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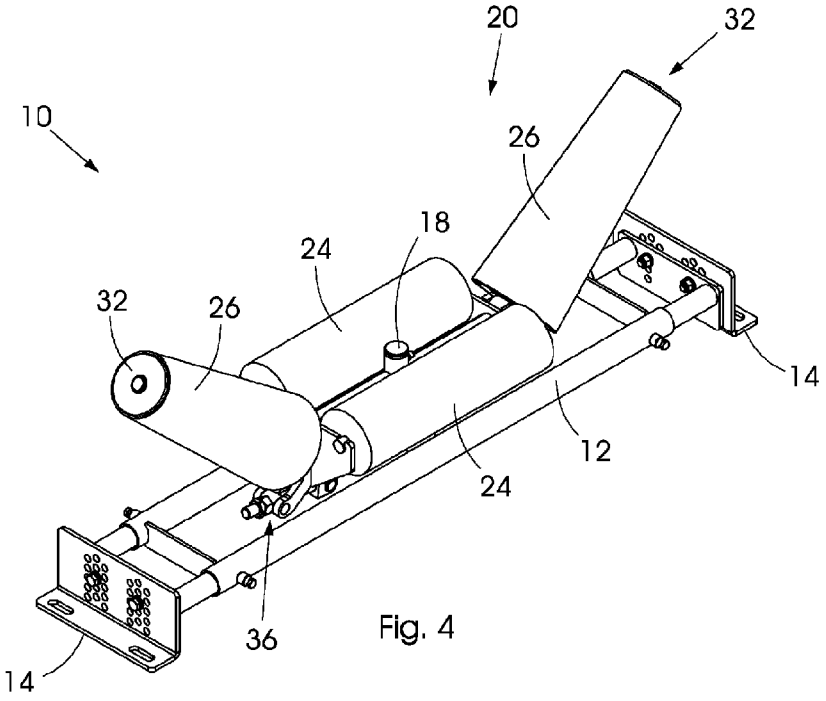

Fig. 4

(57) Abstract: A conveyor alignment mechanism (10, 100, 200) used to guide conveyor belts (20), and typically but not exclusively, belts of trough conveyors. The conveyor alignment mechanism (10, 100, 200), comprises a mounting frame (12) for operatively mounting the conveyor alignment mechanism (10, 100, 200) to a conveyor frame and a substructure (16, 208) which is pivotably mounted to the mounting frame (12) by means of a main pivot (18). A pair of steering or wing rollers (26) are mounted relative to the substructure (16, 208) in outward-facing cantilevered fashion. Specifically, the alignment mechanism (10, 100, 200) is configured to protrude substantially no further laterally than the mounting frame (12) or the conveyor frame. In a preferred form of the invention the steering or wing rollers (26) are adjustable, with a permissible range of adjustment between about 0 degrees and about 65 degrees.

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CONVEYOR ALIGNMENT MECHANISM

BACKGROUND TO THE INVENTION

This application claims priority from Australian application number 2022900965 filed 11 April 2022, the content of which is incorporated in its entirety herein by reference, as if repeated herein.

This invention relates to trough conveyors. More particularly, the present invention relates to trough conveyor alignment mechanisms, used to guide trough shaped conveyor belts.

A device to guide trough shaped belts typically has a central roller or rollers, and wing rollers on either side of the central roller which are angled upwards from the horizontal so as to match the profile or troughing angle of the belt.

Trough shaped conveyor belts tend to be difficult to guide or steer because the alignment or steering mechanism, in particular the wing rollers, tend to push into the belt as the mechanism seeks to align the belt. Also, trough configurations of different belts are not standard and, in particular, the troughing angle can vary from conveyor to conveyor.

Accordingly, known trough conveyor alignment mechanisms are often provided with pivotably adjustable wing rollers. The range of adjustment of these known alignment mechanisms is very limited, and the range is typically only a few degrees. Furthermore, known alignment mechanisms tend to butt out sideways from the side of the alignment mechanism, and often protrude beyond or stand proud of the conveyor frame and into maintenance walkways running along sides of the conveyor.

This may pose potential safety concerns and may inhibit the use of hoods or other covers typically employed over conveyors of this nature. Such hoods, therefore, often have to be customized in areas where alignment mechanisms are installed, which adds complexity to the installation and maintenance of the conveyor.

It is furthermore believed that the bulky construction of prior art alignment mechanisms may negatively impact the efficiency of the alignment mechanism.

It is accordingly an object of the invention to provide a trough conveyor alignment mechanism and a trough conveyor incorporating such an alignment mechanism that will, at least partially, address the above disadvantages.

It is also an object of the invention to provide a trough conveyor alignment mechanism and a trough conveyor incorporating such an alignment mechanism which will be useful alternatives to existing or known alignment mechanisms and trough conveyors.

SUMMARY OF THE INVENTION

According to the invention there is provided an adjustment mechanism for trough conveyor belt alignment devices that protrudes substantially no further laterally than the mounting arrangement by means of which the device is mounted to a conveyor frame. In a preferred form of the invention the steering or wing rollers of the device are mounted cantilever fashion to the device frame, and the adjustment mechanism is incorporated into the cantilever mounting arrangement. Preferably the adjustment mechanism allows the wing rollers to be adjusted to an angle of 0 degrees, so that the wing rollers are substantially in the same plane as the central roller or rollers.

In accordance with a first aspect of the invention, there is provided a conveyor alignment mechanism, comprising

a mounting frame for operatively mounting the conveyor alignment mechanism to a conveyor frame;

a substructure, pivotably mounted to the mounting frame by means of a main pivot;

a pair of steering rollers mounted relative to the substructure in outward-facing cantilevered fashion.

Further in accordance with the first aspect of the invention, at least a portion of each of the steering rollers may be tapered. Each steering roller may be mounted to the subframe by means of a respective tubular bracket having a bore within which a shaft of the respective wing roller is operatively received. This tubular bracket may form part of an angle adjustment mechanism (in cases where the steering rollers are adjustable) or may be fixed relative to the substructure.

Furthermore, in some embodiments of the first aspect of the invention, each steering roller may pivotably adjustable relative to the substructure. Each steering roller may be mounted to the substructure by means of an angle adjustment mechanism. In some examples, each angle adjustment mechanism may comprise a tubular bracket with a bore within which a shaft of the respective steering roller may operatively be received and retained in cantilever fashion. The shaft of the respective steering roller may be fixed relative to the tubular bracket by means of at least a first grub screw.

Towards a first end thereof, the tubular bracket may pivotably be mounted to the substructure by means of a first pivot. An adjustable link mechanism may extend between a second end of the tubular bracket and the substructure. The adjustable link mechanism may pivotably be fixed to both the tubular bracket and the substructure by means of a second and third pivot, respectively. An effective length of the adjustable link mechanism may be adjustable, to

pivot the tubular bracket about the first pivot to adjust an angle of the tubular bracket relative to substructure. The adjustable link mechanism may comprise a threaded rod with a locking nut arrangement for releasably fixing a position of the adjustable link mechanism.

Furthermore, each steering roller may be adjustable between about 0 degrees and 65 degrees relative to a plane in which the central rollers are arranged. It will be appreciated that end values of the range of adjustability may be included. Also, the specific configuration of the alignment mechanism may be such that end values of the range of adjustability may differ from those specified above. Particularly, the end values may take any value between 0 and 65 degrees and any such feasible value is therefore incorporated herein as if specifically repeated herein.

In some cases, the alignment mechanism may further comprise at least a first, but typically two central rollers arranged between the pair of steering rollers (and on opposite sides of the main pivot [in the case of two central rollers being provided]). The central roller(s) may be replaced by bearing plates.

In other cases, the alignment mechanism need not be provided with central rollers or bearing plates. In some such cases, the alignment mechanism may be configured as a return tracker and each angle adjustment mechanism may comprise:

a first pivot connected to the substructure and to a shaft of the respective steering roller;

a lever arranged pivotably relative to the substructure;

a base plate fixed relative to the substructure; and

an adjustable member extending between the lever and base plate.

Now, the adjustable member may comprise a threaded member received within a threaded bore of the lever and may have a first end arranged to bear against the base plate. The threaded member may comprise an elongate member having a second end supported relative to a distal end of the respective steering roller.

Each steering roller may be configured to be pivotably adjustable in a plane substantially perpendicular to a plane in which the substructure is pivotable about the main pivot.

In accordance with a second aspect of the invention, there is provided a conveyor alignment mechanism, comprising

a mounting frame for operatively mounting the conveyor alignment mechanism to a conveyor belt frame;

a substructure, pivotably mounted to the mounting frame by means of a main pivot;

a pair of steering rollers carried by the substructure,

a pair of angle adjustment mechanisms, each associated with a respective one of the steering rollers and comprising:

an adjustable link mechanism extending substantially vertically from a distal part of the substructure; and

an angled support plate extending between the adjustable link mechanism and a distal part of the respective steering roller.

Further according to the second aspect of the invention, the adjustable link mechanism may include a locking arrangement for locking a position thereof relative to the substructure. The adjustable link mechanism may comprise a threaded rod with a lock nut configured as locking mechanism or a rod with a plurality of longitudinally spaced holes with a locking pin configured as locking arrangement. A footprint (viewed in plan) of the substructure and pair of angle adjustment mechanisms may fall within a footprint of the mounting frame (viewed in plan).

In accordance with a third aspect of the invention, there is provided a conveyor, comprising

a main conveyor frame

a conveyor alignment mechanism according to any one of the preceding claims mounted to the main conveyor frame; and

a belt supported at least partially on the conveyor alignment mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a front view of an alignment mechanism for a trough conveyor in accordance with an aspect of the invention;

Figure 2 shows a top view of the alignment mechanism of Figure 1;

Figure 3 shows a side view of the alignment mechanism of Figure 1;

Figure 4 shows a perspective view of the alignment mechanism of Figure 1;

Figure 5 shows a sectioned front view of the alignment mechanism of Figure 1;

Figure 6 shows a detailed view of an angle adjustment mechanism forming part of the alignment mechanism of Figure 1;

Figure 7 shows a partial perspective view of the angle adjustment mechanism shown in Figure 6, with some components omitted to show specific detail;

Figure 8 shows a partial front view of the angle adjustment mechanism shown in Figures 6 and 7, again with some components omitted to show specific detail;

Figure 9 shows an exploded partial front view of another embodiment of the angle adjustment mechanism of Figures 6 to 8;

Figure 10 shows a perspective view of the angle adjustment mechanism of Figure 9;

Figure 11 shows a top view of the angle adjustment mechanism of Figure 9;

Figure 12 shows a front view of a return alignment mechanism for a conveyor in accordance with an aspect of the invention;

Figure 13 shows a top view of the return angle adjustment mechanism of Figure 12;

Figure 14 shows a partial front view of the return angle adjustment mechanism of Figure 12;

Figure 15 shows a partial detailed front view of the angle adjustment mechanism of Figure 12;

Figure 16 shows a perspective view of the return angle adjustment mechanism of Figure 12;

Figure 17 shows a partial detailed perspective view of the return angle adjustment mechanism of Figure 12;

Figure 18 shows a front view of an alternative embodiment of the return angle adjustment mechanism of Figure 12;

Figure 19 shows a front view of an alignment mechanism according to an alternative aspect of the invention;

Figure 20 shows a top view of the alignment mechanism of Figure 19;

Figure 21 shows a side view of the alignment mechanism of Figure 19;

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in several ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms "mounted", "connected", "engaged" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings and are thus intended to include direct connections between two members without any other members interposed therebetween and indirect connections between members in which one or more other members are interposed therebetween. Further, "connected" and "engaged" are not restricted to physical or mechanical connections or couplings. Additionally, the words "lower", "upper", "upward", "down" and "downward" designate directions in the drawings to which reference is

made. The terminology includes the words specifically mentioned above, derivatives thereof, and words or similar import. It is noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the," and any singular use of any word, include plural referents unless expressly and unequivocally limited to one referent. As used herein, the term “include” and its grammatical variants are intended to be non-limiting, such that recitation of items in a list is not to the exclusion of other like items that can be substituted or added to the listed items.

Referring to figures 1 to 11, in which like numerals indicate like features, a non-limiting example of a conveyor alignment mechanism (or simply “alignment mechanism”), in accordance with the invention, is generally indicated by reference numeral 10.

The alignment mechanisms detailed herein are of a type in which outer or wing rollers are configured as steering rollers. Central rollers (if present) typically do not play an active or fundamental role in the steering or alignment of the belt. Therefore, alignment mechanisms with “steering” or “wing” rollers as discussed herein are distinguished from other types of alignment mechanism in which side rollers play a role as "activation rollers” and in which case a central roller plays an active or primary role in steering or alignment of the belt.

The alignment mechanism 10 is specifically configured as a trough conveyor alignment mechanism.

The alignment mechanism 10 comprises a mounting frame 12 with end mounting brackets 14 which, in use, mount to a conveyor belt frame structure (not shown). The mounting frame 12 is telescopically adjustable (in width) to facilitate use with various conveyor belt frame structure configurations.

The alignment mechanism 10 also comprises a substructure in the form of a subframe 16, which is pivotably mounted to the mounting frame 12 by means of a main pivot (or pivot post) 18.

A set of rollers (collectively referred to by reference numeral 20) is supported by the subframe 16. The set of rollers 20 operatively support a conveyor belt, indicated schematically by broken lines and reference numeral 22 in Figure 1.

The set of rollers 20 typically comprises at least one, but preferably a pair of central rollers 24 and a pair of tapered wing rollers 26. The wing rollers 26 are configured as steering rollers, as discussed more fully below. The central rollers 24 are arranged to the front and rear (in a direction of travel of the belt 22) of the main pivot 18. The wing rollers 26 are arranged on either side of the pair of central rollers 24. The wing rollers 26 are arranged at an angle 28 relative to the central rollers 24 such that a troughing angle 30 is defined (the troughing angle 30 is slightly smaller than the wing roller angle 28, due to the taper of the wing rollers 26). Edge portions of the belt 22 are carried and supported by the wing rollers 26. Since the set of rollers 20 is wholly supported by the subframe 16, the complete set 20 is therefore pivotable about the main pivot 18. As is known in

the art, if the belt 22 becomes misaligned in use, one edge of the belt 22 will ride up one of the wing rollers 26 and the other edge of the belt 22 will ride down the opposite wing roller 26. Since the wing rollers 26 are tapered, this puts an uneven force on the two wing rollers 26 which causes a moment about the main pivot 18, causing the subframe 16 to pivot or swing on the main pivot 18. This will in turn cause the alignment mechanism 10 (and in particular, the steering or wing rollers 26) to steer the belt 22 back to a central position in which the forces on the wing rollers 26 are substantially equalised and the subframe 16 is substantially perpendicular to the length or direction of travel of the belt 22.

Importantly, each wing roller 26 is mounted proximally relative to the subframe 16 (therefore towards a centre of the alignment mechanism or towards the main pivot 18) in outward-facing cantilevered fashion. Therefore, an outside-facing end (distal end) 32 of each wing roller 26 is unsupported and therefore, the wing rollers 26 are only supported relative to the subframe 16 at their lower or proximal ends 34.

It will readily be appreciated that arranging the wing rollers in cantilevered fashion:

i. reduces an overall footprint of the subframe 16, which makes fitting of hoods and other structures relative to the conveyor structure more viable, whilst reducing the probability of contact with, catching or pinching of persons or equipment proximate the conveyor structure;

ii. potentially reduces the overall mass of the subframe 16 (due the removal of outer support structures provided for supporting the outside-facing ends 32 of the wing rollers 26);

iii. removes heavy and outwardly projecting support and adjustment mechanisms thereby making the distal ends of subframe 16 and/or wing rollers 26 lighter (the weight distribution of the alignment mechanism is therefore shifted towards the axis of rotation [the main pivot 18]); and

iv. reduces a rotational inertia of the subframe 16 and set 20.

The present inventor has found that a reduction in rotational inertia as aforementioned improves the ability of the alignment mechanism 10 to steer the belt 22 when compared to prior art alignment mechanisms 10 not utilising such cantilevered arrangements. More particularly, a reduced rotational inertia facilitates a quicker pivoting response of the alignment mechanism 10 through its alignment arc. This results in a more responsive, quicker and more accurate reaction to misalignments (even slight misalignments) of the belt 22, which enhances steering and trackability. Put differently, a lower rotational inertia requires a lower moment about the main pivot 18 (caused by the unbalanced forces transferred to the wing rollers 26 as aforementioned) to steer the belt 22 back to a substantially central position.

As discussed in more detail below, the embodiments shown in figures 1 to 11 have wing rollers 26 which are pivotably adjustable relative to the subframe 16. That said, it will be appreciated that the present disclosure is not limited to alignment mechanisms 10 with such pivotably adjustable wing rollers 26, and therefore also extends to configurations in which the wing rollers 26 are fixed in position relative to the subframe 16. Such a configuration is not shown in the figures nor discussed in more detail herein.

The pivotable adjustment of the wing rollers 26 is provided for, since not all trough conveyors or belts have the same configuration – that is – troughing angles 30 of different conveyor arrangements may differ. An angle adjustment mechanism 36 is incorporated into the support structure with which the wing roller 26 is supported in cantilevered fashion relative to the subframe, 16 for this purpose. The angle adjustment mechanism 36 therefore allows adjustment of the wing roller angle 28 which, in turn, results in an adjustment of the troughing angle 30. The angle adjustment mechanism 36 therefore facilitates adjustment of the wing rollers 26 in the direction of the arrow 38.

With specific reference to figures 6 to 11, the angle adjustment mechanism 36 comprises a tubular bracket 40 with a central bore 42 within which a proximal portion of a shaft 44 of the wing roller 26 is received. At least one, but typically two grub screws 46 are used to fix the shaft 44 relative to the tubular bracket 40. The fit between the central bore 42 and the shaft 44 is relatively fine or tight.

The tubular bracket 40 is mounted relative to the subframe 16 by means of a first pivot 48. More particularly, the first pivot 48 is located towards a first end 50, that is, a distal or top end, of the tubular bracket 40. The first pivot 48 attaches to a plate 52 which forms part of the subframe 16. The tubular bracket 40 may therefore pivot about the first pivot 48 relative to the subframe 16.

The angle adjustment mechanism 36 furthermore comprises an adjustable link mechanism 54, which is pivotably fixed towards a second end 56, that is a proximal or lower end, of the tubular bracket 40 by means of a second pivot 58. The adjustable link mechanism 54 is furthermore supported relative to the subframe 16 (and more particularly, the plate 52) by means of a third pivot 60. The adjustable link mechanism 54 therefore extends between the second end 56 of the tubular bracket 40 and the subframe 16. The adjustable link mechanism 54 can slide relative to the third pivot 60, to adjust a distance between the second and third pivots (58, 60). An “effective length” 62 of the adjustable link mechanism 54 defined between the second and third pivots (58, 60) is therefore adjustable. Since the relative locations of the first and third pivots (48, 60) are fixed (both are fixed relative to the subframe 16), adjusting the effective length 62 causes the tubular bracket 40, and therefore the wing roller 26, to pivot about the first pivot 48.

The adjustable link mechanism 54 is releasably lockable in position (to lock the effective length 62 and therefore the wing roller 26). The adjustable link mechanism 54 takes the form of a threaded rod and the third pivot 60 is associated with a bore or bush through which the rod extends (and through which the rod can freely be displaced longitudinally). A position of the rod relative to the third pivot 60 (and therefore the effective length 62) can be locked by means of a stopper in the form of a locknut 64. By adjusting the locknut 64, the effective length 62 can very finely be adjusted, resulting in very fine adjustments of the wing roller angle 28 and the troughing angle 30.

Due to the configuration of the angle adjustment mechanism 36, the wing roller angle 28 can be adjusted between about zero degrees and about 65 degrees and may therefore be adjusted to any angle between (and including) those extremities. It will be appreciated that this represents a relatively large range of angular adjustment (compared to ranges of adjustment of prior art alignment mechanisms). This large range of angular adjustments and the ability to make fine or minor angular adjustments within said range provide important benefits and lend functionality to the alignment mechanism 10:

i. by being adjustable to about 0 degrees, the alignment mechanism 10 can be packaged very compactly, which eases transportability;
ii. a wide range of troughing angles 30 are now achievable with a single alignment mechanism 10, which removes the need to provide different alignment mechanism 10 models for different ranges of troughing angle, removes the need to custom-manufacture alignment mechanisms 10 to order and enables end-users to keep fewer stock or spare items;
iii. fine adjustments (in the order of one or two degrees) are sometimes required to enhance the functionality and effectiveness of the alignment mechanism.

It will be appreciated that the wing rollers 26 are arranged to pivot in a plane which is substantially perpendicular to a plane in which the subframe 16 is allowed to pivot about the main pivot 18. The wing rollers 26 are arranged to pivot in a plane which is substantially perpendicular or vertical relative to the surface on which the conveyor is supported, whereas the subframe pivots in a plane which is substantially horizontal relative to the surface on which the conveyor is supported.

It will be appreciated that the above description only provides one preferred example embodiment of the conveyor alignment mechanism 10 and that there may be many variations without departing from the spirit and/or the scope of the invention.

For example, the first, second and third pivots (48, 58, 60) typically take the form of nut and bolt assemblies extending through suitable bushes, but the use of alternative arrangements, such as pin and C-clips and the like would also be feasible.

In some implementations, a single central roller rather than two central rollers may be provided. In alternative implementations, the one or more central rollers may be replaced all together with one or more bearing plate(s) manufactured from a low-friction material (such as a polished metal or a low-friction polymer) (here it should again be noted that the central rollers in this type of alignment mechanism do not play an instrumental role in the steering of the belt).

A configuration where the central roller(s) 24 is not pivotable relative to the supporting frame 12 or about the main pivot 18 could also theoretically be possible (especially, given that the central roller 24 is not configured as a steering roller).

The adjustable link mechanism 54 and stopper may take other forms, such as an un-threaded rod with a number of longitudinally spaced holes through which a pin may be placed (as stopper). In such a case, the effective length 62 can only be adjusted in increments, and fine adjustments of the wing roller angle 28 would therefore not be possible. Some underlying principles as aforementioned will still be achievable with such a configuration, though. The adjustment mechanism 36 may take alternative forms, such as the adjustment mechanism 210 discussed below (with suitable adjustments to the design, where necessary).

Furthermore, different belt widths, conveyor speeds and load weights will determine the physical characteristics and strength required of the various components, including the angle adjustment mechanism. The invention is not therefore limited to the embodiments depicted in the drawings.

Turning next to figures 12 to 18, an alternative form of alignment mechanism, more particularly taking the form of a return tracker or return alignment mechanism (again simply referred to as an “alignment mechanism”), is generally indicated by reference numeral 200. It will be appreciated that the alignment mechanism 200 may be used with belts configured in a flat or troughed configuration.

The alignment mechanism 200 of figures 12 to 18 shares many components and functionalities with the alignment mechanism 10 of figures 1 to 11, and like features will be indicated by like reference numerals.

The alignment mechanism 200 comprises two steering rollers 202, which have a substantially cylindrical main portion 204 and a tapered end portion 206. Here, the tapered end portions 206 play an instrumental role in the steering of the belt. It will be appreciated that the alignment mechanism 200 does not include central rollers or even central bearing plates.

The alignment mechanism 200 includes a substructure 208 (in this configuration, not taking the form of a subframe) and two angle adjustment mechanisms (one associated with each respective steering roll 202, and collectively indicated by reference numeral 210).

Each angle adjustment mechanism 210 comprises a first pivot 212, a lever 214, a base plate 216 and an adjustable member 218. The lever 214 is pivotable about the first pivot 212 and therefore relative to the substructure 208. The base plate 216 is fixed relative to the substructure 208. The adjustable member 218 extends between the lever 214 and the base plate 216. The shaft 220 of the respective steering roller 202 is fixed relative to the lever 214.

The adjustable member 218 takes the form of a threaded rod received within a threaded bore of the lever 214. A first end 222 of the adjustable member 218 bears against the base plate 216. Adjustment of the adjustable member 218 therefore pivotably adjusts the lever 214 relative to the base plate 216 and the steering roller relative to the substructure 208.

In some cases, and particularly as shown in figure 18, the threaded rod is elongate and extends longitudinally along the length of the steering roller 202. A second end 224 of the threaded rod 218 is now supported by a support plate 226 relative to a distal end 228 of the steering roller 202. The elongate rod 218 enables adjustment of an angle of the roller 202 from the side of the conveyor structure, which eases adjustment.

The alignment mechanism 200 again facilitates fine adjustments of the roller angle (not indicated). In particular, when it comes to return trackers, fine adjustments (in the order of one to two degrees are often very effective in ensuring proper contact of outer edge portions of the belt with the tapered end portions 206, thereby facilitating more effective tracking and alignment of the belt. Such fine adjustments are facilitated by the alignment mechanism 200. Also, the angle adjustment mechanism 210 allows the steering rollers 202 to be arranged in a flat configuration, or a V-configuration, depending on the specific application and requirements. It will be appreciated that many further advantages associated with the alignment mechanism 10, are also obtained by the alignment mechanism 200.

A further aspect of the invention is shown in figures 19 to 21. Here, a further non-limiting example of a trough conveyor alignment mechanism (or simply “alignment mechanism”) is indicated by reference numeral 100. Since the alignment mechanisms (10 and 100) operate in substantially the same way, the manner in which the mechanisms work will not be discussed in detail. Like parts will be numbered the same.

Turning specifically to Figure 19, it will be noted that the steering or wing rollers 26 are mounted and supported at both ends (proximal and distal) to a support mechanism – that is – not in cantilever-fashion. However, in this embodiment the upper or outside facing (distal) end 32 of the wing roller 26 is supported on a support bracket 102 which includes an angled support plate 104 with a slot at its upper end to receive the shaft 44 of the wing roller 26. This support plate 104 is connected to the subframe 16 by an adjustment mechanism 106 which is arranged substantially vertically (relative to the surface on which the conveyor is supported) and therefore configured to

raise or lower the support plate 104 using a threaded rod 108 and nuts 110. By raising or lowering the support plate 104 the angle 28 of the wing roller 26 is changed.

One advantage of the adjustment mechanism shown in Figures 19 to 21 is that it will provide more support to the wing roller 26 which may be useful in heavy duty applications. Another advantage is that the adjustment mechanism does not extend laterally substantially beyond the edge of the mounting brackets 14.

A footprint (viewed in plan) of the subframe and pair of angle adjustment mechanisms falls within a footprint of the mounting frame (and in particular, the mounting brackets 14) viewed in plan. Thus, since conveyors are usually provided with a walkway on either side of the conveyor for maintenance purposes, the fact that the adjustment mechanisms are located inboard of the mounting brackets 14 means that snagging of maintenance crew by the adjustment mechanism as the crew moves past will be significantly reduced. Also, these compact alignment mechanisms can be installed within hooded or covered conveyors without having to make modifications to the hood or cover.

It will be appreciated that each of the alignment mechanisms discussed above, the steering or wing rollers are arranged in-line with the main pivot 18. As result, the tracking mechanisms may be used to align a belt travelling in a forwards or reverse direction.

It will be appreciated that the above description only provides example embodiments of particular aspects of the invention and that there may be many variations without departing from the spirit and/or the scope of the invention.

It will be easily understood from the present description that the particular features of the present invention, as generally described and illustrated in the figures, can be arranged and designed according to a wide variety of different configurations. In this way, the description of the present invention and the related figures are not provided to limit the scope of the invention but simply represent selected embodiments.

The skilled person will understand that the technical characteristics of a given embodiment can in fact be combined with characteristics of another embodiment, unless otherwise expressed or it is evident that these characteristics are incompatible. Also, the technical characteristics described one embodiment can be isolated from the other characteristics of this embodiment unless otherwise expressed.

CLAIMS

1. A conveyor alignment mechanism, comprising

a mounting frame for operatively mounting the conveyor alignment mechanism to a conveyor frame;

a substructure, pivotably mounted to the mounting frame by means of a main pivot;

a pair of steering rollers mounted relative to the substructure in outward-facing cantilevered fashion.

2. The conveyor alignment mechanism according to claim 1, wherein at least a portion of each of the steering rollers is tapered.

3. The conveyor alignment mechanism according to claim 1 or 2, wherein each steering roller is pivotably adjustable relative to the substructure.

4. The conveyor alignment mechanism according to claim 3, wherein each steering roller is mounted to the substructure by means of an angle adjustment mechanism.

5. The conveyor alignment mechanism according to claim 4, wherein each angle adjustment mechanism comprises a tubular bracket with a bore within which a shaft of the respective steering roller is operatively received and retained in cantilever fashion.

6. The conveyor alignment mechanism according to claim 5, wherein the shaft of the respective steering roller is fixed relative to the tubular bracket by means of at least a first grub screw.

7. The conveyor alignment mechanism according to claim 5 or 6, wherein, towards a first end thereof, the tubular bracket is pivotably mounted to the substructure by means of a first pivot.

8. The conveyor alignment mechanism according to claim 7, wherein an adjustable link mechanism extends between a second end of the tubular bracket and the substructure, wherein the adjustable link mechanism is pivotably fixed to both the tubular bracket and the substructure by means of a second and third pivot, respectively.

9. The conveyor alignment mechanism according to claim 8, wherein an effective length of the adjustable link mechanism is adjustable, to pivot the tubular bracket about the first pivot to adjust an angle of the tubular bracket relative to substructure.

10. The conveyor alignment mechanism according to claim 8 or 9, wherein the adjustable link mechanism comprises a threaded rod with a locking nut arrangement for releasably fixing a position of the adjustable link mechanism.

11. The conveyor alignment mechanism according to any one of claims 3 to 10, wherein each steering roller is adjustable between about 0 degrees and 65 degrees relative to a plane in which the central rollers are arranged.

12. The conveyor alignment mechanism according to any one of the preceding claims, further comprising at least a first central roller arranged between the pair of steering rollers.

13. The conveyor alignment mechanism according to claim 12, comprising two central rollers arranged on opposite sides of the main pivot.

14. The conveyor alignment mechanism according to claim 4, wherein each angle adjustment mechanism comprises:

a first pivot connected to the substructure and to a shaft of the respective steering roller;

a lever arranged pivotably relative to the substructure;

a base plate fixed relative to the substructure; and

an adjustable member extending between the lever and base plate.

15. The conveyor alignment mechanism according to claim 14, wherein the adjustable member comprises a threaded member received within a threaded bore of the lever and having a first end arranged to bear against the base plate.

16. The conveyor alignment mechanism according to claim 15, wherein the threaded member comprises an elongate member having a second end supported relative to a distal end of the respective steering roller.

17. The conveyor alignment mechanism according to any one of claims 3 to 16, wherein each steering roller is configured to be pivotably adjustable in a plane substantially perpendicular to a plane in which the substructure is pivotable about the main pivot.

18. A conveyor alignment mechanism, comprising:

a mounting frame for operatively mounting the conveyor alignment mechanism to a conveyor belt frame;

a substructure, pivotably mounted to the mounting frame by means of a main pivot;

a pair of steering rollers carried by the substructure,

a pair of angle adjustment mechanisms, each associated with a respective one of the steering rollers and comprising:

an adjustable link mechanism extending substantially vertically from a distal part of the substructure; and

an angled support plate extending between the adjustable link mechanism and a distal part of the respective steering roller.

19. The conveyor alignment mechanism according to claim 18, wherein the adjustable link mechanism includes a locking arrangement for locking a position thereof relative to the substructure, and wherein the adjustable link mechanism comprises one of a) a threaded rod with a lock nut configured as locking mechanism; and b) a rod with a plurality of longitudinally spaced holes with a locking pin configured as locking arrangement.

20. The conveyor alignment mechanism according to claim 18 or 19, wherein a footprint viewed in plan of the substructure and pair of angle adjustment mechanisms falls within a footprint of the mounting frame viewed in plan.

21. A conveyor, comprising

a main conveyor frame

a conveyor alignment mechanism according to any one of the preceding claims mounted to the main conveyor frame; and

a belt supported at least partially on the conveyor alignment mechanism.

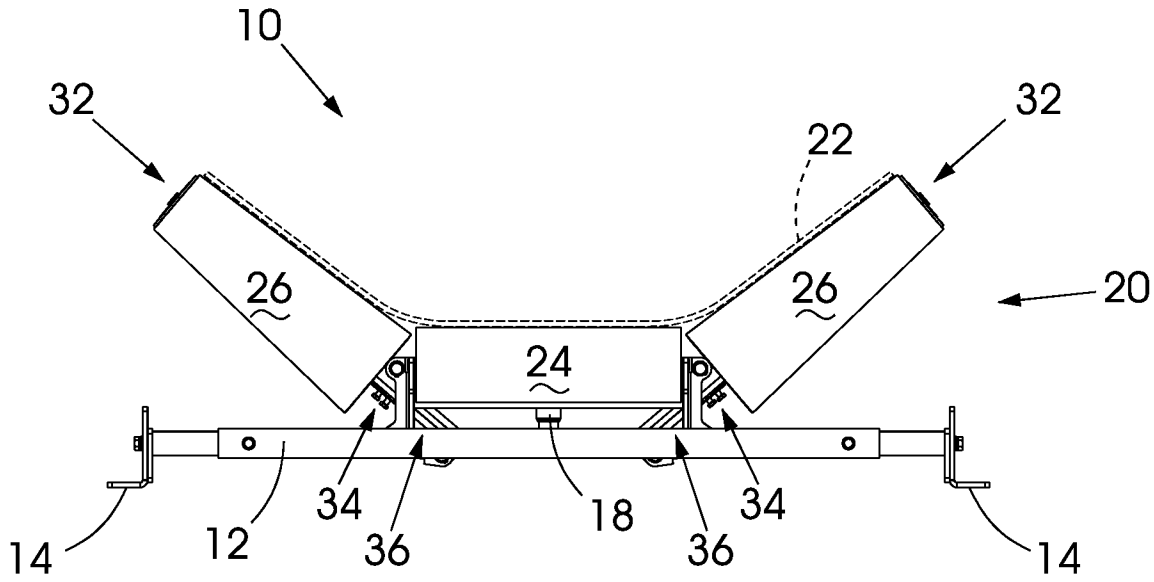

Fig. 1

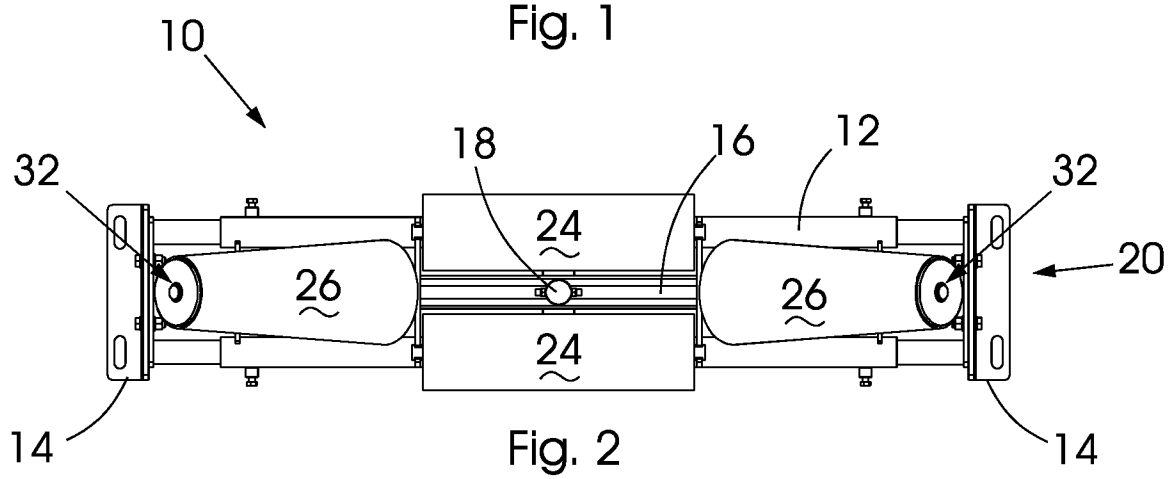

Fig. 2

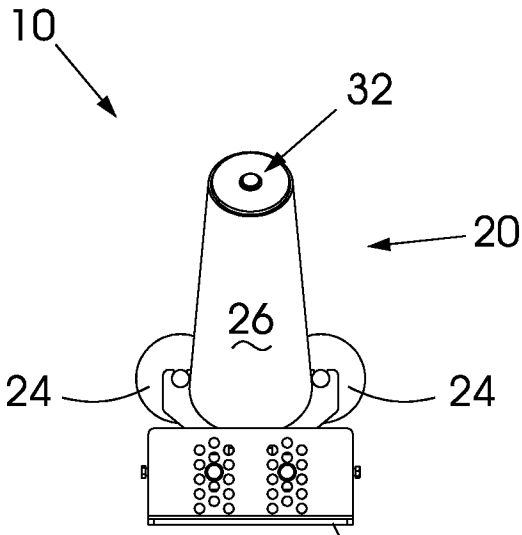

Fig. 3

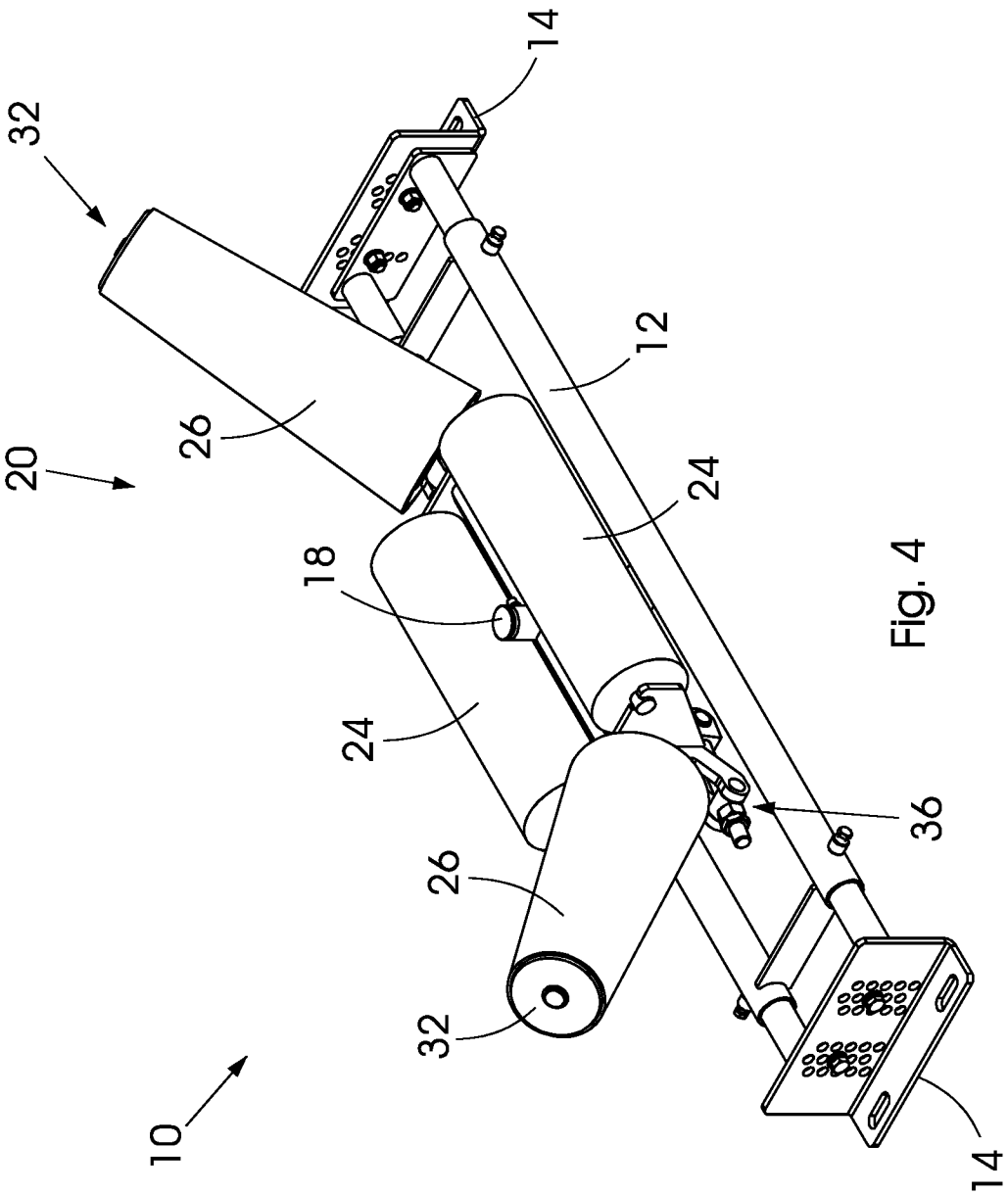

Fig. 4

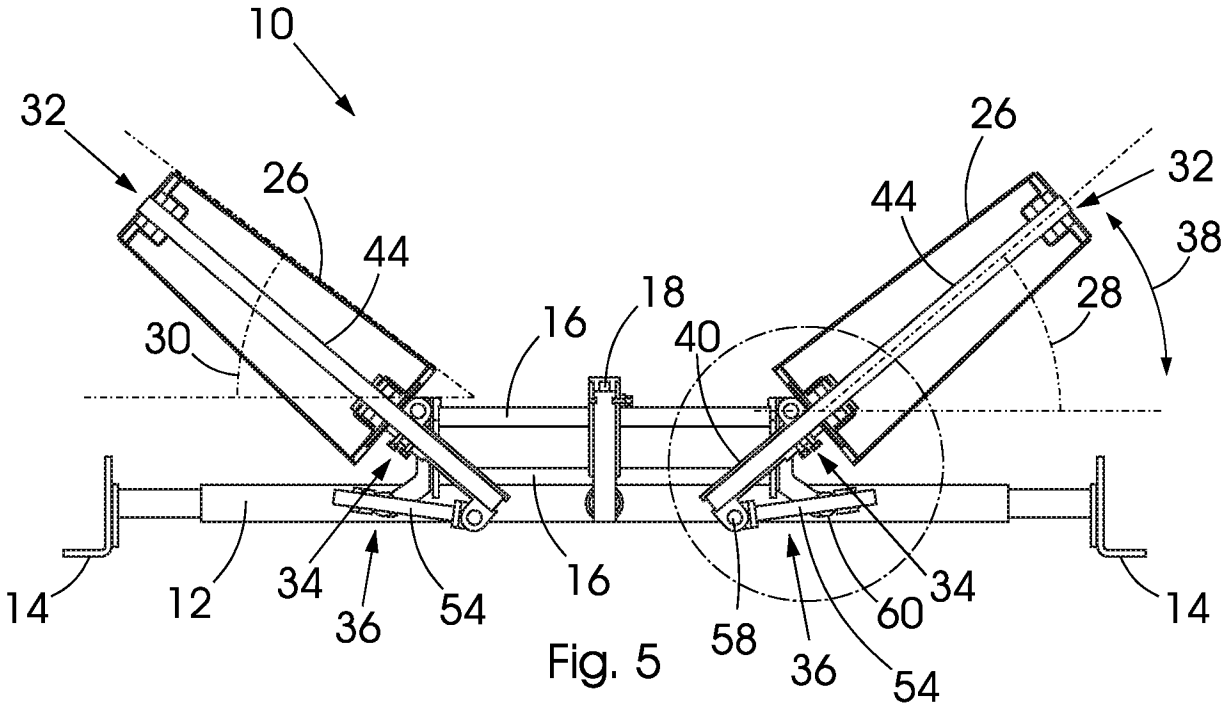
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Fig. 5

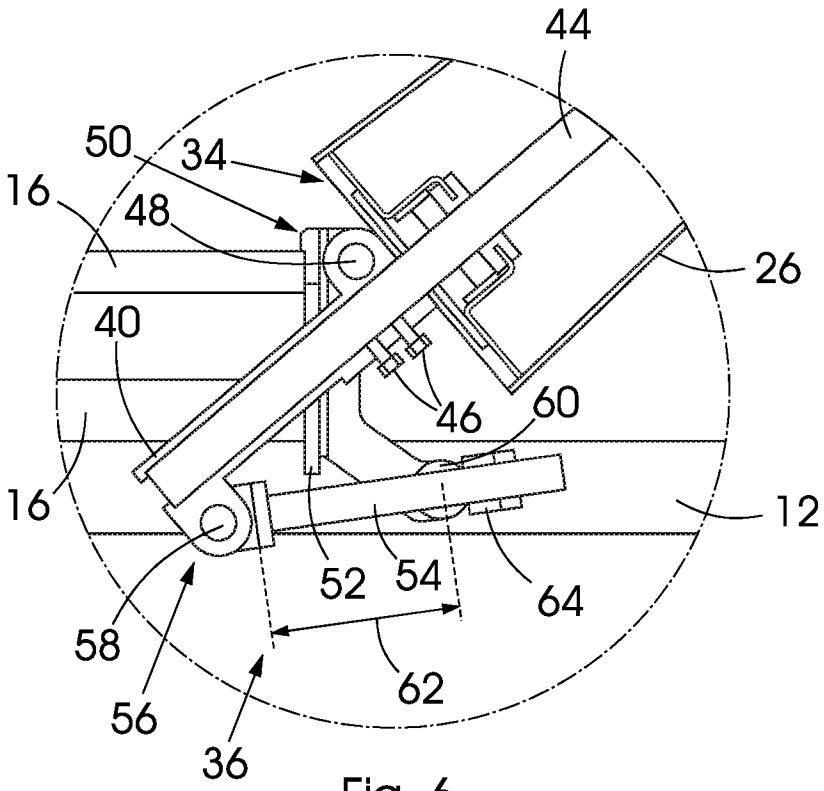
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Fig. 6

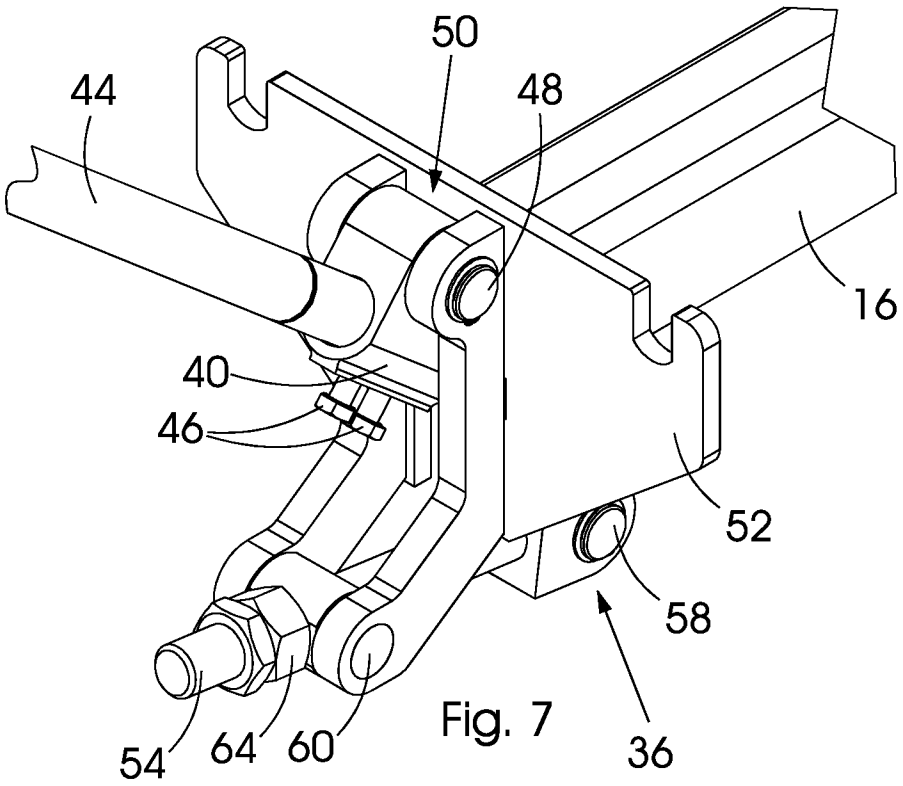
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Fig. 7

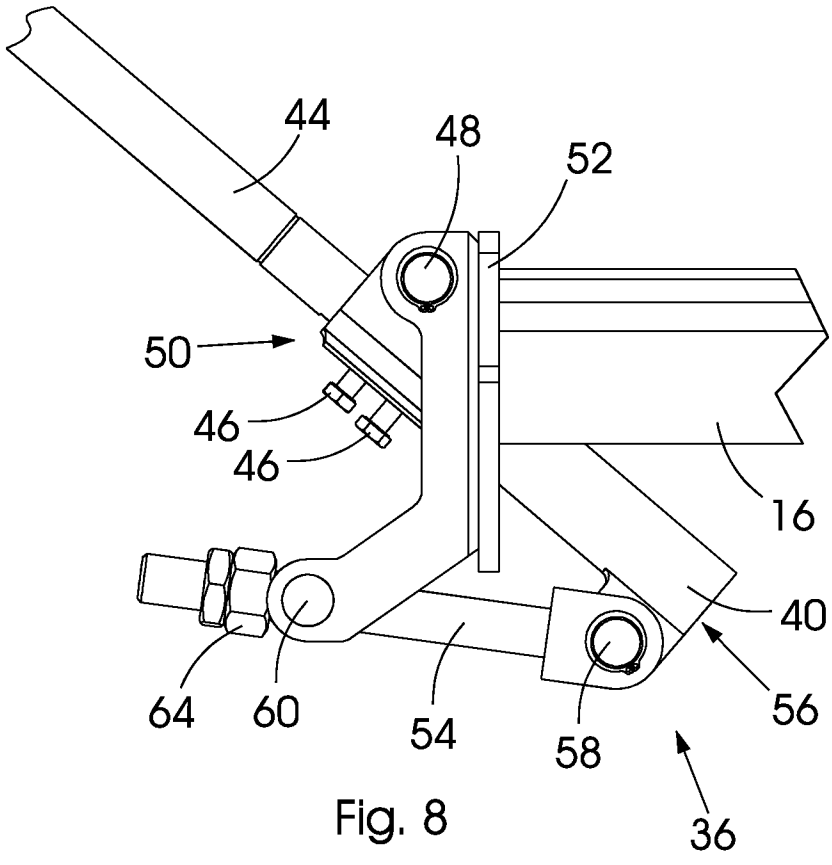
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Fig. 8

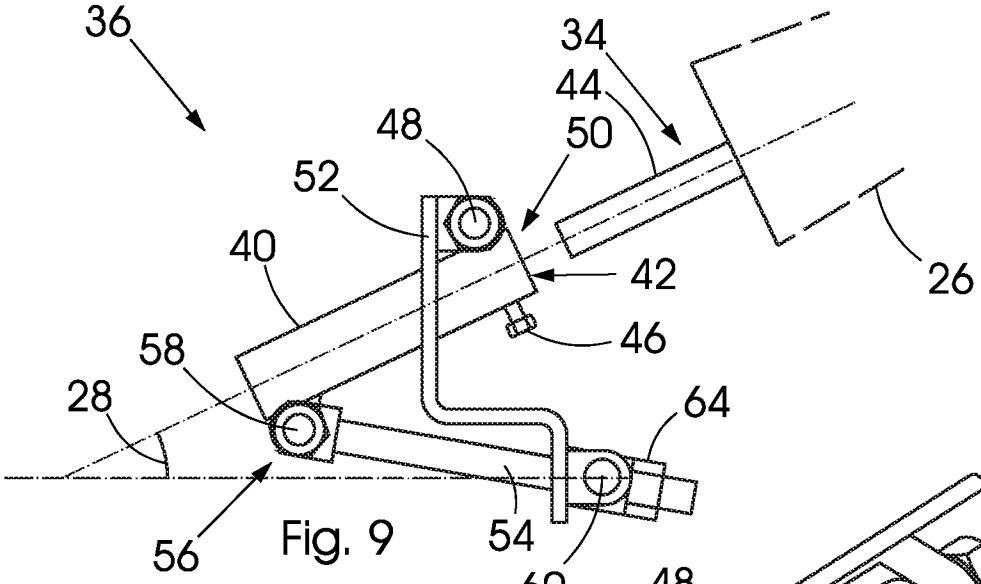

Fig. 9

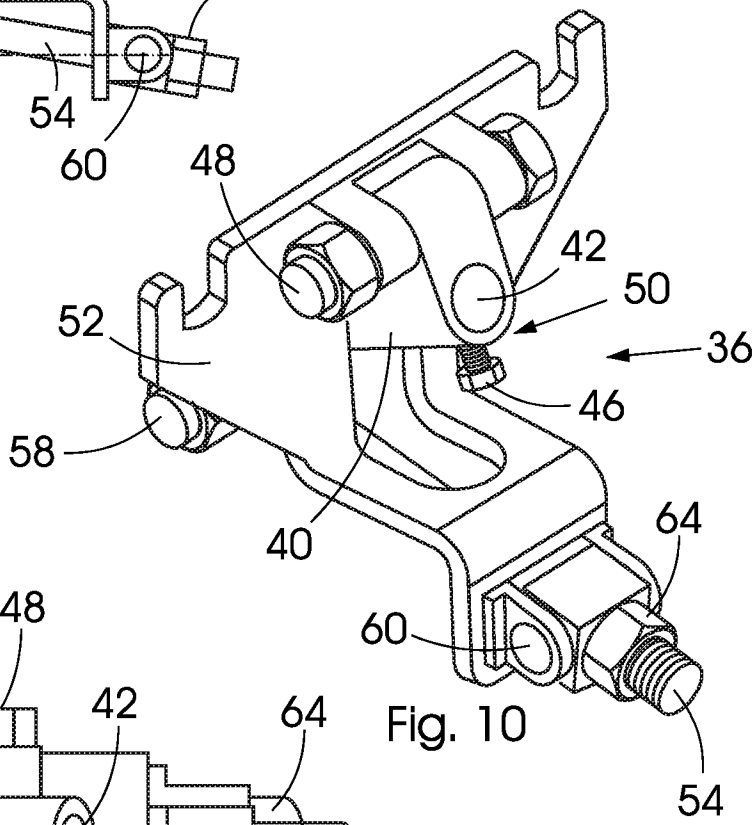

Fig. 10

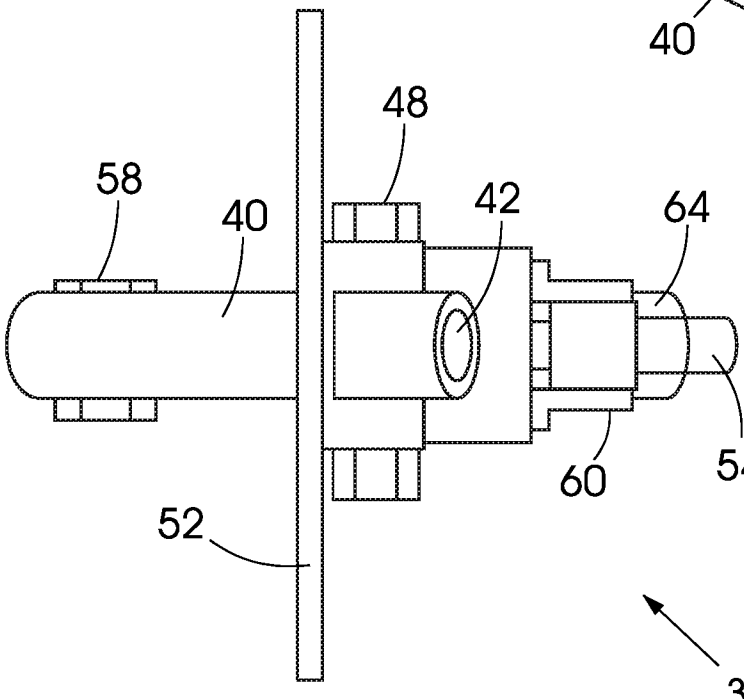

Fig. 11

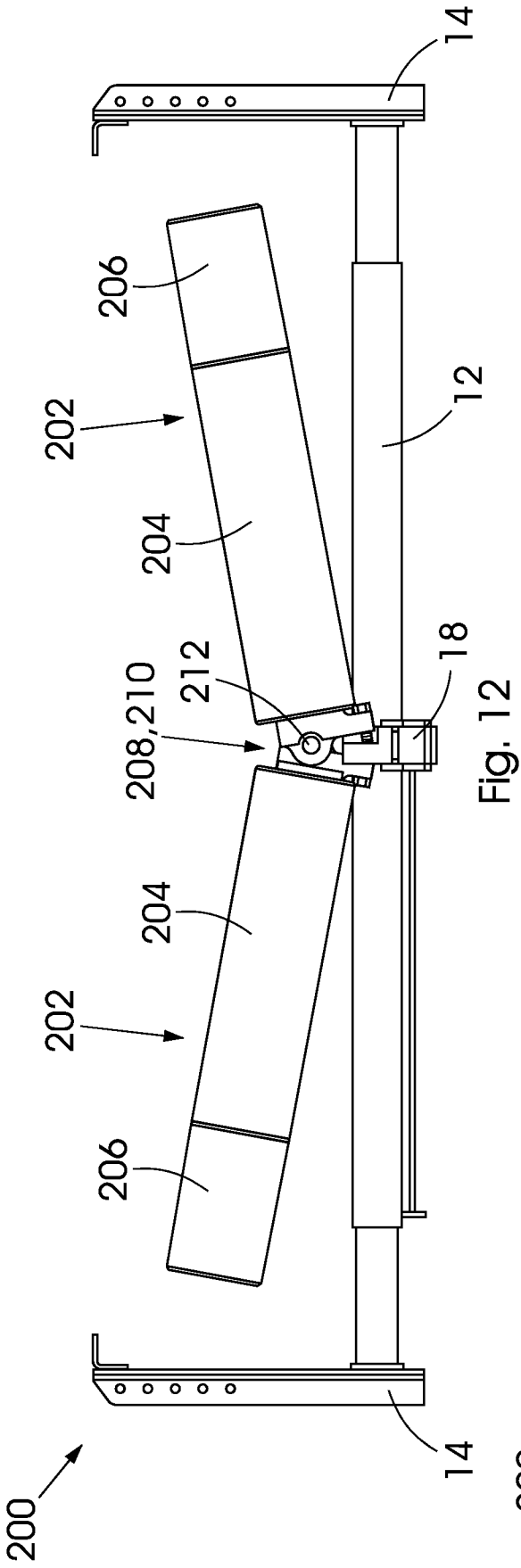
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Fig. 12

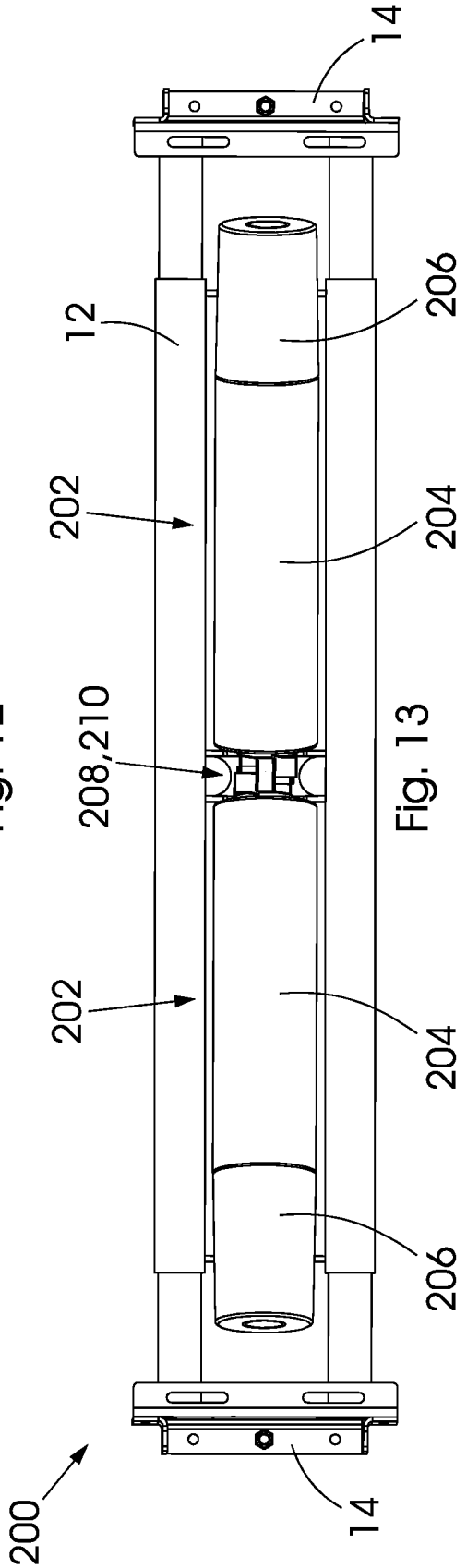
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Fig. 13

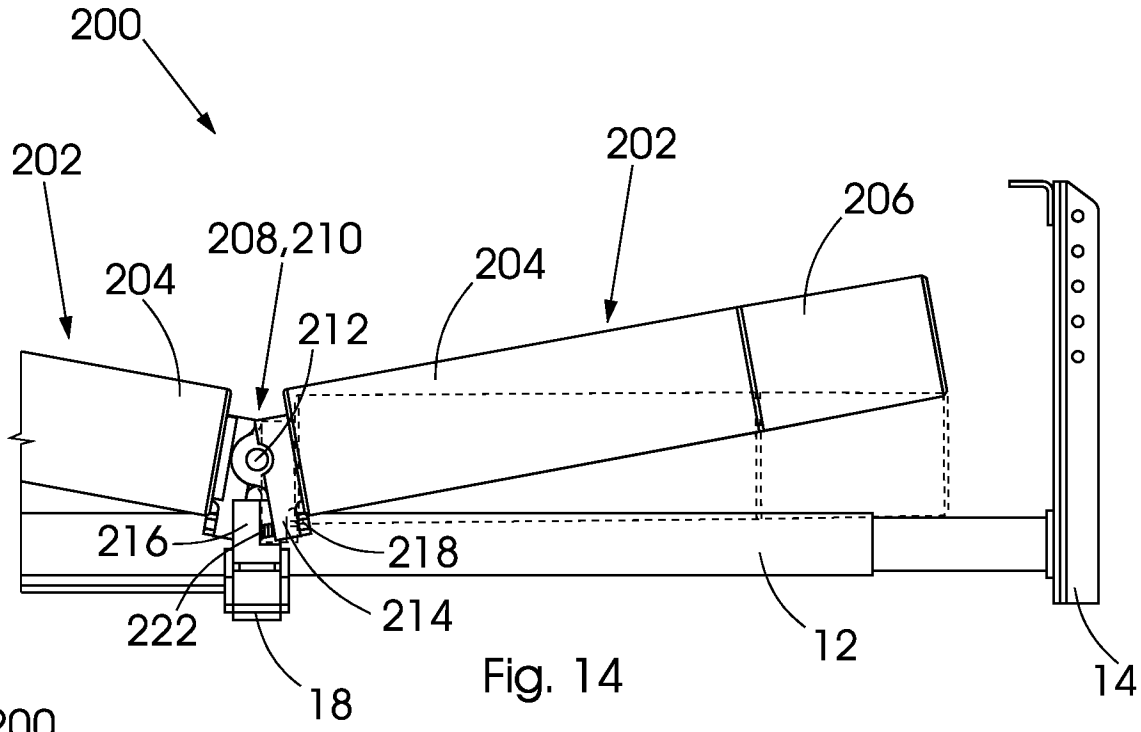
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Fig. 14

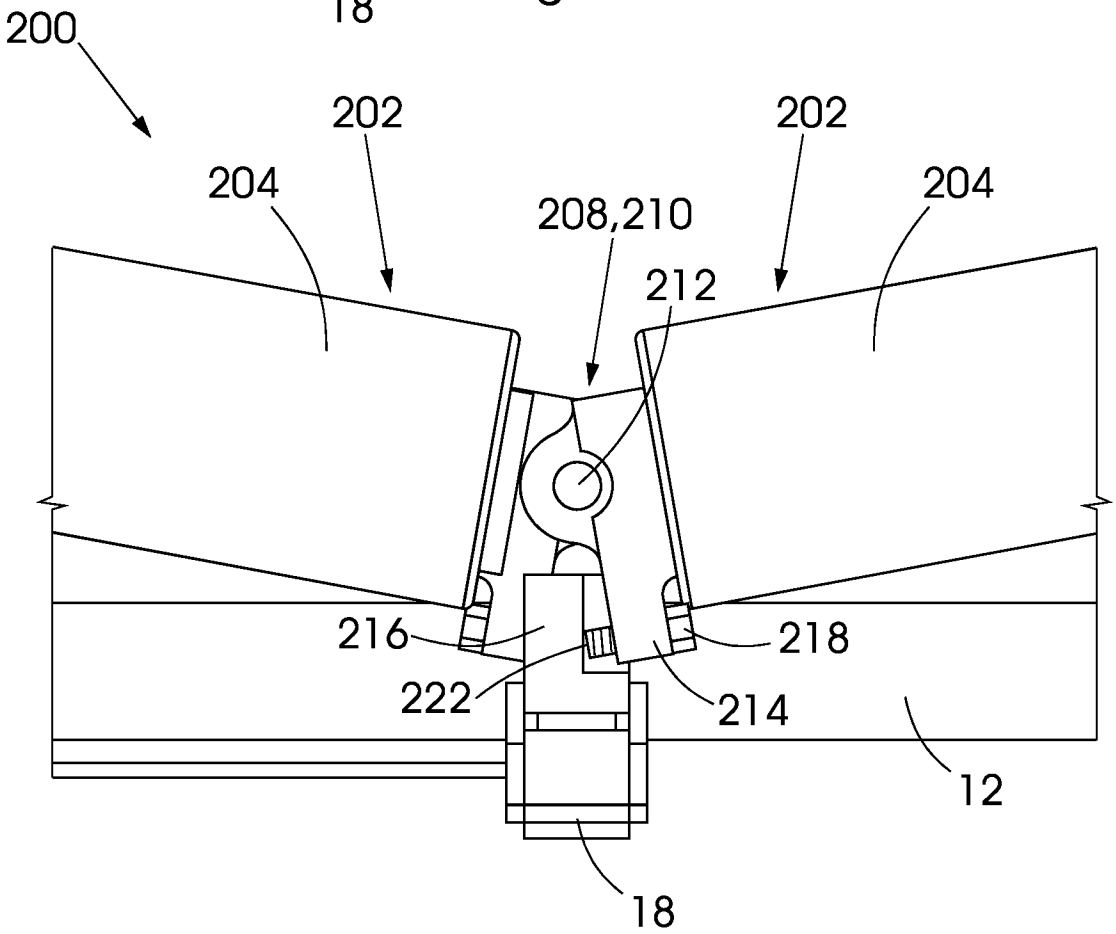
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Fig. 15

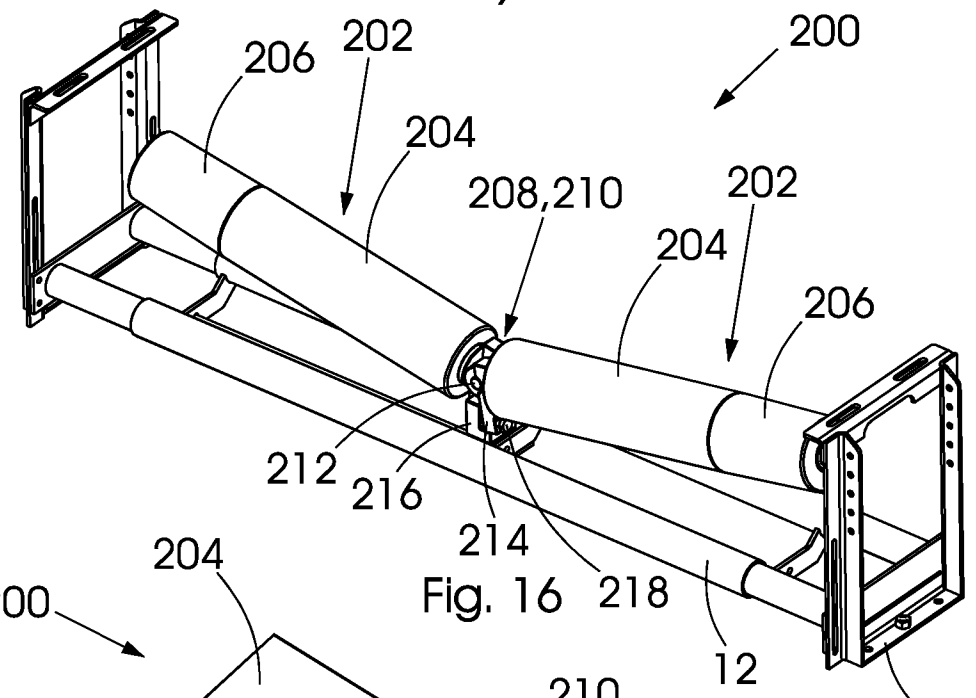

Fig. 16

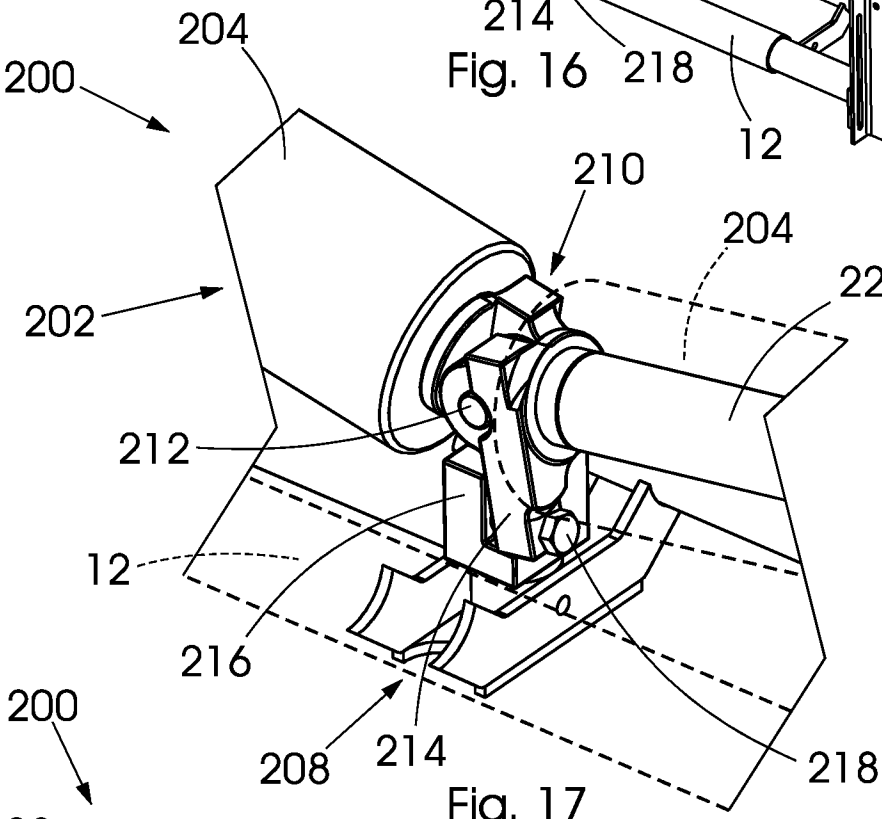

Fig. 17

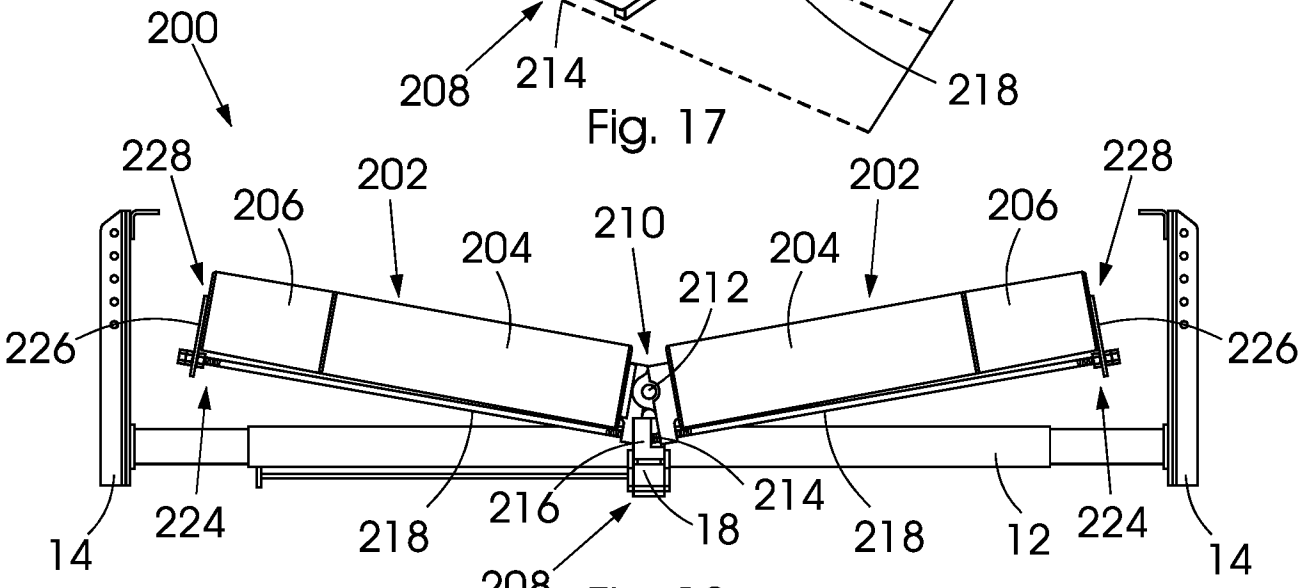

Fig. 18

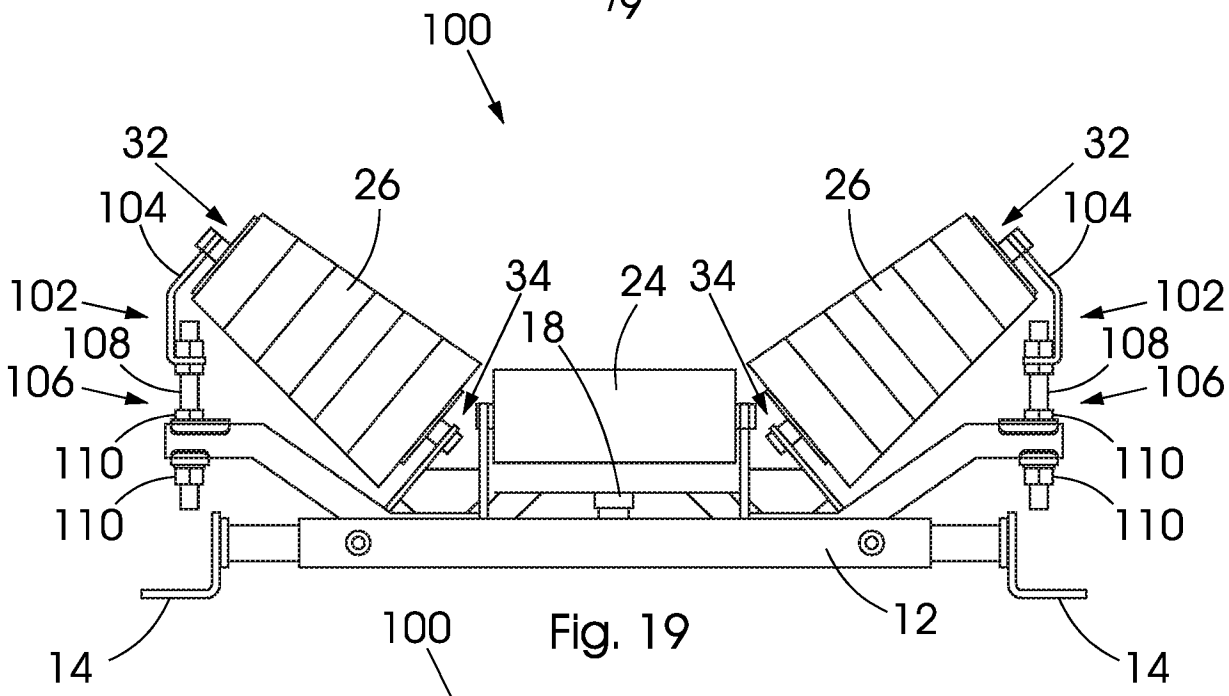

Fig. 19

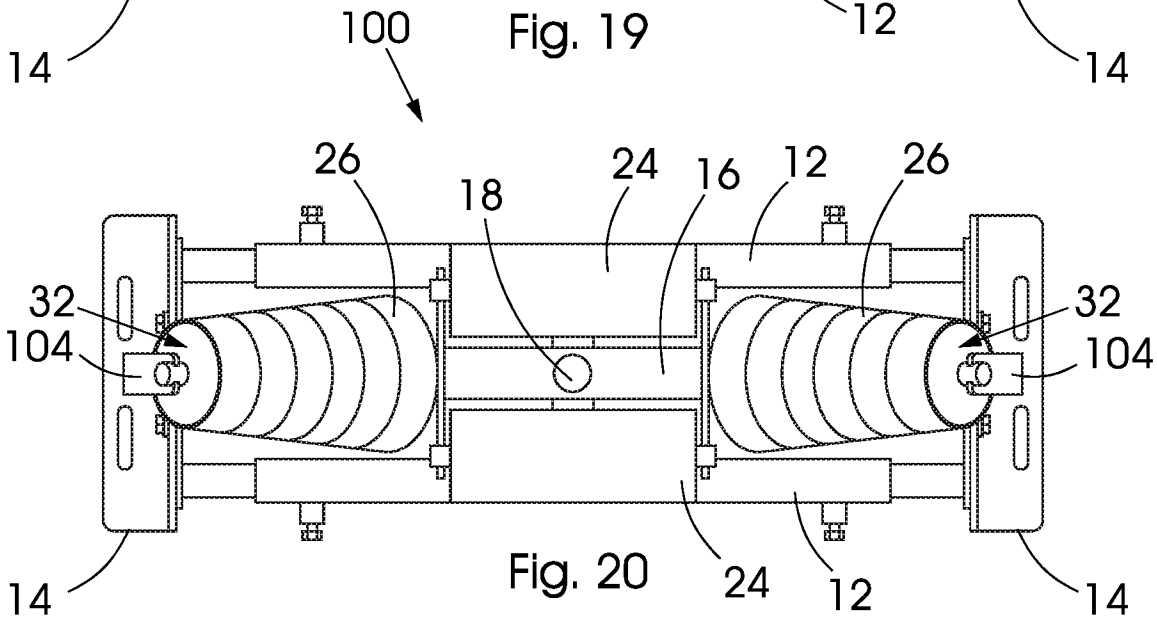

Fig. 20

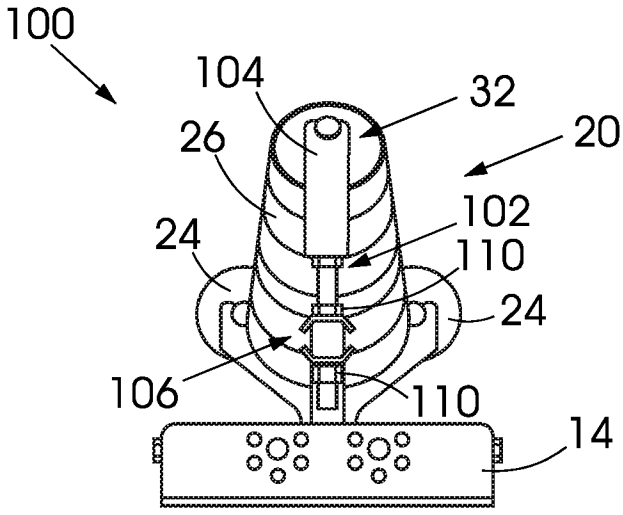

Fig. 21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2023/053667

A. CLASSIFICATION OF SUBJECT MATTER

B65G 39/16 (2006.01) B65G 15/40 (2006.01) B65G 15/60 (2006.01) B65G 21/20 (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)

Databases: Google, Google Images, Google Patents, Espacenet, Youtube, Patenw

IPC/ CPC: B65G15/60, B65G39/16, B65G39/071, B65G21/20, B65G39/125, B65G15/40, B65G15/64

Keywords: adjust, vary, angle, incline, steer, tilt, side, edge, outer, wing, roller, drum, cylinder, idler, cantilever, adapt, frame, pole, strut, camber, trough, belt, conveyor, taper, cone, conical, pivot, swing, rotate, vertical, axis, tubular, hollow, pipe, receive, accommodate, hold, enclose, accept, contain, axle, shaft, lever, rod, mechanism and other similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

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

"D" document cited by the applicant in the international application

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

"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)

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

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

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2023	23 May 2023
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Andre Henry AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61 2 6222 3636

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/IB2023/053667**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 202004002968 U1 (SCHULMEISTRAT HANS DIETER) 13 May 2004 Figure 1, Espacenet translated description paragraphs 0001, 0003, 0006, 0013 & 0014	1-6, 11-14 & 17-21
X	EP 2451730 A2 (TBK GROUP) 16 May 2012 Title, Figure 1-5, Paragraphs 0003, 0005, 0031, 0033, 0038 & 0042-0044	1-6, 11-13 & 17-21
X	KR 101220913 B1 (SHIN HEUNG CO LTD) 06 February 2013 Figures 1 & 14	18-21
X	DE 926658 C (EICKHOFF GEB) 21 April 1955 Figures 1-4	18-21
A	DE 810013 C (WEULE HERMANN) 06 August 1951	
A	FR 483793 A (MAIN BELTING COMPANY) 08 August 1917	
A	US 3301384 A (SOWARDS EDWARD W) 31 January 1967	
A	WO 2002088005 A1 (ANDERSON BERNARD ATHOL) 11 July 2002	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2023/053667

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:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including

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 Supplemental Box for Details

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

Continuation of: **Box 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.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- **Claims 1-17 & 21(in part)** are directed to a conveyor alignment mechanism. The feature of *a pair of steering rollers being mounted relative to the substructure in outward-facing cantilevered fashion* is specific to this group of claims.
- **Claims 18-20 & 21 (in part)** are directed to a conveyor alignment mechanism. The feature of *an angled support plate extending between the adjustable link mechanism and a distal part of the respective steering roller* is specific to this group of claims.

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.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is: *A conveyor alignment mechanism, comprising a mounting frame for operatively mounting the conveyor alignment mechanism to a conveyor frame; a substructure, pivotably mounted to the mounting frame by means of a main pivot.* However, this feature does not make a contribution over the prior art because it is disclosed in:

EP 2451730 B1 (TBK Group) 16th May 2012

Therefore, in the light of this document this common feature cannot be a special technical feature. Therefore, there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied ***a posteriori***.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/IB2023/053667**

This Annex lists known 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/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
DE 202004002968 U1	13 May 2004		
EP 2451730 A2	16 May 2012	EP 2451730 A2	16 May 2012
		EP 2451730 B1	19 Mar 2014
		WO 2011005091 A2	13 Jan 2011
KR 101220913 B1	06 February 2013	KR 101220913 B1	06 Feb 2013
DE 926658 C	21 April 1955		
DE 810013 C	06 August 1951		
FR 483793 A	08 August 1917	FR 483793 A	08 Aug 1917
US 3301384 A	31 January 1967	US 3301384 A	31 Jan 1967
WO 2002088005 A1	11 July 2002	WO 02088005 A1	07 Nov 2002

End of Annex

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