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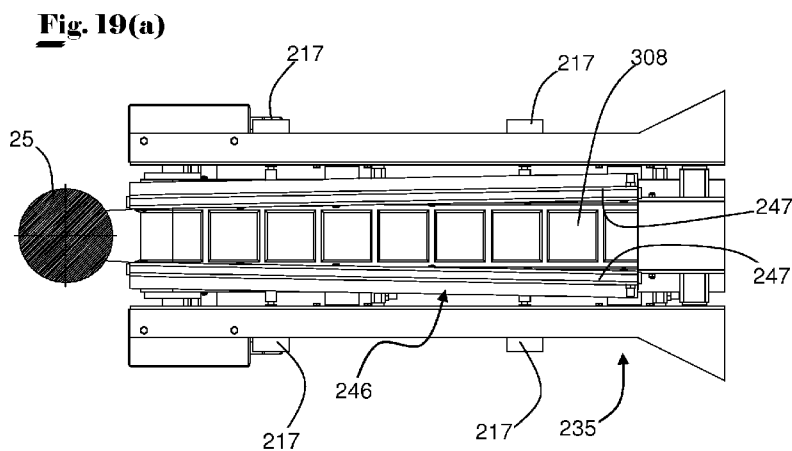
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(54) Title: DRILL CUTTING SAMPLING ASSEMBLY



(57) Abstract: A drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including: (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; (ii) a conveyor means for moving the received sample away from the opening; and (iii) a receptacle for holding the received sample.

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## **“Drill Cutting Sampling Assembly”**

### **Field of the Invention**

The present invention relates to a sampling assembly for drill cuttings from a drill hole. More particularly, the present invention relates to a sampling assembly including a sample receiving means that enables an operator to obtain a representative sample of drill cuttings outside the hole.

### **Background Art**

The following discussion of the background art is intended to facilitate an understanding of the present invention only. The discussion is not an acknowledgement or admission that any of the material referred to is or was part of the common general knowledge as at the priority date of the application.

The purpose of taking a sample from a drill hole is to analyse the chemical content of the drill cuttings to determine the grade of the ore. Based on the grade obtained from the sample the particular block of rock surrounding the drill hole can be assigned generally as waste, ore, or sometimes low grade. Ore is effectively pay dirt. It is what makes a mine economic. Waste costs money to mine, but a certain amount of waste must be removed to allow an orderly and safe extraction of the ore. The assignment of the correct rock type is therefore critical to the economics of the mine. Therefore any sample taken must be truly representative of the entire block of rock that the drill hole is in. Therefore particular attention is paid to ensure that there is no sample bias and that the sample weight is adequate for further processing in the sample laboratory.

Presently, there are a number of methods of sampling a drill hole currently used in the drilling industry. Open hole sampling is where the sample is collected outside the drill hole and in hole sampling is where the sample is collected from within the drill hole.

In an open hole drilling method, compressed air travels down the middle of the drill tube, is exhausted through the bit and returns up the outside of the drill tube. The cuttings thus travel up the outer side of the drill pipe and collect outside of the drill hole at ground level which forms the drilling collar.

A first type of open hole sampling is by tray sampling where a tray is placed at the collar (top) of the drill hole. As the drill rod drills the hole the drill cuttings are forced out of the hole by compressed air and accumulate at the collar of the hole. The cuttings naturally form a cone around the outside of the drill hole. The sample tray is therefore filled with a small slice of the natural cone of material. This tray can be removed and the material collected put into a sample bag ready for processing by the laboratory.

Whilst generally effective, tray sampling is labour intensive and on large diameter holes (e.g. greater than 165 mm) the sample size is also large, meaning that the manual handling and removal of the tray can be quite cumbersome. In addition on many large rigs the sampler (person) must crawl under the drill platform to get to where the sample is collected. Therefore the manual handling needs to be done in a semi-crouched position. Injuries can therefore result from this practice.

Another type of open hole sampling is by use of a Dust collector/ Cyclone/ Splitter. A dust pot is located at the foot of the drill mast which surrounds the drill rod. A suction hose is fitted to the dust pot. The suction hose is connected to a cyclone/ splitter. Another suction line is then connected to a very powerful dust collector, which is effectively the same as a large vacuum cleaner. The drill cuttings are sucked up the sample hose into the cyclone. The cuttings are then dumped into a splitter for collection in a bag.

Whilst also effective, dust collector sampling is only good for smaller hole diameter drill holes (i.e. less than 127 mm) where there is not as much sample to collect. Any greater volume of rock requires far more suction from a dust collector than is technically or economically feasible. Therefore this system cannot generally be used in larger hole diameters. In addition, because the sample travels through suction hoses some samples can remain in the hose. This can

then contaminate the next sample. Therefore unless great care is taken to keep the system clean the sample collected can be adversely biased.

A type of in hole sampling is called the Reverse Circulation (RC) method. Reverse circulation is the method most commonly used in exploration drilling. This method involves using a special two piece drill pipe – an outer tube and an inner tube. Different to the open sampling method, with RC systems the compressed air travels down the annulus between the outer and inner tubes, then travel back up the centre of the inner tube. The cuttings therefore also travel up the centre of the inner tube. A sample collection hose is located at the top of the drill pipe (at the rotary head) and the sample travels down this hose and into a sample collection splitter and cyclone device.

Whilst also effective, RC drilling is comparatively more expensive than conventional open hole drilling. This is due to the larger amount of wearing parts in the system. It is also a slower method of drilling holes. The RC system is also restricted in hole size and is generally only used for hole diameters up to 140 mm.

### **Disclosure of the Invention**

The present invention provides a drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including:

- (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; and
- (ii) a receptacle for holding the received sample.

Preferably, the opening in the sample receiving means, in its open position, is adapted to define a shape that is capable of receiving a representative sample of drill cuttings expelled from a drill hole during the drilling process. In this regard, the opening, in its open position, may define a shape selected from the group of

shapes comprising: trapezoid, sector and segment. When the opening defines a trapezoid it is preferably an isosceles trapezoid.

The opening may be adjusted between its open and closed positions in a variety of ways. The sample receiving means may include a pair of members that are adapted for lateral movement relative to each other to open and close the opening. Both of the said members may be capable of movement or alternatively one member may be fixed and the other member adapted for lateral movement to open and close the opening. Alternatively, the sample receiving means may incorporate a cover for the opening that is capable of moving to a position where it at least partially closes the opening.

The movement of the members to open and close the opening may be achieved through pneumatic actuators that are operable to move the members, as desired. However, it will be appreciated that electrically driven or hydraulic actuators could also be used.

To assist with its transportation and use, the sampling assembly of the present invention may be capable of movement relative to the drill rig upon which it is mounted between a first position at which the opening in the sampling assembly is located proximal to ground level and a second position at which the opening in the sampling assembly is located above ground level. When in the first position, the sampling assembly is preferably located proximal to a drill hole and thus is ready to receive a sample therefrom, whereas in the second position the sampling assembly is preferably located proximal to the deck of the drill rig and hence more conveniently transported.

The movement of the sampling assembly relative to the drill rig may be achieved in a number of ways. Preferably, the sampling assembly itself is fixed but is mounted on the drill rig such that the entire assembly can move between its first and second positions. In this form of the invention it is preferable for the sampling assembly to be slidably and/or pivotally mounted on the drill rig. A slidable and pivotable mounts can be achieved in a number of ways including the use of pneumatic, hydraulic or electric actuators. In particular forms of the invention the

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sampling assembly may be mounted to the drill rig using a mounting means that is specifically designed to provide for the slidable and/or pivotable movement.

When it is desired to have samples retained, for at least a short time, in proximity to the sample receiving means, the receptacle may be located adjacent to the opening in the sample receiving means. In this regard, the receiving means may be provided integrally with the sample receiving means or as an attachment thereto. Thus, the receptacle can be varied and includes a bag, hopper or other means for conveniently holding the received sample. Thus, in one form of the invention the sampling assembly may further comprise a mounting means for a receptacle, the mounting means being located below the opening to allow for sample passing through the opening to be gravity fed directly into the receptacle.

It may also be desired to convey the received sample to a receptacle located some distance from where the sample is received through the opening in the sample receiving means. Thus, the present invention also provides a drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including:

- (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample;
- (ii) a conveyor means for moving the received sample away from the opening;  
and
- (iii) a receptacle for holding the received sample.

Preferably, the conveyor means is a belt conveyor member for moving sample from the sample receiving means to a collection point. Alternatively, the conveyor means may be a bucket, chain, screw or roller conveyor. These conveyor means may be gravity or motor driven. In another form of the invention the conveyor member may be a vacuum means that moves the sample away from the opening and to the receptacle by suction through a conduit. .

The conveyor means may have a plurality of sections configured to transport the sample along at least two different planes. Preferably, the conveyor means has a first section adapted to transport the sample along a substantially horizontal plane and a second section adapted to transport the sample along a plane angled to the horizontal. Preferably, the first section is located proximal to the opening through which the sample passes, such that sample that passes through the opening is received on the first section, and a second section inclined to the horizontal that receives sample from the first section and transports it to an elevated position relative to the first horizontal section. It will be appreciated that through the use of multiple sections the conveyor means is adapted to transport the sample to a desired location.

When the conveyor means is a conveyor belt it preferably includes a plurality of idler rollers spacedly mounted therealong for guiding the belt of the conveyor. When the conveyor means includes a second section inclined to the horizontal that receives sample from the first section and transports it to an elevated position relative to the first section, the second section preferably includes a drive roller adjacent its upper end for driving the conveyor belt.

Preferably, the sampling assembly is enclosed to contain particles, such as dust. The sampling assembly can be enclosed using covers, such as covers for the conveyor means, or alternatively the entire assembly or parts thereof can be provided as an integral sealed unit. When covers are used they may be removable.

As described above, the sample receiving means is for positioning adjacent to a drill hole to receive drill cuttings from the drill hole and thus preferably sits at ground level when in use. With this in mind it is preferable that the sample receiving means be substantially parallel to the ground when the sampling assembly is in use. Thus, the sample means is preferably adapted to be pivoted to adapt to the ground contour. To further assist with positioning the sample receiving means the sampling assembly may further comprise a plurality of pivotable legs that are affixed to the sample assembly to engage the ground and maintain the sample receiving means in position during sampling.

The sampling assembly may further comprise a cleaning means for removing sample residue between sampling runs. This prevents cross-contamination of samples. The cleaning means may be varied but preferably comprises a pressurised fluid system capable of directing pressurised fluid, such as air, into the parts of the sampling assembly that come into physical contact with sample such as the conveyor means. In one form of the present invention the sampling assembly includes a plurality of fluid jets located therein for cleaning.

The sampling assembly may further comprise a receptacle, in the form of a hopper, and a splitter, such as a cone splitter located therebelow.

As indicated above, to assist with its transportation and use, the sampling assembly of the present invention may be capable of movement relative to the drill rig upon which it is mounted between a first position at which the opening in the sampling receiving means is located proximal to ground level and a second position at which the opening is located above ground level. The present invention will now be described with reference to a form of the present invention where the movement of the sampling assembly relative to the drill rig is achieved with a sampling assembly that includes parts that are adapted for longitudinal movement relative to each other such that the sampling assembly can move between its first and second positions.

Thus, the present invention also provides a drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including a conveyor having a first conveyor section and a second conveyor section, wherein the longitudinal position of the first section relative to the second section can be varied as desired, and wherein an end of the first section can be positioned adjacent a drill hole in use for receiving samples from the drill hole and conveying the samples to an opposite end of the second section.

The first and second sections are preferably slidable in a telescopic manner relative to each other. Preferably, wear strips made from low friction material are provided between the first and second sections.

The first and second sections preferably include a plurality of idler rollers spacedly mounted therealong for guiding a conveyor belt of the conveyor. The second section preferably includes a drive roller adjacent its upper end for driving the conveyor belt.

The second section is preferably an upper conveyor section and the first section may comprise an intermediate conveyor section and a lower conveyor section, wherein the lower section is positioned adjacent the drill hole in use. The opposite end of the second section is preferably a top end of the upper section.

The sampling assembly preferably includes a collection hopper positioned below the top end of the second section and a cone splitter located below the collection hopper.

The lower section preferably sits at ground level in use and is preferably substantially parallel to the ground level in use. The lower section can preferably pivot relative to the intermediate section to adapt to the ground contour. The intermediate section preferably includes stopper plates for limiting the angular movement of the lower section relative thereto. The lower section preferably includes an adjustable sample collection chute which can be moved to a desired position between open and closed positions for controlling the amount of sample collected in the chute in use. The chute preferably includes a means for releasing pressurised air thereinto for cleaning same.

The upper and intermediate sections are preferably sealed by an upper conveyor seal and intermediate conveyor seal, respectively. The intermediate seal is preferably substantially the same length as the intermediate section and includes a cover plate and supports extending from each side edge thereof, the supports being dimensioned to be located at opposite sides of the conveyor belt within the intermediate section and to maintain the cover plate substantially parallel and spaced from the conveyor belt. The intermediate seal is preferably attached to the sections for movement therewith via the supports.

The upper seal is preferably substantially the same length as the upper section and includes a cover plate and supports extending from each side edge thereof, the supports being dimensioned to be located at opposite sides of the conveyor belt within the upper section and to maintain the cover plate substantially parallel and spaced from the conveyor belt. The upper seal is preferably attached to the sections via the supports.

The upper seal preferably includes a substantially horizontal top section for covering the conveyor belt portion extending between the top idler roller and the drive roller. The intermediate seal is preferably dimensioned such that when the intermediate section moves relative to the upper section, the upper seal can extend within the intermediate seal. Wear strips are preferably located between the cover plates to allow a low friction slide movement between the upper and intermediate seals.

The conveyor preferably includes a conveyor belt extending around the first and second sections, wherein an operative portion of the conveyor extends and retracts respectively with the extension and retraction of the conveyor. The conveyor belt path preferably includes the operative portion which extends from a bottom idler roller adjacent the lower end of the first conveyor section to the drive roller adjacent a top end of the upper conveyor section. The conveyor belt path preferably includes a return path extending from the drive roller to a tension roller and to the bottom idler roller, the tension roller being movable to maintain the conveyor belt in tension, wherein movement of the tension roller lengthens or shortens the return path to effectively supply belt material to the operative portion as required.

The second section preferably includes a tension roller slot extending longitudinally therealong within which the tension roller is movable. The tension roller is preferably operatively connected to a fixing point which is located adjacent the top end of the first section such that when the conveyor is in the retracted position, the fixing point pulls the tension roller generally downwardly in the slot and when the conveyor extends, the fixing point moves generally downwardly which allows the tension roller to move upwardly along the slot.

Preferably, the first and second conveyor sections include idler rollers therein for guiding the conveyor belt along its path.

The conveyor belt preferably includes a flexible elongated body having two parallel spaced longitudinal ribs formed at an upper surface thereof and spaced lateral ribs extending perpendicularly to and between the longitudinal ribs. A lower surface of the conveyor belt preferably includes a longitudinal tracking strip extending therealong.

The drive roller preferably includes a cylindrical body rotatable around a spindle, a cylindrical external surface of the body being covered with traction material for positive traction with the conveyor belt. The body and the traction material preferably each include a central circular groove for accommodating the conveyor belt tracking strip therewithin.

The idler rollers preferably each include a cylindrical body rotatable around a spindle, the external surface of the body being substantially covered with hard wearing material. The body and the material preferably each include a central circular groove for accommodating the conveyor belt tracking strip therewithin.

The sampling assembly preferably includes an automatic sample bag changer at the catching hopper.

The present invention, in another aspect, provides a drill rig including the sampling assembly of the present invention. Preferably, the sampling assembly is mounted to the drill rig deck. The mounting may be a pivotal mount. The mount maybe direct or the sampling assembly may be mounted to the drill rig via a support frame. When the sampling assembly is mounted to the drill rig it may further comprise angle adjustment means for varying the angle of the conveyor relative to the drill deck. Preferably the angle adjustment means is one or more pneumatic, hydraulic or electric actuators such as hydraulic cylinders. The sampling assembly may extend through an opening in the deck with the lower section being adapted to be located below the deck. Alternatively, the sampling assembly may be mounted on the side of the deck. The upper and lower sections

are preferably generally angled downwardly relative to the deck and the lower section is generally parallel to the deck. The drill rig is preferably movable.

The present invention, in another aspect, provides a method of collecting drilling samples using a drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including: a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; and a receptacle for holding the received sample; the method comprising the steps of:

- (i) locating the sampling assembly in a position proximal to a drill hole with the opening in the sample receiving means in the closed position;
- (ii) adjusting the opening in the sample receiving means between its open and closed positions during drilling.

It will be appreciated that the method of the present invention enables an operator to control the amount of sample taken and/or the depth at which a sample is taken during the drilling process. This allows for the sampling process to be optimised to suit particular requirements that may be set by a geologist.

When the sampling assembly used in the method of the present invention includes a conveyor means for moving the received sample away from the opening the method of collecting drilling samples according to the present invention may further comprise the step of conveying the drill samples away from the opening in the sample receiving means.

When the sampling assembly used in the method of the present invention includes a cleaning means the method of collecting drilling samples according to the present invention may further comprise the step of cleaning at least a portion of the sampling assembly between sampling runs to prevent cross-contamination of samples.

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The present invention also provides a method of collecting drilling samples using a drill rig with the sampling assembly of the present invention mounted thereto, the method comprising the steps of:

- a) transporting the drill rig to a desired location with the conveyor and drill rod in the retracted position,
- b) supporting the drill deck at the desired location;
- c) extending the drill rod to ground level;
- d) pivoting and/or extending the conveyor such that the lower section is at ground level and adjacent to the drill rod;
- e) commencing drilling of the hole in the ground and collecting at least part of the drilling collar into the conveyor lower section;
- f) conveying the drill samples from the conveyor lower section to the upper section for collection;
- g) stopping drilling when a desired sample size is collected; and
- h) retracting the drill rod and the conveyor.

### **Brief Description of the Drawings**

Two preferred forms of the present invention will now be described by way of examples only with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a sampling assembly according to a first preferred embodiment of the present invention including first and second sections that are slidable in a telescopic manner, mounted to a movable drill rig;

Figures 2 (a) to (f) are side elevation views schematically showing the sequential steps in operating the sampling assembly of Figure 1; in Figure 2(e), (A) is a top

view of the lower conveyor section and (B) is a front view of the hopper and cone splitter assembly;

Figure 3 is an exploded perspective view of the sampling assembly of Figure 1;

Figure 4 is a cross-section view of the sliding arrangement between the upper and lower conveyor sections of the conveyor of the sampling apparatus of Figure 1, also showing enlarged views of details A, B and C as marked;

Figure 5 is a schematic side cross-sectional view of the sampling assembly of Figure 1, showing the conveyor belt travel path and the belt tensioning arrangement when the assembly is in the retracted position;

Figure 6 shows a looped portion of the conveyor belt of the sampling assembly according to the first preferred embodiment, where (a) shows a plan view; (b) shows a longitudinal cross-section view along line J-J of (a), (c) shows a lateral cross-section view along line G-G of (a), and (d) is an enlarged view of detail H marked on Figure 6(c);

Figure 7(a) is an end view and 7(b) is a longitudinal cross-section view along line D-D of a drive roller for the conveyor of the sampling assembly according to a first preferred embodiment;

Figure 8(a) is an end view and 8(b) is a longitudinal cross-section view along line E-E of an idler roller for the conveyor of the sampling assembly according to a first preferred embodiment;

Figure 9(a) is an end view and 9(b) is a longitudinal cross-section view along line F-F of a top idler roller for the conveyor of the sampling assembly according to a first preferred embodiment;

Figure 10(a) is a side view of the sampling assembly according to a first preferred embodiment and (b) is an enlarged view of the pivot arrangement between the intermediate conveyor section and the lower conveyor section;

Figure 11 (a) is a top view and (b) is a side view of the lower conveyor section of the conveyor of the sampling assembly according to a first preferred embodiment;

Figure 12(a) is an exploded perspective view and 12(b) is a side view of the hopper and cone splitter assembly of the sampling assembly according to a first preferred embodiment;

Figure 13 is a schematic perspective view of a sampling assembly according to a second preferred embodiment of the present invention including a fixed conveyor means that is slidably mounted on a movable drill rig;

Figures 14 (a) to (c) are side elevation views schematically showing the steps in operating the sampling assembly of Figure 13;

Figure 15 is a top view of the lower conveyor section illustrating the sample receiving means in the form of collection chute;

Figure 16 is an exploded perspective view of the sampling assembly of Figure 13;

Figure 17 (a) is a schematic side cross-sectional view of the sampling assembly of Figure 13, showing the conveyor belt travel path, with Figures 17(b) and (c) showing parts of Figure 17 (a) in more detail;

Figure 18 is a perspective side view of the sampling assembly of Figure 13 showing the pivot arrangement between the upper conveyor section and the lower conveyor section;

Figure 19 (a) is a top view and (b) is a side view of the lower conveyor section of the conveyor of the sampling assembly of Figure 13;

### **Best Mode(s) for Carrying Out the Invention**

The present invention primarily relates to a conveyor 30 which transports drill cuttings from the top of a drill hole up to adjacent the driller's cab where the driller can take and bag samples.

Figure 1 shows a sampling assembly 20 according to a first preferred embodiment of the present invention mounted to a movable drill rig 21. The sampling assembly 20 includes an extendable and positionable conveyor 30, a catching hopper 31 and a sample cone splitter 32.

The drill rig 21 includes a deck 22 elevated from ground level and typically supported by jacks (not shown). The drill rig 21 includes a plurality of drill masts 24 extending from the deck 22 for supporting a drill rod 25. The drill rod 25 is operated in use to drill holes in the ground from an operator's cabin (not shown) for sampling of the ground rock as described above. The operator's cabin is typically adjacent the drill masts 24.

The sampling assembly 20 is mounted onto the deck 22 via a support frame 23 and hydraulic cylinders 29. The conveyor 30 includes an upper conveyor section 33, an intermediate conveyor section 34 and a lower conveyor section 35. The upper and lower sections 33 and 34 extend through an opening 26 in the deck 22, with the lower section 35 located below the deck 22. The upper and lower sections 33 and 34 are generally angled downwardly relative to the deck 22 and the lower section 35 is generally parallel to the deck 22. The hopper 31 is positioned below the top end of the upper section 33 with the cone splitter 32 located below the hopper 31. The height of the cone splitter 32 is such that sample bags can be easily attached underneath the cone splitter 32 by an operator on the deck 22 and thus also easily collected.

The conveyor 30 is extendable such that the longitudinal position of the intermediate section 34 relative to the upper section 33 can be varied. The upper section 33 and intermediate section 34 thus have a generally telescopic arrangement. Also, the lower section 35 can pivot via pivot bush 112 relative to

the intermediate section 34 to adapt to the ground contour. The lower section 35 includes an adjustable sample collection chute 36. The upper section 33 and intermediate section 34 are sealed by an upper conveyor seal 37 and intermediate conveyor seal 38, respectively. Further details regarding these features are described below.

The conveyor 30 is extendable such that the lower conveyor section 35 can be positioned adjacent to the drill rod 25 at ground level. In use, as further explained below, the conveyor 30 collects samples from the top of a drill hole at ground level, conveys the samples to the top end of the conveyor 30 and drops the samples into the catching hopper 31 and the cone splitter 32.

Figures 2 (a) to (f) schematically show the sequential steps in operating the sampling assembly 20. Figure 2(a) shows the transport position of the conveyor 30 and drill rig 21, which allows the drill rig 21 to be moved to a desired location. The drill rod 25 and conveyor 30 are in their retracted position, in that the drill rod 25 is raised from the ground level 27 and the upper and lower ends of the upper and intermediate conveyor sections 33 and 34 are substantially adjacent each other. In this position, the lower conveyor section 35 is adjacent the deck 22. In the transport position, the drill rig 21 can be lowered off its jack supports (not shown) and trammed to the next location without damaging the conveyor 30.

Referring to Figure 2(b), when the drill rig 21 is at the desired location to drill a hole, the jacks of the drill rig are extended to support same. The drill rod 25 is then extended to ground level 27. The height 28 of the drill deck 22 in the embodiment varies typically from 1500 to 2500 mm depending on the jack height and terrain.

Referring to Figure 2(c), the conveyor upper section 33 is pivotally mounted adjacent its upper portion to a top end 39 of an upright member 40 of the support frame 23. The hydraulic angle adjustment cylinders 29 extend between the base of the upright member 40 and a mid-portion of the upper section 33. The cylinders 29 can be extended and retracted to vary the angle 41 of the upper section 33 relative to the deck 22. Typically, the angle 41 ranges between 64°

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and 70°. The required angle 41 of the upper section 33 is calculated and the cylinders 29 actuated to provide this angle 41. Extension of the cylinders 29 moves the conveyor lower section 35 closer to the drill rod 25. The actuation of the cylinders 29 can also be performed manually by the operator.

Referring to Figure 2(d), the conveyor 30 then elongates (it lengthens) so that the conveyor lower section 35 is at ground level 27 and adjacent to the collar of the drill hole. The lengthening of the conveyor 30 is performed by moving the intermediate section 34 downwardly relative to the upper section 33 via hydraulic conveyor extension cylinders 42. A cylinder 42 is located at each side of the conveyor upper section 33 and each has its barrel section 43 mounted to the upper section 33 and its telescoping rod 44 attached to the intermediate section 34. The operator positions the conveyor lower section 35 such that its distal end 45 is about 35 to 70 mm from the drill rod 25. Adjustments in the position of the lower section 35 relative to the drill rod can be performed via the cylinders 29 and 42.

In the extension and retraction of the conveyor 30, the operative length of the conveyor belt thereof (to be described below) also lengthens and retracts.

Referring to Figure 2(e), the operator commences drilling the hole in the ground 27 with the drill rod 25. The drill cuttings collect outside of the drill hole at ground level 27 which forms the drilling collar. Part of the drilling collar cuttings fall into the collection chute 46 of the conveyor lower section 35. The collection chute 46 includes movable strips 47 which can be moved away from each other to allow samples to fall into the chute 46 or toward each other which blocks samples from falling into the chute 46. The distance between the strips 47 can be adjusted to provide a desired sample size falling into the chute 46. Drill cuttings falling in the collection chute 46 falls onto the conveyor belt (described below) which moves the cuttings upwardly toward the upper end of the conveyor upper section 33. The cuttings fall into the collection hopper 31 and into the cone splitter 32 for bagging. Drilling is stopped when a pre-determined hole depth is reached. The collection hopper 31 accumulates a predetermined amount of sample prior to its doors 49 opening and dumping the sample into the cone splitter 32.

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In some situations up to 3 samples are taken per drill hole. In this situation the operator will discard the collected samples from the cone splitter 32 after a predetermined depth is reached. The cone splitter 32 is then cleaned via compressed air and the operator will continue drilling. When the next sample is collected into the collection hopper 31, doors therein momentarily open, dumping the sample into the splitter hopper 32. The conveyor belt continues to run during the sample collection and splitting processes.

Referring to Figure 2(f), the drill rod 25 and the conveyor 30 are then retracted back to their transport position where the drill end and conveyor lower section 35 are adjacent the deck level 22. The drill rig 21 is then be lowered off its jacks and trammed to the next desired location.

Figure 3 is an exploded perspective view of the sampling assembly 20 showing its features in more detail. Figure 3 shows the conveyor 30, its upper section 33, intermediate section 34 and lower section 35. Also shown are the upper and intermediate seals 37 and 38. Figure 3 also shows the support frame 23, cylinders 29 and 42, hopper 31 and cone splitter 32.

Referring to Figures 3 and 4, the conveyor intermediate section 34 includes a pair of parallel elongated sections 50 which are spaced from each other and joined by brackets 51. Each section 50 is generally C-shaped in cross-section and includes a central portion 52, and an upper web 53 and a lower web 54 extending outwardly from upper and lower edges of the central portion 52 respectively. The C-shaped sections thus generally face away from each other. Extending between the sections 50 are a number of longitudinally spaced idler rollers 55. The rollers 55 are mounted to the central portions 52 adjacent the upper web 53.

The conveyor upper section 33 is similar to the intermediate section 34. The upper section 33 includes a pair of parallel elongated sections 60 which are spaced from each other and joined by brackets (not shown). Each section 60 includes a C-shaped cross-section portion which includes a central portion 62, an upper web 63 extending outwardly from an upper edge of the central portion 62 and a lower edge 64 extending outwardly from adjacent a lower edge of the central portion 62. The C-shaped portions thus generally face away from each

other. Two longitudinally spaced idler rollers 55 extend between the sections 60 adjacent its upper end and adjacent the upper webs 63. A drive roller 56 extends between the sections 60 adjacent its upper end and adjacent the lower web 64. The top idler roller 55 and the drive roller 56 are spaced substantially horizontally from each other.

Figure 4 shows how the sections 50 and 60 are dimensioned for movement relative to each other. Generally, the sections 50 are located internally of the respective sections 60, with the sections 60 generally being received within the C-shaped sections 50. In further detail, the central portions 52 are located internally of the central portions 62. The upper web 53 is located above the upper web 63. The central section 62 however includes a longitudinal slot 65 formed therein through which the lower web 54 extends in the relative movement between the sections 50 and 60. The lower web 54 is located above the lower web 64. Located between the upper webs 53, 63, lower webs 54, 64 and central portions 52, 62 are wear strips 66 made from low friction material such as nylon. In the embodiment, the wear strips 66 are bolted to the central portions 62, the upper webs 63 and the lower webs 64. This material 66 allows the sections 50 and 60 to slide relative to each other and to prevent wear on the sections 50 and 60.

Figures 3 and 4 also show the upper conveyor seal 37 and intermediate conveyor seal 38. The intermediate seal 38 is elongated and substantially the same length as the sections 50. The seal 38 in cross section includes a cover plate 71 and supports 72 extending from each side edge thereof. The supports 72 are dimensioned to be located at opposite sides of the conveyor belt (described below) and to maintain the cover plate 71 substantially parallel and spaced from the conveyor belt. The intermediate seal 38 is attached to the sections 50 for movement therewith via the supports 72.

The upper seal 37 is similar to the intermediate seal 38 and is elongated and substantially the same length as the sections 60. The seal 37 in cross section also includes a cover plate 73 and supports 74 extending from each side edge thereof. The supports 74 are dimensioned to be located at opposite sides of the conveyor belt and to maintain the cover plate 73 substantially parallel and spaced

from the conveyor belt. The upper seal 37 is attached to the sections 60 via the supports 74.

The upper seal 37 includes a substantially horizontal top section 75 which is for covering the conveyor belt portion extending between the top idler roller 55 and the drive roller 56. The intermediate seal 38 is dimensioned such that in the movement of the sections 50 relative to the sections 60, the upper seal 37 can extend within the intermediate seal 38. Wear strips 66 are located between the cover plates 71 and 73 to allow a low friction slide movement between the seals 37 and 38.

Figure 5 shows the conveyor belt travel path and the belt tensioning arrangement. The sections 60 of the conveyor upper section 33 each include a tension roller slot 67 extending longitudinally therealong which is located parallel and generally below the lower webs 64. Located within the slots 67 is a tension roller 68 which is movable therealong. The tension roller is connected by a wire cable 69 to a fixing point 70 which is located adjacent the top end of the intermediate conveyor 34. The wire cable 69 travels from the fixing point 70 down to a first idler roller 76 adjacent a lower end of the section 60, up to second idler rollers 77 adjacent an upper end of the section 60, down to third idler rollers 78 adjacent a lower end of the section 60, and then to the tension roller 68. When the conveyor 30 is in the retracted position, the fixing point 70 pulls the tension roller 68 downwardly in the slot 67 via the cable 69. When the conveyor 30 extends, the fixing point 70 moves downwardly which allows the tension roller 68 to move upwardly along the slot 67.

The conveyor belt path is shown in Figure 5 as dashed line 80. The belt path 80 extends from the drive roller 56, down to the tension roller 68, up to an upper idler roller 81 attached to the sections 60, down to a first bottom idler roller 82 adjacent the lower end of the sections 50, across to a second bottom idler roller 83 adjacent the distal end 45 of the conveyor lower section 35, across to a third bottom idler roller 84 adjacent the lower end of the sections 50 (above the roller 82) and up to the top idler roller 55 and then across back to the drive roller 56.

In use, the drive roller 56 causes movement of the conveyor belt along the path 80. The operative section 85 of the path 80 extends from the second bottom roller 83, the third bottom roller 84, the top idler roller 55 and the drive roller 56. Sample cuttings are received in the portion between the second and third rollers 83 and 84 which are conveyed up the operative section 85 up to the drive roller 56 at which the sample cuttings drop into the hopper 31. The portion of the belt extending between the third bottom roller 84 and the top idler roller 55 are supported by the other idler rollers 55 shown in Figure 3.

As the conveyor 30 extends, the operative section 85 also extends. This is achieved by the upward movement of the tension roller 68 as the conveyor 30 extends as explained above. The upward movement of the tension roller 68 shortens the belt path 80 extending between the drive roller 56, the tension roller 68 and the upper idler roller 81. Thus, additional conveyor belt material is available for the operative section 85.

In operation, the tension roller 68 is used to maintain the conveyor belt in tension. When the conveyor retracts, the fixing point 70 moves upwardly which moves the tension roller 68 down, which pulls on the conveyor belt keeping same in tension and effectively shortening the operative section 85. When the conveyor extends via the cylinders 43, the fixing point 70 moves downwardly which allows the tension roller 68 to move up. This upward movement of the tensions roller 68 is against the lengthening of the operative section 85 and thus the conveyor belt is maintained in tension. In this manner, the operative section 85 is effectively self-lengthening and self-shortening with the extension and retraction of the conveyor 30.

Figure 6 shows a looped portion of the sampling conveyor belt 90. The belt includes a flexible elongated substantially flat body 92 having an upper surface 93 and a lower surface 94. The upper surface 93 includes two parallel spaced longitudinal ribs 95 extending co-distant from a longitudinal centre of the body 92. Extending perpendicularly to and between the longitudinal ribs 95 are lateral ribs 96 which are equally spaced from each other. The lower surface 94 includes a longitudinal tracking strip 97 extending along the longitudinal centre of the body 92. Individual spaces 98 are formed between the lateral ribs 96 and the

longitudinal ribs 95 which in use receive the sample cuttings. The cuttings are thus retained in the belt 90 along the operative section 85 thereof by the ribs 95 and 96.

Figure 7 shows the drive roller 56. The drive roller 56 includes a spindle 86 and a cylindrical body 87. The cylindrical external surface of the body 87 is covered with traction material 88 such as rubber material for positive traction with the conveyor belt 90. The body 87 and the traction material 88 each include a central circular groove 89 for accommodating the conveyor belt tracking strip 97 therewithin. In this manner, the conveyor belt 90 is maintained centrally of the drive roller 56.

Figure 8 shows an idler roller 55. The idler roller 55 includes a spindle 101 and a generally cylindrical body 102 typically made from nylon bushing material. The external surface of the body 102 is substantially covered with hard wearing material 103 such as stainless steel pipe. The body 102 and the material 103 each also include a central circular groove 89 for accommodating the conveyor belt tracking strip 97 therewithin. In this manner, the conveyor belt 90 is maintained centrally of the idler roller 55 and thus the path of the belt 90 is centrally maintained along the rollers 55. The idler roller 55 also includes retaining plates 104 at each end for attachment to the conveyor sections 50, 60 or the lower conveyor section 35.

Figure 9 shows the upper idler roller 81 which includes a spindle 105 and a central body 106. Lateral retainers 107 are located at either end of the body 106 which defines a recess 108 therebetween for receiving the upper surface 93 of the belt 90 which includes the ribs 95 and 96.

Figure 10 shows the pivot arrangement between the intermediate conveyor section 34 and the lower conveyor section 35. The lower conveyor section 35 in use sits parallel to ground level supported by spaced feet 111. The feet 11 are pivotable to suit the variable ground conditions. The pivot attachment between the lower section 35 and the intermediate section 34 allows the lower section 35 to sit parallel to the ground regardless of the angle of the upper and intermediate sections 33 and 34 relative to the deck 22 as adjusted by the cylinders 29. The pivot attachment is provided by a pivot bush 112 (also shown in Figure 3)

between a lower end 116 of the intermediate section 34 and a proximal end 48 of the lower section 35. A stop tab 113 is provided at the proximal end 48 which can engage a first stopper plate 114 provided at the lower end 116 to limit the downward angular movement of the lower section 35. A second stopper plate 115 adapted to engage the proximal end 48 is provided at the lower end 116 to limit the upward angular movement of the lower section 35. The range of angular movement of the lower section 35 between the first and second stopper plates 114, 115 is about 15°.

Figure 11 shows the conveyor lower section 35 with the collection chute 46 in the closed position and positioned adjacent the drill rod 25. As described above, the collection chute 46 includes the movable strips 47 which can be moved away from each other (as indicated by arrow 120) to allow samples to fall into the chute 46 and thus onto the conveyor belt 90 or toward each other which blocks samples from falling into the chute 46. The distance between the strips 47 can be adjusted to provide a desired sample size falling into the chute 46. The strips 47 are each movable by a pneumatic actuator 117 turning respective sprockets 118 engaging the strip 47. The chute 46 includes an air manifold 119 for releasing pressurised air onto the strips 47 for cleaning same after each sample is collected to substantially prevent cross-contamination between samples.

Figure 12 shows the hopper 31 and cone splitter assembly 32. The hopper 31 includes an upper dump box 121 and dump hopper 122. The dump hopper 122 is attached to the cone splitter assembly 32 which includes a splitter cover 123, a waste diverter 124, a cone splitter 125, a bag/waste hopper 126 and door latch 127. The cover 123 and bag/waste hopper 126 together form a space therewithin in which the cone splitter 125 and diverter 124 are located. In use, samples drop from the belt 90 into the hopper 31. After a desired sample size is collected in the hopper 31, doors 49 thereof open and dump the sample into the cone splitter assembly 32. The samples travel along the sides of the cone splitter 125 and a representative sample can be diverted out through the door latch 127 via the diverter 124. Typically, a sample bag (not shown) is attached to the latch 127 for collecting the sample. The bag/waste hopper 126 includes a waste outlet 128 for diverting the other portions of the sample out of the cone splitter assembly 32. If

required, the diverter 124 can be used to divert all portions of the sample out onto the outlet 128. The assembly 32 also includes an air manifold (not shown) for directing pressurised air onto internal surfaces of the hopper 31 and the cone splitter assembly 32 for cleaning such surfaces to substantially prevent cross contamination with other samples.

The second embodiment of the present invention will now be described with reference to Figures 13 to 19. Where possible, common or related features between the first and second embodiments will be referred to with the same referred by the same number or with the same number prefixed with the number 2.

Figure 13 shows a sampling assembly 220 according to a second preferred embodiment of the present invention mounted to a movable drill rig 21. The sampling assembly 220 includes a conveyor means in the form of an enclosed conveyor belt 230 including cover 237, a catching hopper 31 and a sample cone splitter 32.

The drill rig 21 includes a deck 22 elevated from ground level and typically supported by jacks (not shown). The drill rig 21 includes a plurality of drill masts 24 extending from the deck 22 for supporting a drill rod 25. The drill rod 25 is operated in use to drill holes in the ground from an operator's cabin (not shown) for sampling of the ground rock as described above. The operator's cabin is typically adjacent the drill masts 24.

The sampling assembly 220 is mounted onto the deck 22 via a support frame 223 and a pair of hydraulic cylinders 229. The conveyor belt 230 includes a second section in the form of upper conveyor belt 233 (see Figure 16) and a first section in the form of lower conveyor belt section 235. The sampling assembly 220 is slidably movable so that the lower section 235 can be moved down to ground level and positioned to receive sample and retracted back up to be located adjacent the underside of the deck 22. The upper section 233 is generally angled downwardly relative to the deck 22 and the lower section 235 is generally parallel to the deck 22. The hopper 31 is positioned below the top end of the upper section 233 with the cone splitter 32 located below the hopper 31. The height of

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the cone splitter 32 is such that sample bags can be easily attached underneath the cone splitter 32 by an operator on the deck 22 and thus also easily collected.

The lower section 235 incorporates the sample receiving means in the form of an adjustable sample collection chute 246 (best seen in Figures 15 and 19) that is described in more detail hereunder. The upper section 233 of the conveyor belt is sealed with cover 237.

The sample assembly 220 is extendable such that the lower conveyor section 235 can be positioned adjacent to the drill rod 25 at ground level. In use, as further explained below, the sample assembly 220 collects samples via its sample receiving means in the form of a collection chute 246 from the top of a drill hole at ground level, conveys the samples to the upper end of the conveyor 233 and drops the samples into the catching hopper 31 and the cone splitter 32.

Figures 14(a) to (c) schematically show the sequential steps in operating the sampling assembly 220. Figure 14(a) shows the transport position of the sampling assembly 220 and drill rig 21, which allows the drill rig 21 to be moved to a desired location. The drill rod 25 and sampling assembly 220 are in their retracted position, in that the drill rod 25 is raised from the ground level 27 and the lower section 235 of the conveyor belt is adjacent to the underside of the deck 22 of drill rig 21. In the transport position, the drill rig 21 can be lowered off its jack supports (not shown) and trammed to the next location without damaging the sampling assembly 220.

Referring to Figure 14(b), when the drill rig 21 is at the desired location to drill a hole, the jacks (not shown) of the drill rig are extended to support same. The drill rod 25 is then extended to ground level 27. Retraction of the cylinders 29 moves the conveyor lower section 235 to the drill rod 25. The actuation of the cylinders 229 can be performed manually by the operator. When lowered the lower section 235 of the sample assembly 220 is at ground level 27 and adjacent to the collar of the drill hole. The operator can position the lower section 235 such that its distal end 245 is about 35 to 70 mm from the drill rod 25.

Referring to Figure 14(c), the operator commences drilling the hole in the ground 27 with the drill rod 25. The drill cuttings collect outside of the drill hole at ground level 27 forming a drilling collar. Part of the drilling collar cuttings fall into and pass through an opening in the collection chute 246 that is shown in greater detail in Figures 15 and 19(a) and (b). The opening 308 in the collection chute 246 is adjustable and can be opened or closed using movable sections 247 which can be moved away from each other to increase the size of the opening to receive samples falling into the chute 246 or toward each other to block samples from falling into the chute 246. The distance between the sections 247 can be adjusted to provide a desired sample size falling into the chute 246.

Drill cuttings falling in the collection chute 246 fall onto the lower section 235 of the conveyor belt (described below) which moves the cuttings away from the opening 308 and toward the upper end of the conveyor belt 233. The cuttings then fall into the collection hopper 31 and into the cone splitter 32 for bagging.

It will be appreciated that during drilling the sampling assembly of the present invention can be used to take samples of predetermined volume(s) and at a predetermined depth(s) over the course of a drilling run. The collection chute 246 and in particular its ability to receive a representative sample and be opened to varying degrees or closed provides this functionality.

When the sampling and drilling is complete the sampling assembly can be retracted to the position depicted in Figure 14(a) and is ready for transport.

Figure 16 is an exploded perspective view of the sampling assembly 220 showing its features in more detail. Figure 16 shows the conveyor belt 230, its upper section 233 and lower section 235. Also shown is the seal or cover 237 that limits the escape of dust from the assembly. Figure 16 also shows the support frame 223, cylinders 229 and the retainers 300 for attaching the cylinders to the sampling assembly 220. The moveable members in the form of strips 247 of the collection chute 246 are also shown in Figure 16.

Figure 17(a) shows the travel path of conveyor belt 285. In use, the drive roller 256 causes movement of the conveyor belt along its path. The path extends

between the tail roller 283, a number of underside idler rollers 284, a number of topside idler rollers 255 and the drive roller 256. Figure 17(a) also shows the cleaning means in the form of air jets 302 that are shown in more detail in Figure 17(c) and belt scraper 304, shown in more detail in Figure 17(b).

Figures 18, 19(a) and 19 (b) provides a more detailed view of the sample receiving means in the form of sample collection chute 246 and shows the pivot arrangement between the lower conveyor section 235 and the upper conveyor section 233. The lower conveyor section 235, in use, sits parallel to ground level supported by spaced feet 211. The feet 211 are pivotable to suit variable ground conditions. The pivot attachment between the lower conveyor section 235 and the upper section 233 is illustrated in Figure 18 and allows the lower section 235 to sit parallel to the ground regardless of the angle of the upper section 233. The pivot attachment is provided by a pivot bush 212 at the intersection between the upper section 233 and the lower section 235.

Figure 19(a) shows the conveyor lower section 235 with the collection chute 246 in the open position and positioned adjacent the drill rod 25. As described above, the collection chute 246 defines an opening 308 that is defined on two sides by movable sections in the form of strips 247 which can be moved together or away from each other to define the size and shape of the opening and thus control the volume of sample passing into the chute 246 and thus onto the conveyor belt 285. The strips 247 are each movable by a pair of pneumatic actuators 217. The chute 246 includes an air manifold (not shown) for releasing pressurised air onto the strips 247 for cleaning same after each sample is collected to substantially prevent cross-contamination between samples.

The driller generally controls the functions of the sampling assembly from the cab of the drill rig. Additionally, the assembly can include a control system which automatically determines the adjustments needed to lengthen and locate the conveyor next to the drill hole.

The preferred embodiments of the present invention thus provides a sampling assembly which substantially overcomes the problems associated with the prior art. The preferred embodiments provide one or more of the following features:

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1. The self lengthening conveyor 30 which includes telescopic sealing components 37 and 38 and a self tensioning belt 90.
2. The control system senses the relative position of the drill hole collar compared to the conveyor 30 and automatically determines the adjustments 30 need to lengthen and locate the conveyor 30 next to the drill hole. This allows the driller to place the conveyor 30 close to the drill hole with only one control point, being the drill hole.
3. The belt 90 in the embodiment includes moulded PVC ribs 95 and 96 to allow the belt 90 to transfer the samples at steep conveyor angles.
4. The idler rollers 55 consist of stainless steel material 103 and nylon body 102 which substantially eliminates maintenance. However, other components could be used instead such as roller bearings and a stainless steel roller. Components without nylon may have a longer life, in use.
5. The collection chute 46 has been designed so that it is radial from the centre of the drill hole so that it collects a representative sample.
6. The collection chute 46 can be adjusted so that the strips 47 can be moved to 10 collect a smaller or larger sample, whilst maintaining the representativeness of the sample.
7. The collection chute 46 can also be completely closed so that no sample can enter the belt. This feature allows the driller to continue to drill without collecting a sample. This is sometimes needed during the normal drilling process.
8. The whole method of transferring the sample from the collar of the hole to another location via the conveyor 30 is innovative and is not currently in use in the mining industry.
9. The sampling assembly 20 can incorporate an automatic sample bag changer at the catching hopper 32 so that the sample bags do not have to be fitted and changed manually.

The preferred embodiments of the present invention have one or more of the following advantages that the prior art methods do not have:

1. scalable to allow large hole diameters to be sampled effectively.
2. cheaper than RC drilling.
3. safer in that it does not require a person to handle sample trays.
4. labour saving device that can do away with the need for a sampler for each drill rig.
5. allows drilling productivity to be maximized whilst ensuring that samples are always at the highest quality.
6. can be integrated with other sample processing systems, such as existing technology on-stream analysers that can be used to fully integrate the processing of sample information and grade reconciliation. An example of this system is Scantechs Geoscan (see the following link <http://scantech.com.au/scantech//products/geoscan.php>)

Although preferred embodiments of the present invention have been described, it will be apparent to skilled persons that modifications can be made to the embodiments described.

The sample collection point can be a manual or an automatic collection device.

The sampling assembly 20, 220 is designed to be fitted to a drill rig, typically (but not exclusively) a 45,000lb – 90,000lb down hole hammer or rotary drill.

The assembly can further comprise an additional conveyor below the hopper 32 for taking the samples to another location, such as an on-stream analyser or other sample testing apparatus. This would allow the material on the additional conveyor (the sample) to be automatically chemically sampled without the need to get batch processed in a laboratory. This will provide a more automated grade control system which would be of great benefit to the industry.

Throughout the specification and claims, unless the context requires otherwise, the word “comprise” or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

Modifications and variations such as would be apparent to a skilled addressee are deemed to be within the scope of the present invention.

**The Claim Defining the Invention is as Follows:**

1. A drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including:
  - (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; and
  - (ii) a receptacle for holding the received sample.
2. A drill cutting sampling assembly according to claim 1 wherein the opening in the sample receiving means, in its open position, is adapted to define a shape that is capable of receiving a representative sample of drill cuttings expelled from a drill hole during the drilling process.
3. A drill cutting sampling assembly according to claim 1 or 2 wherein the opening, in its open position, defines a shape selected from the group of shapes comprising: trapezoid, sector and segment.
4. A drill cutting sampling assembly according to any one of claims 1 to 3 wherein the opening, in its open position, defines an isosceles trapezoid.
5. A drill cutting sampling assembly according to any one of claims 1 to 4 wherein the sample receiving means includes a pair of members that are adapted for lateral movement relative to each other to open and close the opening.
6. A drill cutting sampling assembly according to claim 5 wherein both of said members are capable of movement.

7. A drill cutting sampling assembly according to claim 5 wherein one of said members is fixed and the other of said members is adapted for lateral movement to open and close the opening.
8. A drill cutting sampling assembly according to any one of claims 1 to 4 wherein the sample receiving means includes a cover for the opening that is capable of moving to a position where it at least partially closes the opening.
9. A drill cutting sampling assembly according to any one of claims 1 to 8 for mounting to a drill rig, wherein the assembly is capable of movement relative to the drill rig between a first position at which the opening in the sampling assembly is located proximal to ground level and a second position at which the opening in the sampling assembly is located above ground level.
10. A drill cutting sampling assembly according to claim 9 wherein in the first position, the sampling assembly is located proximal to a drill hole and, in the second position, the sampling assembly is located proximal to the drill rig deck.
11. A drill cutting sampling assembly according to claim 9 or 10 adapted to be mounted on a drill rig such that the entire assembly can move between the first and second positions.
12. A drill cutting sampling assembly according to claim 11 that is slidably and/or pivotally mounted on the drill rig.
13. A drill cutting sampling assembly according to any one of claims 10 to 12 wherein the sampling assembly is adapted to be mounted to the drill rig using a separate mounting means.

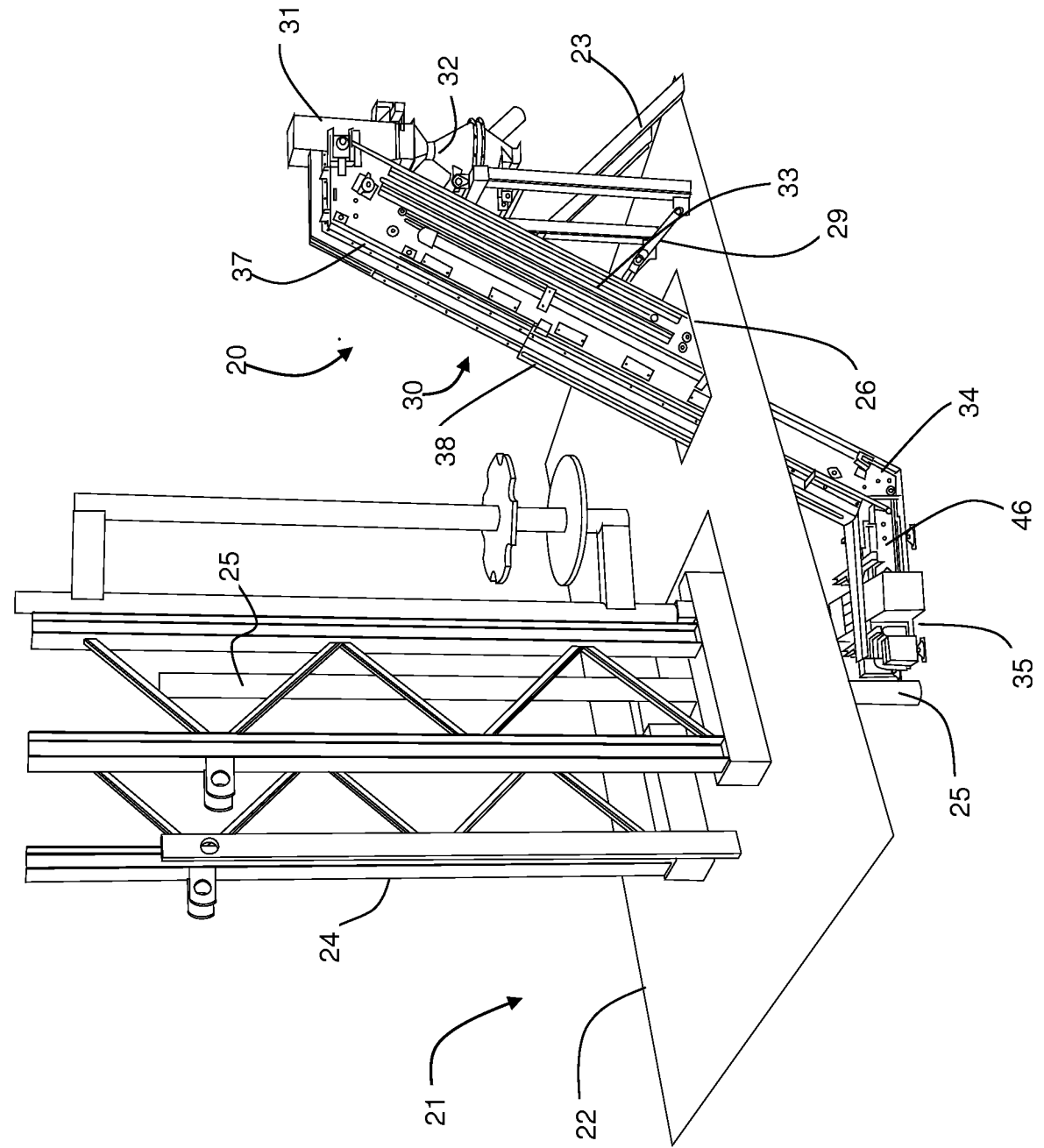
14. A drill cutting sampling assembly according to any one of the preceding claims wherein the receptacle is located adjacent to the opening in the sample receiving means.
15. A drill cutting sampling assembly according to claim 14 wherein the receiving means is provided integrally with the sample receiving means or as an attachment thereto.
16. A drill cutting sampling assembly according to claim 14 or 15 further comprising a mounting means for the receptacle located below the opening to allow for sample passing through the opening to be gravity fed directly into the receptacle.
17. A drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including:
  - (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample;
  - (ii) a conveyor means for moving the received sample away from the opening; and
  - (iii) a receptacle for holding the received sample.
18. A drill cutting sampling assembly according to claim 17 wherein the conveyor means is a belt conveyor member.
19. A drill cutting sampling assembly according to claim 17 wherein the conveyor means is a bucket, chain, screw or roller conveyor.
20. A drill cutting sampling assembly according to claim 17 wherein the conveyor member is a vacuum means that moves the sample away from the opening and to the receptacle by suction through a conduit.

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21. A drill cutting sampling assembly according to any one of claims 17 to 20 wherein the conveyor means has a plurality of sections configured to transport the sample along at least two different planes.
22. A drill cutting sampling assembly according to any of the preceding claims that is enclosed to contain particles, such as dust.
23. A drill cutting sampling assembly according to any one of the preceding claims adapted to be located substantially parallel to the ground when in use.
24. A drill cutting sampling assembly according to claim 23 adapted to be pivoted to adapt to the ground contour.
25. A drill cutting sampling assembly according to claim 23 or 24 further comprising a plurality of pivotable legs that are affixed to the sample assembly to engage the ground and maintain the sample receiving means in position during sampling.
26. A drill cutting sampling assembly according to any one of the preceding claim further comprising a cleaning means for removing sample residue between sampling runs.
27. A drill cutting sampling assembly according to claim 26 wherein the cleaning means comprises a pressurised fluid system capable of directing pressurised fluid, such as air, into the parts of the sampling assembly that come into physical contact with sample.
28. A drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including a conveyor having a first conveyor section and a second conveyor section, wherein the longitudinal position of the first section relative to the second section can be varied as desired, and wherein an end of the first section can be positioned adjacent a drill hole in

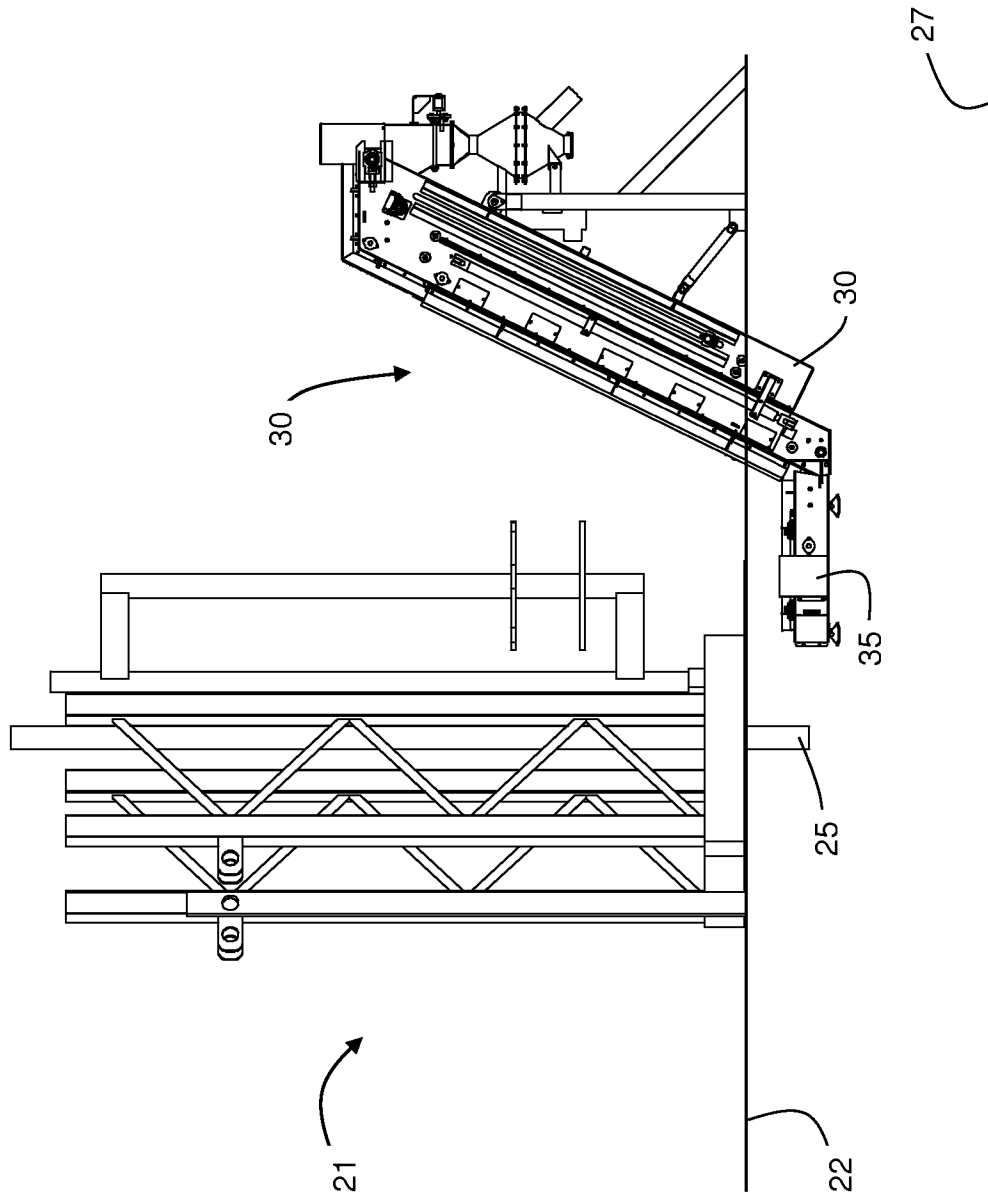
use for receiving samples from the drill hole and conveying the samples to an opposite end of the second section.

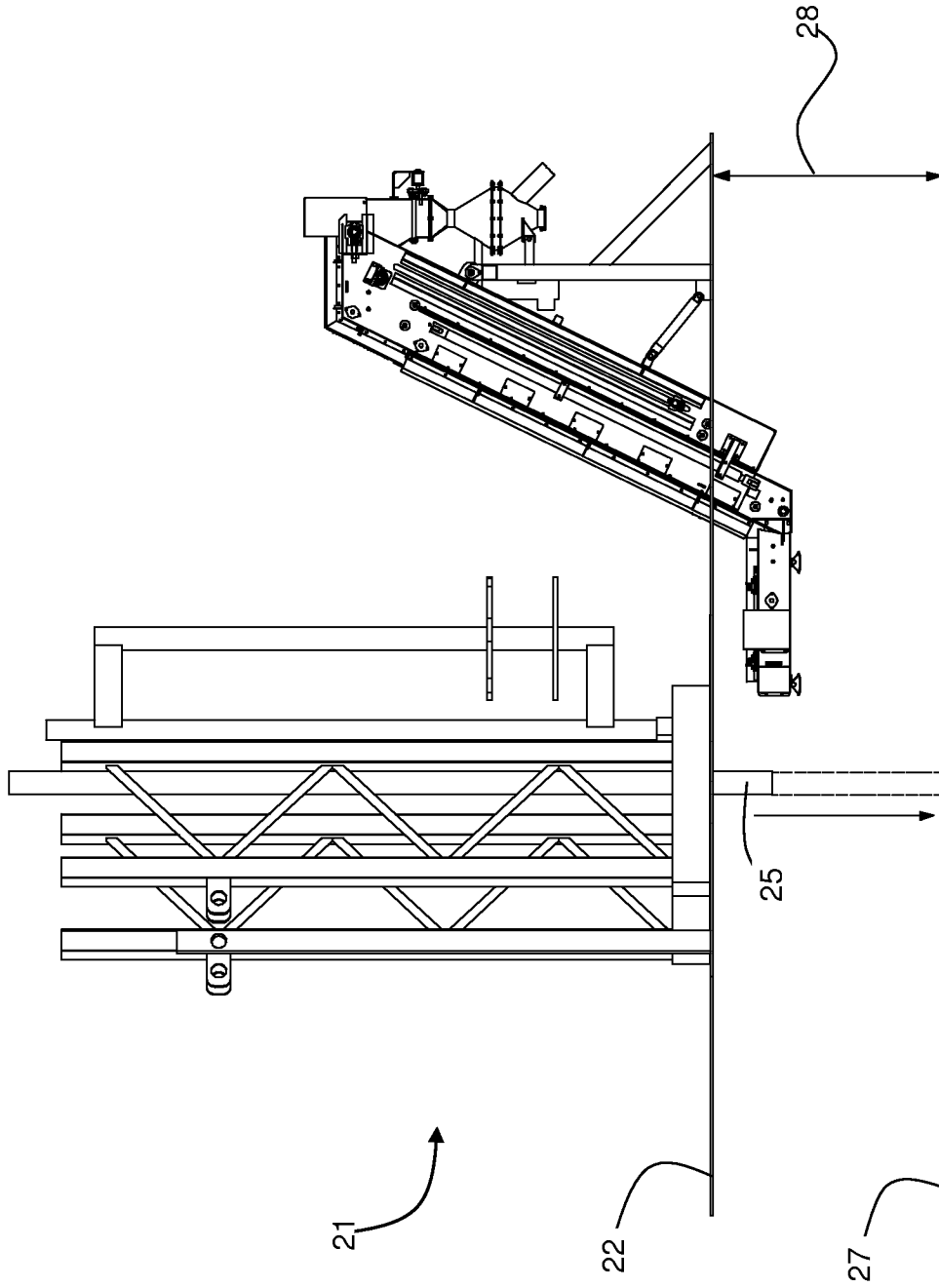
29. A drill cutting sampling assembly according to claim 28 wherein the first and second sections are telescopically slidable relative to each other.
30. A drill rig including a drill cutting sampling assembly, the sampling assembly including:
  - (i) a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; and
  - (ii) a receptacle for holding the received sample.
31. A method of collecting drilling samples using a drill cutting sampling assembly for mounting to a drill rig, the sampling assembly including: a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings from the drill hole through an opening adjustable between an open and closed position to control the volume of received sample; and a receptacle for holding the received sample; the method comprising the steps of:
  - (i) locating the sampling assembly in a position proximal to a drill hole with the opening in the sample receiving means in the closed position;
  - (ii) adjusting the opening in the sample receiving means between its open and closed positions during drilling.



**Fig. 1**

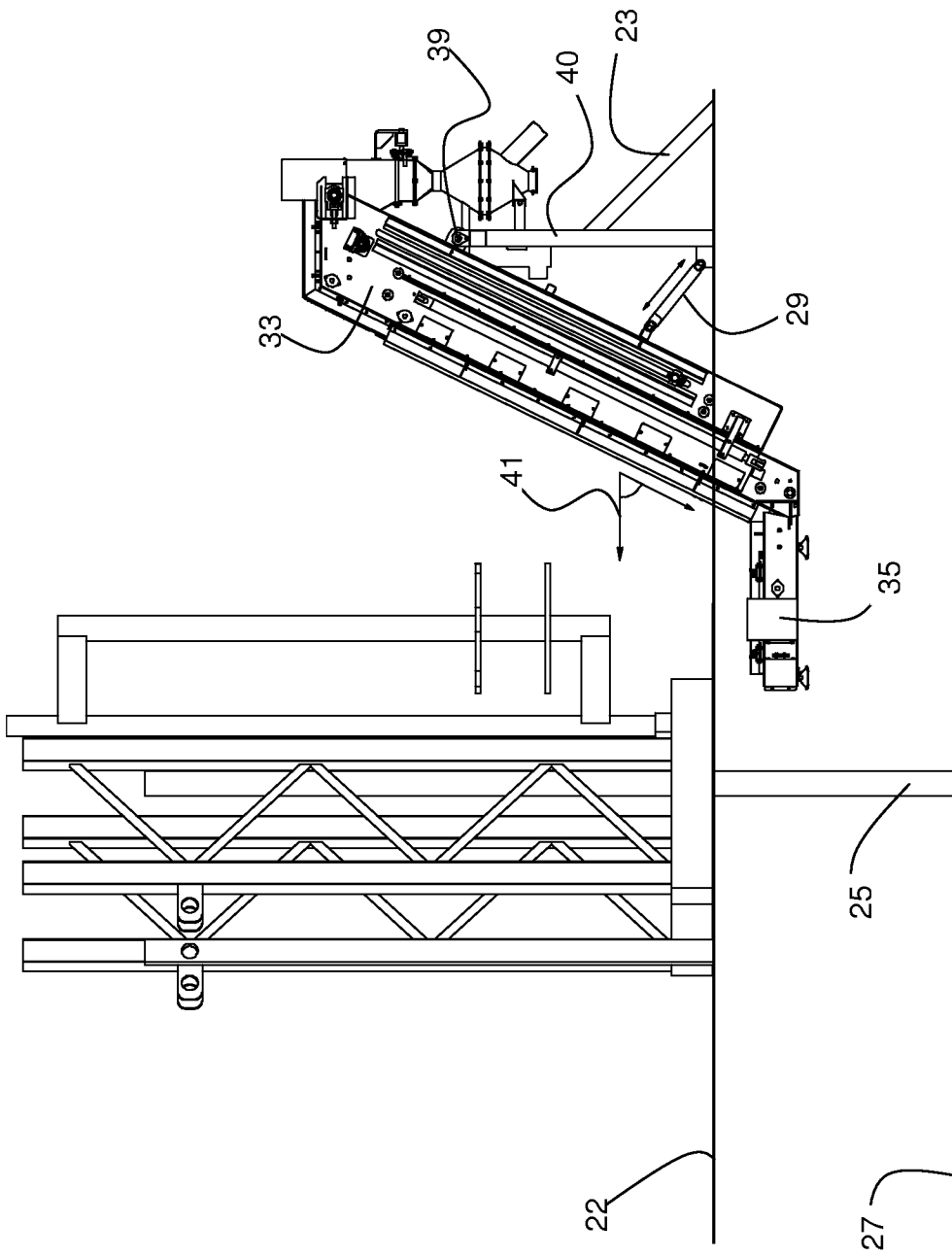
**Fig. 2(a)**



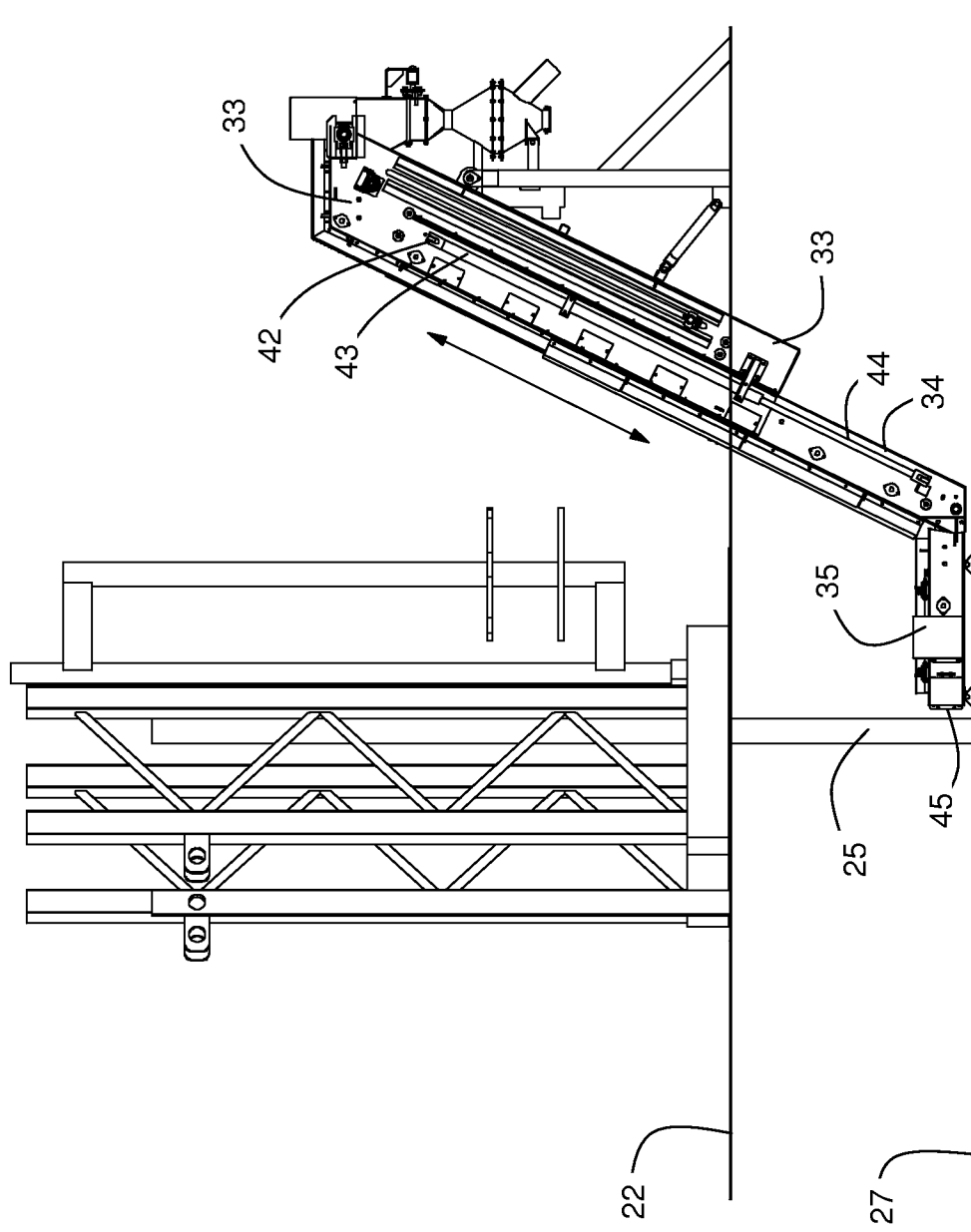


**Fig. 2(b)**

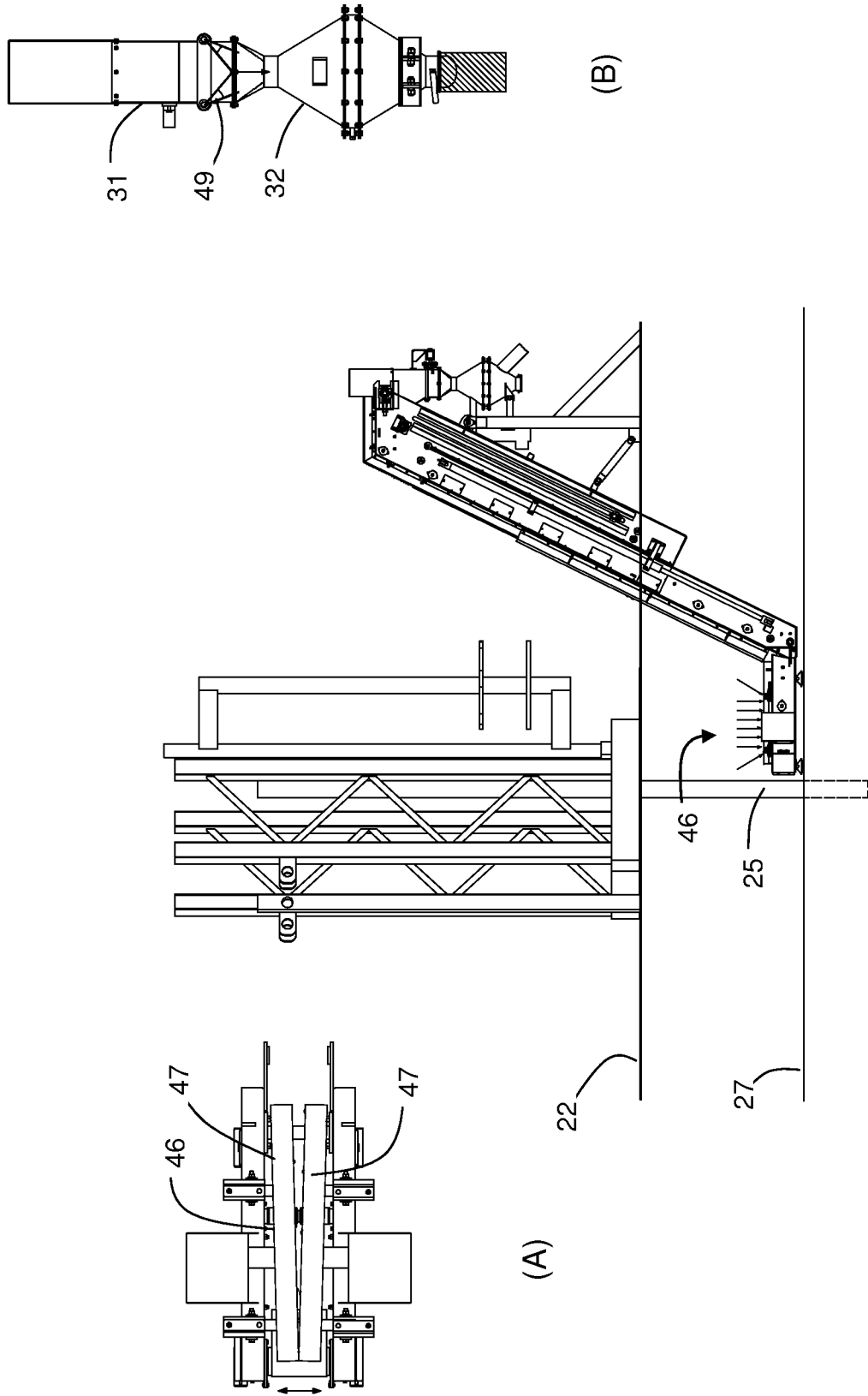
**Fig. 2(c)**

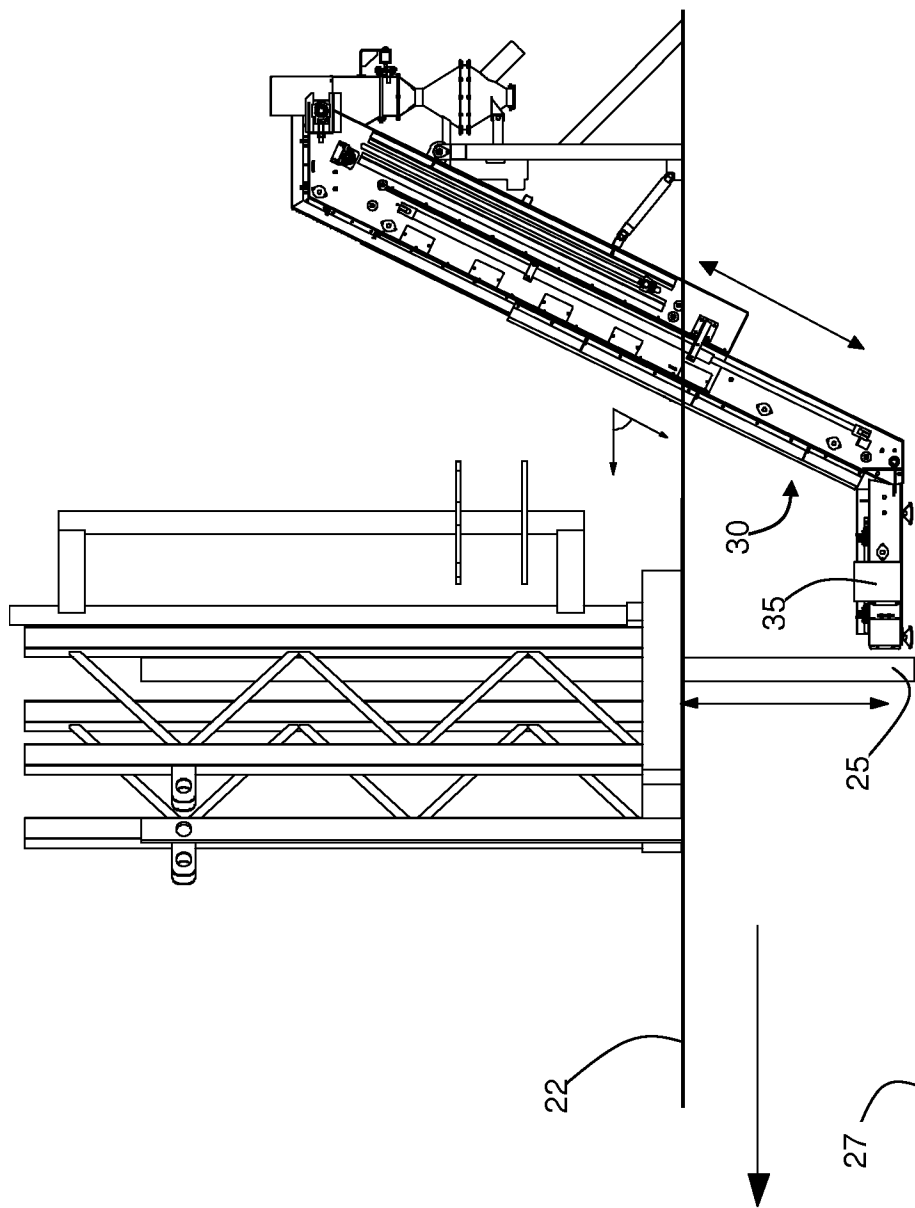


**Fig. 2(d)**



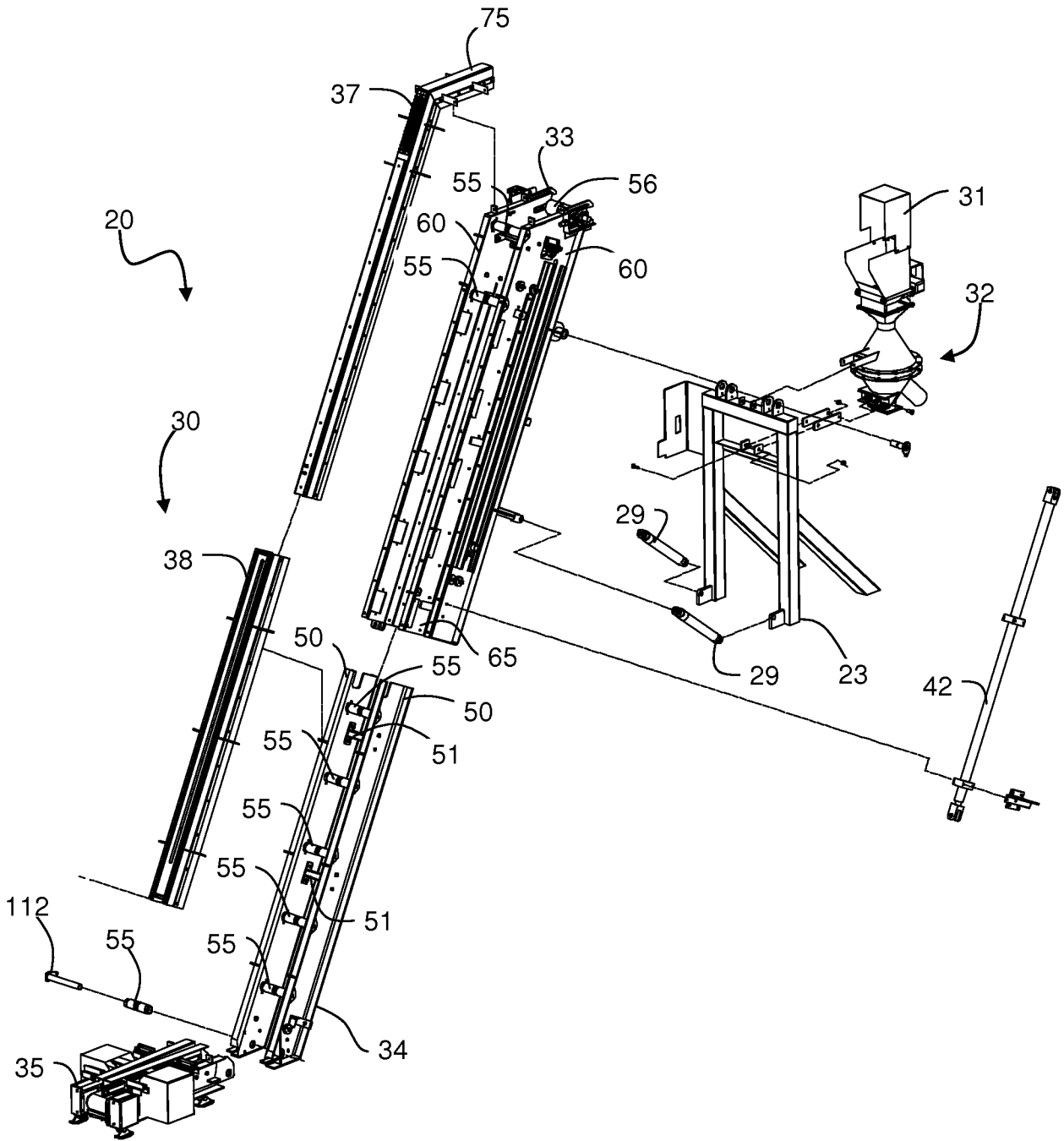
**Fig. 2(c)**



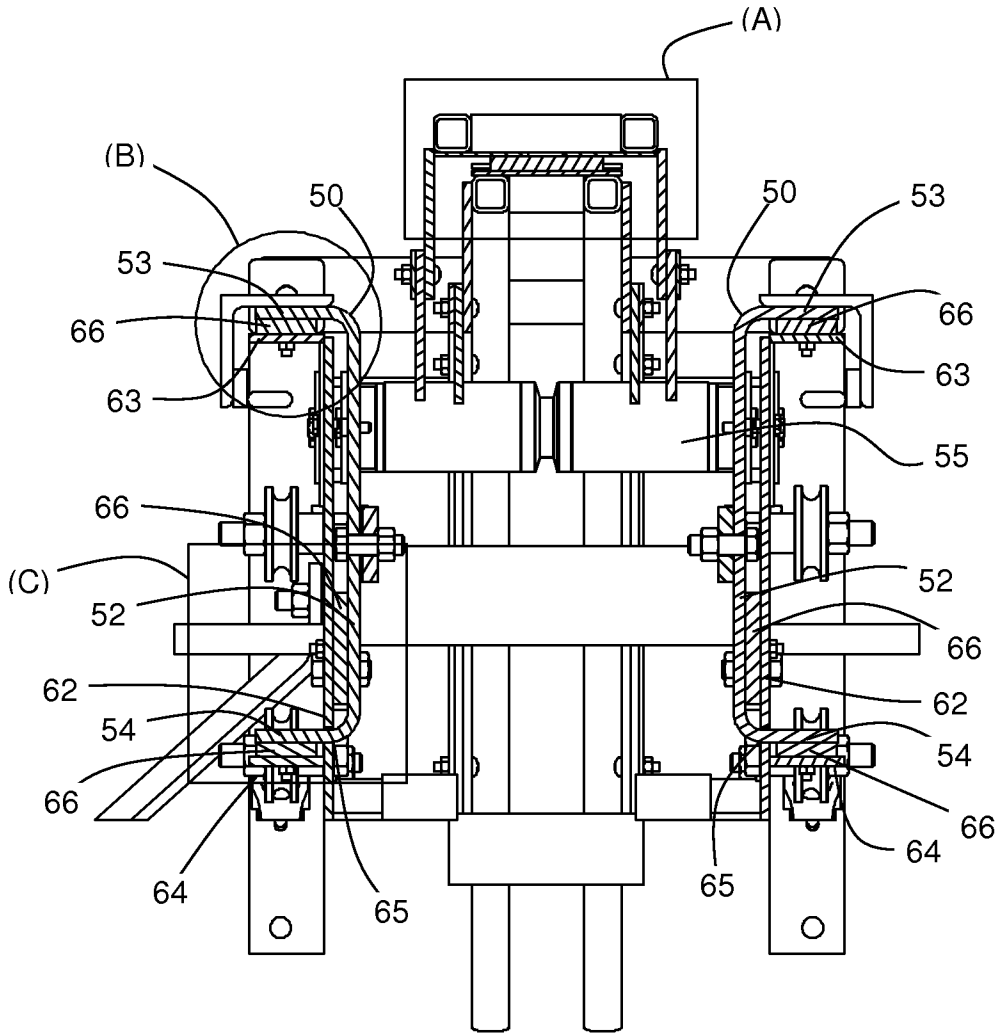


**Fig. 2(f)**

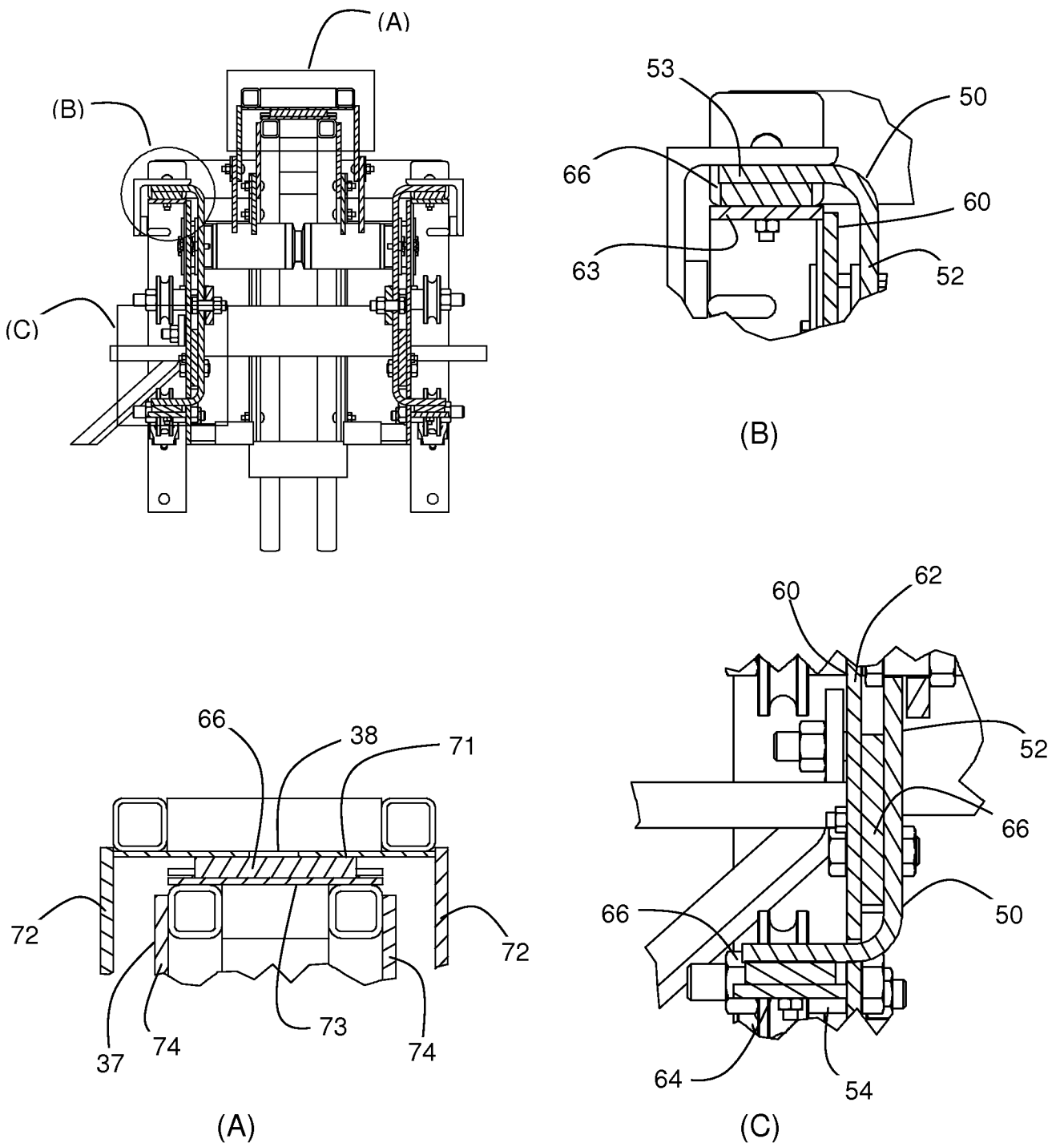
**Fig. 3**



**Fig. 4(a)**

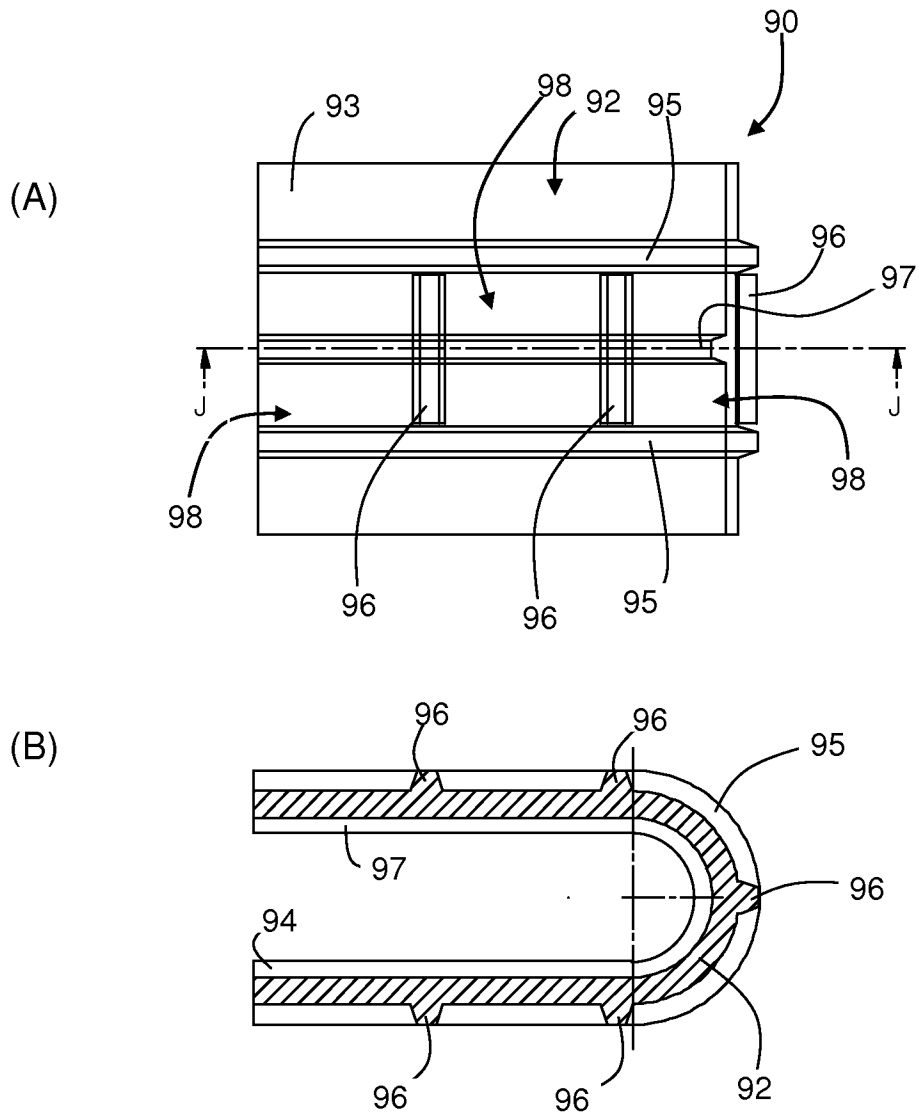


**Fig. 4(b)**

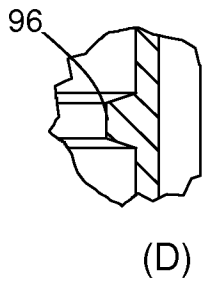
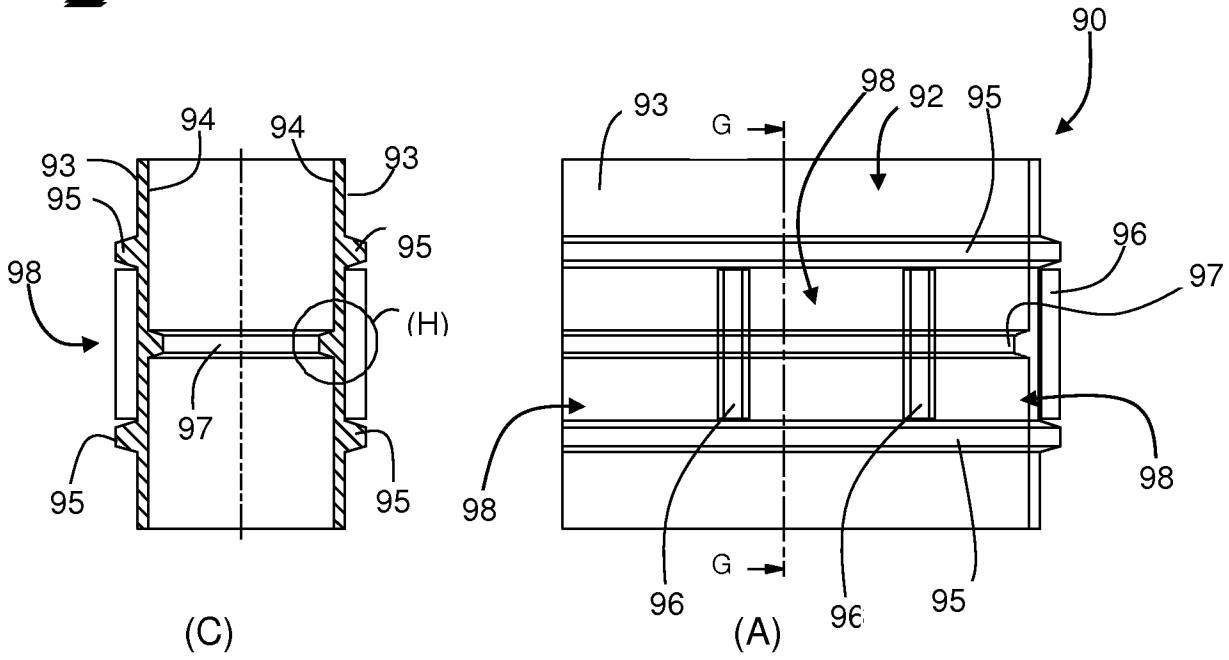




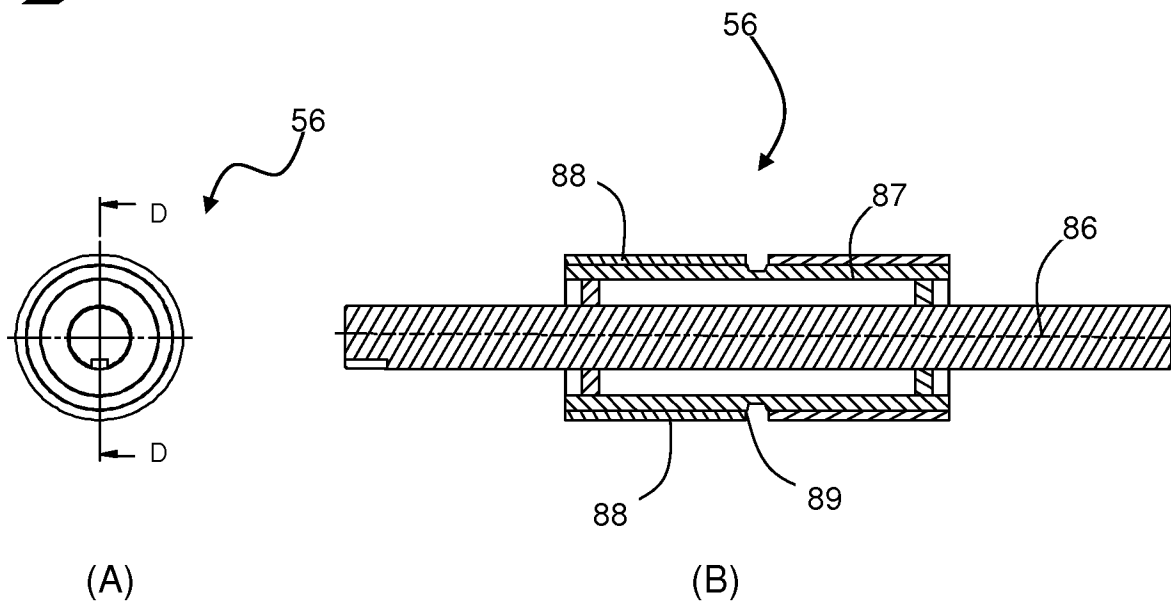
**Fig. 6**



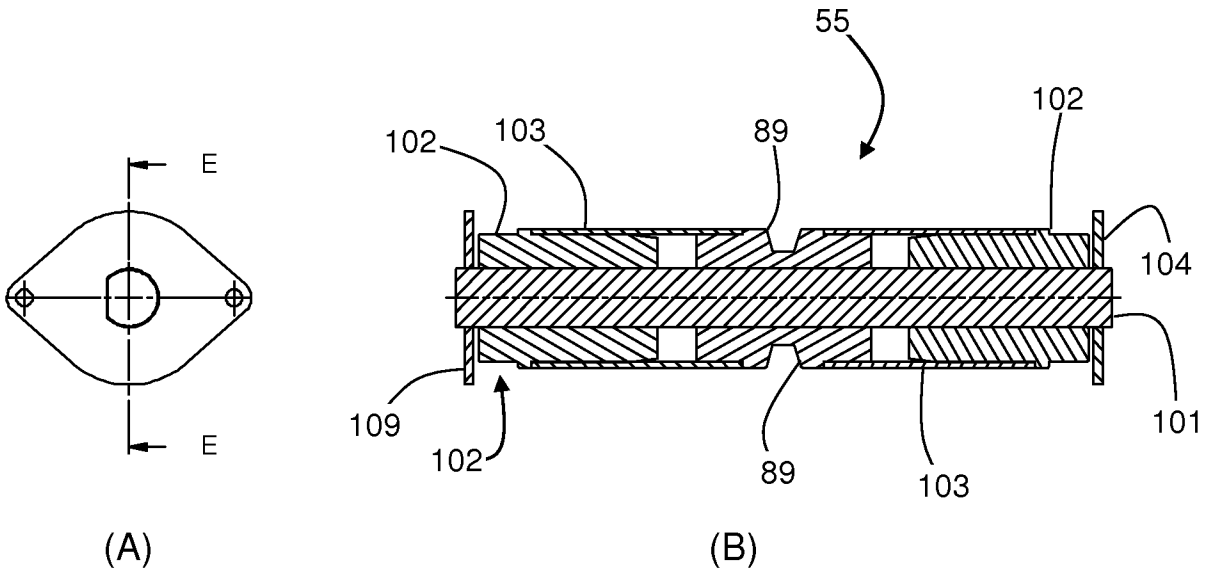
**Fig. 6(b)**



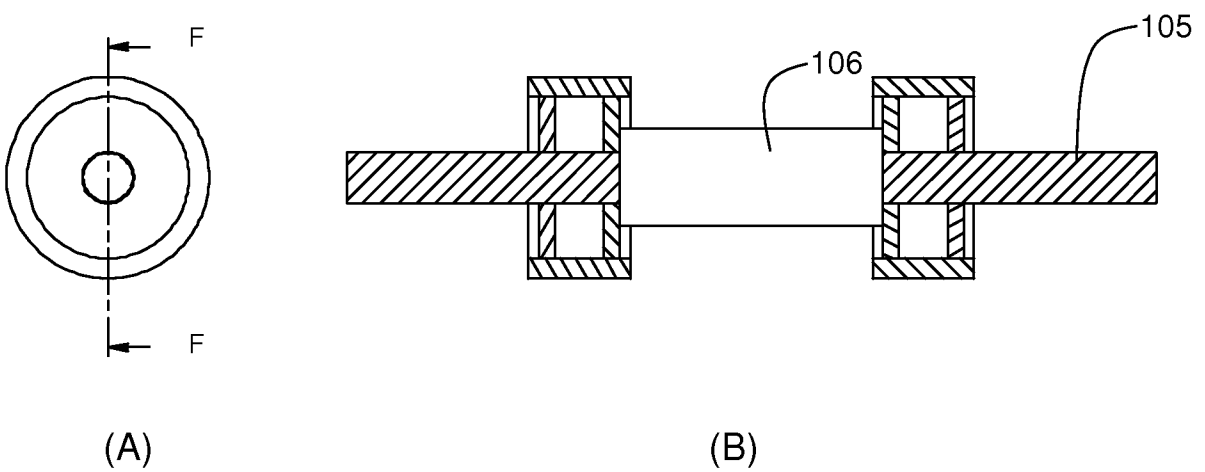
**Fig. 7**



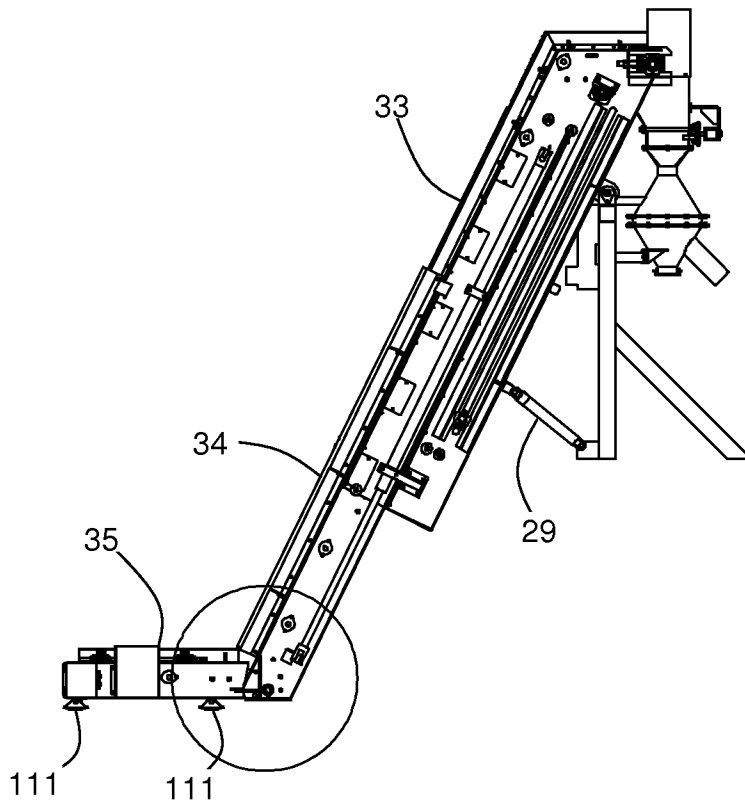
**Fig. 8**



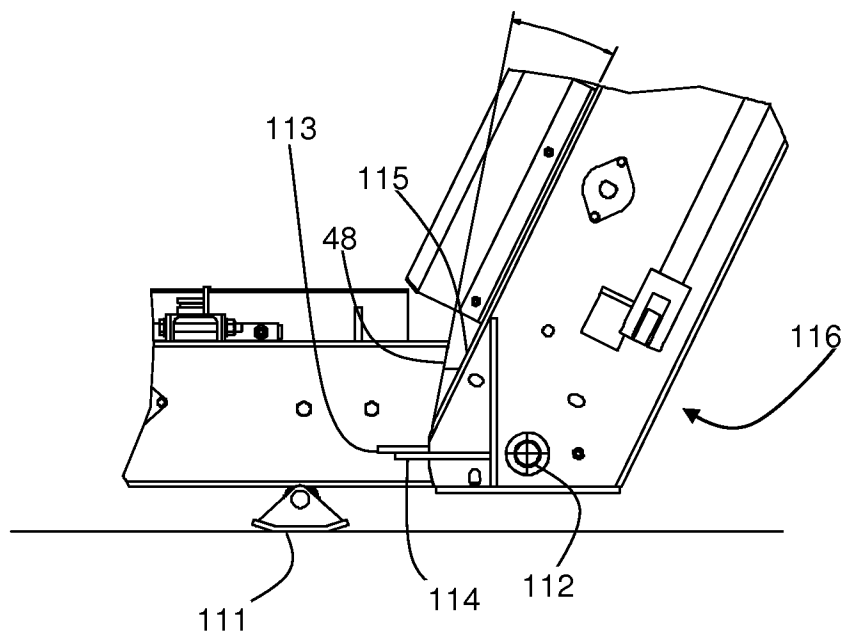
**Fig9**



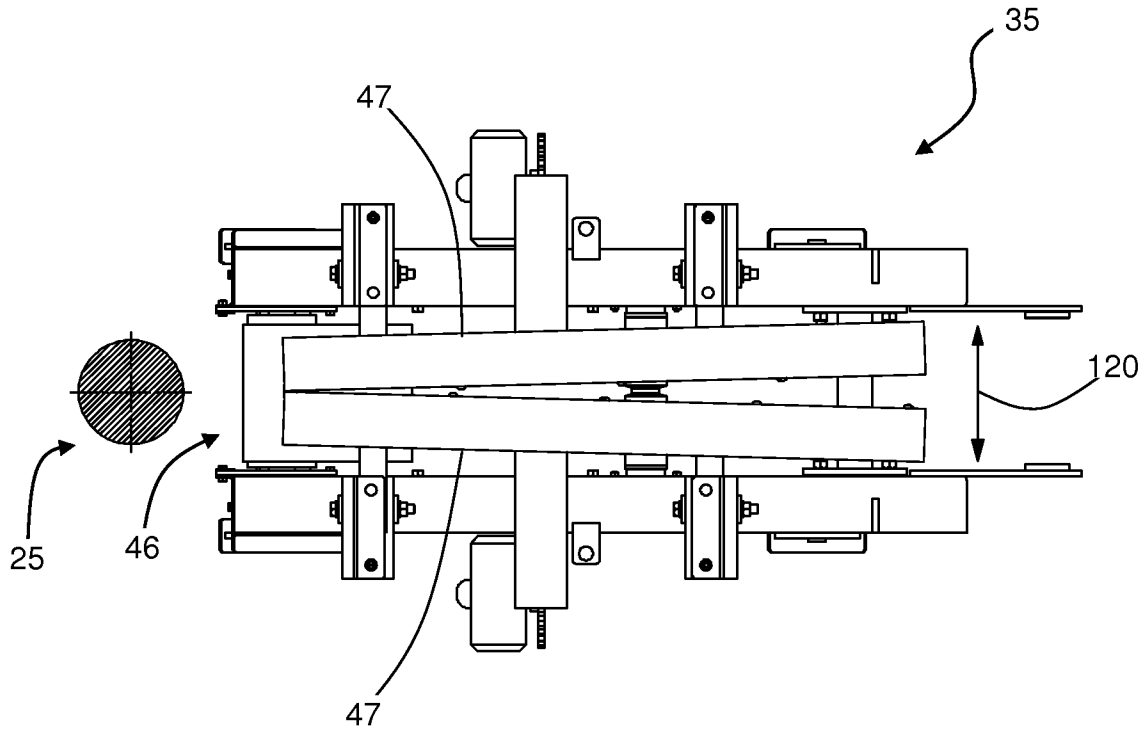
**Fig. 10(a)**



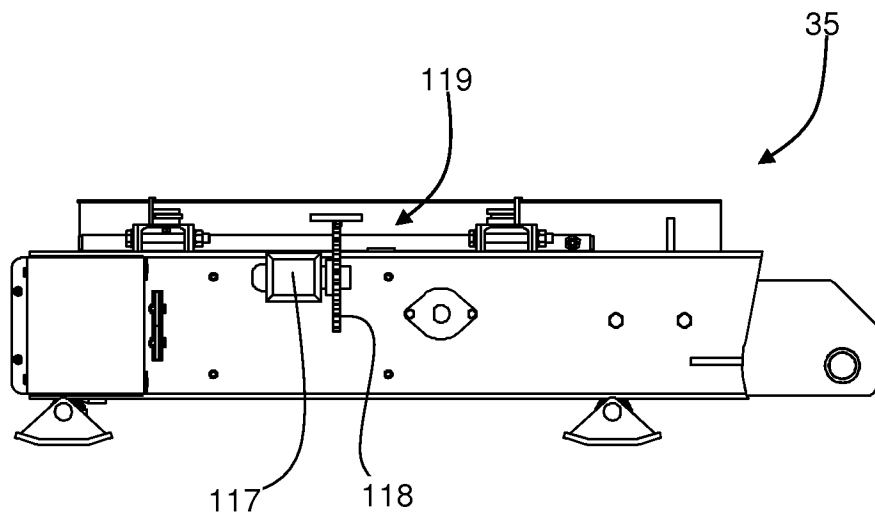
**Fig. 10(b)**



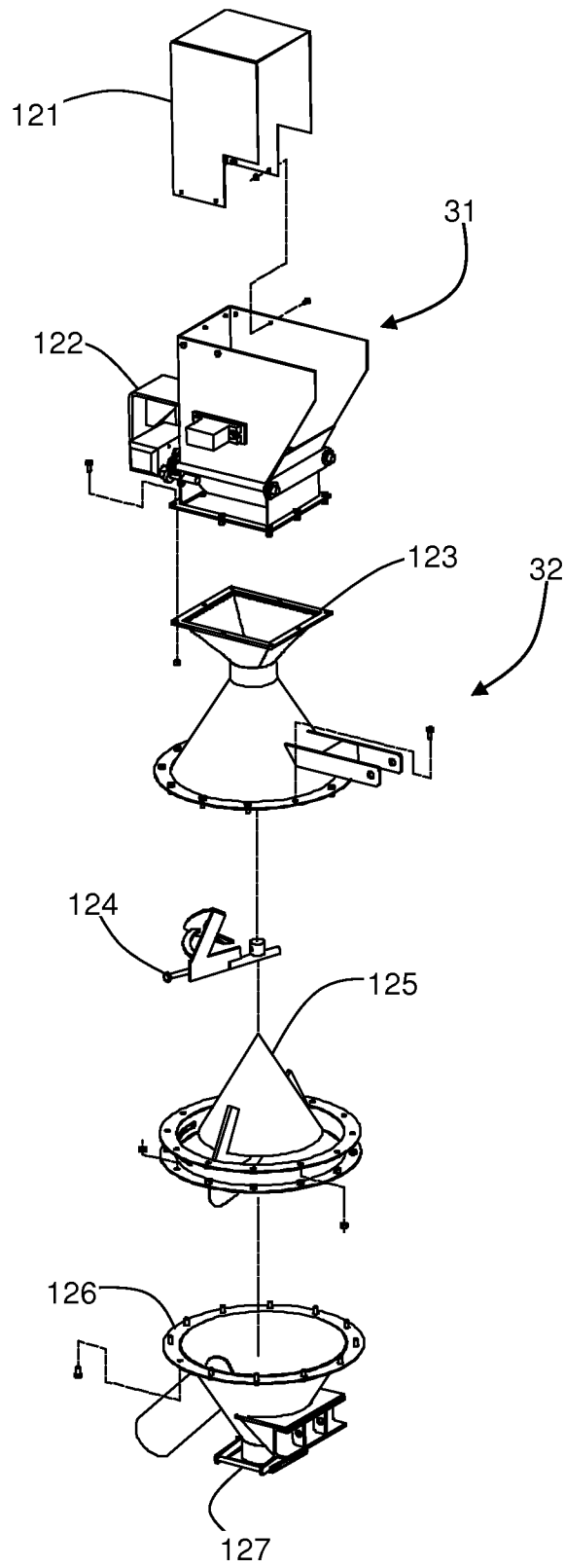
**Fig. 11(a)**



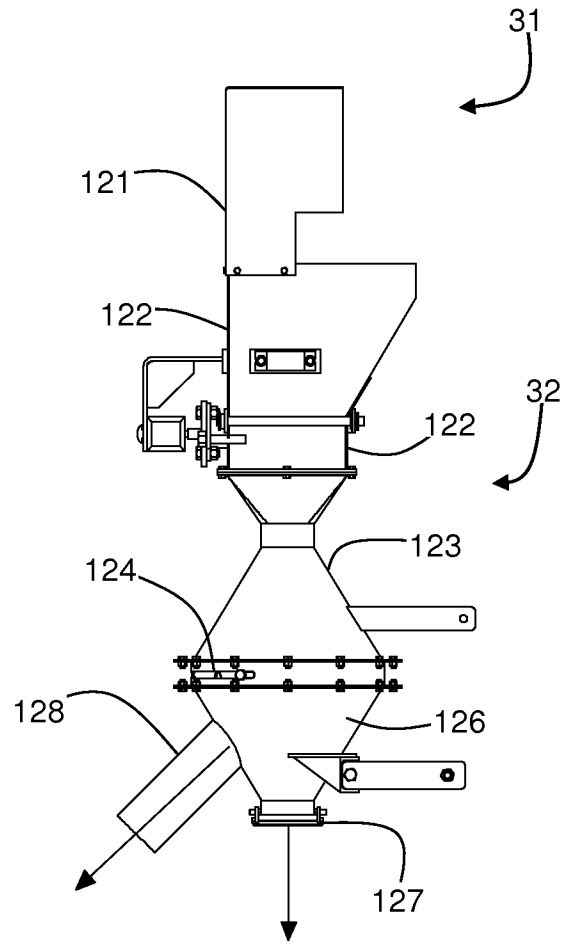
**Fig. 11(b)**



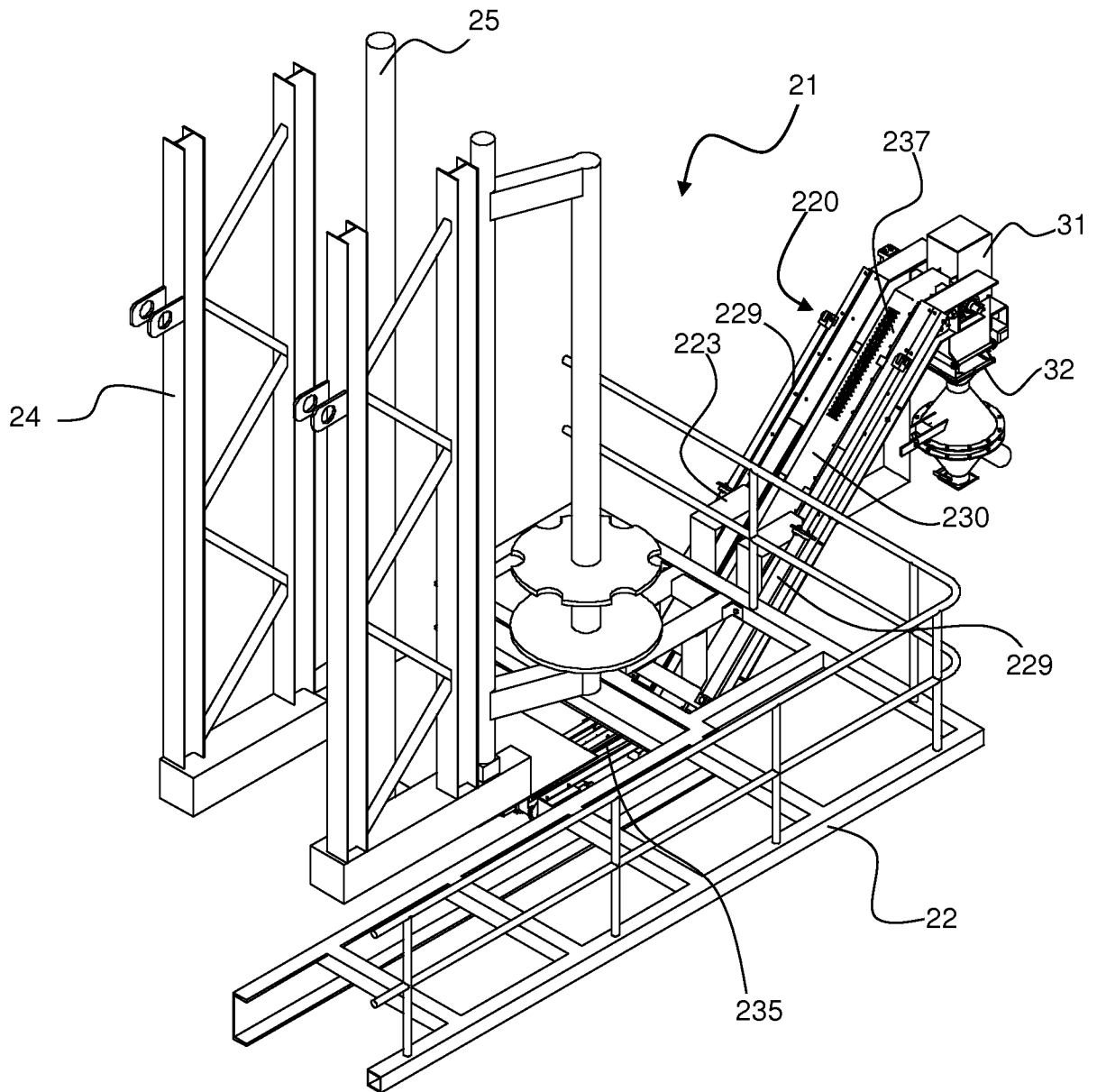
**Fig. 12(a)**



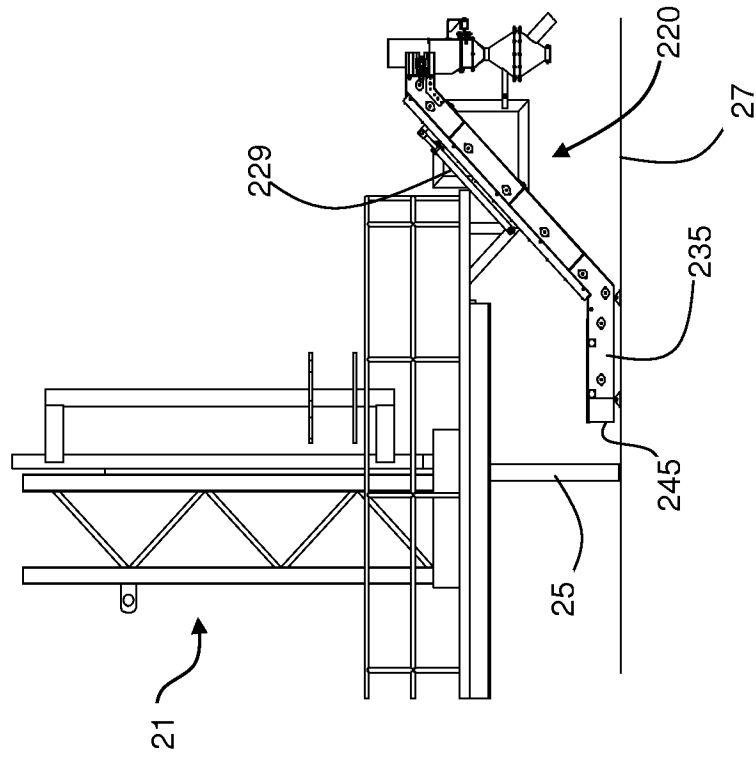
**Fig. 12(b)**



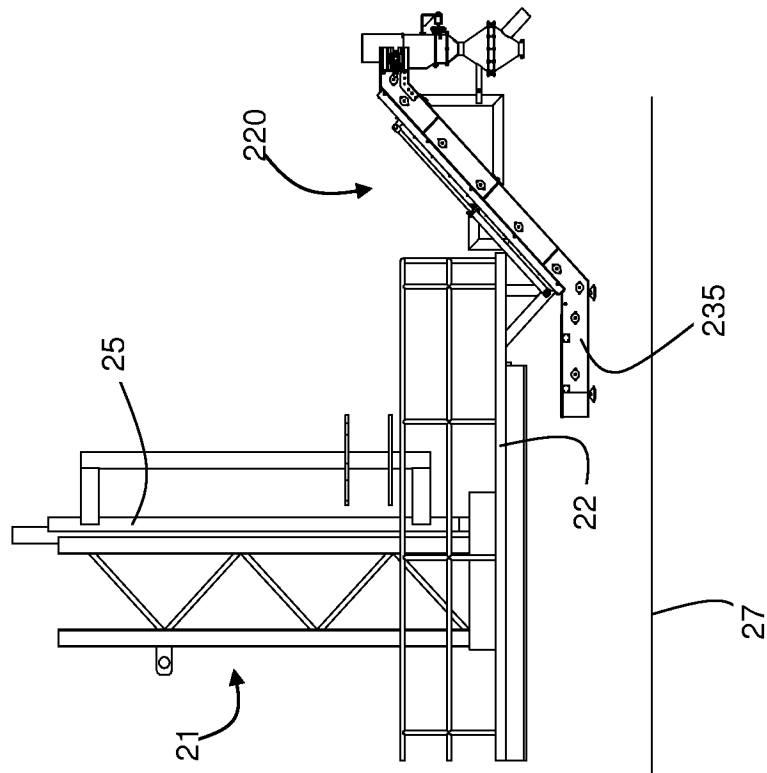
**Fig. 13**



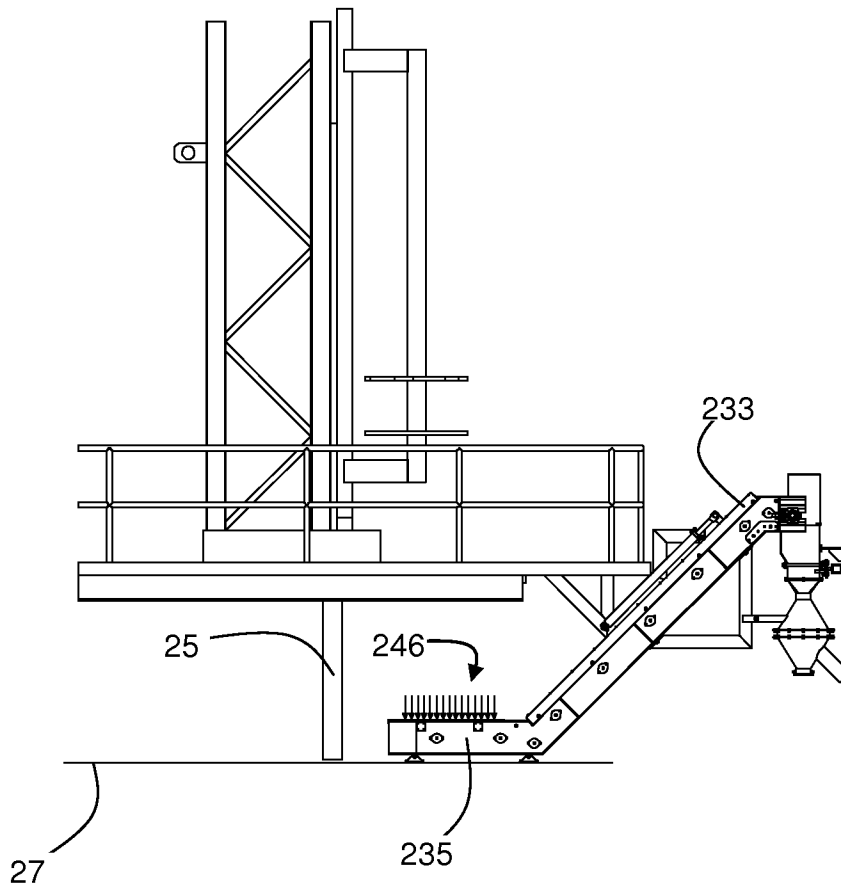
**Fig. 14(b)**



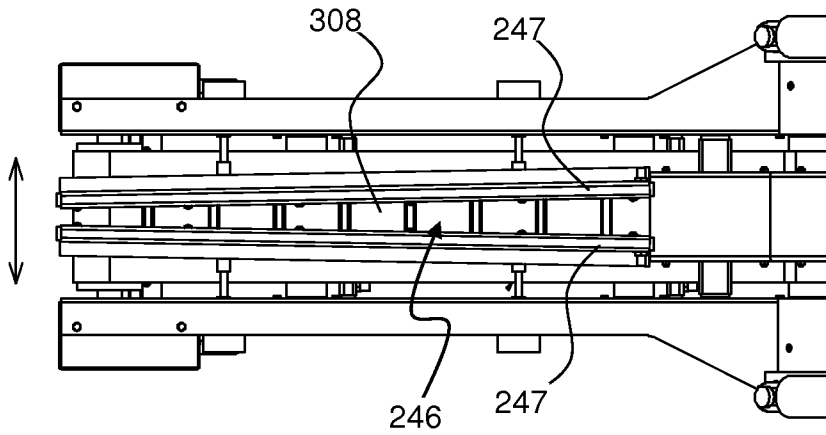
**Fig. 14 (a)**



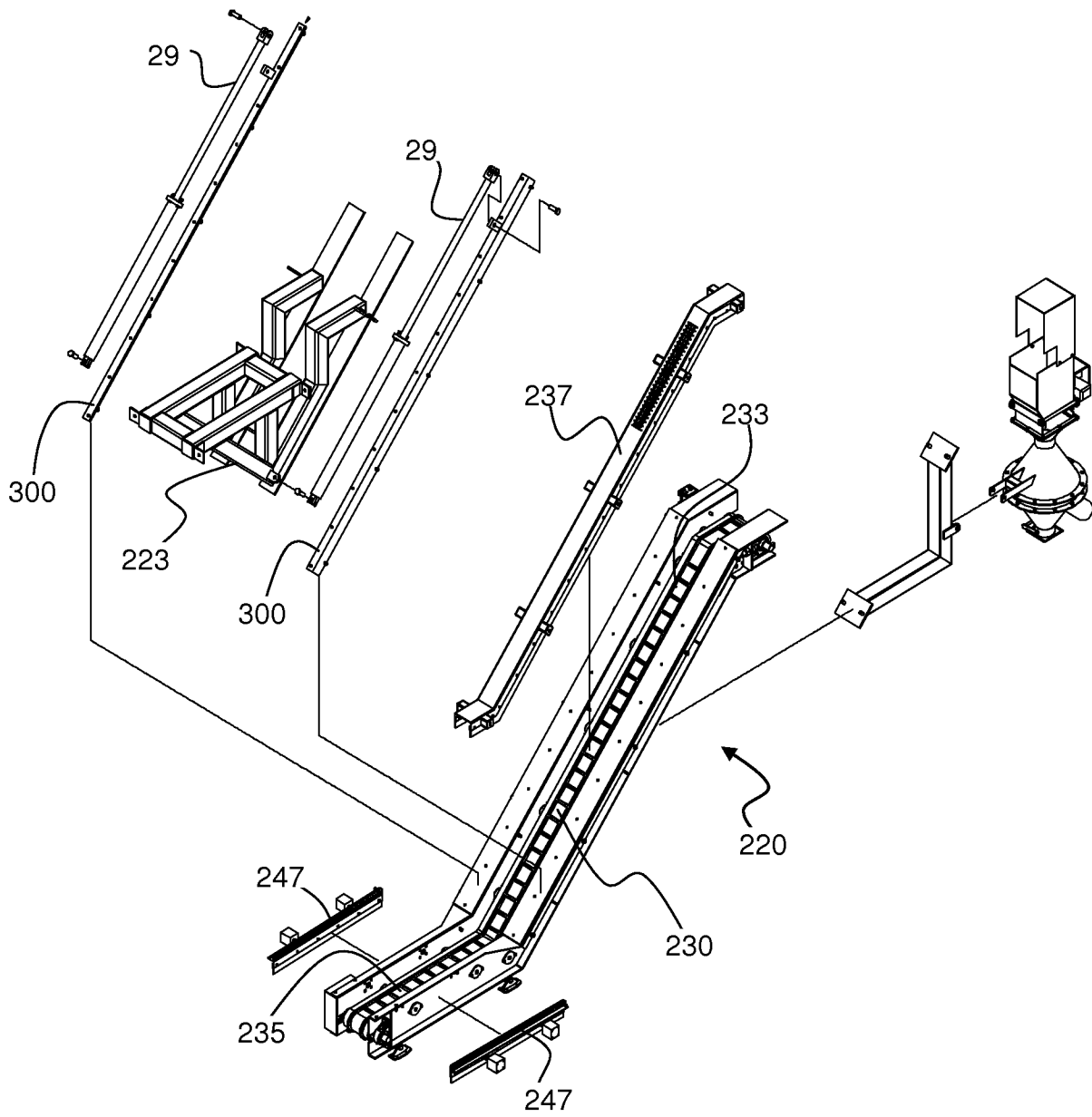
**Fig. 14(c)**



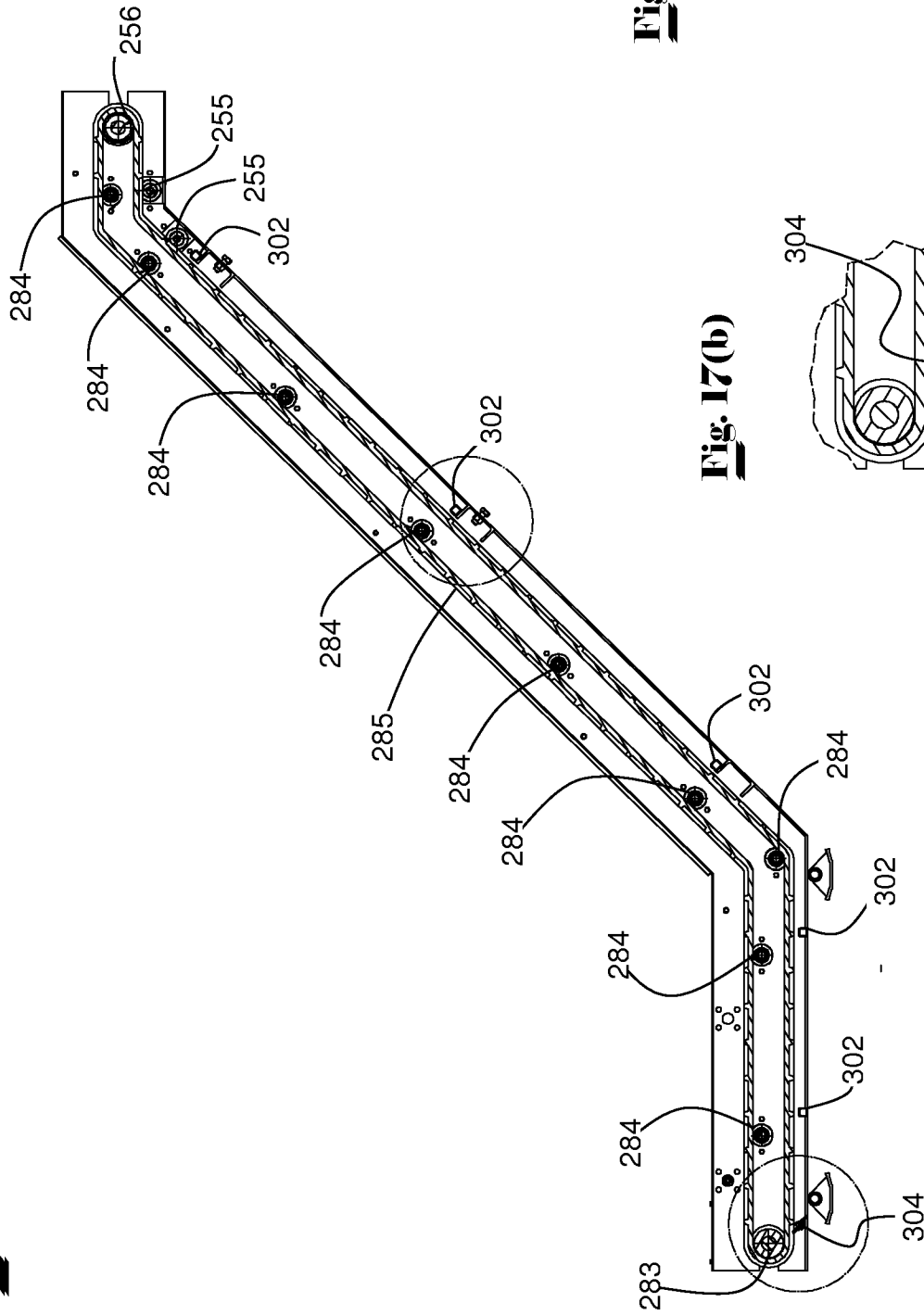
**Fig. 15**



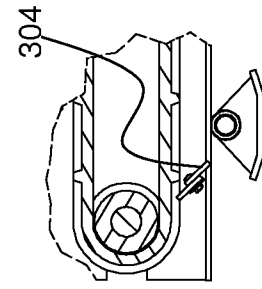
**Fig. 16**



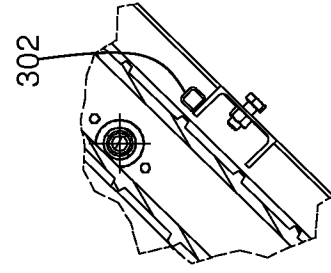
**Fig. 17(a)**



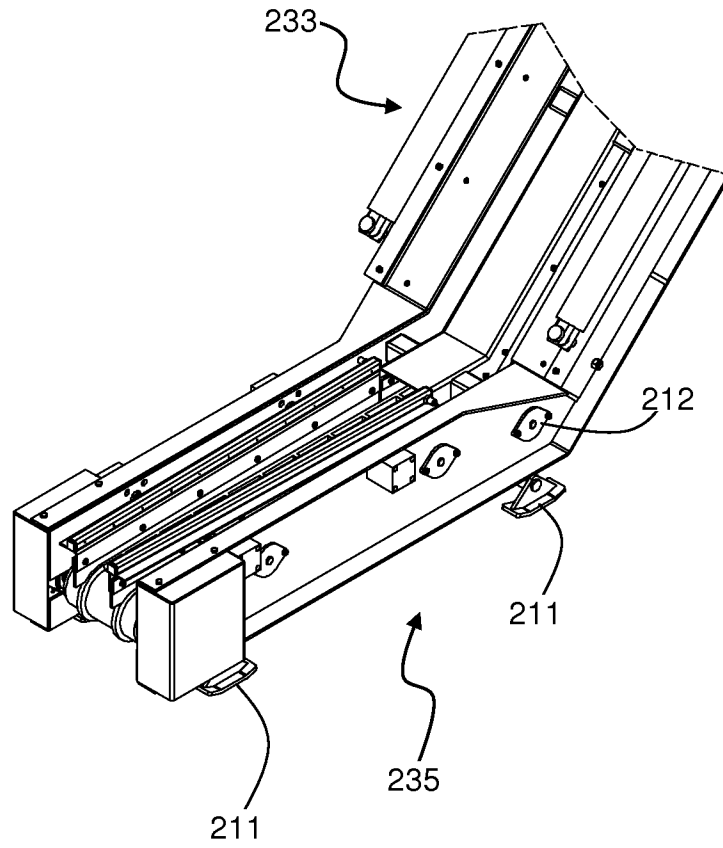
**Fig. 17(b)**



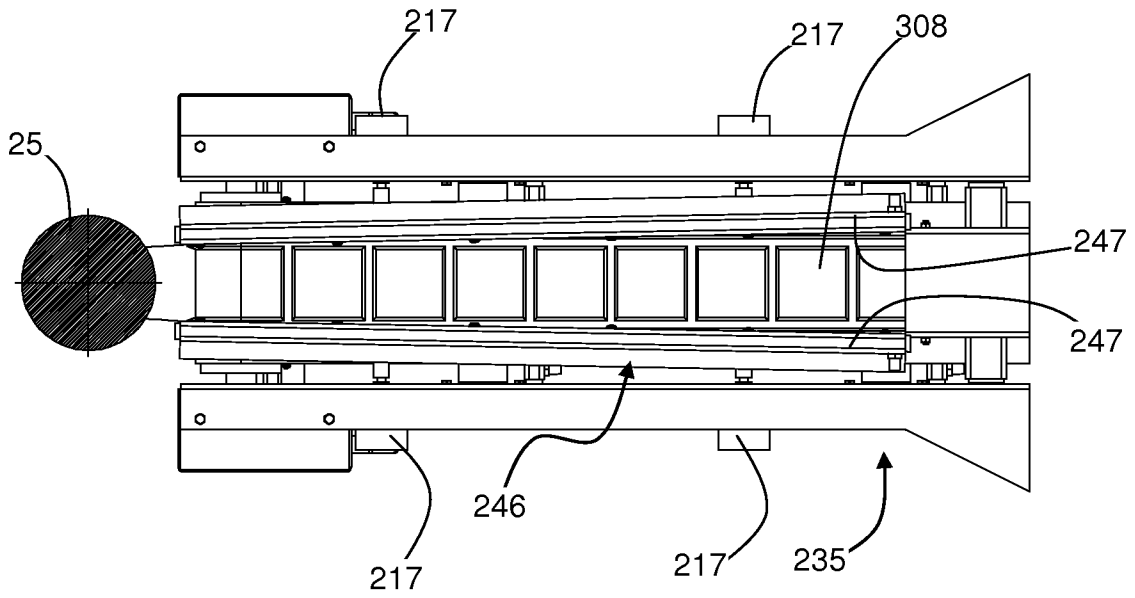
**Fig. 17(c)**



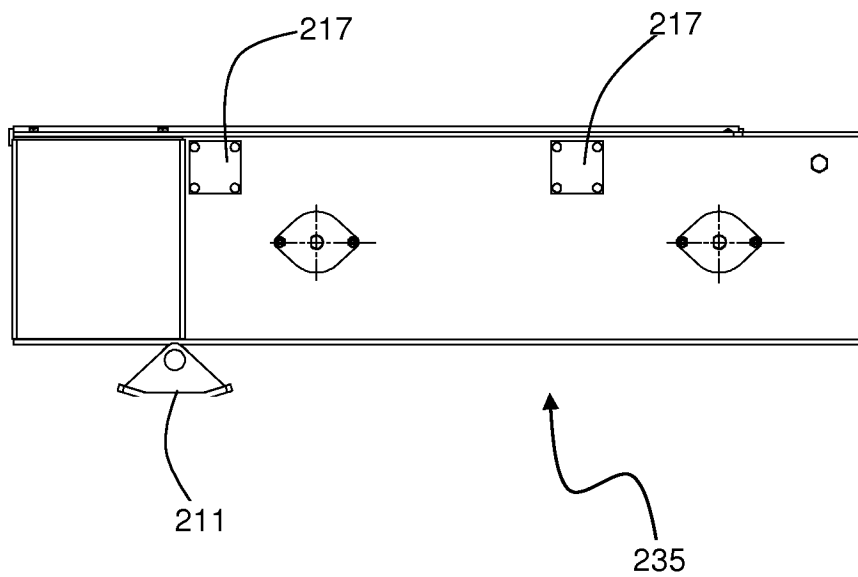
**Fig. 18**



**Fig. 19(a)**



**Fig. 19(b)**



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2009/000867

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

E21B 49/02 (2006.01)

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)

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 practicable, search terms used)

EPODOC, WPI : E21B 49/02, 25/00 and Keywords (collect+, receiv+, receptacle, chute, hopper, sampl+, cor+, cutting+, side+, transvers+, lateral+, open+, clos+, adjust+, cover+, convey+, transport+, shape, trapezoid+, sector, segment+, clean+ and like terms)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5894096 A (KOTRABA et al) 13 April 1999 Column 4 line 3 – column 5 line 23 and figures 3, 5, 6 and 15	1-4, 8, 14, 15, 22-27, 30, 31
A	US 6845657 B2 (WILLIAMS) 25 January 2005	
A	US 5931236 A (MAHLUM et al) 3 August 1999	
A	US 5372037 A (BUTT) 13 December 1994	

 Further documents are listed in the continuation of Box C See patent family annex

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"E" earlier application or patent but published on or after the international filing date

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"O" document referring to an oral disclosure, use, exhibition or other means

"&amp;" document member of the same patent family

"P" document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search  
05 August 2009Date of mailing of the international search report  
11 AUG 2009Name and mailing address of the ISA/AU  
AUSTRALIAN PATENT OFFICE  
PO BOX 200, WODEN ACT 2606, AUSTRALIA  
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Facsimile No. +61 2 6283 7999Authorized officer  
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**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

**See extra sheet**

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**Supplemental Box**

(To be used when the space in any of Boxes I to IV is not sufficient)

**Continuation of Box No: III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1 to 27, 30 and 31 are directed a drill cutting sampling assembly, a drill rig and a method for collecting drilling samples using the said sampling assembly, wherein the sampling assembly includes a sample receiving means for positioning adjacent to a drill hole to receive drill cuttings through an opening which is adjustable between an open and closed position. It is considered that the feature of the adjustable opening comprises a first distinguishing feature.
- Claims 28 and 29 are directed to a drill cutting sample assembly including a conveyor having a first conveyor section and a second conveyor section, wherein (a) the longitudinal position of the first section can be varied relative to the second section and (b) the first section is placed adjacent a drill hole for receiving samples and conveying the same to an opposite end of the second section. It is considered that features (a) and (b) comprise a second distinguishing feature.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

Each of the abovementioned groups of claims has a different distinguishing feature and they do not share any feature which could satisfy the requirement for being a special technical feature. Because there is no common special technical feature it follows that there is no technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a priori*.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2009/000867

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5894096	NONE					
US	6845657	AU	2003228414	CA	2480719	ES	2293762
		GB	2405888	MX	PA04009466	US	2003182997
		WO	03083249	ZA	200407808		
US	5931236	EP	0896101				
US	5372037	NONE					

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX