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(54) Title: A method for the handling of aggregate in an asphalt plant

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"A method of handling aggregate in an asphalt plant"

Introduction

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The present invention relates to an improved method of handling aggregate in an asphalt plant.

There are various problems in asphalt plants.

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One of the major problems relates to the drying of stone or aggregate material. If the asphalt is to be manufactured correctly, it is essential that when the aggregate is delivered into the asphalt mixer, the aggregate be dry and that additionally, as well as being dry, the aggregate must be sufficiently warm so that when it is mixed with the bitumen, the bitumen is not chilled unduly, as the bitumen must retain its fluidity if it is to coat the asphalt and if it is to mix successfully with the finer aggregate such as filler material.

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Furthermore, what is generally done during asphalt manufacture is to deliver metered quantities of the various aggregates to the dryer drum, dry the aggregate under fairly intense heat and then remove the aggregate from the drum onto a screen where it is again screened into the correct sizes where they are then placed or delivered into holding bins which are insulated. Then, they are delivered from the holding bins to a weigh hopper and into the mixer.

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Essentially, the initial batching or weighing of the aggregate into the dryer is a relatively crude weighing for the very simple reason that, if nothing else, the abrading of the aggregate in the dryer will cause additional fragmentation, so that one would expect to get a greater output of finer materials in the resultant batch, after drying, than before.

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Further, the drying operation will also lead to the formation of dust and fine filler material, etc. which has to be removed and in some way handled for removal or further processing.

- 2 -

In addition, the processing and handling of the aggregate and filler material results in degradation of the previously metered aggregate and filler material. Thus, the metering and obtaining the correct proportions of the materials used in asphalt manufacture can be problematic when manufactured on an industrial scale.

The present invention is directed towards overcoming these problems and providing an improved method of handling the aggregate and fine filler material for subsequent use in the manufacture of asphalt on an industrial scale.

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Statements of Invention

According to a first aspect of the invention, there is provided a method of handling aggregate material in an asphalt plant comprising:

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passing aggregate material from a storage bin (2,3) through a coarse screen (4);

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delivering the aggregate material from the coarse screen (4) to a rotary dryer drum (5) at a proximal drum inlet;

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transporting the aggregate material in contra flow to combustion gases delivered from a burner located at a distal exit of the drum;

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initially causing the aggregate material to be delivered into the combustion gases being delivered from the burner and then to be substantially retained against the interior wall of the drum, as the aggregate material approaches the burner to prevent burning of the aggregate material by the hot gases to form dried and heated aggregate material;

collecting the products of combustion as it exits the dryer (5);

filtering the products of combustion to provide fine filler material;

storing the fine filler material in a filler bin (10);

removing exhaust gases via an exhaust fan (8);

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transporting the dried and heated aggregate material via elevator buckets (6, 130) to a screen assembly (7), wherein the elevator buckets (6, 130) comprise at least one air release hole (131) such that when the elevator buckets are inverted for delivery of the dried and heated aggregate material to the screen assembly (7), air is delivered through the air release holes which prevents retention by vacuum of the dried and heated aggregate material;

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passing the dried and heated aggregate material through a screen assembly which is a vibrating multi-deck screen assembly (7) to form screened aggregate;

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delivering the screened aggregate material to heat-insulated holding bins (13,14,15,16);

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storing the screened aggregate material in heat-insulated holding bins (13,14,15,16) and the fine filler material in a filler bin (10);

introducing air into the filler bin (10) via an air injection system (120, 121, 122) located adjacent the outlet end of the filler bin (10) and delivering a set amount of fine filler material from the filler bin (10) through a rotary metering valve (11) located at the outlet of the filler bin (10) to a screw feeder (125) and then to a filler weigher hopper (12);

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delivering a set amount of screened aggregate by screw feeders to a weigher hopper (17);

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discharging the contents of both weigher hoppers (12, 17) into an asphalt mixing drum (20);

delivering hot bitumen to the asphalt mixing drum (20) from a heated bitumen kettle;

5 mixing the asphalt; and

delivering the asphalt out of the asphalt mixing drum.

According to a second aspect of the invention, there is also provided an apparatus for
10 handling aggregate material in an asphalt manufacturing plant comprising:

a number of storage bins (2, 3) housing aggregate material;

15 a coarse screen (4) located downstream of the storage bins (2, 3) for screening the aggregate material from the storage bins (2, 3);

a dryer (5) located downstream of the coarse screen (4) for heating and drying the aggregate material;

20 an exhaust fan (8) for extracting exhaust gases and entrained fine material from the dryer (5);

a cyclone filter (9) located between the exhaust fan (8) and the dryer (5) for separating the exhaust gases from the fine material;

25 a filler bin (10) located adjacent to the cyclone filter (9) for collecting the separated fine filler material wherein the filler bin (10) comprises an air injection system (120, 121, 122) adjacent to the the outlet end of the filler bin (10) which delivers air into the filler bin (10) to ensure free flow of filler
30 material from the filler bin (10) to a rotary metering valve (11) located at the outlet of the filler bin (10);

a screw feeder (125) located next to the rotary metering valve (11) for delivery of a set amount of fine filler material to the filler weigher hopper

(12);

a bucket elevator (6, 130) for delivering heated aggregate material from the dryer (5) to a vibrating multi-deck screen assembly (7) ;

a number of heat-insulated storage bins (13, 14, 15, 16) located below the vibrating multi-deck screen assembly (7) for storing the heated aggregate material;

10 an aggregate weigh hopper (17) for weighing a set amount of hot aggregate material delivered from one or more of the heat-insulated storage bins (13, 14, 15, 16); and

15 an asphalt mixing drum (20) for mixing together the set amounts of heated aggregate material and fine filler material to produce asphalt.

Detailed Description of the Invention

20 It will be understood that the aggregate material is chosen from one or more of the following including sand, gravel, crushed stone, slag, and/or recycled concrete.

25 According to a general aspect, the present invention is directed towards providing an improved method of handling the aggregate and fine filler material for subsequent use in the manufacture of asphalt on an industrial scale. In particular the invention provides a method for ensuring that the aggregate material and fine filler material required for asphalt production are provided in the correct amount to the asphalt mixing drum, thereby overcoming the problems associated with the handling, drying and fragmentation of the asphalt raw materials.

30 Previously, there have been problems with aggregate material being degraded and/or lost during the handling steps. Furthermore, the fine filler material produced during the drying of the aggregate can be difficult to handle. The present invention addresses these problems by providing a method with several defined stages.

The present invention provides a method wherein metered quantities of various aggregate material (aggregate material, sand etc) are delivered, preferably by conveyors, to a dryer which is rotated and which mounts a burner delivering hot combustion gases at the distal end of the drum. The aggregate material which has
5 been crudely metered is delivered into the drum at the proximal end of the drum. Firstly, the aggregate is tossed vigorously around the drum abrading against itself and against the side walls of the drum, so that the aggregate is tossed, as it were, within the hot combustion gases being delivered towards the proximal end of the drum. Then, as the aggregate is delivered along the drum, it is retained more against
10 the sides of the drum as it approaches the burner at the distal end of the dryer. In this way, the aggregate is then retained against the side walls of the drum and does not burn as it would if it were to be exposed directly to the hottest part of the burner flame. This is one of the advantages of the dryer of the present invention. The heated aggregate material is then delivered out of the dryer.

15 Another important aspect of the invention is that metering may take place at several points during the asphalt manufacturing process. It will be appreciated that it is not sufficient to simply meter the aggregate before it goes into the dryer because the aggregate material will naturally be abraded and reduced in size in the dryer.

20 For example, the aggregates are delivered out of the various standard cold storage bins to the dryer in a normal manner by means of, for example, chutes and conveyors, each of the chutes ideally having a door which is opened for a sufficient time to allow the desired quantity of aggregate to be delivered by the conveyor to the
25 dryer. This is a relatively crude metering and can be assisted by measuring the number of inversions of the motor driving the conveyor so that the speed of the conveyor can be accurately assessed by calibration. It is then possible to fairly easily determine when a hopper door is open and just what quantity of material has been delivered out the hopper or bin door.

30 In one embodiment of the invention, the amount of aggregate being delivered to the dryer may be continuously weighed to determine the amount of aggregate in the dryer.

Additionally, the delivery of the aggregate may be further monitored by measuring the number of inversions of the motors driving the conveyors delivering the aggregate to the dryer.

- 5 After being delivered out of the dryer, the hot dry aggregate is delivered by bucket elevators into a multiple deck screen where it is screened again into desired sizes and stored in insulated holding bins.

10 The present invention also addresses problems associated with bucket elevators and delivery of hot dry aggregate. The elevator buckets of the invention comprise air release holes such that when the elevator buckets are inverted for delivery of the dried and heated aggregate material to the screen assembly air is delivered through the air release holes which prevents retention by vacuum of the dried and heated aggregate material. This is one of the major advantages of the present invention and
15 again ensures that the correct amount of aggregate material reaches the next stages of the process, the vibrating multi-deck screen.

According to another embodiment of the invention, the vibrating multi-screen deck assembly is provided with a steel wear plate. The advantage of the aggregate
20 material being discharged onto the steel wear plate is that it is better able to take the wear and tear that the top screen mesh which would wear away very quickly due to abrasion of the material discharged from the bucket elevator.

The dried, heated and screened and correctly metered aggregate material is then
25 stored in hot storage bins.

At the same time, the dust and exhaust material (caused by abrasion fragmentation of the aggregate in the dryer) that exits from the dryer is filtered, optionally bagged, and then sent to a filler bin which is ideally mounted adjacent a weigh hopper in the
30 asphalt plant. Any waste gases are released out of the plant via an exhaust.

Thus, the present invention uses in the production of asphalt the previously unwanted products of combustion, this fine filler material. This is another major advantage of the present invention.

However, delivery of the fine filler material from the filler bin to the weigher hopper can be problematic. The present invention provides a method for the accurate measuring and delivery of this filler material to the weight hopper so that the correct
5 amount of filler material can be mixed in the asphalt mixer along with the screened and heated aggregate and hot bitumen to form asphalt.

Previously, fine filler material was dropped onto a screw conveyor which fed into a weigher hopper. However, when the screw conveyor stopped, because of the air
10 pressure within the filler bin, there was a blow-through of filler material through the screw conveyor so that additional material ended up in the weigh hopper. This led to very inaccurate quantities of material ending up in the weigh hopper. This was very erratic sometimes and might happen and other times might not happen and various different amounts would end up in the weigh hopper each time the feed of the screw
15 conveyor was stopped. The method and apparatus of the present invention overcomes this problem.

Firstly, there is provided a rotary vane feeder or metering valve located between the filler bin and screw conveyor. This substantially isolates the air in the silo from the
20 screw conveyor. Even if some air leaks past the vanes into the screw conveyor, it is not enough to blow material through the screw conveyor. This makes the feed much slower. However, this is not a problem as there is plenty of time in the weighing of other aggregate materials etc. and it also allows for very accurate metering of the material into the filler weigh hopper.

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Additionally, the filler bin is also provided with a pressurized air supply source with an air injection system adjacent the outlet end to ensure free flow of filler material.

According to a preferred embodiment of the invention, pressurised air from a
30 pressurised air supply feeds a manifold with a number of circumferentially spaced-apart air inlets for delivery of air to the silo.

Once the filler material, aggregate material and hot bitumen have been accurately measured, they are mixed in the asphalt mixing drum to form bitumen.

In the final steps of the invention, the hot bitumen is delivered to the asphalt plant from a bitumen kettle and the bitumen is often at a temperature of the order of 180°C. It is essential, however, that the temperature is in excess of 165° so as to ensure that efficient mixing and coating of the aggregate, filler and bitumen takes place. This means that the aggregate has to be both dry and hot because if not, then the temperature of the bitumen will fall too low and it will then no longer be able to coat the stone. The present invention overcomes these problems.

10 **Brief Description of the Drawings**

Fig. 1 is a schematic illustration of the asphalt production process and apparatus of the invention;

15 Fig. 2 is a schematic sectional elevational view of a dryer apparatus used in the process;

Fig. 3 is a detail perspective view showing an inlet portion of the dryer apparatus;

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Fig. 4 is a detail perspective view showing an intermediate portion of the dryer apparatus;

Fig. 5 is a detail perspective view showing a final stage portion of the dryer apparatus;

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Fig. 6 is another detail perspective view of the final stage portion of the dryer apparatus;

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Fig. 7 is a schematic elevational view of an asphalt production apparatus used in the process;

Fig. 8 is a detail schematic illustration showing filler material handling apparatus of the asphalt mixing plant;

Fig. 9 is a detail perspective view showing an inlet of a multi-deck screen forming portion of the asphalt mixing plant;

5 Fig. 10 is a detail, partially cut-away view showing the multi-deck screen;

Fig. 11 is a detail perspective view of a bucket forming portion of a bucket conveyor used in the asphalt mixing plant.

10 The invention will now be more clearly understood from the following description of some embodiments thereof given by way of example only with reference to the accompanying drawings.

Referring to the drawings, Fig. 1 shows the general layout of the asphalt mixing plant and apparatus of the invention indicated generally by the reference numeral 1. The apparatus 1 includes raw material storage bins 2, 3 for aggregate material and sand. Selected quantities of raw material from the bins 2, 3 are delivered as required through a coarse screen 4 to a dryer 5. As the raw materials pass through the dryer 5, they are heated to a required temperature. Upon discharge from the dryer 5 the heated raw materials are delivered by a bucket elevator 6 onto a vibrating multi-deck screen 7. A burner is used to heat the air within the dryer 5 for heating the raw materials. An exhaust fan 8 draws out exhaust gases and any entrained fine material through a cyclone filter 9. The cyclone filter 9 separates out the fine dust material from the exhaust gases. The exhaust gases are delivered to a flue for venting to atmosphere in the usual way. The fine material is delivered from the cyclone filter 9 to a filler silo 10. The filler silo 10 discharges material as required through a rotary vane feeder 11 to a filler weigh hopper 12.

The vibrating multi-deck screen 7 separates the heated aggregate material into different sizes (typically 6mm, 10mm, 15mm, 20mm), each of which is then collected and stored in hot stone storage bins 13, 14, 15, 16. Selected quantities of material from each bin 13, 14, 15, 16 can be delivered as required to a weigh hopper 17.

Selected ingredient materials are delivered from the filler weigh hopper 12, the

aggregate weigh hopper 17 and a bitumen kettle 18 into an asphalt mixer 20. After mixing in the asphalt mixer 20 the asphalt is discharged into a truck 22.

Referring now to Figs. 2 to 6, the construction and operation of the dryer 5 will be described. The dryer 5 comprises a cylindrical metal drum 25. A pair of spaced-apart metal bands 26 are mounted on an exterior of the drum 25. Each band 26 is supported on a pair of rollers 27. At least one pair of rollers 27 is driven to rotate the drum 25 on the roller supports 27.

The drum 25 has an inlet 28 at one end and an outlet 29 adjacent the other end. A burner assembly 30 is mounted adjacent the outlet end of the drum 25. The burner 30 is operable for heating air within the drum 25 to thus heat aggregate materials as they pass through the drum 25 between the inlet 28 and the outlet 29. The drum 25 is inclined downwardly slightly between the inlet 28 and outlet 29 so the aggregate materials will naturally feed under gravity between the inlet 28 and outlet 29.

The drum 25 has an inlet section 35, an intermediate heating section 36 and an outlet heating section 37. Circumferentially spaced-apart discharge buckets 38 at the outlet end of the drum 25 feed heated material from the final heating section 37 to the outlet 29.

As shown in Figure 3, the inlet section 35 has a number of spiral channels formed by inwardly extending walls 40 which project inwardly from the inside surface of the drum 25. A plurality of juxtaposed angle iron ribs 41 extend between the walls 40. The spiral channels formed by the walls 40 feed material quickly from the inlet 28 to the intermediate heating section 36. The channel section ribs 41 protect the interior of the drum 25 from abrasion by the aggregate material as it passes through the drum 25. Some of the aggregate material will lodge between the ribs to form a protective layer on the inside of the drum 25 so the incoming material is effectively abrading against itself as it moves into the drum 25. This is particularly advantageous as you can have very high wear rates on the drum sidewall without these ribs.

The aggregate material is then passed into the intermediate heating section 36. A

number of spaced-apart finger lifters 45 are arranged around the inside circumference of the drum 25. These lift up material as the drum rotates and pours the material out into the drum interior for heating by hot gases within the drum 25. Essentially this forms a curtain or "waterfall" of aggregate material across the gas stream for good heat transfer to the aggregate materials. A number of the angle iron ribs 41 are located between the finger lifters 45.

The finger lifters are shown in more detail in Fig. 4. These essentially comprise a shelf 50 which extends inwardly from the drum sidewall, a number of fingers 51 project upwardly at an innermost end of the shelf 50. Each finger 51 has a supporting web 52. This reinforces each finger 51 and prevents it collapsing which tends to happen as the fingers abrade and weaken due to the rubbing action of the aggregate on the fingers 51. Each of the finger lifters 45 is mounted by associated mounting brackets 55 on the drum sidewall to which they are bolted so they can be easily replaced as the fingers wear down.

After passing through the intermediate section 36, the aggregate material is then delivered into the final section 37. A number of spaced-apart combustion lifters 60 are arranged around the inside surface of the drum 25. These catch and keep the heated aggregate material around the drum sidewall. This keeps the aggregate material out of the flame from the burner 30 which could overheat and damage the aggregate material. Also they effectively form a band of material on the inside of the drum wall which helps insulate the drum sidewall from excessive heat due to the burner 30. Such excessive heat can cause expansion and cracking of the drum sidewall and bearing 26, 27 arrangement. There is also a fuel saving as less heat is lost through the drum sidewall due to the increased insulation effect.

The combustion lifters are shown in Figs. 5 and 6. They essentially comprise an elongate panel 61 spaced-apart from the drum sidewall with an outwardly bent leading edge 62 and trailing edge 63. The leading edge 62 is spaced-apart from the drum sidewall leaving a gap 64 while the trailing edge 63 engages the drum sidewall. Thus, aggregate material can enter through the gap 64 and collect within the lifters 60.

It will be noted also that one end wall 66 of each combustion lifter 60 is closed. The combustion lifters 60 are arranged in two rows. The downstream end wall 66 of the first row of combustion lifters 60 is closed, whereas the upstream end wall 66 of the second row of combustion lifters is closed. In this way material coming from the intermediate section 36 can enter an opening 68 as well as the opening 64 in the first row of combustion lifters 60, whilst the closed end wall at the opposite end prevents the material spilling out at the far end. As the combustion lifts the material up and around the top of the drum as it is coming down the far side, the opening 64 is then facing downwardly and the material can fall out of the opening. Because of the tilt of the drum 25, the material as it falls out of the first row of combustion lifters 60 moves downwardly towards the second row of combustion lifters 60. Here it can similarly enter through the opening 64 in the leading edge of each combustion lifter 60. For the second row of combustion lifters 60, the upstream end wall 66 is closed to prevent any material working back up the drum whereas the downstream end is open to allow discharge out from the opening 64 and the end wall into the discharge bucket arrangement 38. A canopy 70 extends over the burner 30 assembly to protect the burner assembly 30 from any falling aggregate. One side of this canopy 70 forms portion of an exit chute leading to the outlet 29 for discharge of heated aggregate material from the drum 25. As the discharge buckets 38 reach towards the top of the drum 25, they discharge material out into the exit chute 29 as shown in Fig. 6.

Referring now to Figs. 7 to 11, the asphalt mixing plant 80 is shown. This comprises an upright steel tower 81 with the various components mounted thereon.

Referring to Fig. 8, the handling of the filler material is shown in more detail. The filler material silo 10 has air injection adjacent the outlet end to ensure free flow of filler material. Pressurised air from a pressurised air supply 120 feeds a manifold 121 with a number of circumferentially spaced-apart air inlets 122. The rotary vane feeder 11 at the outlet of the silo 10 discharges material into a screw conveyor 125 which discharges the required material into the filler weigh hopper 12 when required. Previously, the material just dropped into a screw conveyor or the like and was fed along to the weigh hopper. However, this led to very inaccurate quantities of material ending up in the weigh hopper. When the screw conveyor stopped, because of the air pressure within the silo, they generally got a blow-through of material through the

screw conveyor so additional material ended up in the weigh hopper. This was very erratic sometimes and might happen and other times might not happen and various different amounts would end up in the weigh hopper each time the feed of the screw conveyor was stopped. The present invention overcomes this problem by installing a rotary vane feeder (otherwise known as rotary metering valve) 11 and an air supply system. The rotary vane feeder substantially isolates the air in the silo 10 from the screw conveyor 125. Even if some air leaks past the vanes into the screw conveyor, it is not enough to blow material through the screw conveyor 125. This makes the feed much slower. This is not a problem as there is plenty of time in the weighing of other aggregate materials etc. and it also allows for very accurate metering of the material into the filler weigh hopper 12. This is one of the major advantages of the present invention.

Referring in particular to Fig. 9 an inlet of the vibrating multi-screen 7 is shown. The bucket elevator 6 discharges aggregate material onto a steel wear plate 83. This is better able to take the wear and tear than the top screen mesh 84 which would wear away very quickly due to the input and abrasion of the material discharged from the bucket elevator 6. Also, because the bucket elevator 6 is discharging material from a side of the screen 7, the material tends to migrate to a back wall 85 of the screen 7 and then downwardly onto the mesh 84. Thus, only portion of the mesh 84 adjacent the back wall 85 was being used. To overcome this, a deflector plate or wall 86 is mounted on the wear plate 85 for directing the aggregate material onto a centre of the mesh 84 so that it will distribute fairly evenly over the mesh 84 as it travels to a bottom wall 88 of the screen 7.

Referring now to Fig. 10, the screen 7 is shown in more detail. The screen 7 has a rectangular base 90 with an upstanding wall 91, rear wall 85, top end wall 92 and bottom end wall 93. The bottom end wall 93 is lower than the top end wall 92 as the screen 7 is mounted on an incline to feed material between the top end wall 92 and bottom end wall 93. The screen 7 is mounted at each corner on springs 95. A vibrating mechanism 96 comprises a shaft 97 mounted in bearings 98 on the front wall 91 and rear wall 85 at a mid-way position. Eccentric weights 99 are mounted on the shaft 97 for creating the vibration as the shaft 97 rotates. The shaft 97 has a pulley 100 at one end which is driven by a drive belt 101 and drive pulley 102

connected to a drive motor 103. A number of vertically spaced-apart screens 84, 105, 106 are mounted within the screen 7. In operation, aggregate material is thrown out from the bucket elevator onto the top screen 84 and works its way down through the various screens 84, 105, 106 being directed off to the hot stone bins 13, 14, 15, 16 from the various screens. The vibrating mechanism is operated during use of the screen 7. A problem arises when stopping the vibrating mechanism due to the big weights 99 which just at the very end tend to swing back and forth shaking the whole screen and potentially causing damage. To overcome this problem, a controller 110 associated with the motor 103 operates at the very end when the weights are just about to start swinging back and forward to reverse the motor 103 very briefly for a half second or so that it stops the weights in their track and they just suddenly stop instead of swinging back and forth.

Fig. 11 shows a perspective view of a bucket of the bucket elevator 6, indicated generally by the reference numeral 130. The bucket 130 has two spaced-apart holes 131 drilled through the base 132 to add in the release of material from the bucket 130 and it is discharging into the screen 7 by breaking the vacuum in the bucket and venting air into the bucket to release the material.

In the specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms "include, includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation and vice versa.

The invention is in no way limited to the embodiment hereinbefore described but may be varied in both construction and detail.

CLAIMS

1. A method of handling aggregate material in an asphalt manufacturing plant (1) comprising:
 - 5 passing aggregate material from a storage bin (2,3) through a coarse screen (4);
 - 10 delivering the aggregate material from the coarse screen (4) to a rotary dryer drum (5) at a proximal drum inlet;
 - transporting the aggregate material in contra flow to combustion gases delivered from a burner located at a distal exit of the drum;
 - 15 initially causing the aggregate material to be delivered into the combustion gases being delivered from the burner and then to be substantially retained against the interior wall of the drum, as the aggregate material approaches the burner to prevent burning of the aggregate material by the hot gases to form dried and heated aggregate material;
 - 20 collecting the products of combustion as it exits the dryer (5);
 - filtering the products of combustion to provide fine filler material;
 - 25 storing the fine filler material in a filler bin (10);
 - removing exhaust gases via an exhaust fan (8);
 - 30 transporting the dried and heated aggregate material via elevator buckets (6, 130) to a screen assembly (7), wherein the elevator buckets (6, 130) comprise at least one air release hole (131) such that when the elevator buckets are inverted for delivery of the dried and heated aggregate material to the screen assembly (7), air is delivered through the air

release holes which prevents retention by vacuum of the dried and heated aggregate material;

5 passing the dried and heated aggregate material through a screen assembly which is a vibrating multi-deck screen assembly (7) to form screened aggregate;

10 delivering the screened aggregate material to heat-insulated holding bins (13,14,15,16);

 storing the screened aggregate material in heat-insulated holding bins (13,14,15,16) and the fine filler material in a filler bin (10);

15 introducing air into the filler bin (10) via an air injection system (120, 121, 122) located adjacent the outlet end of the filler bin (10) and delivering a set amount of fine filler material from the filler bin (10) through a rotary metering valve (11) located at the outlet of the filler bin (10) to a screw feeder (125) and then to a filler weigher hopper (12);

20 delivering a set amount of screened aggregate by screw feeders to a weigher hopper (17);

 discharging the contents of both weigher hoppers (12, 17) into an asphalt mixing drum (20);

25 delivering hot bitumen to the asphalt mixing drum (20) from a heated bitumen kettle;

 mixing the asphalt; and

30 delivering the asphalt out of the asphalt mixing drum.

2. The method according to claim 1 wherein the air is introduced into the filler bin (10) through an air injection system comprising pressurised air from a

pressurised air supply source (120) which feeds a manifold (121) with a number of circumferentially spaced-apart air inlets (122) for delivery of the pressurized air into the filler bin (10).

- 5 3. The method according to any of the preceding claims wherein the amount of aggregate material being delivered to the dryer is continuously weighed to determine the amount of aggregate material in the dryer.
- 10 4. The method according to any of the preceding claims wherein conveyors deliver the aggregate material to the dryer and the delivery of the aggregate material to the dryer is further monitored by measuring the number of inversions of the motors driving the conveyors delivering the aggregate to the dryer.
- 15 5. The method according to any of the preceding claims wherein the elevator buckets (6, 130) comprise two or more air release holes (131)
- 20 6. The method according to any of the preceding claims wherein the temperature of the bitumen is in excess of 165°C.
- 25 7. A method of handling aggregate material in an asphalt manufacturing plant substantially as hereinbefore described with reference to the accompanying description and/or drawings.
- 30 8. An apparatus for handling aggregate material in an asphalt manufacturing plant comprising:
 - a number of storage bins (2, 3) housing aggregate material;
 - a coarse screen (4) located downstream of the storage bins (2, 3) for screening the aggregate material from the storage bins (2, 3);
 - a dryer (5) located downstream of the coarse screen (4) for heating and drying the aggregate material;

- an exhaust fan (8) for extracting exhaust gases and entrained fine material from the dryer (5);
- 5 a cyclone filter (9) located between the exhaust fan (8) and the dryer (5) for separating the exhaust gases from the fine material;
- 10 a filler bin (10) located adjacent to the cyclone filter (9) for collecting the separated fine filler material wherein the filler bin (10) comprises an air injection system (120, 121, 122) adjacent to the the outlet end of the filler bin (10) which delivers air into the filler bin (10) to ensure free flow of filler material from the filler bin (10) to a rotary metering valve (11) located at the outlet of the filler bin (10);
- 15 a screw feeder (125) located next to the rotary metering valve (11) for delivery of a set amount of fine filler material to the filler weigher hopper (12);
- 20 a bucket elevator (6, 130) for delivering heated aggregate material from the dryer (5) to a vibrating multi-deck screen assembly (7) ;
- 25 a number of heat-insulated storage bins (13, 14, 15, 16) located below the vibrating multi-deck screen assembly (7) for storing the heated aggregate material;
- an aggregate weigh hopper (17) for weighing a set amount of hot aggregate material delivered from one or more of the heat-insulated storage bins (13, 14, 15, 16); and
- 30 an asphalt mixing drum (20) for mixing together the set amounts of heated aggregate material and fine filler material to produce asphalt.
9. The apparatus according to claim 8 further comprising a hot bitumen bin and a bitumen weigher hopper (18).

10. The apparatus according to claim 8 or claim 9 wherein the air injection system comprises pressurised air from a pressurised air supply (120) which feeds a manifold (121) comprising a number of circumferentially spaced-apart air inlets (122) for delivery of the pressurized air to the filler bin (10).
5
11. An apparatus substantially as hereinbefore described with reference to the accompanying description and/or drawings.

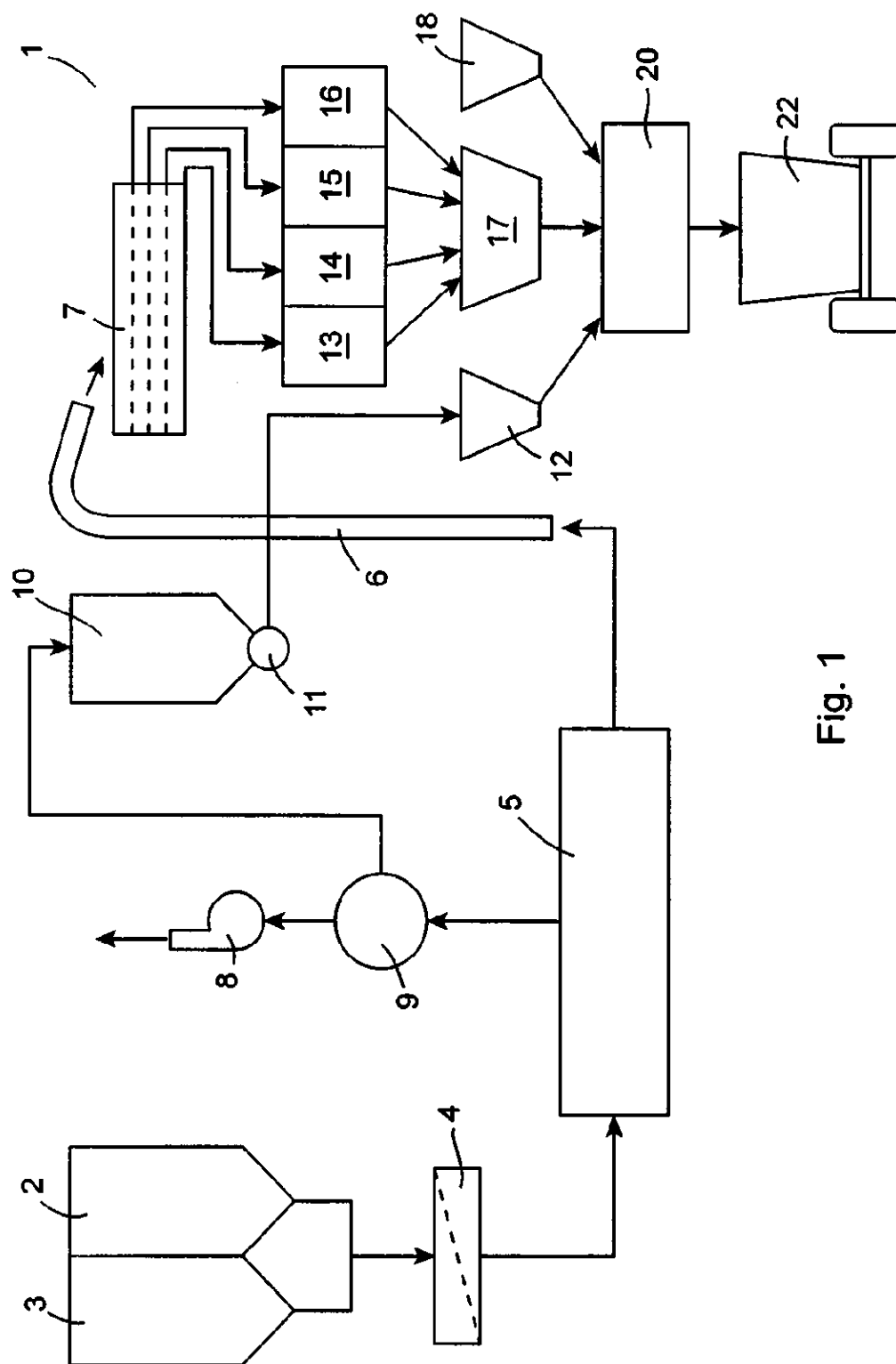


Fig. 1

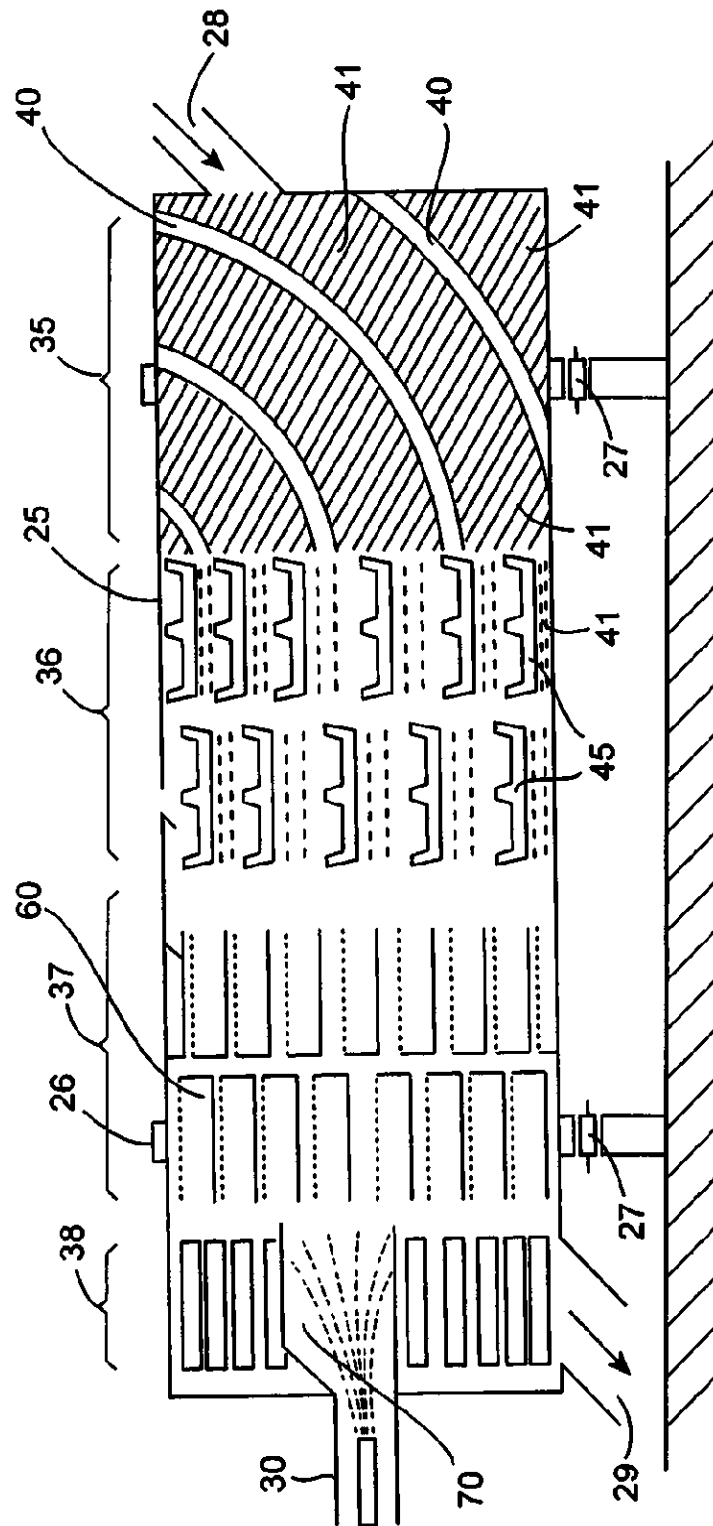


Fig. 2

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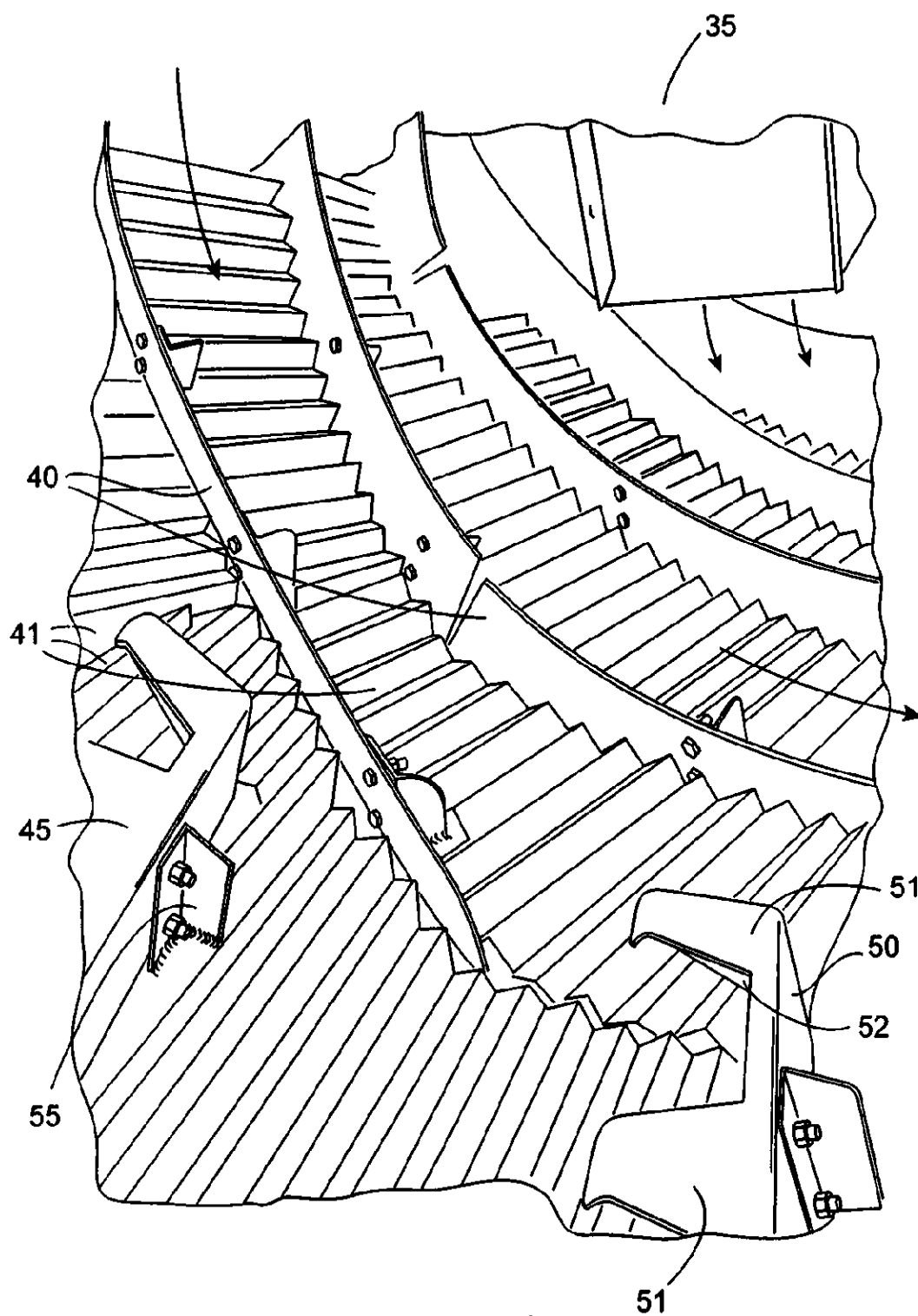
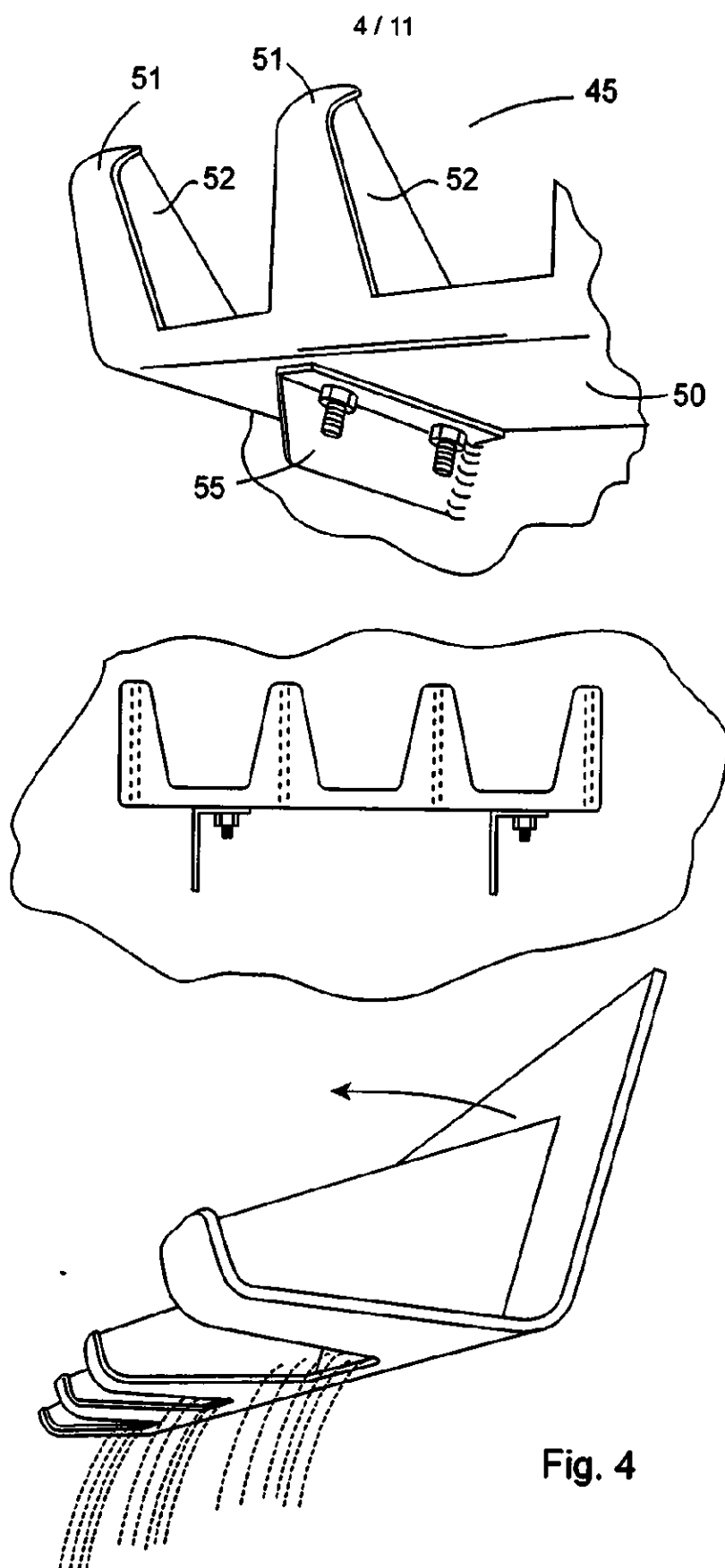


Fig. 3



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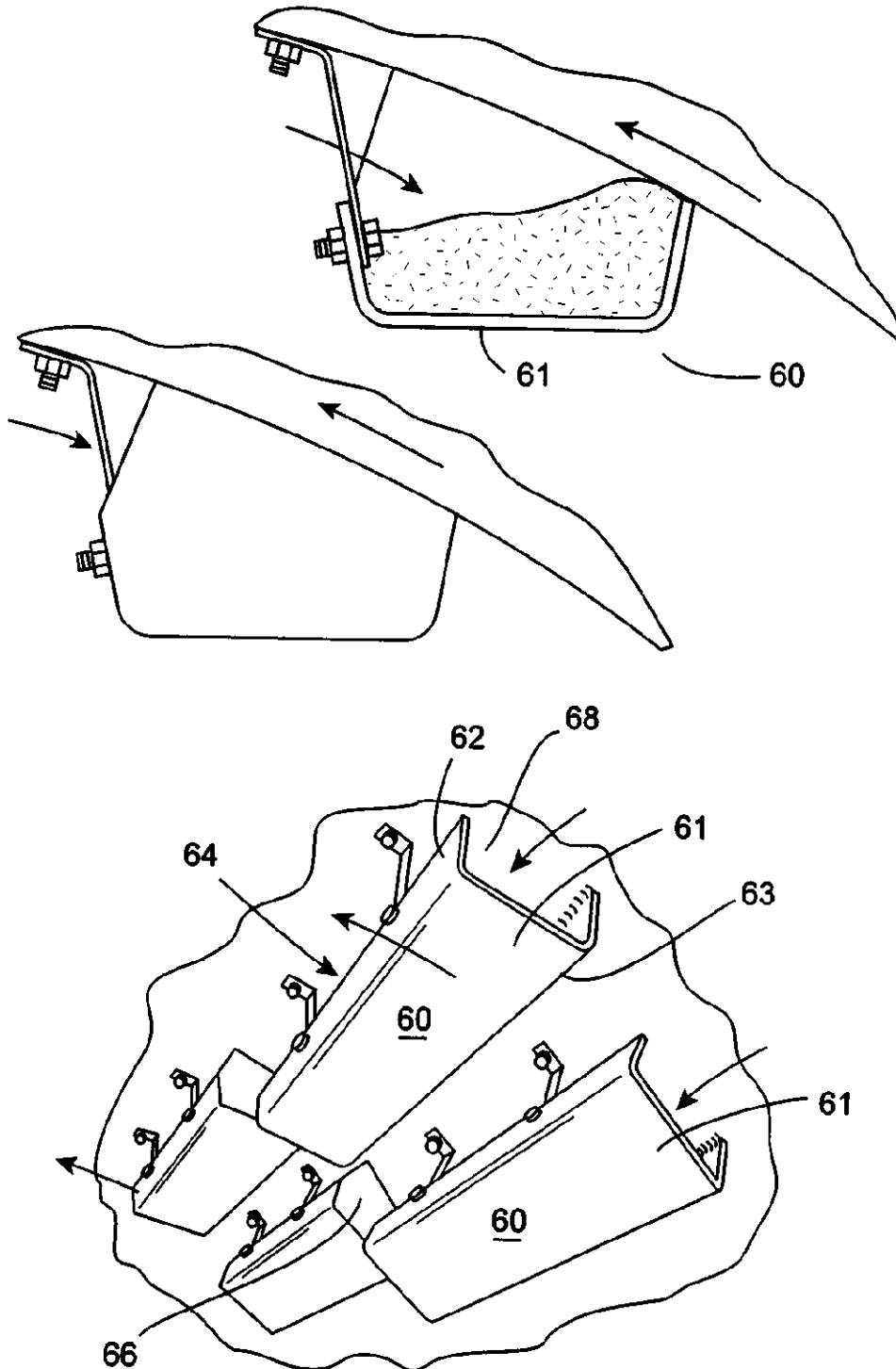


Fig. 5

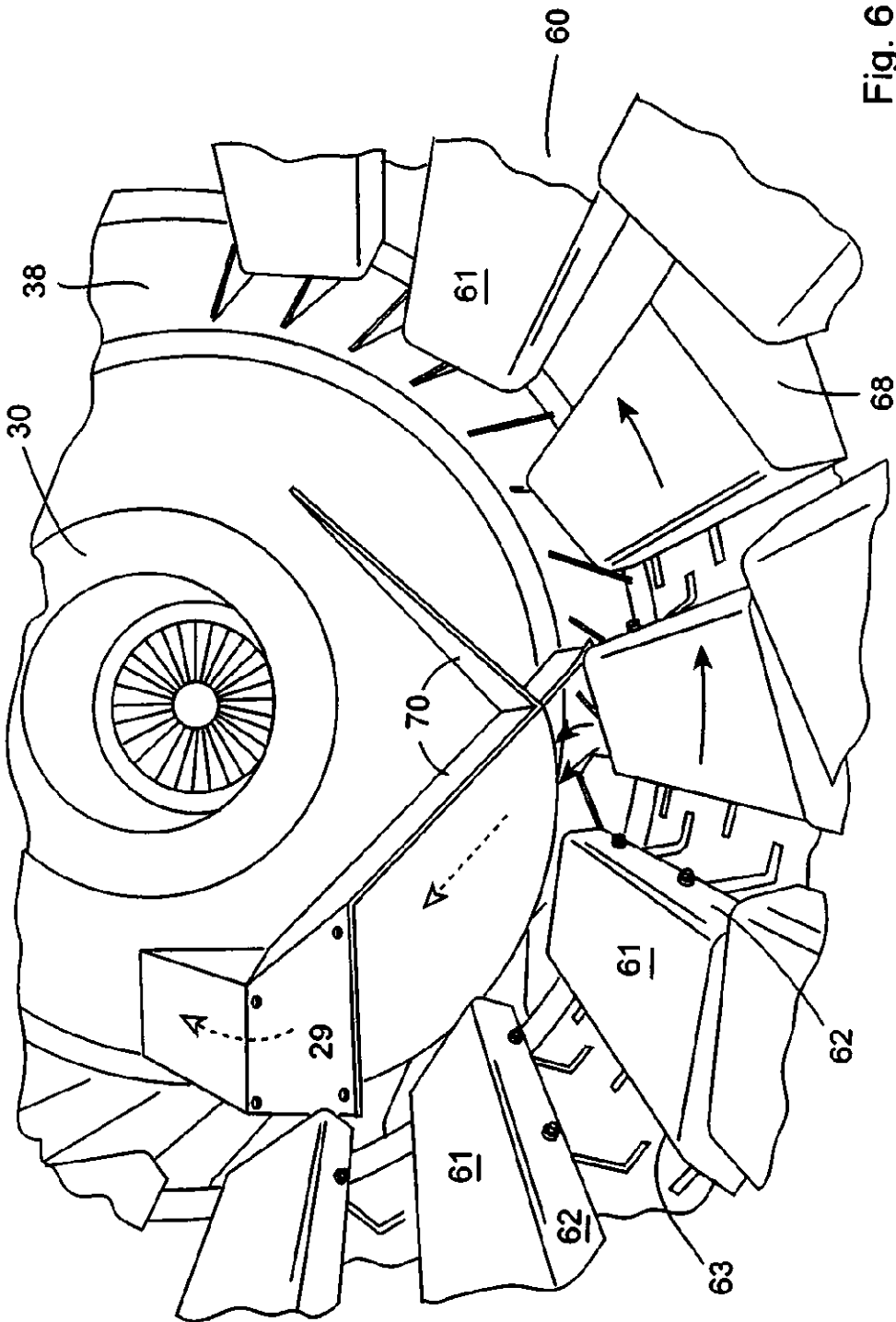


Fig. 6

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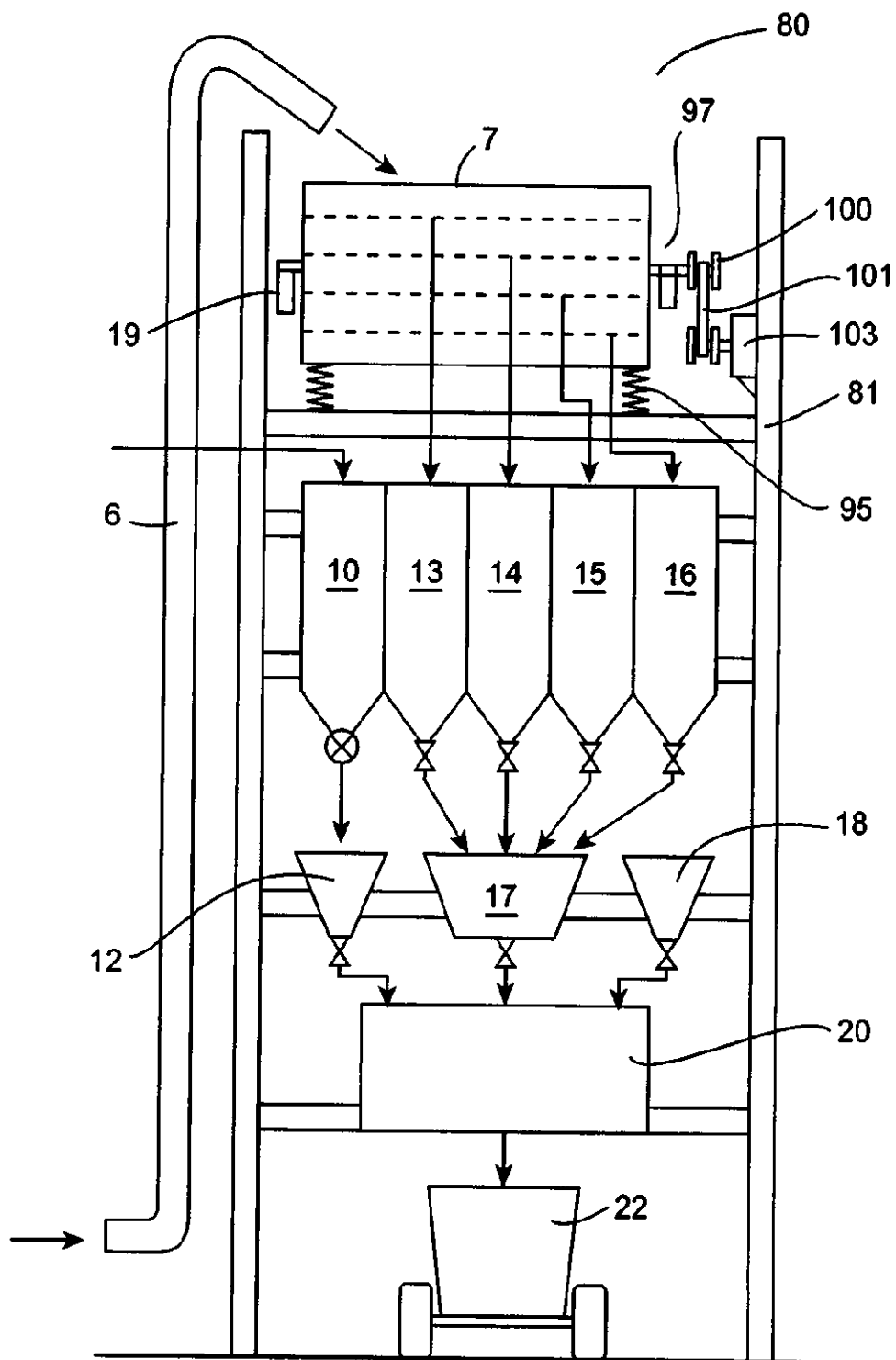


Fig. 7

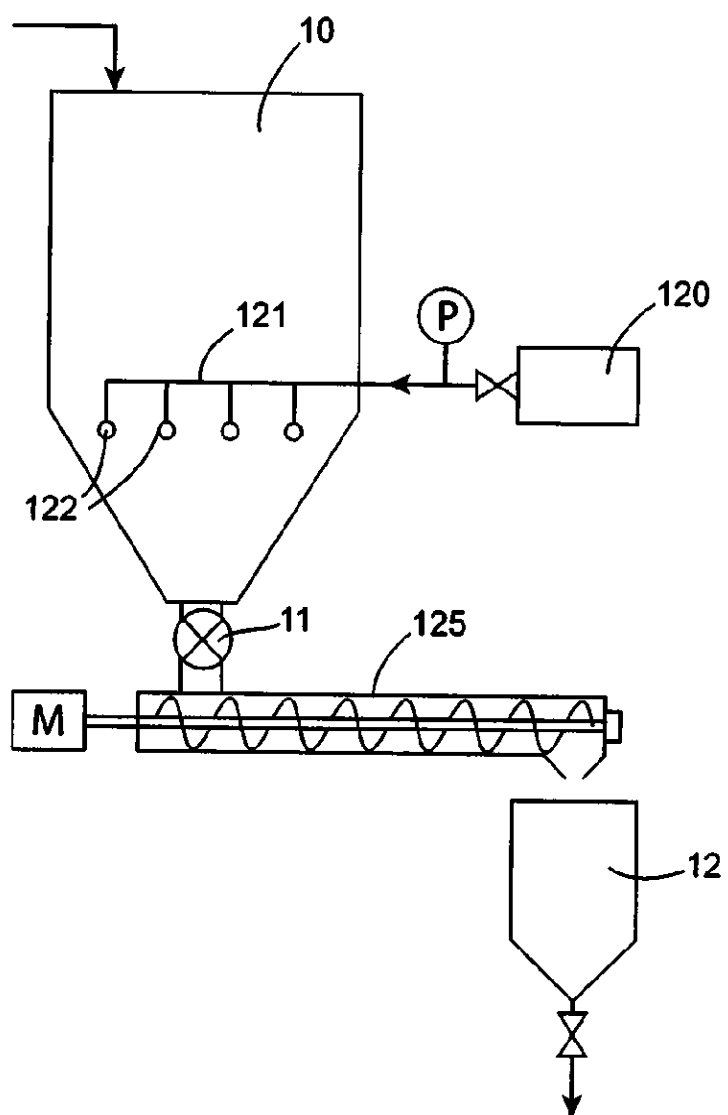


Fig. 8

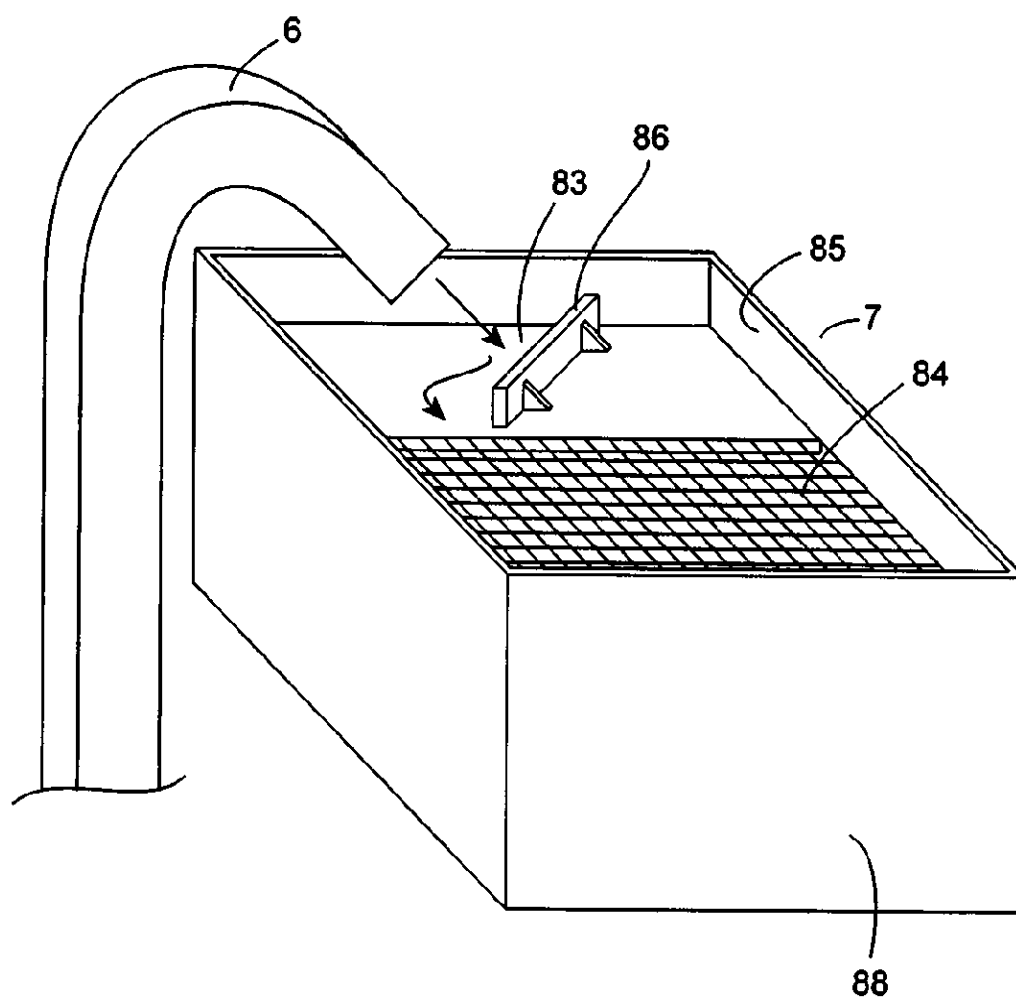


Fig. 9

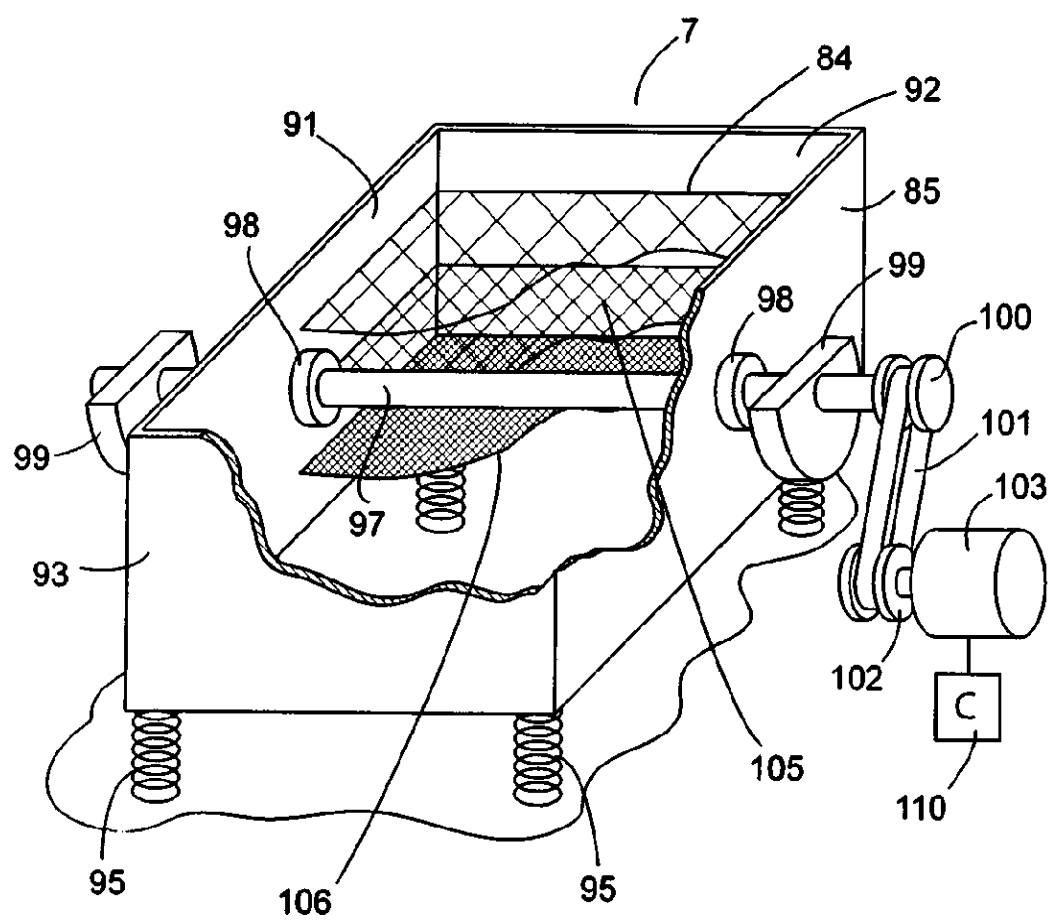


Fig. 10

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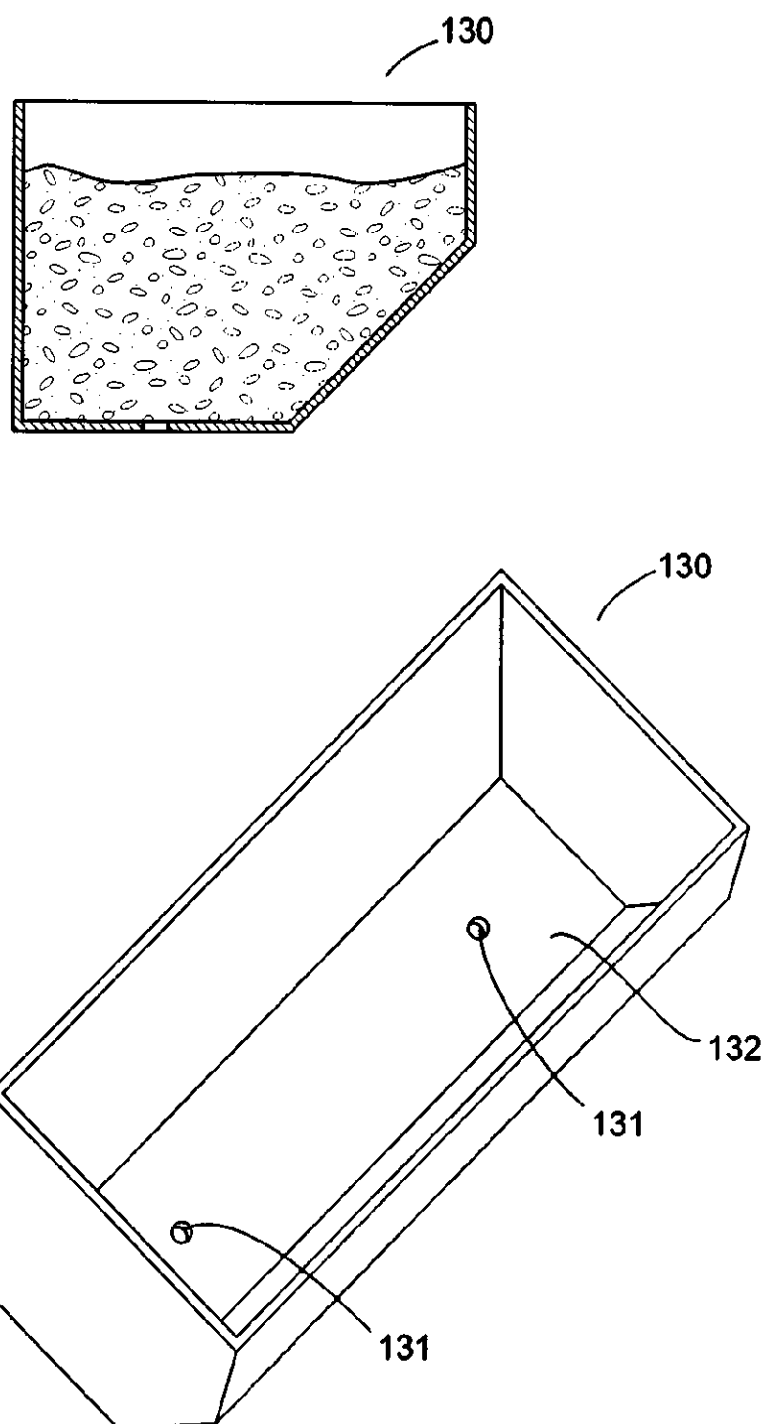


Fig. 11