hollow interior region of the dispensing hopper. Preferably, at least one of the sidewalls of the dispensing hopper is inclined inwardly upwardly for preventing bridging of material within the hollow interior region of the dispensing hopper. Ideally, at least two of the opposite side walls of the dispensing hopper incline inwardly upwardly towards each other for preventing bridging of material within the hollow interior region of the dispensing hopper. Preferably, opposite pairs of side walls incline inwardly upwardly towards each other.

The aforementioned arrangement of walls prevents particulate material such as ice from being funnelled together with can lead to compression resulting in jamming and/or bridging.

In another aspect of the invention the secondary delivery augers extend parallel to each other, and ideally, extend closely side by side to each other, and almost abut each other side by side to substantially define a base of the dispensing hopper.

An advantage of said secondary delivery auger arrangement is that

material can be conveyed from substantially the entire base of the dispensing hopper and jamming prevented across the entire base.

In another aspect of the invention the main delivery auger and the anti-jamming auger extend the length of one of the sides of the dispensing hopper, and in another aspect of the invention the main delivery auger extends through the dispensing outlet into a dispensing pipe extending from the dispensing outlet for preventing the passage of a conveying medium in the dispensing pipe into the hollow interior region of the dispensing hopper or into the dispensing compartment.

In another aspect of the invention a portion of the conveying conduit is supported on weighing means for weighing material in the portion. Preferably, the portion is suspended on load cells and advantageously, the portion of the pipe which is suspended on the load cells is flexibly connected to the dispensing pipe and to the remainder of the conduit for facilitating weighing of material in the said portion of the dispensing pipe.

Preferably, the main delivery auger extends into the dispensing pipe for a distance of at least 20mm. Advantageously, the main delivery auger extends into the dispensing pipe for a distance of at least 100mm, and preferably, for a distance of at least 200mm. Suitably, the main delivery auger extends into the dispensing pipe for a distance of approximately 250mm.

Extension of the main delivery auger into the dispensing pipe causes the extension to function as a valve to prevent backflow of conveying medium from the dispensing pipe into the hollow interior region.

Preferably, the ridges and grooves in the dispensing pipe bore define a plurality of longitudinally extending internal spines. More preferably, the material cooperating means comprises an abutment projection extending axially from a flight of the auger

extension for engaging other materials.

Most preferably, the abutment projection extends radially across the auger flight.

Suitably, one side of the abutment projection is ramped in a circumferential direction for facilitating easy passage of the material across the abutment projection for facilitating axial flow of the material along the auger extension in a downstream direction.

The invention also provides a dispensing apparatus comprising a base, an upstanding side wall extending upwardly from the base, and an elongate discharge means extending across the base for discharging material through a dispensing outlet means, the discharge means being movable relative to the base so that the discharge means may be swept over the base.

An advantage of the invention is that sweeping of the discharge means over the base causes particulate material to be separated to avoid bridging and/or jamming where more than one discharge means is provided, the sweeping action is coordinated so as to undermine the contents of the storage bin.

In one aspect of the invention the discharge means is sweepable over substantially the entire base. Such discharge means ensure that no bridging or blocking occurs across the entire base of the hopper.

In a preferred aspect of the invention the base is a four sided base having a pair of first opposite sides and a pair of second opposite sides, the discharge means extending between the two first opposite sides and being movable with rectilinear motion between the second opposite sides for sweeping the base between the first and second opposite sides. Preferably, the discharge means extends substantially the length of the base between the two

first opposite sides.

In one aspect of the invention the discharge means is carried on a carriage which is in turn movable along a track. Ideally, the carriage is located externally of the hopper.

In a preferred aspect of the invention the discharge means comprises an elongate auger rotatably mounted on the carriage. Preferably, a first drive means is provided for rotating the auger. Ideally, the first drive means is mounted on the carriage.

A second drive means can be used to propel the carriage from side to side.

An advantage of an auger is that the auger can convey the material in the hopper.

In one aspect of the invention the dispensing outlet means comprises a dispensing pipe, and ideally, the auger extends into the dispensing pipe. Preferably, the auger extends into the dispensing pipe which in turn is connected to a conveying conduit.

More preferably, the conduit comprises a flexible material.

Advantageously, a second drive means is provided for driving the carriage along the track.

Alternatively, the discharge means is carried on at least one pivotable arm. Preferably, the pivotable arm is controllable by hydraulic/pneumatic control means.

Suitably, the control means are located externally of the hopper. Preferably, the discharge means comprises an elongate auger sweepable along the base of the hopper by the pivotable arm.

More preferably, the pivotable arm is suspended from a pivot point

external the hopper side wall. Suitably, the elongate auger is attached to the pivotable arm at each end while the dispensing outlet comprises an open base.

In one particular embodiment of the invention the hopper comprises a pair of spaced apart first side walls extending upwardly from the respective first sides of the base, which are joined by a pair of spaced apart second side walls which extend upwardly from the respective second sides of the base.

Ideally, the second side walls diverge downwardly outwardly, and preferably, the first side walls diverge downwardly outwardly. This arrangement and orientation of the walls prevents particulate material such as ice from being funnelled together which can lead to compression resulting in jamming and/or bridging.

In another aspect of the invention returns are provided extending between the respective second sides of the base and the second side walls for accommodating the discharge means in its two extreme positions. Ideally, the returns are sized and shaped for facilitating cooperation between the discharge means and lower edges of the respective second side walls for removing any ice build up on the respective second side walls adjacent the lower edges thereof as the discharge means moves into and/or out of the respective returns.

Preferably, a pair of elongate slots are provided in each first side wall for accommodating the discharge means.

More preferably, moveable sealing means are disposed between the auger and the elongate slots. Most preferably, the sealing means comprises a sliding plate. Advantageously, the sealing means comprises a flexible material.

Alternatively, where a pivotable arm is used, the elongate slots are downwardly arcuate to follow the arcuate path of the auger.

A drive means pivots the swinging arm from side to side.

In another aspect of the invention the dispensing pipe feeds into a two way valve for selectively communicating the dispensing pipe with the conveying conduit and a conveying medium supply source for delivering material from the hopper into the dispensing pipe and for subsequent conveying of the material therethrough.

Alternatively, a single way ball valve is used with an air inlet on the downstream side of the pipeline.

In one aspect of the invention the first drive means intermittently drives the discharge auger for intermittently discharging material through the dispensing outlet means, i.e. loading a batch of ice into the pipeline.

In a further embodiment of the invention, a receptacle is disposed below the base of the hopper for receiving material from the hopper. Suitably, the receptacle comprises a movable cart. Preferably, a chute is disposed between the hopper and the cart or the receptacle.

The invention also provides a dispensing hopper comprising a base and a side wall upstanding from the base characterised in that at least one opposing face of the side walls is inclined inwardly upwardly for preventing bridging of material within the hollow interior region of the hopper.

Preferably, the hopper comprises four side walls extending upwardly from the base. More preferably, opposite pairs of the side walls are inclined inwardly upwardly towards each other.

The invention also relates to a dispensing apparatus comprising a dispensing hopper having a base and a side wall upstanding from the base characterised in that at least one opposing face of the side walls is inclined inwardly upwardly for preventing bridging

of material within the hollow interior region of the hopper. Preferably, the dispensing apparatus comprises at least one auger disposed at the base of the hopper. More preferably, the at least one auger extends across the entire base of the hopper.

Suitably, the at least one auger comprises a plurality of augers arranged side by side in the hopper. Alternatively, the at least one auger comprises an auger moveable relative to the base so that the auger may be swept over the base.

Preferably, the dispensing apparatus further comprises a principle delivery auger for receiving material from the series of augers or the moving auger and discharging material from the hopper.

An advantage of the dispensing apparatus of the invention is that bridging and jamming is substantially or entirely eliminated. The presence of a moving auger and/or multiplicity of secondary delivery augers across the base of the hopper ensures that the complete load of the hopper is undermined by the augers to ensure an effective and complete discharge of hopper contents.

The invention will be more clearly understood from the following description of some embodiments thereof which are given by way of example only with reference to the accompanying drawings in which:

Fig. 1 is a partially cut-away perspective view of a dispensing hopper according to the invention;

Fig. 2 is a front elevation in partial cross-section of the dispensing hopper of Fig. 1;

Fig. 3 is a side view of the dispensing hopper in partial cross section along the line III-III of Fig. 2;

Fig. 4 is a front view in partial cross-section of a detail of the dispensing hopper;

Fig. 5 is a partial cross-sectional view of a further detail of the dispensing hopper of Fig. 1;

Fig. 6 is a partial cross-sectional side elevation of a dispensing hopper according to another embodiment of the invention;

Fig. 7 is a cross-sectional end view of a portion of the hopper along the line VII-VII of Fig. 6;

Fig. 8 is a side elevation of a detail of the hopper of Fig. 6;

Fig. 9 is a perspective view of a portion of the detail of Fig. 8;

Fig. 10 is a perspective view of a third embodiment of a dispensing hopper of the invention with the discharge auger and the motor shown in broken lines;

Fig. 11 is a front elevation of a fourth embodiment of the hopper of the invention disposed over an ice cart, and

Fig. 12 is a front elevation of disposed over a collection chute and gravity conduit.

Referring to the drawings and initially to Figs. 1 to 5 there is illustrated dispensing apparatus according to the invention, in this case, a dispensing hopper indicated generally by the reference numeral 1 for dispensing material, which in this case is ice. The dispensing hopper 1 is of sheet metal material and comprises a base 2 and four side walls which extend upwardly from the base, namely, front and rear side walls 3 and 4 and end walls 5 and 6. Alternatively, the hopper 1 can comprise plastics. The side walls 3,4,5,6 terminate at their upper end in an open mouth 7 which provides access to a hollow interior region 8 which is

formed by the base 2 and the side walls 3,4,5,6. Each end wall 5 and 6, and the rear side wall 4 extend vertically upwardly at the region identified by the reference numeral 10, and then inwardly at the region identified by the reference numeral 11 before proceeding upwardly to the open mouth 7. A portion 12 of the end walls 5 and 6 and the rear wall 4, and a corresponding portion 14 of the front wall 3 incline inwardly upwardly towards the open mouth 7. This is to prevent bridging of ice within the dispensing hopper 1.

An elongate dispensing compartment 15 extends longitudinally along one side of the base 2 between the base 2 and the front side wall 3. The dispensing compartment 15 also extends sidewardly outwardly from the base 2 and the front side wall 3. The front side wall 3 abuts a top wall 16 of the dispensing compartment 15, and defines with the base 2 a dispensing slot 17 with which the dispensing compartment 15 communicates with the hollow interior region 8 of the dispensing hopper 1 for receiving ice for dispensing.

A main delivery auger 20 is located in the dispensing compartment 15 and extends longitudinally along the dispensing compartment 15 parallel thereto for dispensing ice from the dispensing compartment 15 through a dispensing outlet 22 in the end wall 6. The main delivery auger 20 is rotatable in a bearing 23 in the end wall 5, and is driven by an electrically-powered motor (not shown) mounted externally of the dispensing hopper 1.

A plurality, in this case, three secondary delivery augers 25 located in the hollow interior region 8 of the dispensing hopper 1 just above the base 2 extend transversely of the main delivery auger 20, and urge ice in the hollow interior region 8 towards the main delivery auger 20 for dispensing through the dispensing outlet 22. The secondary delivery augers 25 extend across the base 2 from the rear wall 4 through the dispensing slot 17, and terminate adjacent the main delivery auger 20. The secondary

delivery augers 25 are parallel to each other, and are located in close proximity side by side to each other across the base 2 from the end wall 5 to the end wall 6, and essentially, define a base to the hollow interior region 8. The secondary delivery augers 25 are rotatably carried in bearings 26 in the front and rear walls 3 and 4 and are driven through a chain and sprocket drive (not shown) by an electrically-powered motor, (also not shown) mounted externally of the dispensing hopper 1. The secondary delivery augers 25 are each rotated in the required direction for urging the ice towards the main delivery auger 20.

An anti-jamming means, in this case provided by an anti-jamming auger 27 is located in the dispensing compartment 15 and cooperates with the main delivery auger 20 for preventing jamming of ice which is urged towards the main delivery auger 20 by the secondary delivery augers 25. In this embodiment of the invention the anti-jamming auger 27 extends the full length of the dispensing compartment 15, is located just above the main delivery auger 20 and adjacent and parallel thereto. The anti-jamming auger 27 is rotated for urging the ice in a direction directly opposite to the direction in which the main delivery auger 20 urges the ice through the dispensing outlet 22. The anti-jamming auger 27 is rotatably supported in bearings 28 in the two end walls 5 and 6, and is driven by an electrically-powered motor (not shown) mounted externally of the dispensing hopper 1.

The anti-jamming auger 27 is provided with a relatively long pitch which acts to throw ice from the anti-jamming auger 27 onto the main delivery auger 20. In this embodiment of the invention the anti-jamming auger 27 is rotated at 1,000 RPM. The main delivery auger 20 is rotated at approximately 600 RPM. The three secondary delivery augers 25 are rotated at a speed of approximately 2 RPM to 3 RPM.

A plate 30 extends downwardly from the top wall 16 of the dispensing compartment 15 just below the front wall 3 into the

dispensing slot 17, and is shaped at 31 for accommodating the secondary delivery augers 25 therethrough into the dispensing compartment 15. This can most clearly be seen in Fig. 4. It has been found that the provision of the plate 30 further minimises the possibility of ice jamming the main delivery auger 20. A plate 33 extends downwardly from the rear wall 4, and is shaped at the region indicated by the reference numeral 34 to accommodate the secondary delivery augers 25. Plates 32 extend downwardly from the inclined portions 12 of the end walls 5 and 6 and stop short of the secondary delivery augers 25.

The diameter of the main delivery auger 20 is significantly smaller than the diameter of the anti-jamming auger 27, and preferably, and in this embodiment of the invention the diameter of the main delivery auger 20 is substantially half that of the anti-jamming auger 27. The secondary delivery augers 25 are each of diameter which is substantially equal to the sum of the diameters of the main delivery auger 20 and the anti-jamming auger 27. The secondary delivery augers 25 terminate just short of the main delivery auger 20, and preferably, a clearance gap "*a*" is provided between the end of the secondary delivery augers 25 and the main delivery auger 20 which does not exceed 12mm. It is preferable that the gap "*a*" should be in the order of 5mm. This can most clearly be seen in Fig. 3. A clearance gap "*b*" of up to 6mm is provided between the end of the secondary delivery augers 25 and the anti-jamming auger 27. It has been found that by providing a clearance gap "*c*" between the main delivery auger 20 and the anti-jamming auger 27 jamming of ice between the two augers 20 and 27 is minimised. It is preferable that the clearance gap "*c*" should not exceed 10mm, and in this embodiment of the invention is approximately 5mm which has been found to provide good results. It has also been found that by providing a clearance gap "*d*" between the plate 30 and the secondary delivery augers 25 of not greater than 15mm, and preferably, 5mm also facilitates in minimising jamming of ice. By providing a clearance gap "*e*" between the plate 33 and the secondary delivery

augers 25 of not greater than 15mm, and preferably, of the order of 5mm jamming of ice is minimised. It has also been found that the provision of the plates 30 and 33 and the clearance gaps "*d*" and "*e*" in combination with the inclined portions 12 of the walls 3, 4, 5 and 6 significantly minimises, and almost entirely eliminates bridging of ice in the hollow interior region 8 above the secondary delivery augers 25. The plates 32 terminate short of the secondary delivery augers 25 to form a gap "*f*" between the plates 32 and the adjacent secondary delivery augers 25. It has been found that by maintaining the gap "*f*" at approximately 5mm, bridging of ice above the secondary delivery augers 25 is further minimised. In general, it is preferable that the gap "*f*" should not exceed 10mm. The fact that the rear wall 4 and the end walls 5 and 6 are shaped at 10 and 11 also facilitates in minimising, and in general, eliminating bridging of ice above the secondary delivery augers 25.

In this embodiment of the invention the main delivery auger 20 extends through the dispensing outlet 22 and into a dispensing pipe 35 which extends from the dispensing outlet 22 through which ice is dispensed from the dispensing hopper 1. The portion of the main delivery auger 20 which extends into the dispensing pipe 35 acts as a valve for blocking backflow of a conveying medium in the dispensing pipe 35 into the hollow interior region 8. It has been found that by extending the main delivery auger 20 into the dispensing pipe 35 for between approximately 20mm and 250mm, the combination of the main delivery auger 20 and the ice which it is conveying into the dispensing pipe 35 act to block the backflow of conveying medium, typically, conveying air.

A portion 36 of the conveying conduit 60 is flexibly connected at one end to the dispensing pipe 35 and at the other end to the remainder of the conveying conduit 60 by flexible connectors 37 for facilitating weighing of ice in the portion 36. The portion 36 is suspended on load cells 38 for weighing the portion 36, for thereby enabling the weight of ice in the portion 36 to be

determined.

An air inlet 39 to the dispensing pipe 35 is located intermediate the first flexible mounting 37 and the end of the main delivery auger 20 for delivery conveying air into the dispensing pipe 35 for conveying ice through the dispensing pipe 35 into the portion 36 and the conveying conduit 60. The air inlet 39 is located approximately 250mm from the end of the dispensing outlet 22. It has been found that by locating the air inlet 39 spaced apart from the end of the dispensing outlet 22, ice accumulates in the dispensing pipe 35 between the air inlet 39 and the main delivery auger 20, and this ice acts to minimise backflow of air through the dispensing pipe 35 into the hopper. In general, the air inlet 39 should be spaced from the end of the dispensing outlet 22, a distance of at least 20mm and adjacent to the end of the auger extension 63.

It has also been found that the performance of the auger extension 63 and the air conveying medium is further enhanced when the air inlet 39 is located at a bend in the dispensing pipe 35 (not shown). Location of the air inlet at a bend further improves ice discharge either in batches or continuously.

In use, ice delivered into the dispensing hopper 1 through the open mouth 7 is stored therein. On a demand for ice from the dispensing hopper 1, the main delivery auger 20, the secondary delivery augers 25 and the anti-jamming auger 27 are rotated. Ice in the hollow interior region 8 is urged by the secondary delivery augers 25 into the dispensing compartment 15, where a batch of ice is delivered by the main delivery auger 20 through the dispensing outlet 22, and into the dispensing pipe 35. The batch of ice is urged into the portion 36 of the conveying conduit 60 where it is weighed using the load cells 38. Conveying air is delivered through the air inlet 39 into the dispensing pipe 35 for conveying the batch of ice through the conduit 60.

It is envisaged in certain cases, that the entire portion 36 or conduit 60 may be a flexible pipe, and in which case, by appropriately supporting the flexible pipe on load cells 38, the weight of a batch of ice could be determined.

It is envisaged that instead of extending the inclined portions 12 of the end walls 5 and 6 downwardly at 32 to form the gaps "*f*", the spacing between the inclined portions 12 of the end walls 5 and 6 could be such that the point at which the portions 12 of the end walls 5 and 6 join the portions 11 could be sufficiently close to the adjacent secondary delivery augers 25 as to form a gap "*f*" of approximately 5mm.

Referring now to Figs. 6 to 9, there is illustrated dispensing apparatus according to another embodiment of the invention, which in this case, is also a dispensing hopper which is indicated generally by the reference numeral 50 for dispensing ice. In this embodiment of the invention the hopper 50 comprises a base 51, a pair of upstanding front and rear walls 52 and 53 joined by upstanding end walls 54 which define with the base 51 a hollow interior region 55 for the ice. A main delivery auger 56 is located in the bottom of the hollow interior region 55 adjacent the base 51 for dispensing ice from the hopper 50 through a dispensing outlet 58. A dispensing pipe 59 extends from the hopper 50 from the dispensing outlet 58 for delivering ice from the hollow interior region 55 into a conveying conduit 60 for conveying therethrough by a fluid conveying medium, which in this case, is conveying air. The conveying air is delivered into the conveying conduit 60 through an air inlet 61 which is located between the conveying conduit 60 and the dispensing pipe 59. A valve 62 is located in the air inlet 61 for regulating and controlling the flow of conveying air into the conveying conduit 60 and to further prevent the backflow of conveying air into the hopper in the event of the hopper having no ice in it. The air valve 62 can be of a flexible material or can pivot so that in the event of air tending to flow in the direction A (i.e. upstream),

the flap will move to block dispensing pipe 59 and prevent such flow.

In a preferred embodiment, the flap 62 and air inlet 61 are located at a bend in the dispensing pipe 35,59. In this embodiment, the flap 62 will seal the dispensing pipe 35,59:

(a) in continuous dispensing, the hopper 50 empties,

(b) in batch dispensing, during batch delivery (by air along the conduit to its destination).

Advantageously, a sensor is provided to control the main delivery auger 56. The sensor will sense if the hopper is empty in order to stop the auger 56 when appropriate. Suitable sensors include sensors which can be mounted on the hopper to determine the presence of ice within the hopper or the level of ice within the dispensing pipe 35. For example, if the sensor senses that the hopper is empty, a message is relayed to the auger which is stopped but the flap remains open to allow air to pass through the conveying conduit 60 to clear any blockages. The sensor can be used to clear the conveying conduit 60 of any blockages and also to control movement of ice where no ice is coming into the dispensing pipe 35.

The main delivery auger 56 is rotatably carried in a bearing (not shown) in the rear wall 53 and is driven by an electrically powered motor, (also not shown) mounted externally of the hopper 50. An auger extension 63 extends from the main delivery auger 56 adjacent the dispensing outlet 58 into the dispensing pipe 59 for preventing backflow of conveying air from the conveying conduit 60 through the dispensing pipe 59 when the auger extension 63 has ice in it.

A material cooperating means for cooperating with the ice in the dispensing pipe 59 for preventing backflow of ice through the auger extension 63 can be provided in the dispensing pipe 59.

In this embodiment of the invention two material cooperating means are provided. A first material cooperating means is provided by a plurality of longitudinally extending grooves 65 which extend longitudinally along a length of the bore 66 close to the dispensing outlet of the dispensing pipe 59, in the form of internal splines for engaging ice for preventing ice moving circumferentially around the auger extension 63 between the auger flights in a generally upstream direction, namely, in the direction of the arrow A along the bore 66 of the dispensing pipe 59. It has been found that, in the event of such undesirable movement as the ice commences to move circumferentially around the main dispensing auger extension 63 between the auger flights, ice catches on shoulders 67 of ridge portions 68 which form the grooves 65 stops further movement of the ice circumferentially around the auger extension 63. A second material cooperating means in this embodiment of the invention, is located on the auger extension 63, and in this case, comprises a plurality of abutment projections 70 which project from the auger flight in a generally axially direction in a generally downstream direction. Each abutment projection 70 includes an abutment face 72 which extends in a generally axially downstream direction and also radially across the flight of the extension auger 63 for cooperating with and abutting ice as it commences to move circumferentially around the extension auger 63 between the auger flights in the generally upstream direction A. It has been found that as ice engages the faces 72 of the abutment projections 70 as the ice commences to move upstream in the direction A and circumferentially around the auger extension 63 between the flights, further movement of ice circumferentially around the auger extension 63 is prevented. The projections 70 are ramped having a circumferentially extending ramp portion 73 for facilitating relative movement between the auger flight of the extension auger 63 and the ice, when the ice is being urged in a downstream direction, namely, in the direction of the arrow B through the dispensing pipe 59 by the auger extension 63.

The ridge portions 68 in this embodiment of the invention define the bore 66, the diameter of which is substantially similar to the outer diameter of the auger extension 63.

It will be appreciated that while the material cooperating means for preventing backflow of ice around the auger extension 63 has been described as comprising a plurality of grooves 65 in the bore of the dispensing pipe 59, and abutment projections 70 located on the auger extension 63, any other suitable material cooperating means for preventing the backflow of ice may be provided, and in certain cases only one or more of the various material cooperating means may be provided. In certain cases it may be preferable that a material cooperating means may extend a short distance from 58 in direction towards 61.

It will of course be appreciated that the main delivery auger of the dispensing hopper 1 which has been described with reference to Figs. 1 to 5, may be provided with an auger extension and a dispensing pipe and material cooperating means similar to the auger extension 63 and dispensing pipe 59 and material cooperating means of the hopper 50. Likewise, it will be appreciated that the hopper 50 may be replaced by a hopper substantially similar to the hopper 1.

While the dispensing hopper of Figs. 1 to 5 has been described as comprising three secondary delivery augers, it will be appreciated that any number of secondary delivery augers may be provided. It will also be appreciated that the relative dimensions of the main delivery auger, the secondary delivery augers and the anti-jamming auger of the hopper of Figs. 1 to 5 may vary.

Fig. 10 shows a perspective view of a third embodiment of a dispensing apparatus of the invention indicated generally by the reference numeral 1. In this embodiment of the invention the dispensing hopper 1 is particularly suitable for dispensing ice of the type hereinbefore described in batches into a dispensing pipe

35. The hopper 1 comprises a flat rectangular base 74 having first opposite side edges 75 and second opposite side edges 76 extending between the first opposite side edges 75. First walls, namely, a front and rear 77,78 extend upwardly from the first side edges 75 of the base 74, and are joined by opposite spaced apart second walls, namely, side walls 79. A pair of returns 80 formed by return walls 81 extend from lower edges 82 of the side walls 79 to the second side edges 76 of the base 74. An inlet 94 to the hopper 1 is defined by upper edges 83 of the front and rear walls 77,78 respectively, and the side walls 79. In this embodiment of the invention the front and rear walls 77,78 diverge downwardly from each other and the side walls 79 also diverge downwardly from each other for avoiding any danger of ice bridging between the respective front and rear walls 77,78 and the respective end walls 79.

A discharge means, in this embodiment of the invention a discharge auger 84 is located adjacent the base 74 for discharging material from the hopper 1 intermittently through a dispensing outlet 85. The outlet pipe 85 is connected to the dispensing pipe 35 as will be described below. In this embodiment of the invention the auger 84 has an extension 63 which extends for a short distance into the dispensing pipe 35. The discharge auger 84 is rotatably carried on a carriage 86 which is in turn mounted externally of the hopper 1. The discharge auger 84 extends transversely across the base 74 from one first side edge 75 to the other first side edge 75 and extends through corresponding elongate slots 87 formed in the front and rear wall 77,78 where it is rotatably mounted on the carriage 86. A bearing mounting 108 rotatably carries the auger extension 63 at one end of the carriage 86, and the other end of the auger 84 is coupled to a drive shaft (not shown) of a first drive means, namely, an electrically powered motor 88 which is carried on the carriage 86 at the other end thereof. The motor 88 is illustrated in broken lines in block representation in the drawing. The carriage 86 is movable with rectilinear motion along a pair of spaced apart tracks 89 on opposite sides of the base 74

of the hopper 1 for sweeping the auger 84 from one of the opposite side edges 76 to the other opposite side edge 76 of the base 74 for collecting and dispensing ice from the hopper 1. Wheels 90 rotatably carried on the carriage 86 engage the tracks 89 for guiding the carriage 86 along the tracks 89. A second drive means (not shown), typically, an electrically powered motor or a pneumatic ram is provided for moving the carriage 86 between the respective opposite second side edges 76 of the base 74.

A sliding sealing plate (not shown) slides across each elongated slot to prevent the loss of ice from the open sections of the slots not occupied by the discharge means (84).

A two way valve 91 connects the dispensing pipe 35 to the conduit 60 and also to a conveying medium supply pipe 92 for selectively and alternately connecting the conduit 60 to the dispensing pipe 35 for receiving a batch of ice, and to the conveying medium supply pipe 92 for receiving conveying medium, namely, conveying air for conveying the batch of ice through the conduit 60. An air blower 93 illustrated in block representation in the drawing supplies the conveying air through the supply pipe 92 to the valve 91. In this embodiment of the invention the conduit 60 is flexible and the supply pipe 92 is also flexible to accommodate movement of the carriage 86, and in turn, the dispensing pipe 35 as the carriage 86 sweeps the auger 84 along the base 74. In this embodiment, the conduit 60 also extends downwardly from the valve 91 so that a batch of ice can be more conveniently collected in the conduit 60 for subsequent delivery therethrough.

In use, ice stored in the hopper 1 which is received through the inlet 94 is dispensed by the discharge auger 84 through the dispensing outlet 85. During dispensing, the auger 84 is swept from one of the second side edges 76 of the base 74 to the other second side edge 76 by the motor or ram (not shown) which urges the carriage 86 in the directions of the arrows A and B, and the discharge auger 84 is rotated by the motor 88. In this particular

embodiment of the invention the ice is dispensed in batches through the dispensing outlet 85 into the dispensing pipe 35 and in its open position through the valve 91 into the conduit 60. During dispensing of ice into the dispensing pipe 35 the valve 91 is positioned so that the dispensing pipe 35 communicates directly with the conduit 60 and isolates both the dispensing pipe 35 and the conduit 60 from the air blower 93.

On a batch of ice of the desired quantity having been dispensed into the conduit 60, the auger 84 is deactivated and the motor or ram (not shown) which drives the carriage 86 is also deactivated. The valve 91 is operated to allow communication between the conduit 60 and the air blower 93, and to convey air from the air blower 93 to deliver the batch of ice in the conduit 60 to its destination. In this position, the valve 91 isolates the dispensing pipe 35 from the conduit 60 and the air blower 93.

If it is desired to continuously dispense ice lumps from the hopper 1 the motor or ram (not shown) which drives the carriage 86 from second side 76 to second side 76 of the base 74, and the auger 84 are continuously active, the blower 93 is kept on and the valve 91 is dispensed with and the air inlet pipe 92 connected directly to conduit 60.

Whether in the batch or continuous modes, as the carriage 86 sweeps the auger 84 across the base from one side edge 76 to the other side edge 76 on reaching a side edge 75, the auger 84 enters the corresponding return 80. As it enters the return 80, the auger 84 cooperates with the lower edges 82 of the corresponding end wall 79 for removing any ice which may accumulate and build up on the end wall 79 adjacent the lower edge 82.

It will be appreciated that while the discharge auger is arranged to sweep with rectilinear motion across the base of the hopper, the auger may be arranged to sweep across the base with any other suitable sweeping motion, for example, in certain cases, it is

envisaged that the outlet pipe may be provided at the centre of, for example, a circular base, and the auger would be swept through 360° around the centre point of the base.

Fig. 11 shows a front elevation of a fourth embodiment of the dispensing apparatus of the invention in which the dispensing hopper 1 is disposed over an ice cart 100. As shown in the drawing, the dispensing hopper 1 is similar in construction to the dispensing hopper 1 shown in Fig. 10 and has a base 74, first opposite side edges 75 and second opposite side edges 76 extending between the first opposite side edges 75 as previously described. In addition, the hopper 1 is provided with front and rear first walls 77,78 which extend upwards from the first side edges 75 and are joined by opposite spaced apart end walls 79. The hopper 1 is also provided with a pair of returns 80 formed by return walls 81 which extend from lower edges 82 of the end walls 79 to the second side edges 76 as previously described. The front and rear walls 77,78 diverge downwardly from each other and the end walls 79 also diverge downwardly from each other to avoid ice bridging as previously described. The apparatus is also provided with a discharge auger 84 which extends transversely from one first side edge 75 to the other first side edge 75 and extends through corresponding elongate slots 87 formed in the front and rear walls 77,78 of the hopper 1. However, in the present embodiment, the discharge auger 84 is adapted to travel along a downwardly arcuate path adjacent the base of the hopper 1.

More particularly, two double acting pneumatic rams 95 are disposed over the hopper 1 at the front and rear walls 77,78. Each ram 95 has a piston 96. Each double acting pneumatic ram 95 is supported on a mounting bracket 97. Each piston 96 is attached to the top end of an elongate swingable arm 99 disposed at the outside faces of the front and rear walls 77,78 and which extends between the piston 96 and the discharge auger 84. A pivotable mounting 98 is disposed located between the piston 96 and the elongate swinging arm 99 to facilitate swinging of the arm 99.

The front pivotable mounting 98 is located along the central longitudinal axis of the front wall 77 of the hopper 1.

A tube or similar rigid structural element is securely attached to both the front and the rear swingable arm 99 to prevent any misalignment of the auger 84 or its bearings.

The swinging arm 99 of each pneumatic ram 95 supports the discharge auger 84. Extension and retraction of the piston 96 causes the mounting 98 and the swinging arm 99 to pivot so that the discharge auger 84 is swept across the base of the hopper 1 in the arcuate slot 87.

More particularly, the piston 96 of the double acting pneumatic ram is extended and retracted to cause the swinging arm 99 to pivot about the pivot point 98 thereby sweeping the discharge auger 84 along an arcuate path.

The two pivotable arms 99 are structurally connected to each other, e.g. by a cross-bar to ensure a coordinated movement of the auger 84.

The auger 84 feeds ice into a short open ended pipe 35 similar to that previously described so that engagement of the discharge auger 84 with ice within the hopper 1 causes ice to fall from the opened end of pipe 35. An ice cart 100 having wheels 101 at the base thereof is disposed beneath the open end of the pipe 35 to receive discharge ice. Accordingly, discharged ice can be conveyed in the ice cart 100 to the desired location.

Fig. 12 shows a further front elevation of the hopper of Fig. 11. However, as shown in Fig. 12 an ice maker 102 is disposed over the hopper 1 while the hopper 1 is located on a first floor 106 of a building structure. A chute 103 is disposed below the base of the hopper 1. The chute 103 communicates with a gravity conduit 104 which extends downwards from the chute 103 through the first floor

106 to a ground floor level 107. The gravity conduit is open at its free end and terminates above a receptacle 105.

Accordingly, ice can be discharged by the discharge auger 84 from the hopper 1 as described above into the chute 103. Ice can then travel through the chute 103 into the gravity conduit 104 and finally from the gravity conduit 104 into the receptacle 105.

As an alternative to the pneumatic ram shown in Fig. 11 a hydraulic ram or other suitable means to pivot the swinging arm 99 may be used.

An advantage of the arrangement shown in Figs. 11 and 12 is that the pneumatic ram 95 ensures a constant feed of ice from the hopper 1. In addition, the controlled pressure actuation of the discharge auger 84 across the hopper 1 by the double acting ram 95 ensures that the discharge auger 84 is not overloaded.

The invention is not limited to the embodiments hereinbefore described which may be varied in construction and detail.

CLAIMS

1. A dispensing apparatus comprising a dispensing hopper (1,50), a main delivery auger (20,56,84) for delivering material from the dispensing hopper (1,50) through a dispensing outlet (22,58,85), an auger extension (63) extending from the main delivery auger (20,56,84) adjacent the dispensing outlet (22,58,85), the auger extension (63) extending into the bore of a dispensing pipe (35,59) which extends from the dispensing outlet (22,58,85), the dispensing pipe (35,59) being adapted for connection to a conveying conduit (36,60) for delivering material from the hopper (1,50) into the conveying conduit (36,60), the conveying conduit (36,60) being of the type through which material is conveyed by a fluid conveying medium, the auger extension (63), the dispensing pipe (35,59) and the material being cooperable with each other for minimising backflow of conveying medium through the dispensing pipe (35,59).

2. A dispensing apparatus as claimed in Claim 1 further comprising a material cooperating means (65,70) located within the dispensing pipe (35,59) for minimising backflow of conveying medium through the dispensing pipe (35,59).

3. A dispensing apparatus as claimed in Claim 1 or 2 characterised in that the diameter of the bore of the dispensing pipe (35,59) substantially defines the outer diameter of the flight of the auger extension (63).

4. A dispensing apparatus as claimed in Claim 2 or 3 characterised in that the material cooperating means (65,70) comprises at least one ridge (68), or at least one groove (65) extending generally longitudinally along the bore of the dispensing pipe (35,59) for engaging material.

5. A dispensing apparatus as claimed in Claim 4 characterised in that a plurality of ridges (68) and/or grooves (65) are provided extending generally longitudinally in the dispensing pipe

(35,59) bore.

6. A dispensing apparatus as claimed in Claim 5 characterised in that the internal diameter of the ridges (65) extending longitudinally inwardly into the bore of the dispensing pipe (35,59) substantially define the outer diameter of the auger extension (63).

7. A dispensing apparatus as claimed in Claim 6 characterised in that the ridges (68) and grooves (65) in the dispensing pipe (35,59) bore define a plurality of longitudinally extending internal splines.

8. A dispensing apparatus as claimed in any of Claims 2 to 7 characterised in that the material cooperating means (65,70) comprises an abutment projection (70) extending axially from a flight of the auger extension (63) for engaging the material.

9. A dispensing apparatus as claimed in Claim 8 characterised in that the abutment projection (70) extends radially across the auger flight.

10. A dispensing apparatus as claimed in Claim 9 characterised in that one side of the abutment projection (70) is ramped in a circumferential direction for facilitating easy passage of the material across the abutment projection (70) for facilitating axial flow of the material along the auger extension (63) in a downstream direction, the abutment projection being further provided with an abutment face (72) disposed in an axially downstream direction to abut material moving in the upstream direction.

11. A dispensing apparatus as claimed in any of Claims 1 to 10 characterised in that the main delivery auger (20,56,84) extends into the dispensing pipe (35,59) for a distance of at least 20mm.

12. A dispensing apparatus as claimed in Claim 11 characterised in that the main delivery auger (20,56,84) extends into the dispensing pipe (35,59) for a distance of at least 50mm.

13. A dispensing apparatus as claimed in Claim 12 characterised in that the main delivery auger (20,56,84) extends into the dispensing pipe (35,59) for a distance of at least 100mm.

14. A dispensing apparatus as claimed in Claim 13 characterised in that the main delivery auger (20,56,84) extends into the dispensing pipe (35,59) for a distance of at least 200mm.

15. A dispensing apparatus as claimed in Claim 14 characterised in that the main delivery auger (20,56,84) extends into the dispensing pipe (35,59) for a distance of at least 250mm.

16. A dispensing apparatus as claimed in any of Claims 1 to 15 characterised in that a fluid conveying medium inlet pipe (39,92) communicates with the dispensing pipe (35,59).

17. A dispensing apparatus as claimed in Claim 16 wherein the fluid conveying medium comprises pressurised air.

18. A dispensing apparatus as claimed in Claim 17 wherein the air inlet is located at a bend in the dispensing pipe (35,59) adjacent the auger extension (63).

19. A dispensing apparatus as claimed in any of Claims 1 to 18 characterised in that the conveying conduit (36,60) comprises a valve means (62) to restrict back flow of the fluid conveying medium to the dispensing hopper (1,50).

20. A dispensing apparatus as claimed in Claim 19 characterised in that the valve means comprises a flap (62).

21. A dispensing apparatus as claimed in Claim 20 characterised

in that the flap (62) comprises a flexible material.

22. A dispensing apparatus as claimed in Claim 20 or 21 characterised in that the flap (62) is mounted on a hinge and is moveable between a first substantially closed position in which the flap (62) forms a sealing relationship with the dispensing pipe (35,59) and a second open position which allows for the passage of both the conveying fluid medium and the material from the dispensing pipe (35,59) past the valve (62).

23. A dispensing apparatus as claimed in Claim 22 characterised in that the flap (62) is maintained in the second open position by the material being conveyed in the dispensing pipe (35,59)

24. A dispensing apparatus as claimed in any of Claims 19 to 23 characterised in that the valve means (62) further comprises a sensor to detect the rate of discharge of material from the dispensing hopper (1,50).

25. A dispensing apparatus comprising a dispensing hopper (1,50), a dispensing outlet (22,58,85) in the dispensing hopper (1,50), a conveying conduit (36,60) in communication with the dispensing outlet (22,58,85), delivery means (20,56,84) for delivering material from the hopper (1,50), through the outlet (22,58,85) into the conduit (36,60), and a fluid conveying medium source in communication with the conduit (36,60) to provide conveying medium to convey material in the conduit (36,60), the conveying conduit (36,60) being provided with a valve means (62) to restrict backflow of conveying medium from the conveying medium source to the hopper (1,50).

26. A dispensing apparatus as claimed in Claim 25 characterised in that the valve means (62) comprises a flap (62).

27. A dispensing apparatus as claimed in Claim 26 characterised in that the flap (62) comprises a flexible material.

28. A dispensing apparatus as claimed in Claim 26 characterised in that the flap (62) is mounted on a hinge and is moveable between a first substantially closed position in which the flap (62) forms a sealing relationship with the conveying conduit (36,60) and a second open position.

29. A dispensing apparatus as claimed in Claim 28 characterised in that the flap (62) is maintained in the second open position by the material being conveyed in the conveying conduit (36,60).

30. A dispensing apparatus as claimed in any of Claims 25 to 29 characterised in that the valve means (62) further comprises a sensor to detect the rate of discharge of material from the dispensing hopper.

31. A dispensing apparatus comprising a dispensing hopper (1), the dispensing hopper (1) comprising a base (2), an upstanding side wall (3,4,5,6) extending upwardly from the base (2), the base (2) and side wall (3,4,5,6) defining a hollow interior region (8), a main delivery auger (20) extending along one side of the base (2) for delivering material from the hollow interior region (8) through a dispensing outlet (22) from the hopper (1), a plurality of secondary delivery augers (25) arranged side by side in the hollow interior region (8) above the base (2) and extending transversely of and towards the main delivery auger (20) for urging material in the hopper (1) to the main delivery auger (20), and an anti-jamming means (27) cooperable with the main delivery auger (20) for preventing jamming of the main delivery auger (20) and of the secondary delivery augers (25) by material being delivered to the main delivery auger (20) by the secondary delivery augers (25).

32. A dispensing apparatus as claimed in Claim 31 characterised in that the anti-jamming means (27) is an anti-jamming auger (27) located adjacent and above and extending parallel to the main delivery auger (20).

33. A dispensing apparatus as claimed in Claim 32 characterised in that the main delivery auger (20) is of a diameter less than the diameter of the anti-jamming auger (27).

34. A dispensing apparatus as claimed in Claim 33 characterised in that the diameter of the main delivery auger (20) is substantially half the diameter of the anti-jamming auger (27).

35. A dispensing apparatus as claimed in Claim 34 characterised in that the secondary delivery augers (25) are each of diameter greater than the diameter of the anti-jamming auger (27).

36. A dispensing apparatus as claimed in Claim 35 characterised in that the diameter of each of the secondary delivery augers (25) is greater than the diameter of the main delivery auger (20), and preferably, is significantly greater than the diameter of the main delivery auger (20).

37. A dispensing apparatus as claimed in Claim 36 characterised in that the diameter of each secondary delivery auger (25) is substantially similar to the sum of the diameters of the main delivery auger (20) and the anti-jamming auger (27).

38. A dispensing apparatus as claimed in Claim 37 characterised in that the speed of rotation of the anti-jamming auger (27) is greater than that of the main delivery auger (20).

39. A dispensing apparatus as claimed in any of Claims 31 to 38 characterised in that an elongate dispensing compartment (15) extends longitudinally along one side edge of the dispensing hopper (1), and the main delivery auger (20) is located in the dispensing compartment (15), the main delivery auger (20) extending parallel within the dispensing compartment (15).

40. A dispensing apparatus as claimed in Claim 39 characterised in that the anti-jamming auger (27) is located within the

dispensing compartment (15).

41. A dispensing apparatus as claimed in Claim 40 characterised in that the side wall (3) defines with the base (2) an elongate dispensing slot (17) through which the dispensing compartment (15) communicates with the hollow interior region (8) of the dispensing hopper (1), and the dispensing compartment (15) extends sidewardly outwardly from the side wall (3) and the base (2) and longitudinally along the side edge of the base (2).

42. A dispensing apparatus as claimed in any of the preceding claims characterised in that the hopper (1) comprises four side walls extending upwardly from the base (2).

43. A dispensing apparatus as claimed in Claim 42 characterised in that at least one of the sidewalls (3,4,5,6) of the dispensing hopper (1) is inclined inwardly upwardly for preventing bridging of material within the hollow interior region of the dispensing hopper (1).

44. A dispensing apparatus as claimed in Claim 42 characterised in that at least two of the opposite side walls (3,4,5,6) of the dispensing hopper (1) incline inwardly upwardly towards each other for preventing bridging of material within the hollow interior region (8) of the dispensing hopper (1).

45. A dispensing apparatus as claimed in Claim 44 characterised in that opposite pairs of side walls (3,4,5,6) incline inwardly upwardly towards each other.

46. A dispensing apparatus as claimed in any of Claims 31 to 45 characterised in that the secondary delivery augers (25) extend parallel to each other.

47. A dispensing apparatus as claimed in any of Claims 31 to 46 characterised in that the secondary delivery augers (25)

substantially define a base (2) of the dispensing hopper (1).

48. A dispensing apparatus as claimed in any of Claims 31 to 47 characterised in that the main delivery auger (20) and the anti-jamming auger (27) extend the length of one of the sides (3,4,5,6) of the dispensing hopper (1).

49. A dispensing apparatus as claimed in any of Claims 31 to 48 characterised in that the main delivery auger (20) extends through the dispensing outlet (22) into a dispensing pipe (35) extending from the dispensing outlet (22) for preventing the passage of a conveying medium in the dispensing pipe (35) into the hollow interior region (8) of the dispensing hopper (1) or into the dispensing compartment (15).

50. A dispensing apparatus as claimed in any of Claims 31 to 49 characterised in that a portion (36) of the conveying conduit (60) is supported on weighing means (38) for weighing material in the portion (36).

51. A dispensing apparatus as claimed in Claim 50 characterised in that the portion (36) is suspended on load cells (38).

52. A dispensing apparatus as claimed in Claim 51 characterised in that the portion (36) of the pipe which is suspended on the load cells (38) is flexibly connected to the dispensing pipe (35) and to the remainder of the conduit (60) for facilitating weighing of material in the said portion (36).

53. A dispensing apparatus as claimed in any of Claims 49 to 52 characterised in that the main delivery auger (20) extends into the dispensing pipe (35) for a distance of at least 20mm.

54. A dispensing apparatus as claimed in Claim 53 characterised in that the main delivery auger (20) extends into the dispensing pipe (35) for a distance of at least 50mm.

55. A dispensing apparatus as claimed in Claim 54 characterised in that the main delivery auger (20) extends into the dispensing pipe (35) for a distance of at least 100mm.

56. A dispensing apparatus as claimed in Claim 55 characterised in that the main delivery auger (20) extends into the dispensing apparatus for a distance of at least 200mm.

57. A dispensing apparatus as claimed in Claim 56 characterised in that the main delivery auger (20) extends into the dispensing pipe (35) for a distance of approximately 250mm.

58. A dispensing apparatus comprising a hopper (1) having a base (74), an upstanding side wall (77,78,79) extending upwardly from the base (74), and an elongate discharge means (84) extending across the base (74) for discharging material through a dispensing outlet (85) means, the discharge means (84) being movable relative to the base (74) so that the discharge means (84) may be swept over the base (74).

59. A dispensing apparatus as claimed in Claim 58 characterised in that the discharge means (84) is sweepable over substantially the entire base (74).

60. A dispensing apparatus as claimed in Claim 59 characterised in that the base (74) is a four sided base (74) having a pair of first opposite sides (77,78) and a pair of second opposite sides (79), the discharge means (84) extending between the two first opposite sides (77,78) and being movable with rectilinear motion between the second opposite sides (79) for sweeping the base (74) between the first and second opposite sides (79).

61. A dispensing apparatus as claimed in Claim 60 characterised in that the discharge means (84) extends substantially the length of the base (74) between the two first opposite sides (77,78).

62. A dispensing apparatus as claimed in Claim 61 characterised in that the discharge means (84) is carried on a carriage (86) movable along a track (89).

63. A dispensing apparatus as claimed in Claim 62 characterised in that the carriage (86) is located externally of the hopper (1).

64. A dispensing apparatus as claimed in Claim 62 characterised in that the discharge means (84) comprises an elongate auger (84) rotatably mounted on the carriage (86).

65. A dispensing apparatus as claimed in Claim 64 characterised in that a first drive means (88) is provided for rotating the auger.

66. A dispensing apparatus as claimed in Claim 65 characterised in that the first drive means (88) is mounted on the carriage (86).

67. A dispensing apparatus as claimed in Claim 58 to 66 characterised in that the outlet means comprises a dispensing pipe 35.

68. A dispensing apparatus as claimed in Claim 67 characterised in that the auger (84) extends into the dispensing pipe (35).

69. A dispensing apparatus as claimed in Claim 67 characterised in that the auger (84) extends into the dispensing pipe (35) which in turn is connected to a conveying conduit (60).

70. A dispensing apparatus as claimed in Claim 69 characterised in that the conveying conduit (60) comprises a flexible material.

71. A dispensing apparatus as claimed in any of Claims 62 to 70 characterised in that a second drive means is provided for driving the carriage (86) along the track (89).

72. A dispensing apparatus as claimed in Claim 58 to 61 characterised in that the discharge means (84) is carried on at least one pivotable arm (99).

73. A dispensing apparatus as claimed in Claim 72 characterised in that the pivotable arm (99) is controllable by hydraulic/pneumatic control means (95).

74. A dispensing apparatus as claimed in Claim 73 characterised in that the control means (95) are located externally of the hopper (1).

75. A dispensing apparatus as claimed in Claim 74 characterised in that the discharge means (84) comprises an elongate auger (84) sweepable along the base of the hopper (1) by the pivotable arm (99).

76. A dispensing apparatus as claimed in Claim 75 characterised in that the pivotable arm (99) is suspended from a pivot point external the hopper side wall (77,78).

77. A dispensing apparatus as claimed in Claim 76 characterised in that the elongate auger (84) is attached to a pivotable arm (99) at each end.

78. A dispensing apparatus as claimed in Claim 77 characterised in that the dispensing outlet (85) comprises a dispensing pipe (35).

79. A dispensing apparatus as claimed in any of Claims 58 to 78 characterised in that the hopper (1) comprises a pair of spaced apart first side walls (77,78) extending upwardly from the respective first sides (75) of the base (74), the first side walls (77,78) being joined by a pair of spaced apart second side walls (79) which extend upwardly from the respective second sides (76) of the base (2).

80. A dispensing apparatus as claimed in Claim 79 characterised in that one or both of the second side walls (79) diverge downwardly outwardly.

81. A dispensing apparatus as claimed in Claim 80 characterised in that one or both of the first side walls (77,78) diverge downwardly outwardly.

82. A dispensing apparatus as claimed in any of Claims 79 to 81 characterised in that returns (80) are provided extending between the respective second sides (76) of the base (74) and the second side walls (79) for accommodating the auger (84) in its two extreme positions.

83. A dispensing apparatus as claimed in Claim 82 characterised in that the returns (80) are sized and shaped for facilitating cooperation between the auger (84) and lower edges of the respective second side walls (79) for removing any ice build up on the respective second side walls (79) adjacent the lower edges thereof as the auger (84) moves into and/or out of the respective returns (80).

84. A dispensing apparatus as claimed in any Claims 58 to 83 characterised in that a pair of elongate slots (87) are provided in each first side wall (77,78) for accommodating the discharge means (84).

85. A dispensing apparatus as claimed in Claim 84 characterised in that moveable sealing means are disposed between the auger (84) and the elongate slots (87).

86. A dispensing apparatus as claimed in Claim 85 characterised in that the sealing means comprises a sliding plate.

87. A dispensing apparatus as claimed in Claim 85 characterised in that the sealing means comprises a flexible material.

88. A dispensing apparatus as claimed in Claim 84 characterised in that the elongate slots (87) are downwardly arcuate to follow the arcuate path of the auger (84).

89. A dispensing apparatus as claimed in any of Claims 67 to 88 characterised in that the dispensing pipe (35) feeds into a two way valve (91) for selectively communicating a dispensing pipe (35) with the conveying conduit (60) and a conveying medium supply source (93) for delivering material from the hopper (1) into the dispensing pipe (35) and for subsequent conveying of the material therethrough.

90. A dispensing apparatus as claimed in any of Claims 65 to 89 characterised in that the first drive means (88) intermittently drives the discharge auger (84) for intermittently discharging material through the dispensing pipe (35).

91. A dispensing apparatus as claimed in any Claims 31 to 90 further comprising a receptacle (100,105) disposed below the base for receiving material from the hopper (1).

92. A dispensing apparatus as claimed in Claim 91 characterised in that the receptacle comprises a moveable cart (100).

93. A dispensing apparatus as claimed in Claim 92 further comprising a chute (103) disposed between the hopper (1) and the cart (100) or the receptacle (105).

94. A dispensing apparatus as claimed in any of Claims 58 to 93 characterised in that the discharge means (84) is pressure controlled.

95. A dispensing hopper comprising a base (2) and a side wall (3,4,5,6,77,78,79) upstanding from the base (2) characterised in that at least one opposing face of the side walls (3,4,5,6,77,78,79) is inclined inwardly upwardly for preventing

bridging of material within the hollow interior region (8) of the hopper (1).

96. A dispensing hopper as claimed in Claim 95 characterised in that the hopper (1) comprises four side walls (3,4,5,6,77,78,79) extending upwardly from the base (2).

97. A dispensing hopper as claimed in Claim 96 characterised in that opposite pairs of the side walls (3,4,5,6,77,78,79) are inclined inwardly upwardly towards each other.

98. A dispensing apparatus comprising a dispensing hopper (1) as claimed in any of Claims 95 to 97.

99. A dispensing apparatus as claimed in Claim 98 comprising at least one auger (20,25,84) disposed at the base (2) of the hopper (1).

100. A dispensing apparatus as claimed in Claim 99 characterised in that the at least one auger (20,25,84) extends across the entire base (2) of the hopper (1).

101. A dispensing apparatus as claimed in Claim 100 characterised in that the at least one auger (20,25,84) comprises a plurality of augers (20,25,84) arranged side by side in the hopper.

102. A dispensing apparatus as claimed in Claim 100 characterised in that the at least one auger (20,25,84) comprises an auger (20,25,84) moveable relative to the base so that the auger (20,25,84) may be swept over the base.

103. A dispensing apparatus as claimed in Claim 101 or 102 further comprising a principle delivery auger (20,84) for receiving material from the series of augers (25) or the moving auger (84) and discharging material from the hopper (1).

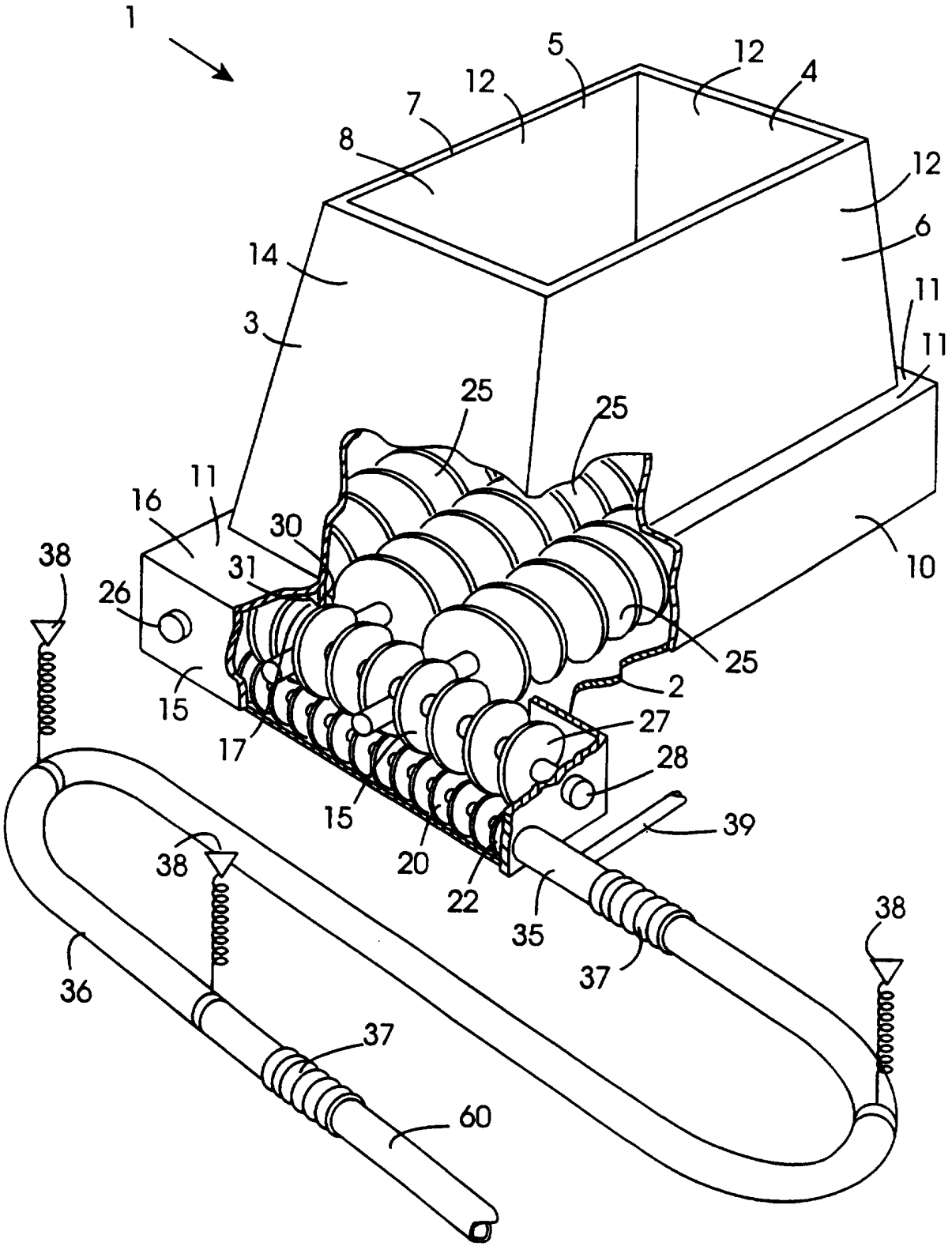
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Fig. 1

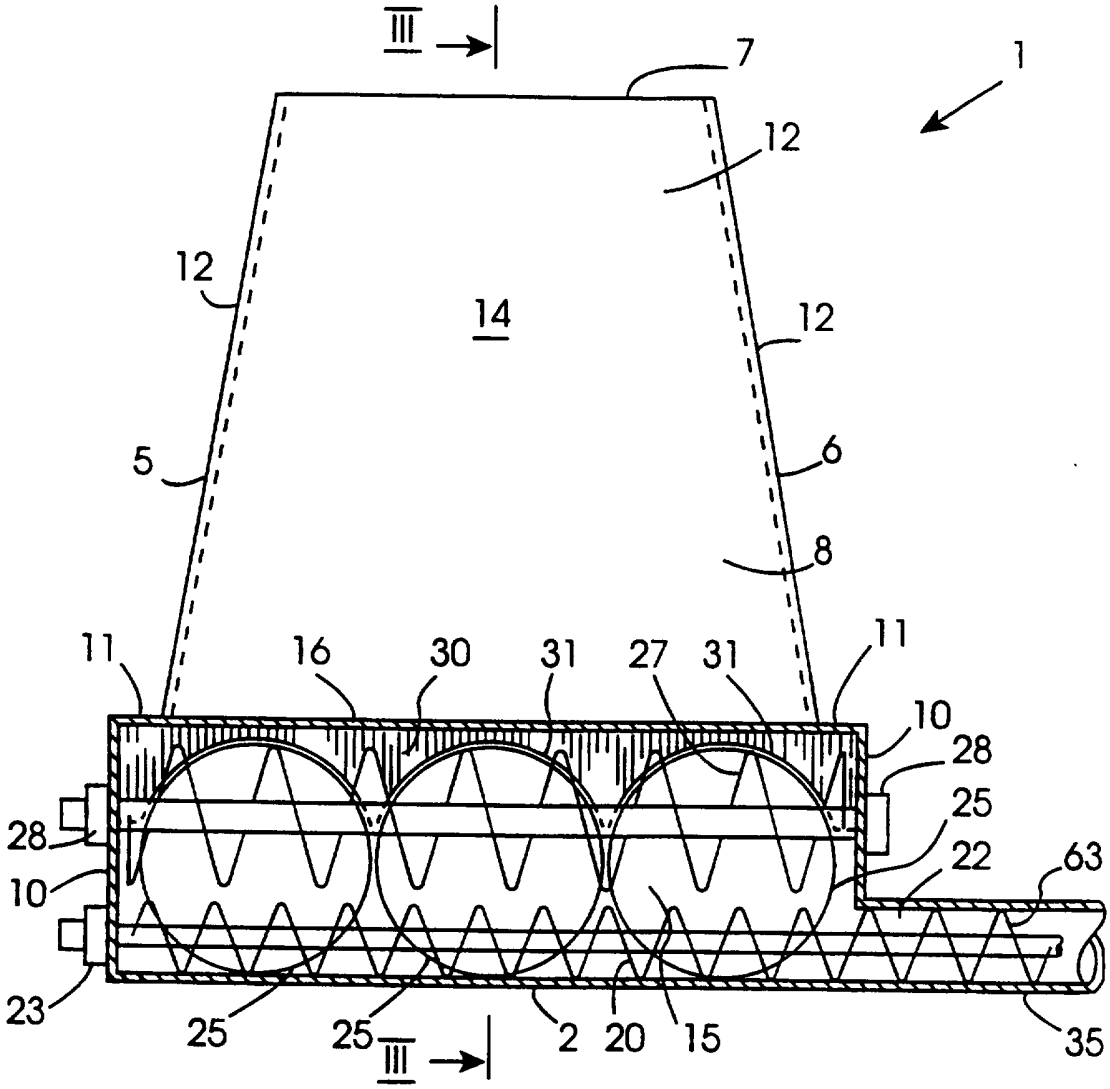
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Fig. 2

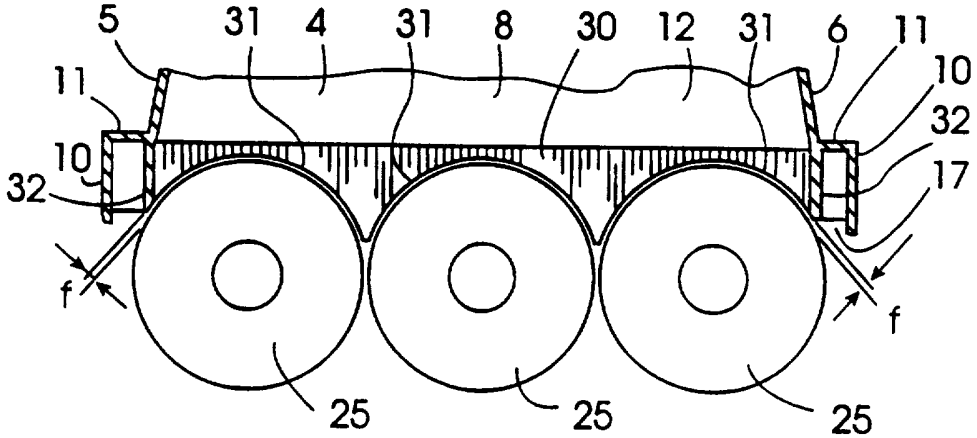
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Fig. 4

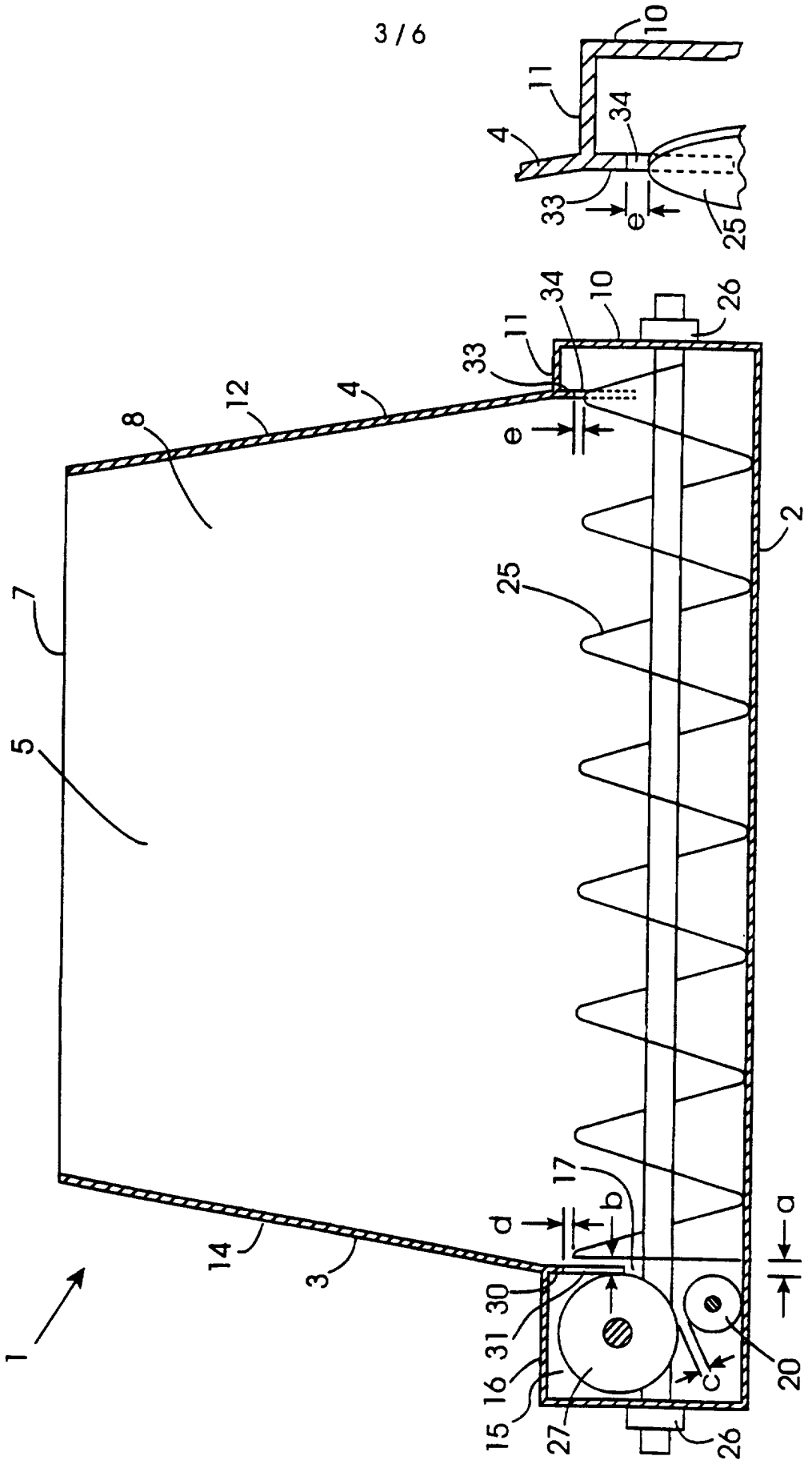
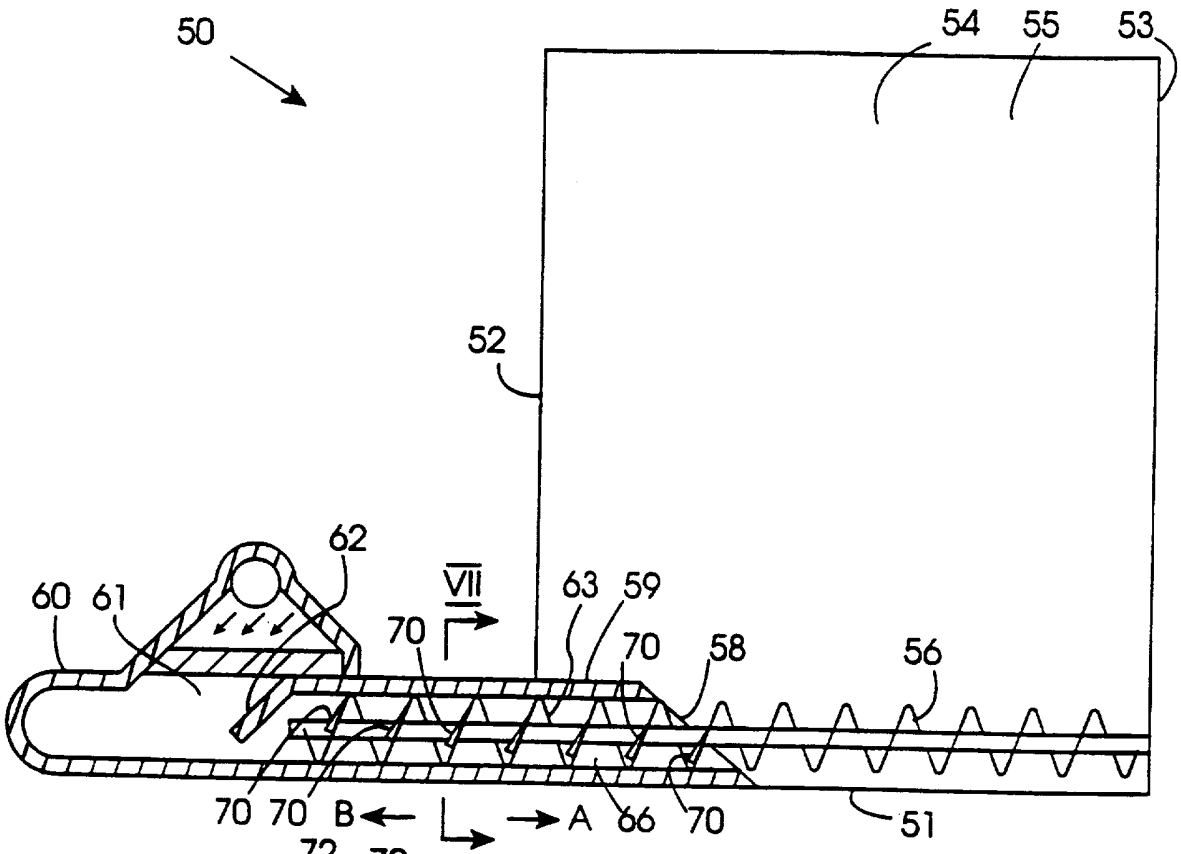


Fig. 5

Fig. 3



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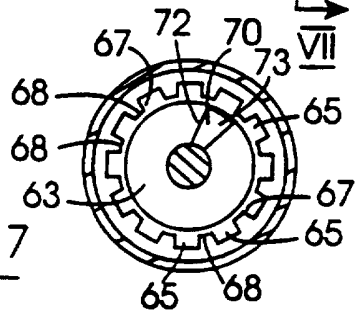
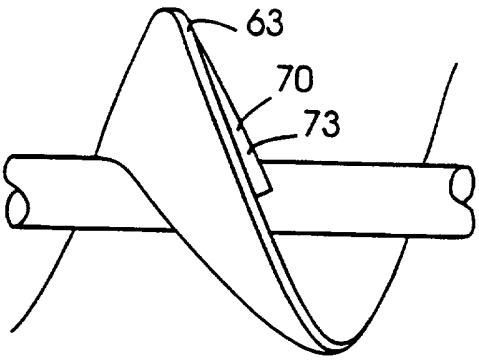


Fig. 7



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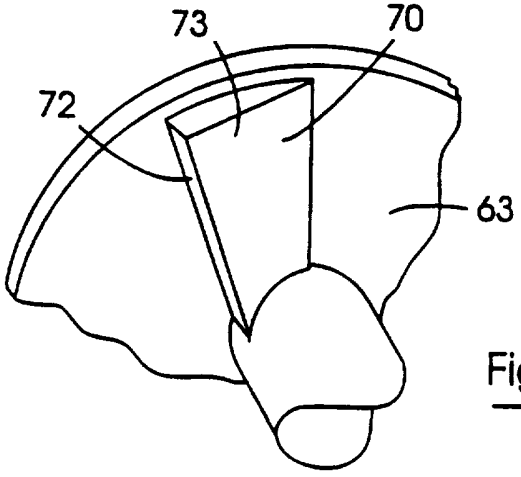

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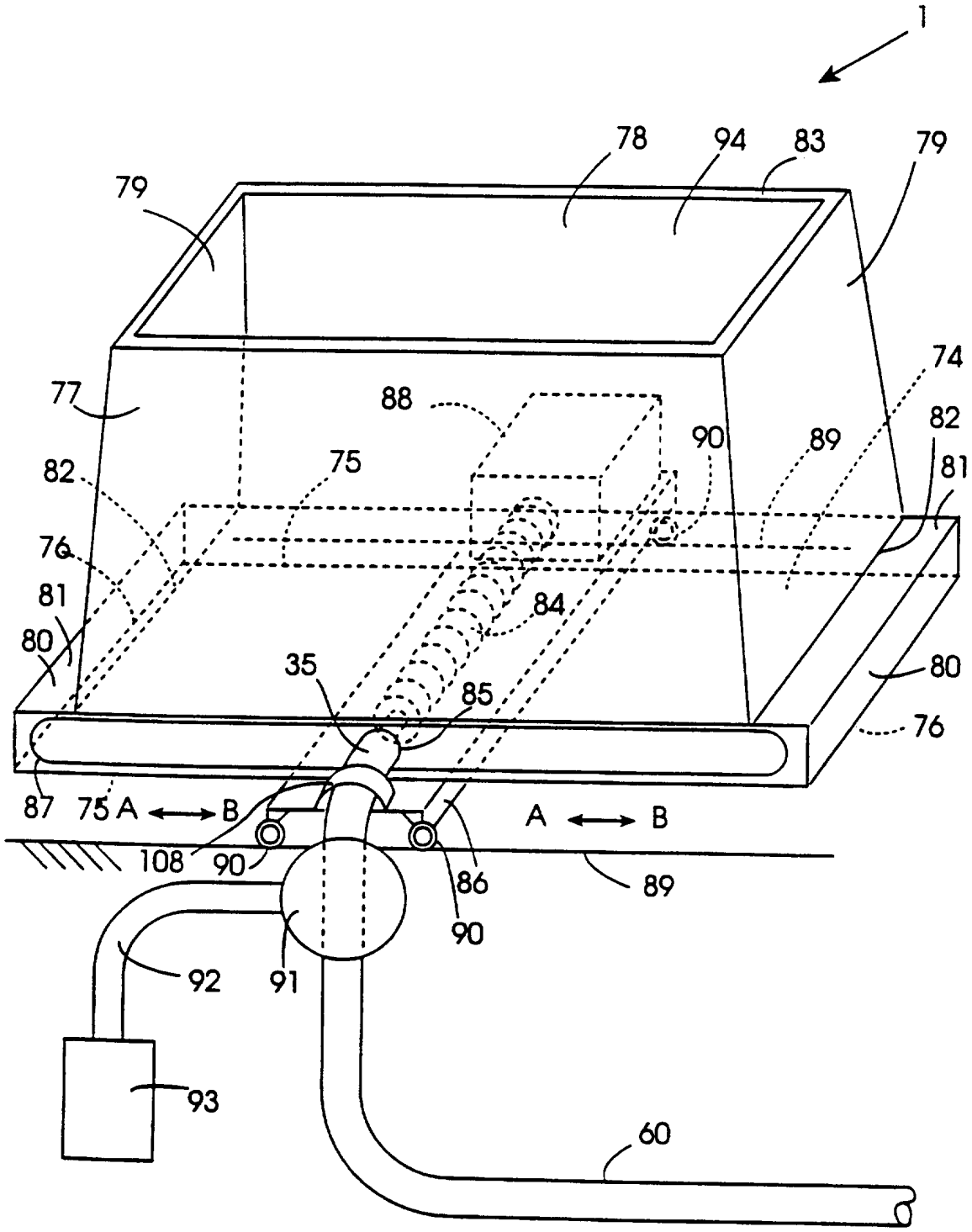
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Fig. 10

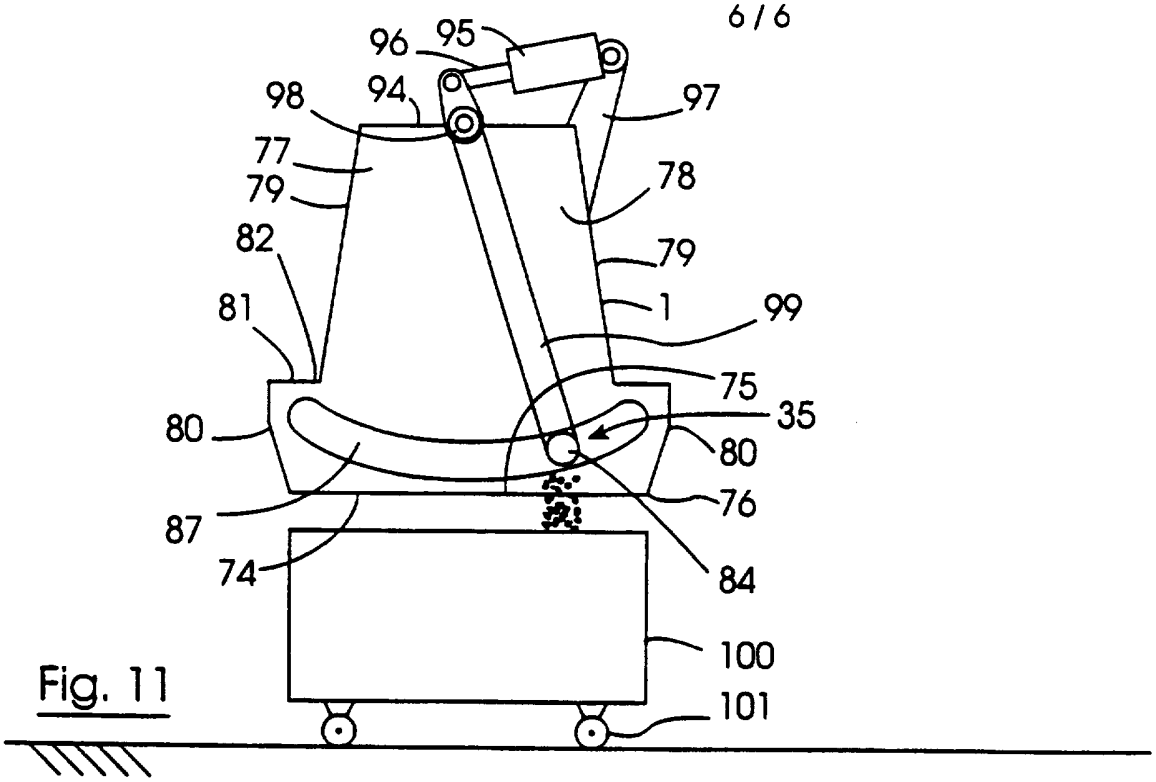
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Fig. 11

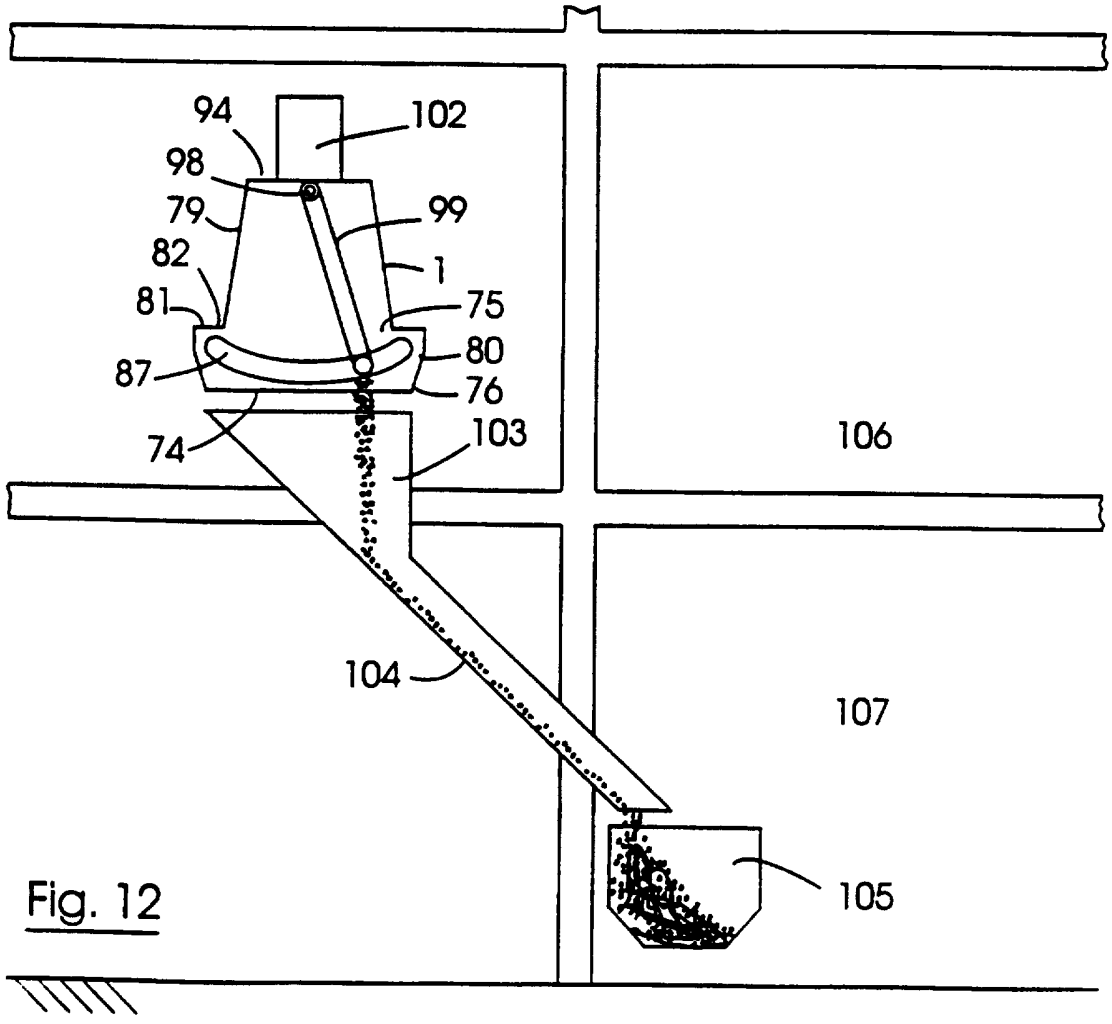
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Fig. 12

INTERNATIONAL SEARCH REPORT

Inte. nal Application No
PCT/IE 97/00008

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F25C5/00 B65G65/46

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)
IPC 6 F25C B65G

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	US 3 136 454 A (KEMPTON) 9 June 1964 see column 3, line 29 - line 38; figure 3 ---	1,16,17, 19 31
Y X	DE 26 18 911 A (WALDEMAR GLOWATZKI) 1 December 1977 see page 9, paragraph 1 - page 11, paragraph 1; figures 1-5 --- -/--	42-45, 79-81, 101-103 95-100

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 June 1997	13.06.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Boets, A

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INTERNATIONAL SEARCH REPORT

Inter. ial Application No
PCT/IE 97/00008

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	US 3 785 512 A (GATZ) 15 January 1974 see column 2, line 35 - column 5, line 54; figures 1-4	101,103 1,31,39, 46,47
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