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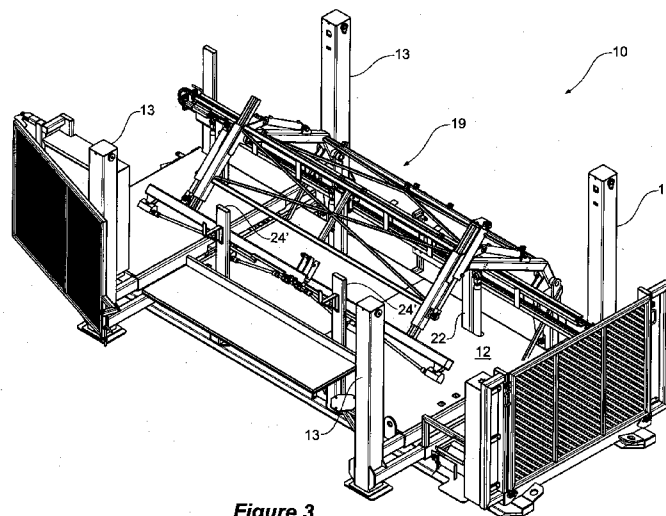
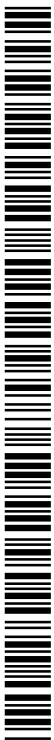


Figure 3

(57) Abstract: A conveyor (15) for delivering lengths of drill pipe (14) to and from a use position having elongate conveying means (30) for supporting and conveying drill pipe (14) towards or away from a use position, the conveying means (30) having a conveying surface means (41) that allows movement of the drill pipe (14) with respect to the conveying surface means (41) if conveying movement of the drill pipe (14) is obstructed so that the conveying surface means (41) can continue to move with respect to the drill pipe (14). The invention allows handling of drill pipe (14), but that allows the drill pipe (14) to slip if inadvertently obstructed.



CONVEYOR FOR USE WITH A DRILL PIPE STORAGE SLOOP

The present invention relates to handling of a drill pipe used on drilling rigs such as diamond core drilling, rotary drilling or drill rigs used in the oil or gas industries. The invention concerns conveyor means used for loading and unloading drill pipe to and from a drill rig.

BACKGROUND OF THE INVENTION

In the drilling of exploration holes or oil and gas wells the drill string on a drilling rig is made up of many drill pipe segments. The drill pipes are generally stored horizontally on a cradle referred to as a sloop. The drill pipes have threaded couplings at either end and are generally manipulated by a hoist into a vertical position for feeding onto the drill rig as the drill string is tripped into the hole.

Individual lengths of drill pipe are sequentially screwed to one another to trip the drill string into the hole. In the reverse, as the drill string is tripped out of the hole, each individual drill pipe is unthreaded and then lowered into a storage sloop.

The individual lengths of drill pipe can be as long as nine metres and therefore are of a considerable weight. It is undesirable to manually handle drill pipe and slings and hoists results in slow assembly and it is time consuming assembling and disassemble of drill strings. Some drill rigs are equipped with drill pipe handling equipment comprising a gripping head that can grasp the end of the drill pipe from a horizontal position raise it vertically and then swing it into the desired position on a drill rig. It is common to have a table or support system where a number of drill rods can be positioned horizontally during loading and unloading of the drill rig. However, there is still a need to slide the drill pipe from the table to the drill rig or from the drill rig to the table which is either physically demanding or alternatively requires a sling or hoist to make the task easier. Also, the individual drill pipe needs to be placed onto the table from a storage sloop or removed from the table to a sloop.

It is common for the length of drill pipe to vary in length or diameter depending on the type of drilling being undertaken. Accordingly, any handling systems used with respect to drill pipe need to take this change of length and diameter into account.

Accordingly, one aspect of this invention amongst many is to provide a means of easily moving drill pipe towards or away from the pipe handler on the drill rig. Another aspect is to provide a means of handling drill pipe onto and off of a drill rig with respect to a storage container such as a sloop.

SUMMARY OF THE INVENTION

In one aspect, the invention is a conveyor for delivering lengths of drill pipe to and from a use position having an elongate conveying means for supporting and conveying said drill pipe towards or away

from a use position, the conveying means having a conveying surface means that allows movement of said drill pipe with respect to the conveying surface means if conveying movement of said drill pipe is obstructed so that the conveying surface means can continue to move with respect to said drill pipe.

5 Preferably, the conveyor is used to load or unload drill pipe from a rode handler of a drill rig.

The conveyor can be positioned so that the drill pipe is aligned with the drill rig and in particular the drill pipe gripping assembly on the drill rig so that the drill pipe is delivered directly to it. Obviously, this aspect of the invention enables the drill pipe to be easily delivered to or away from the drill rig. In
10 particular, the invention does not use any positive drive engagement between the conveyor and the drill pipe in order to push the drill pipe towards or away from the drill rig. Instead, there is sufficient friction between the conveying surface or surfaces on the conveyor to provide motive force to the drill pipe. The arrangement has a significant safety advantage in that, if the drill pipe is obstructed during operation of the conveyor, then it will simply slip with respect to the conveying surface or surfaces.
15 For example, if a person were to inadvertently stand between the drill pipe and the gripping assembly while the conveyor is operating, then significant injury that would otherwise occur with positive drive of the drill pipe will be avoided.

The conveyor may comprise an elongate continuous chain with a pair of sprockets at either end of the
20 conveyor. One of the sprockets can be driven so as to operate the conveyor. The conveyor chain may have a plurality of roller elements which enable the chain to move along supports intermediate of the sprockets.

The chain may be provided with a number of spaced support plates which are either curved or V-
25 shaped in cross-section to support drill pipe. In addition, side rails and other supports may be located either side of the conveyor which slope upwardly and outwardly with respect to the conveyor to provide additional support, particularly for larger diameter drill pipe.

The conveyor may be used with a table positioned adjacent the conveyor for loading the drill pipe onto
30 or off of the conveyor. Alternatively, in another aspect of the invention, the conveyor may be located within a drill pipe storage container such as a sloop. Conveniently, the conveyor may be located on one side of the sloop so that drill pipe can be stacked between the conveyor and the opposite side of the sloop. This places drill pipe conveniently with respect to the conveyor thereby reducing the number of handling sequences of each individual drill pipe.

35 In another aspect of the invention, a mechanical handling means may be positioned on the sloop which is designed to lift drill pipe onto and off of the conveyor. The mechanical handling means may

comprise a number of articulated arms or frames that can be hydraulically operated with a gripping means at the end of one of the arms which may comprise a magnetic means which can be switched on and off so as to pick up and release the drill pipe.

- 5 In another aspect, the invention may be the method of handling drill pipe to load and unload a drill rig using a conveyor as discussed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

10 A description of the preferred embodiment with respect to the drawings follows. However, it will be appreciated by those skilled in the art that the invention is not restricted in its use to the particular application described. Neither is the present invention restricted in its preferred embodiment with regard to the particular elements and/or features described or depicted therein. It will be appreciated that the invention is not limited to the embodiment or embodiments disclosed, but is capable of numerous rearrangement, modifications and substitutions without departing from the scope of the
15 invention as set forth.

BRIEF DESCRIPTIONS OF THE DRAWINGS

- Figures 1 and 2 show views of a drill pipe conveyor feeding drill pipe to a drill rig and rod handler on the drill rig,
- 20 Figure 3 shows a perspective view of a storage sloop showing the conveyor and mechanical handling means,
- Figure 4 shows an end view of Figure 3,
- Figure 5 shows an exploded view of the conveyor,
- Figure 6 shows an assembled top view of an end of the conveyor,
- 25 Figure 7 shows an end view of the driven end of the conveyor,
- Figure 8 shows a cross-section of the assembled frame and runner elements of the conveyor,
- Figure 9 shows a part cross-section view of the conveyor chain with different diameter drill pipe on the conveyor,
- Figures 10 and 11 show the mechanical handling means,
- 30 Figure 12 shows a tube stop in its disengaged inoperative position,
- Figure 13 shows the tube stop of Figure 12 in its operative position,
- Figures 14 and 15 show the end of the sloop opposite to the drill rig and a secondary loading conveyor,
- Figure 16 shows the secondary loading conveyor in its collapsed stowed position for transport of the
35 sloop,
- Figure 17 shows a stop used at the end of the secondary conveyor in a closed position,
- Figure 18 shows the stop of Figure 17 in an open position, and

Figure 19 shows the rig end of the sloop with doors and side fences attached.

DETAILED DESCRIPTION

5 Figures 3 and 4 show perspective views of a storage sloop for drill pipe 14 incorporating a conveyor and mechanical handling means. The sloop 10 comprises a base rails 11 and a drill pipe 14 support surface 12. The sloop 11 has hydraulic cylinders provided within jacking columns 13 that operate to support the sloop 11 in use and can be used to level the sloop on uneven ground. The jacking columns can also be used to raise the sloop 11 sufficiently to enable a transport vehicle to drive underneath. This will assist in the loading and unloading of the sloop 10 from a transport vehicle.

10

A conveyor 15 for handling drill pipe 14 is positioned on one side of the support surface 12. As can be seen in the Figures, the conveyor 15 runs longitudinally along the length of the sloop 10. The conveyor 15 is supported by posts 16 which extend through apertures within the support surface 12 and are secured with respect to the base rail 11 below.

15

A mechanical handling means 19 for lifting drill pipe 14 on to and off of the conveyor 15 is attached to the side of the sloop 10 adjacent to the conveyor 15. The mechanical handling means 19 comprises a pair of hinged frames 20 and 21 where the first hinged frame 20 is pivotally attached at one edge to supports 22 that are secured to the base 11 with the second hinged frame 21 being pivotally attached to the other side of the hinged frame 20. The mechanical handling means 19 will be described in further detail below.

20

As can be seen in Figures 1 and 2, the sloop 10 can be positioned with respect to a drill rig 25 so that the conveyor 15 is both aligned and at the same height as the drill pipe handling assembly 26 on the drill rig 25. The drill rig handling assembly 26 comprises a rod handler 27 having a grasping chuck that can firstly rotate through 90° to take the drill pipe 14 from a horizontal position to a vertical position and then can rotate about a vertical axis to position the drill pipe 14 within the mast of the drill rig for coupling the individual drill pipes to the drill string. In reverse, as the drill string is tripped out of the hole, the drill handling assembly 26 is used to take individual drill pipe 14 elements from the drill rig mast and to rotate them to a horizontal position and place them on top of the conveyor 15.

30

As seen in Figures 1 to 3, 5 and 6 the conveyor 15 comprises a conveyor chain mounted within an elongate frame 31. At either end of the conveyor 15 are sprockets 32 and 33 around which the conveyor chain 30 rotates. In this embodiment, sprocket 32 is an idler sprocket and sprocket 33 is driven by a hydraulic motor 34.

35

The elongate frame 31 comprises upper and lower runners 36 and 37 that are located between outer support frame elements 38 and 39. Threaded fasteners are used to bolt the upper and lower runners 36 and 37 between the outer support frame elements 38 and 39. The sprockets 32 and 33 are journaled for rotation with respect to the outer support frame elements 38 and 39.

5

As seen in Figure 9 the conveyor chain 30, at the connection point between adjacent links has a roller 40 and each of the rollers 40 in the conveyor chain 30 support the conveyor chain 30 on the upper surfaces of the upper runner 36 and lower runner 37. The sprockets 32 and 33 engage each of the rollers 40 as the conveyor chain 30 rotates around the sprockets 32 and 33. Drill pipes support plates 41 can be welded to each pair of adjacent links of the conveyor chain 30. Each support plate is folded to form a shallow V-shape in cross-section so as to support a drill pipe 14. In addition, the upper edges of the outer support frame elements 38 and 39 have flange portions 42 that extend upward and outwardly to also provide supports to ensure that drill pipe 14 is centrally located on the conveyor 15. As seen in Figure 9 this arrangement enables a variety of difference diameter drill pipe 14 to be used on the conveyor 15.

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The conveyor 15 does not positively engage a drill pipe 14 that is located there on. Instead, the support plates 41 provide sufficient motive force to the drill pipe 14 to move it onto or off of the drill rig 25. If for any reason the drill pipe 14 is obstructed, then it will readily slide with respect to the support plates 41 until the conveyor 15 can be stopped.

20

Sprocket adjustment means 44 is provided with the bearing supports for the idler sprocket 32. The bearings 45 are mounted to bearing rods 46 that is slidably mounted with respect to a support pipe 49 a threaded push rod 48 is located through a threaded end in the support pipe 47 and bears against the bearing rod 46. Tension in the conveyor chain 30 can be adjusted by moving the threaded push rod 48 in or out of the support pipe 47.

25

In order to feed drill pipe to a drill rig 25, a stacked sloop is positioned with respect of drill rig 25 so that the conveyor 15 is at approximately the same height as the drill pipe handling assembly 26 on the drill rig 25. The mechanical handling means 19 is then used to load drill pipe 14 onto the conveyor 15 which in turn feeds it to the grasping chuck 27 of the drill handling equipment 26.

30

In reverse, as drill pipe 14 is removed from the drill rig 25, the drill handling equipment 26 rotates each drill pipe 14 from a vertical position to a horizontal position over the conveyor 15 and the conveyor 15 then runs the drill pipe 14 away from the drill rig back into sloop 10 where the mechanical handling means 19 can take the drill pipe 14 from the conveyor 15 and place it within the sloop 10.

35

Figures 3, 4, 10 and 11 show further views of the mechanical handling means 19 located on the sloop 10. The mechanical handling means 19 is designed to have sufficient reach to locate drill pipe 14 across the support surface 12 of the sloop 10 and to reach all drill pipe 14 to or from a sloop 10 full of drill pipe 14.

As seen in Figures 10 and 11, the frame 20 is pivotally attached to supports 22 and hydraulic actuators 28 are positioned between the supports 22 and the frame 20. This provides controlled movement of the frame 20 with respect to the supports 22. Hydraulic actuators 28' are positioned between the two hinged frames 20 and 21 to enable movement of frame 21 with respect to frame 20. Frame 21 supports the carry bar 23 on the outer edge of the hinged frame 21 and operation of the hydraulic actuators 18 and 18' enables the carry bar to move both up and down and in and out with respect to the support surface 12 of the sloop 10.

Further, the carry bar 23 is arranged to move with respect to frame 21. The carry bar 23 is attached to two rods 29 that telescopically engage with edge tubes 29' of frame 21. Hydraulic actuators 35 act to move the carry bar 23 away from or towards the frame 21.

As seen in Figure 11, the carry bar 23 has magnetic blocks 53 which can magnetically grasp and release the drill pipe 14 within the sloop 10. The magnetic blocks 53 can be turned on and off to grasp and release a pipe. An hydraulic actuator 54 can be used to actuate the on/off switches via a number of shafts 55 connected between the actuator 54 and the magnetic blocks 53. The actuator 54 is attached to a crank 56 which in turn rotate the shafts 55 to turn the magnetic blocks 53 on or off.

The operation of the mechanical handling means 19 is to both place drill pipe 14 onto the conveyor 15 or to take drill pipe 14 from conveyor 15 and place it within the sloop 10. Posts 24 and 24a support the drill pipe 14 within the sloop 10 with posts 24 acting to prevent the loaded drill pipe 14 resting against the conveyor 15. Posts 24 have extension elements that can be hydraulically raised and lowered. As the drill pipe 14 is first being loaded into the sloop 10 onto the support surface 12, the posts 24 can be lowered so that the mechanical handling means 19 has more direct access to the support surface 12 and does not need to lift the drill pipe 14 up and over the otherwise extended support posts 24. As the loading of the drill pipe 14 reaches the upper level of the lowered posts 24, they can then be extended when the stack of pipe is at a height that requires support.

Figures 14 to 16 show a secondary loading conveyor 60 located at the rear end (end opposite to the drill rig 25) that can assist in loading drill pipe 14 into the sloop 10. The secondary conveyor 60 comprises two sections of u-shaped channel 61 and 62 with a number of rollers 63 mounted within the

channel 61 and 62. Channel 61 is supported by upright 65 and braces 66 and 67. Channel 62 is supported by leg 68.

As can be seen in Figure 16, the secondary conveyor 60 can be moved to a stowed position for transport. Channels 61 and 62 are pivotally attached so that channel 62 can be folded onto the top of channel 61. Upright 65 is pivotally secured to the back of the sloop 10 so that the channels 61 and 62 and the brace 66 can be rotated through 90 degrees to a position against the back of the sloop 10. The brace 67, which releasably attaches to bracket 69 and pivotally moves in relation to brace 66, can also move to a stowed position as shown in Figure 16. The leg 68 is pivotally attached to the channel 62 so that it can fold on top of channel 62.

The rear end of the sloop 10 is also provided with a gate 70 shown in an open position in Figure 14 and a closed position in Figure 15. As seen in Figure 11, the gate 70 does not extend fully across the back of the sloop, but leaves a gap to allow drill pipe 14 to move from the secondary conveyor 60 onto the conveyor 15.

The secondary conveyor 60 allows for convenient loading of the sloop 10. Drill pipe 14 can be presented to the secondary conveyor 60, for example, on the tines of a fork lift truck requiring only for the drill pipe 14 to be lifted manually onto the secondary conveyor 60. The drill pipe 14 which is resting on the rollers 63 can then be easily pushed onto the conveyor 15 sufficiently for the conveyor 15 to move the drill pipe 14 by itself. The drill pipe 14 can then be moved to the required position for the mechanical handling means 19 to lift the drill pipe 14 into the sloop 10. Alternatively, the drill pipe 14 could also be fed by the conveyor 15 directly to the drill rig 25.

Figures 17 and 18 shows an indexing stop 73 in its operative position in Figure 17 and in its open position in Figure 18. In its operative position, it is used to provide a back stop for drill pipe 14 being unloaded from the drill rig 25. It is important to ensure that the drill pipe 14 moves to a predetermined position so that the mechanical handling means 19 lifts the drill pipe 14 off of the conveyor 15 and places it in the sloop 10 so that the position of the ends of the drill pipe 14 with respect to the sloop 10 do not vary significantly. Rather than having to take the care to stop the drill pipe 14 in a precise position, the operator can simply run the conveyor 15 until the drill pipe 14 contacts the indexing stop 73. It will not matter if the conveyor 15 continues to run after initial contact as the drill pipe 14 will simply slip on the conveyor 15.

The indexing stop 73 is moved to its open position as shown in Figure 18 when the secondary conveyor 60 is used to load the sloop 10. A similar indexing stop (not shown) can be located at the other end of the conveyor 15 to again allow the operator to position the drill pipe 14 easily with

accuracy prior to it being loaded into the sloop. Figures 12 and 13 show an indexing stop 50 that is pivotally attached to the upper runner 36 of the conveyor 15. The indexing stop 50 can be moved between an inoperative position shown in Figure 12 to an operative position shown in Figure 13 where the indexing stop is positioned over the top of the conveyor 15. Rotation of the indexing stop 50 is via an hydraulic actuator 51 on end of which is pivotally attached to the indexing stop 50, the other end being pivotally attached to the lower runner 37.

The indexing stop 50 can used to position two shorter lengths of drill pipe 14 such as 3 meter lengths. One of the lengths of drill pipe 14 abuts against the indexing stop 73 with the other abutting against the indexing stop 50. The second drill pipe 14 located against indexing stop 73 will remain in the required position even with further operation of the conveyor 15 until the other drill pipe is in the required position against indexing stop 50. This then ensures that each drill pipe 14 is in the required position to be accurately loaded into the sloop 10.

The operation of the conveyor 15, mechanical handling means 19 and the drill rig handling assembly 26 can be via radio control. An operator can use a hand held controller/transmitter to operate all of these functions.

Figure 19 shows the front end of the sloop 10 and gate 75 that is hinged thereto. The gate 75 does not extend fully across the sloop 10, but instead leaves a gap for drill pipe 14 to fed into a drill rig 25. Also seen in Figure 23 are side fences 76 that are used on either side of the sloop 10 to enclose the sloop 10. Further either end of the sloop can have the features shown in Figure 19 so that a drill rig 25 can be positioned at either end of the sloop 10.

As it can be seen from the above description, the conveyor 15 and sloop 10 enable a greater range of length and diameter of drill pipe to be handled in a very quick and efficient manner. Obviously, reducing the handling time of the drill pipe greatly improves the efficiency and therefore operating profit of the drill rig. In addition, the invention eliminates the need for any manual handling of drill pipe either in respect of loading or unloading a drill rig which greatly increases the safety for operators.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia or elsewhere before the priority date of each claim of this application.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

THE CLAIMS

1. A conveyor for delivering lengths of drill pipe to and from a use position having an elongate conveying means for supporting and conveying said drill pipe towards or away from a use position, the conveying means having a conveying surface means that allows movement of said drill pipe with respect to the conveying surface means if conveying movement of said drill pipe is obstructed so that the conveying surface means can continue to move with respect to said drill pipe.
2. A conveyor according to claim 1 wherein said use position comprises a drill rig pipe handler.
3. A conveyor according to either claim 1 or claim 2 wherein the conveyor is used in relation to a drill pipe storage means.
4. A conveyor according to either claim 1 or 2 wherein said conveyor is located within a drill pipe storage means.
5. A conveyor according to any one of the preceding claims wherein the surface of the conveying means comprises a smooth hard surface or a plurality of smooth hard surfaces.
6. A conveyor according to claim 5 wherein the conveying means comprises a plurality of metal plates.
7. A conveyor according to claim 6 further comprising a chain supported at either end by a sprocket.
8. A conveyor according to claim 7 wherein one of said sprockets has associated drive means to provide conveying movement to said chain.
9. A conveyor according to any one of claims 6 to 8 wherein said plates have a v-shaped cross-section.
10. A conveyor according to any one of claims 7 to 9 further comprising an elongate runner that supports the chain between said sprockets.

11. A conveyor according to claim 10 wherein the chain includes a plurality of rollers for engaging said runner.
- 5 12. A conveyor according to any one of the preceding claims further comprising at least one stop means that is moveable to a position over the conveyor to provide abutment means to arrest movement of drill pipe on the conveyor at a predetermined position.
- 10 13. A drill pipe storage means including a conveyor according to any one of claims 1 to 2 or claims 5 to 12 wherein the conveyor is used to convey drill pipe stored in the storage means.
14. A drill pipe storage means according to claim 13 wherein the conveyor is positioned within the storage means.
- 15 15. A drill pipe storage means according to claim 14 wherein the storage means comprises a storage sloop including a base and side supports and wherein the conveyor is mounted parallel to the longitudinal axis of the sloop adjacent a side support.
- 20 16. A drill pipe storage means according to any one of claims 13 to 15 further comprising mechanical handling means positioned with respect to the sloop for loading drill pipe onto and off the conveyor.
17. A drill pipe storage means according to claim 16 wherein the mechanical handling means is attached to the sloop.
- 25 18. A drill pipe storage means according to either claim 16 or 17 wherein the mechanical handling means comprises a plurality of articulated arms that can be moved between the conveyor and the stored drill pipe.

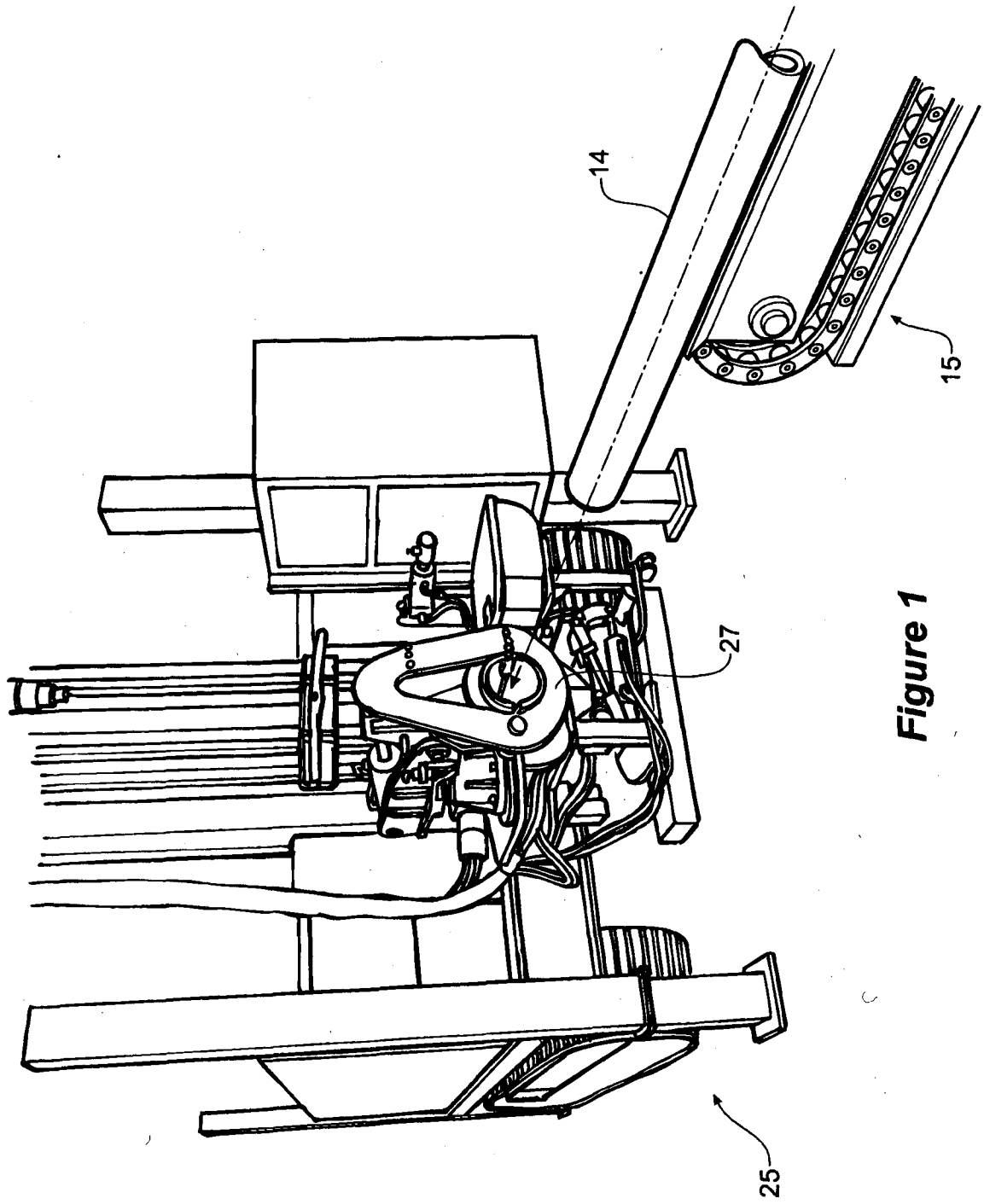


Figure 1

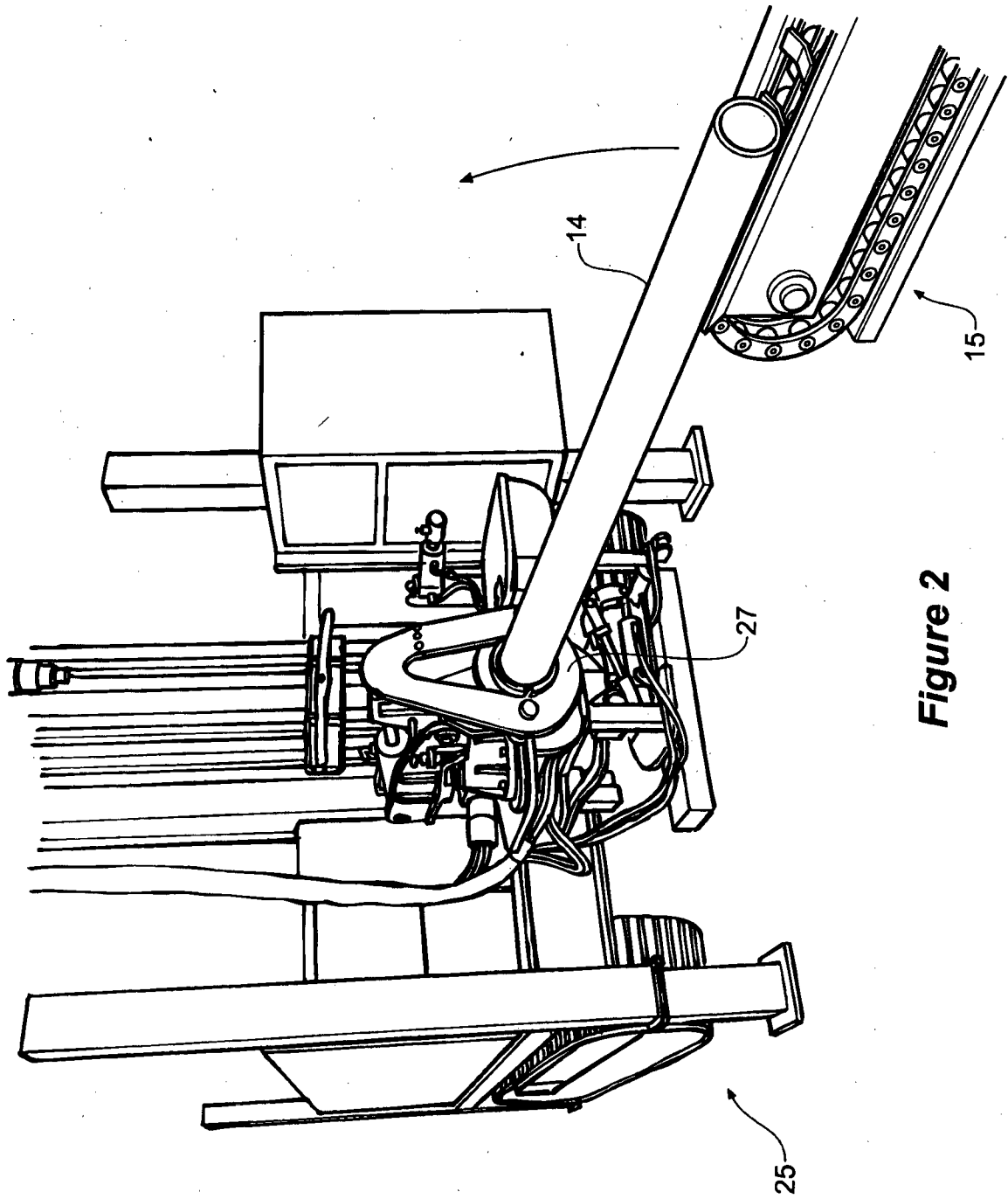


Figure 2

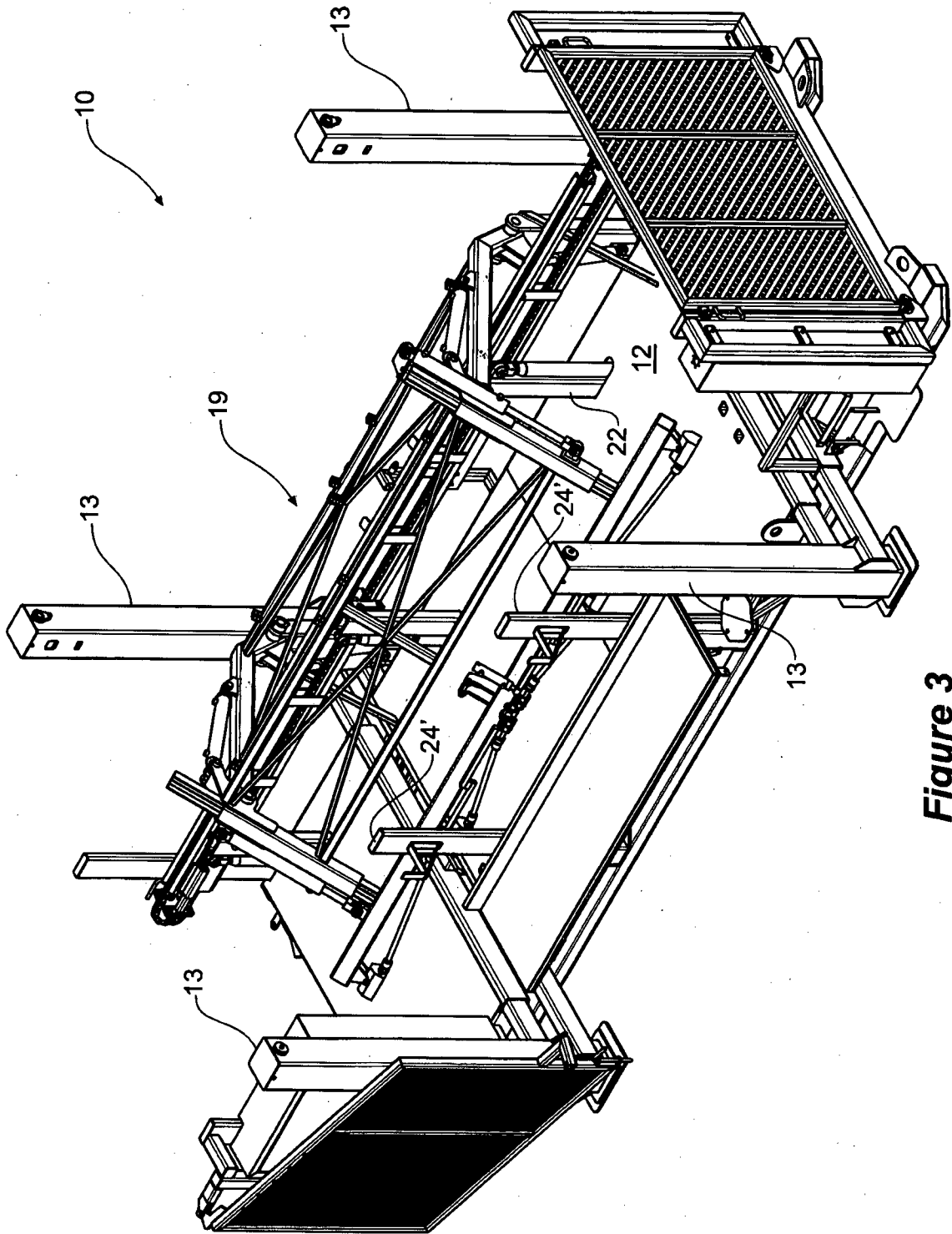


Figure 3

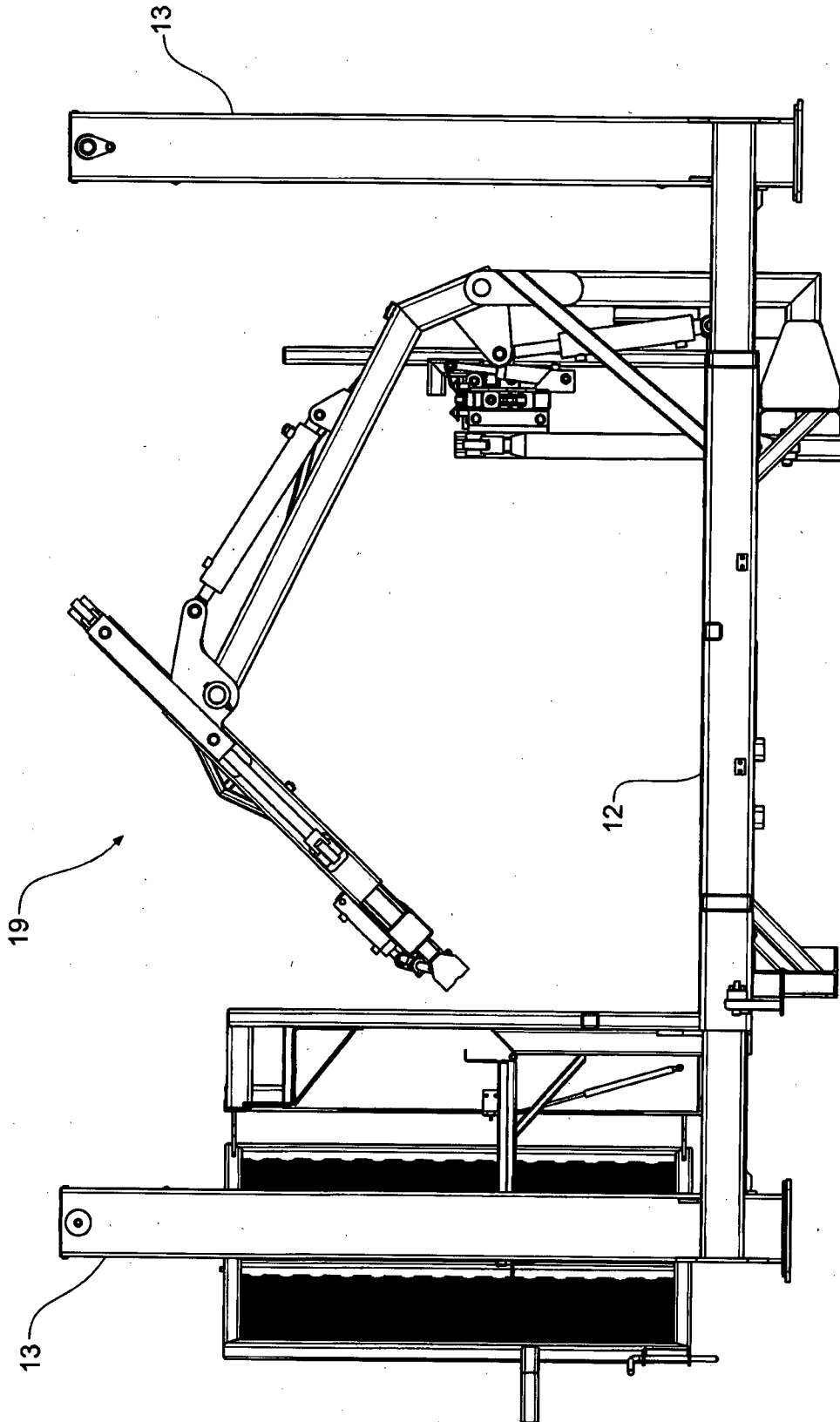


Figure 4

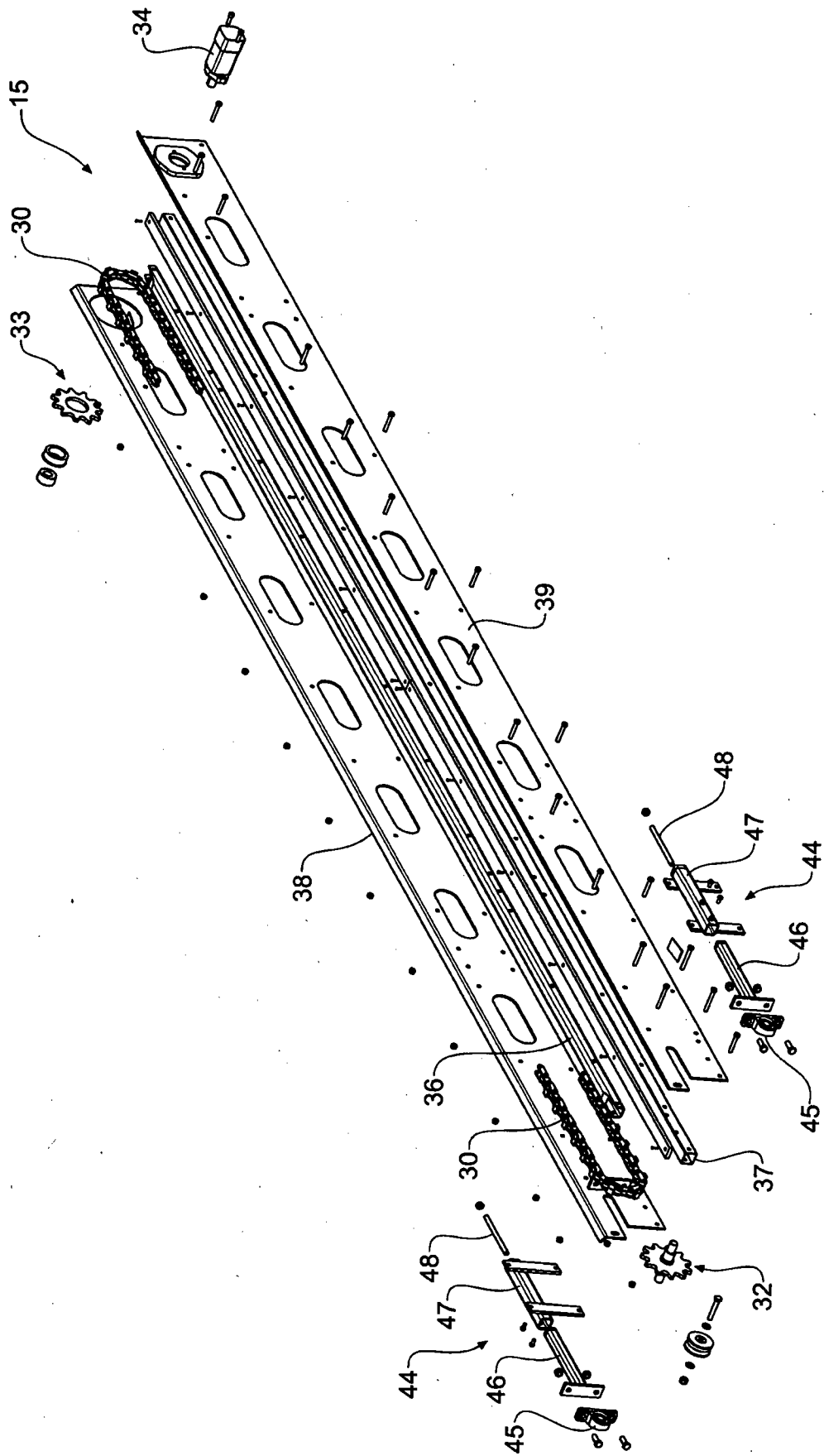


Figure 5

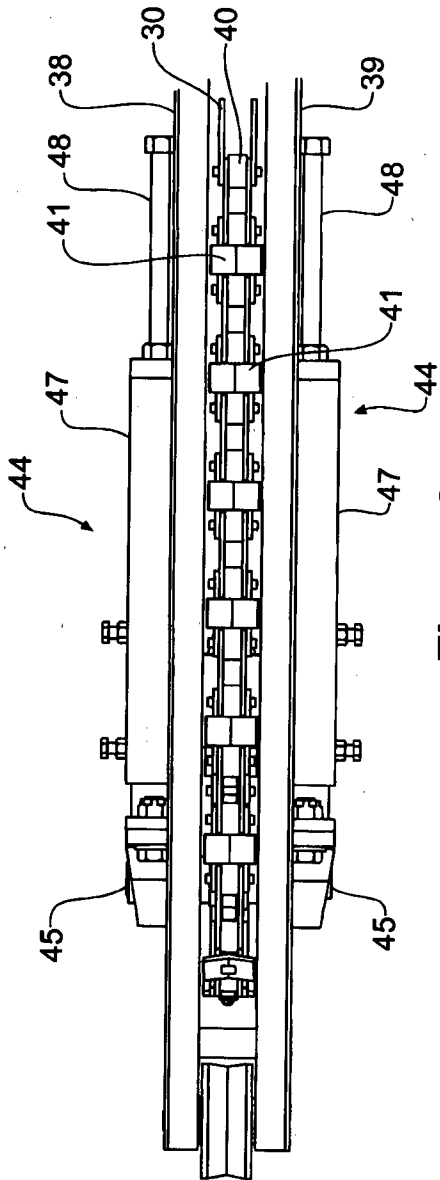


Figure 6

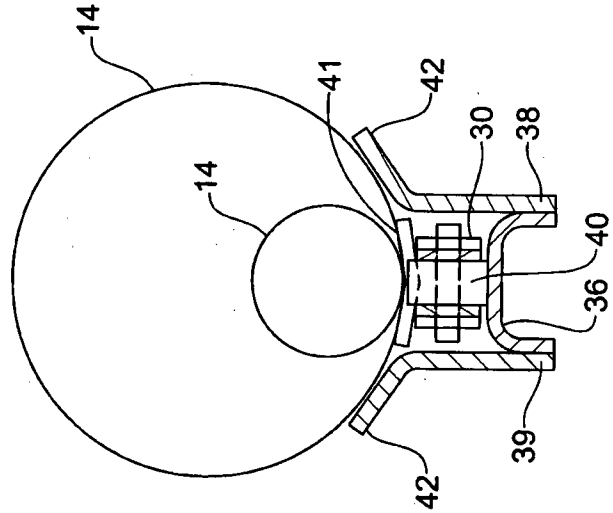


Figure 9

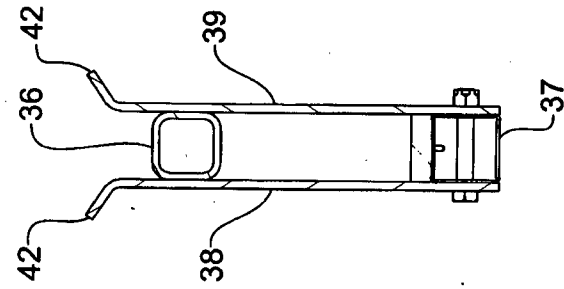


Figure 8

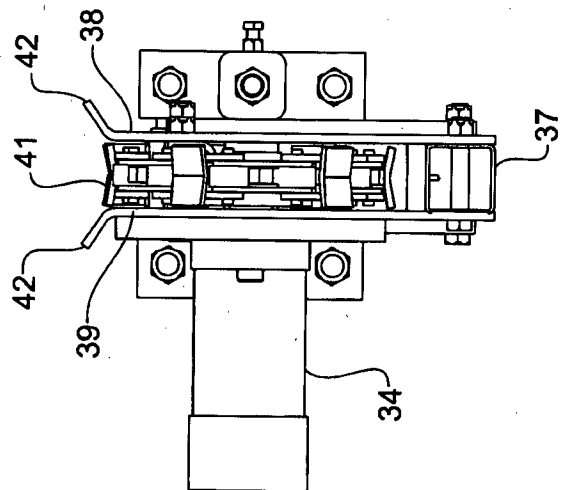


Figure 7

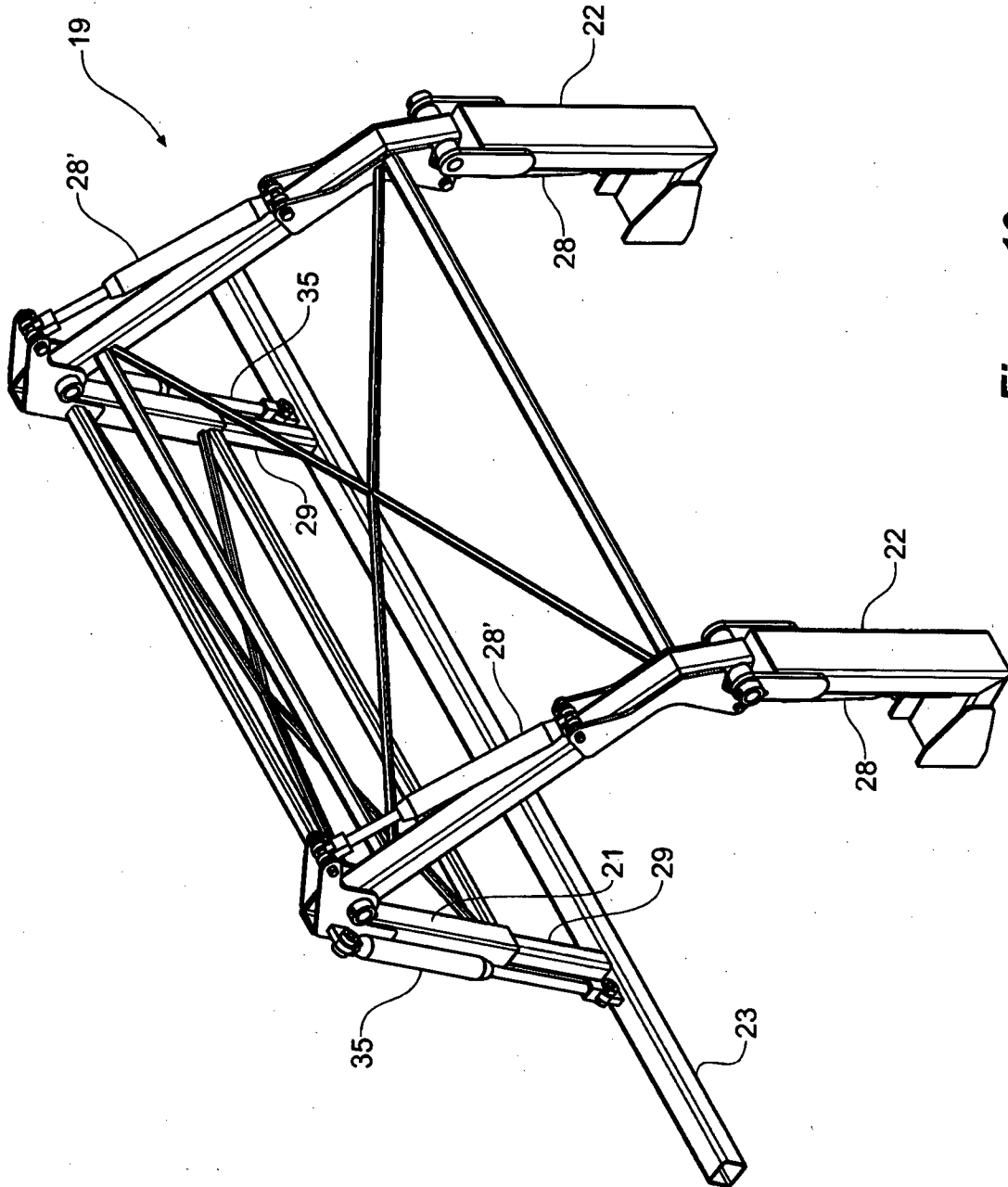


Figure 10

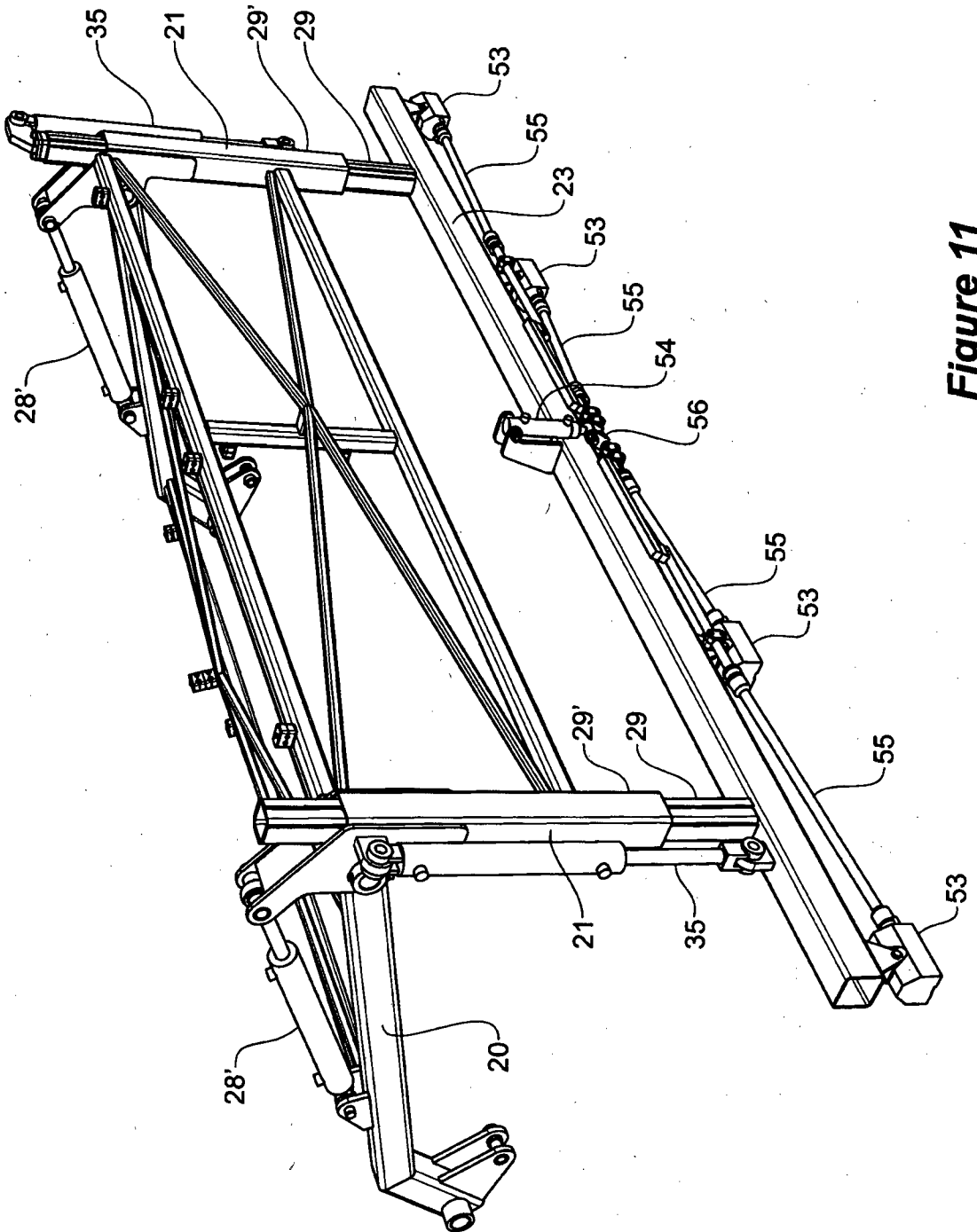


Figure 11

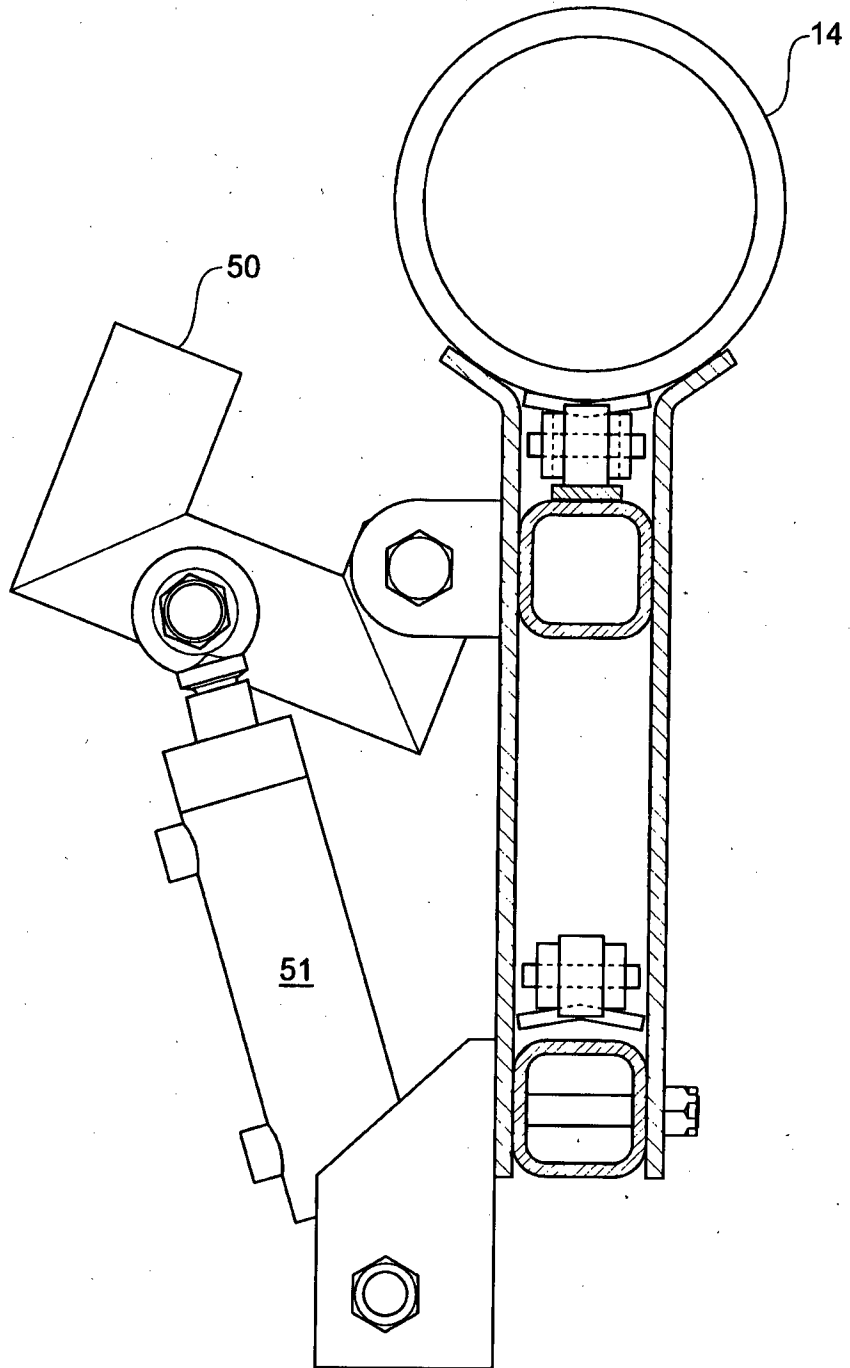


Figure 12

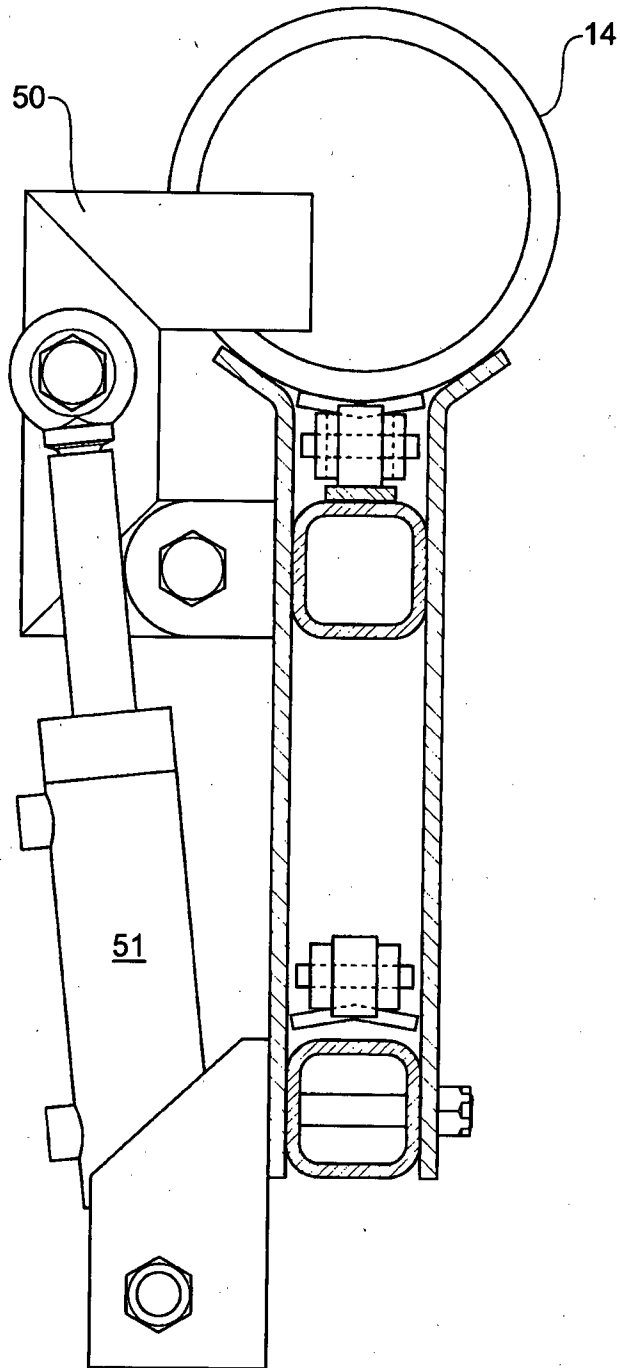


Figure 13

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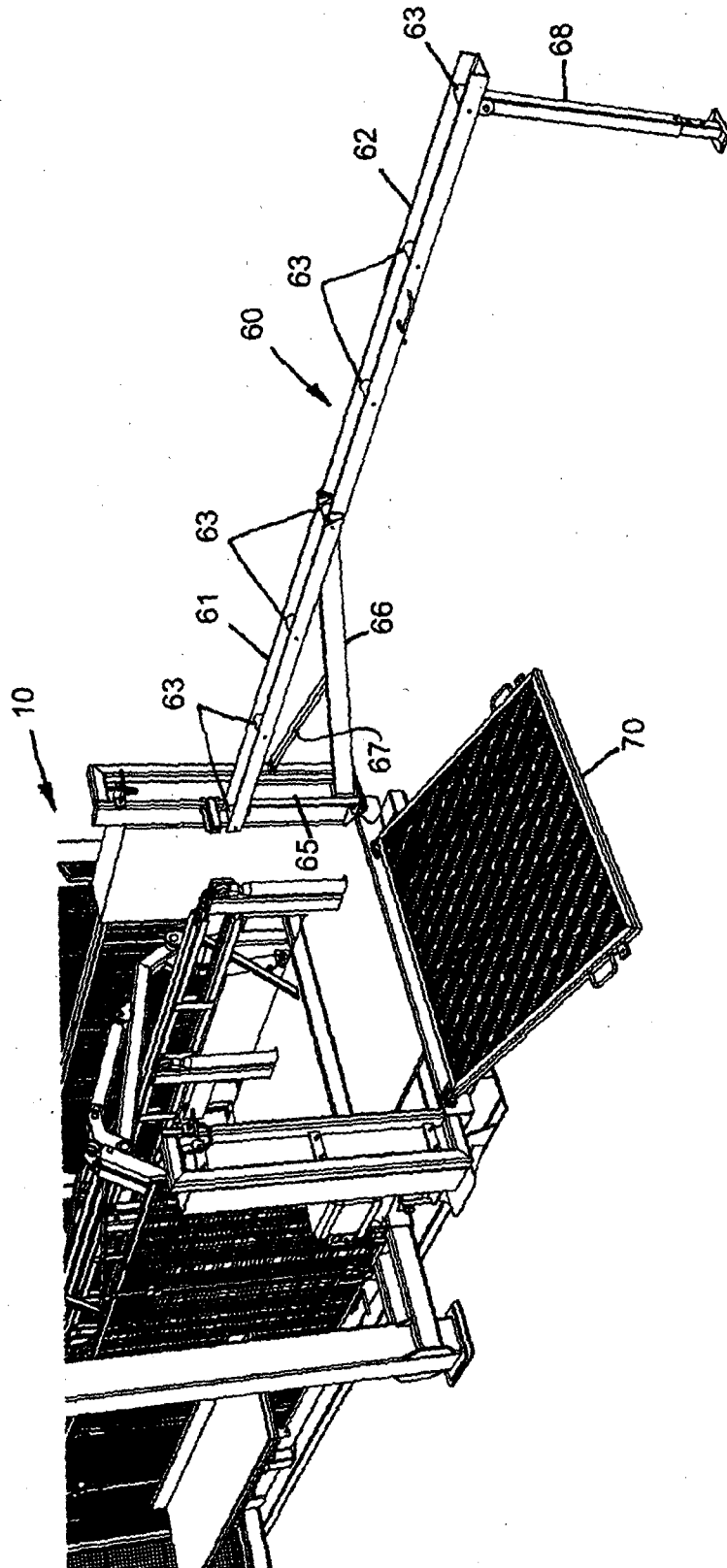


Figure 14

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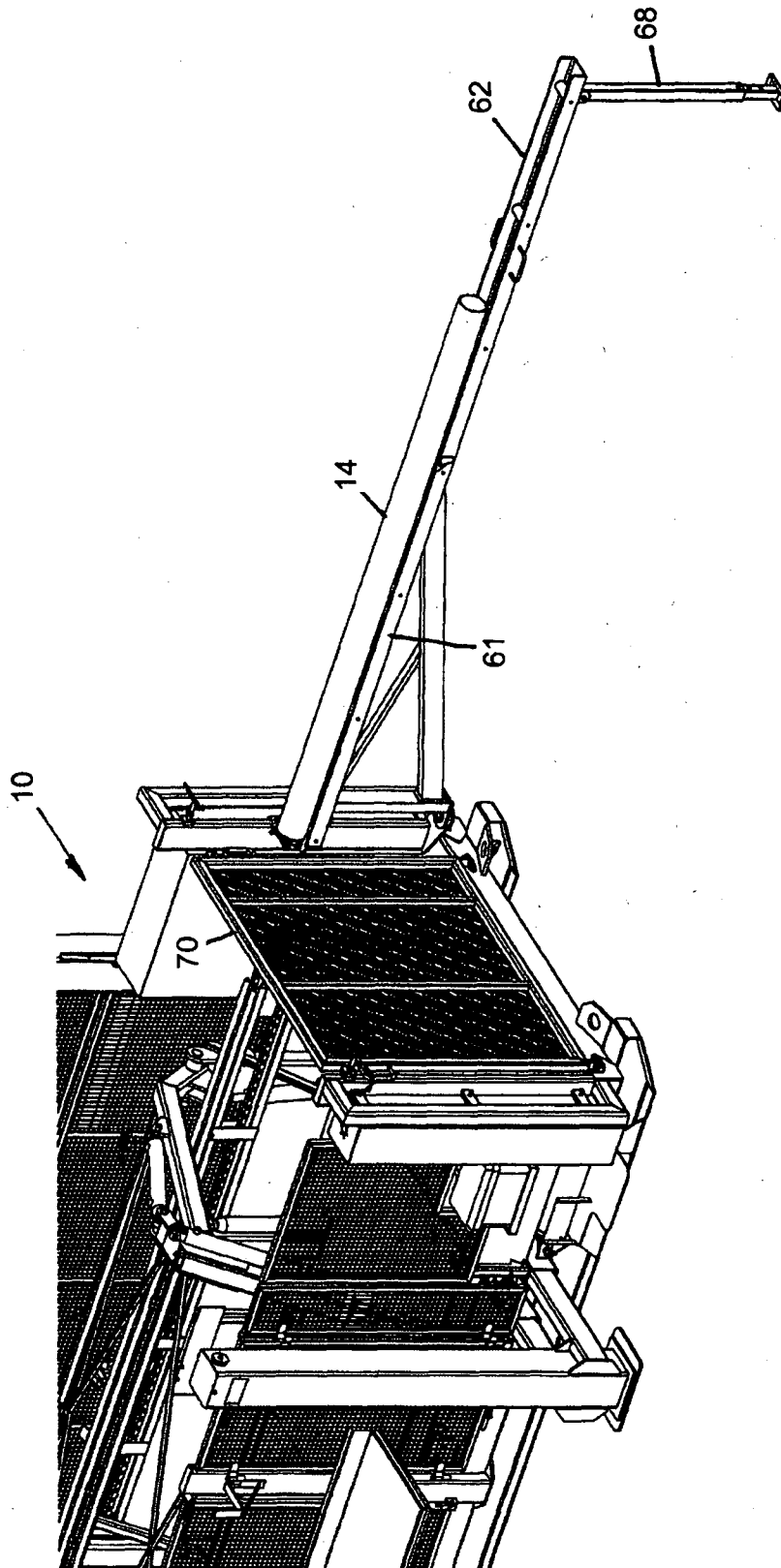


Figure 15

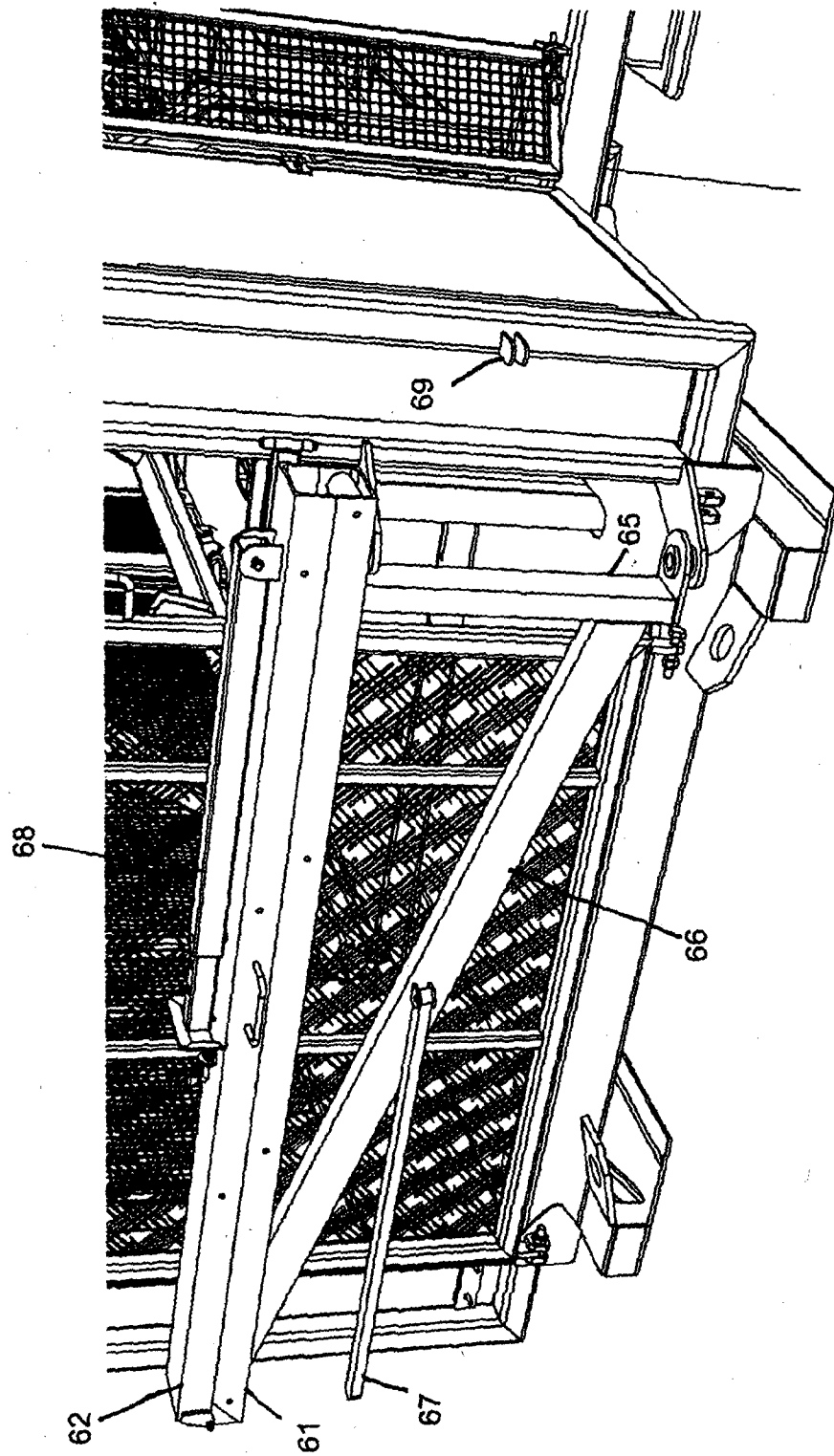


Figure 16

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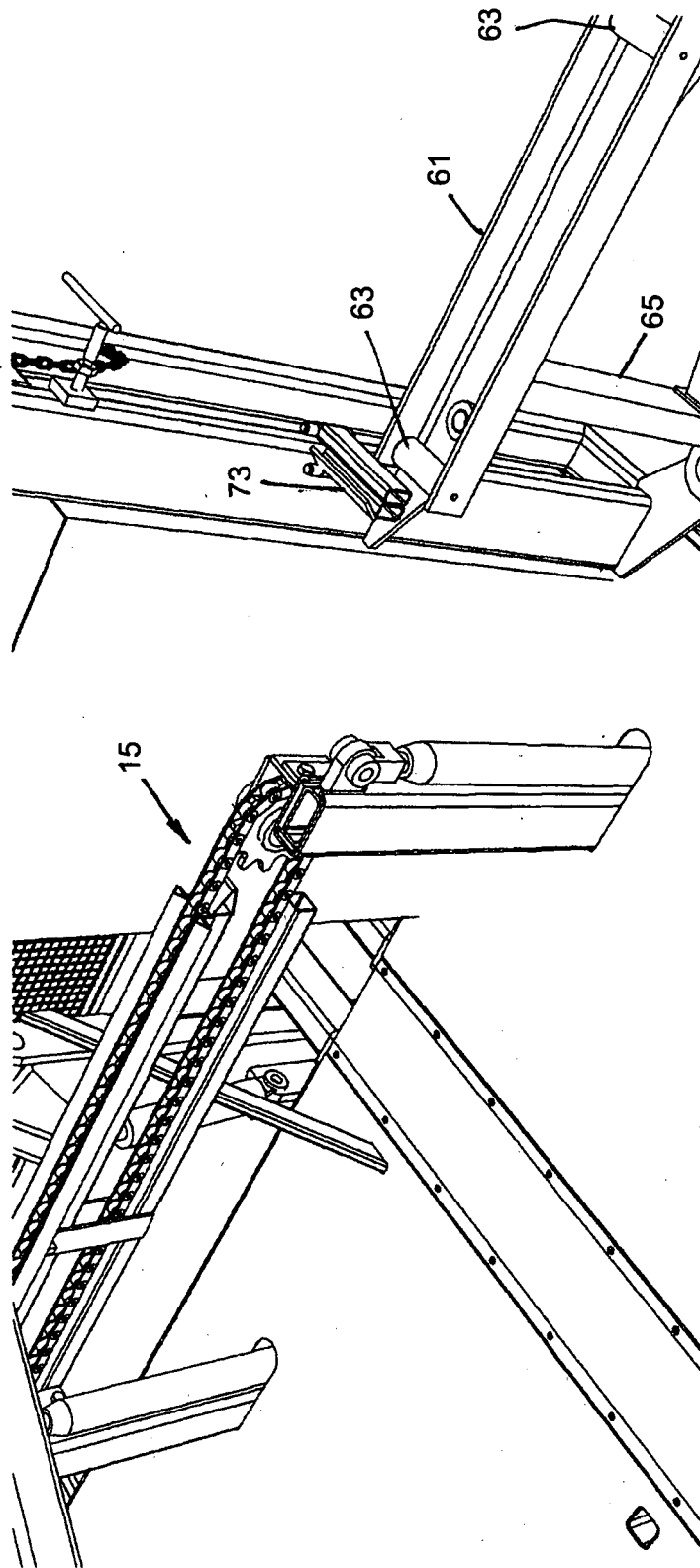


Figure 17

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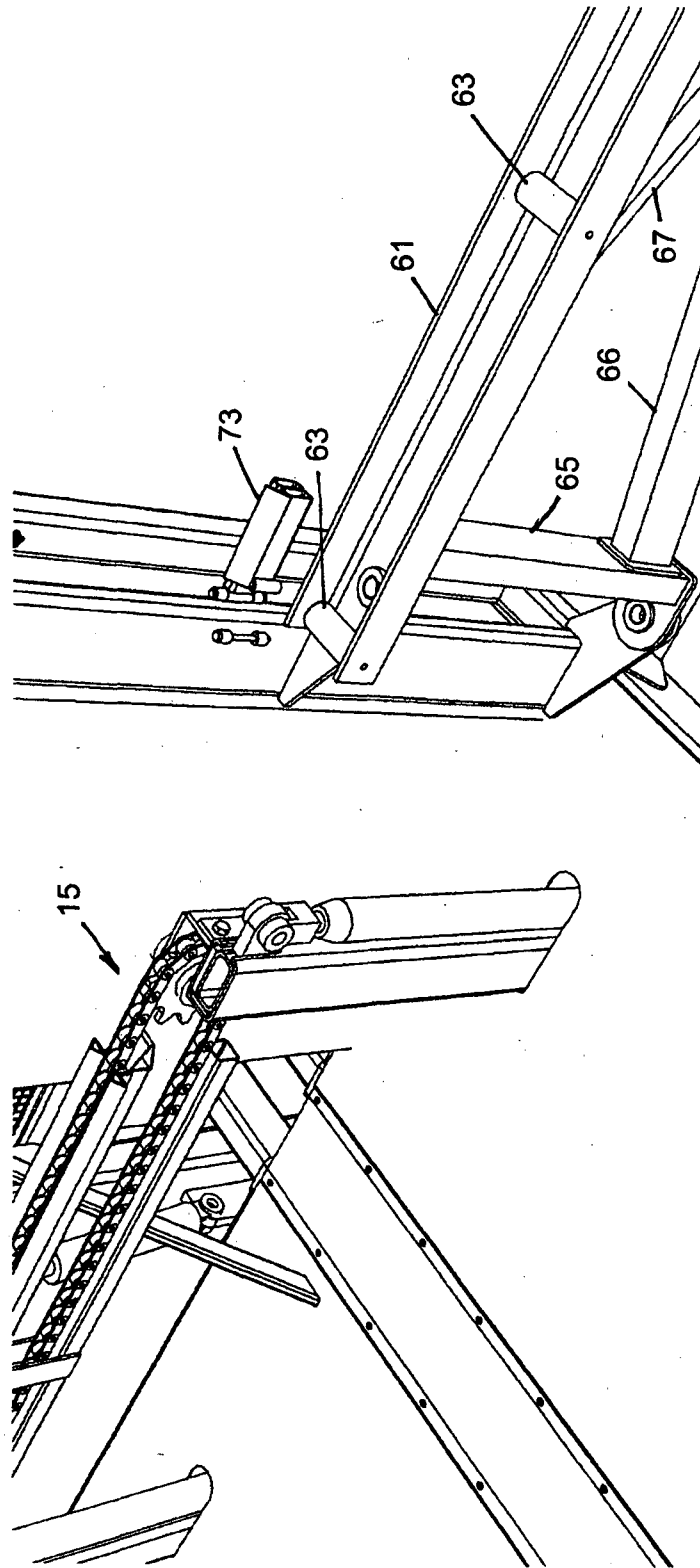


Figure 18

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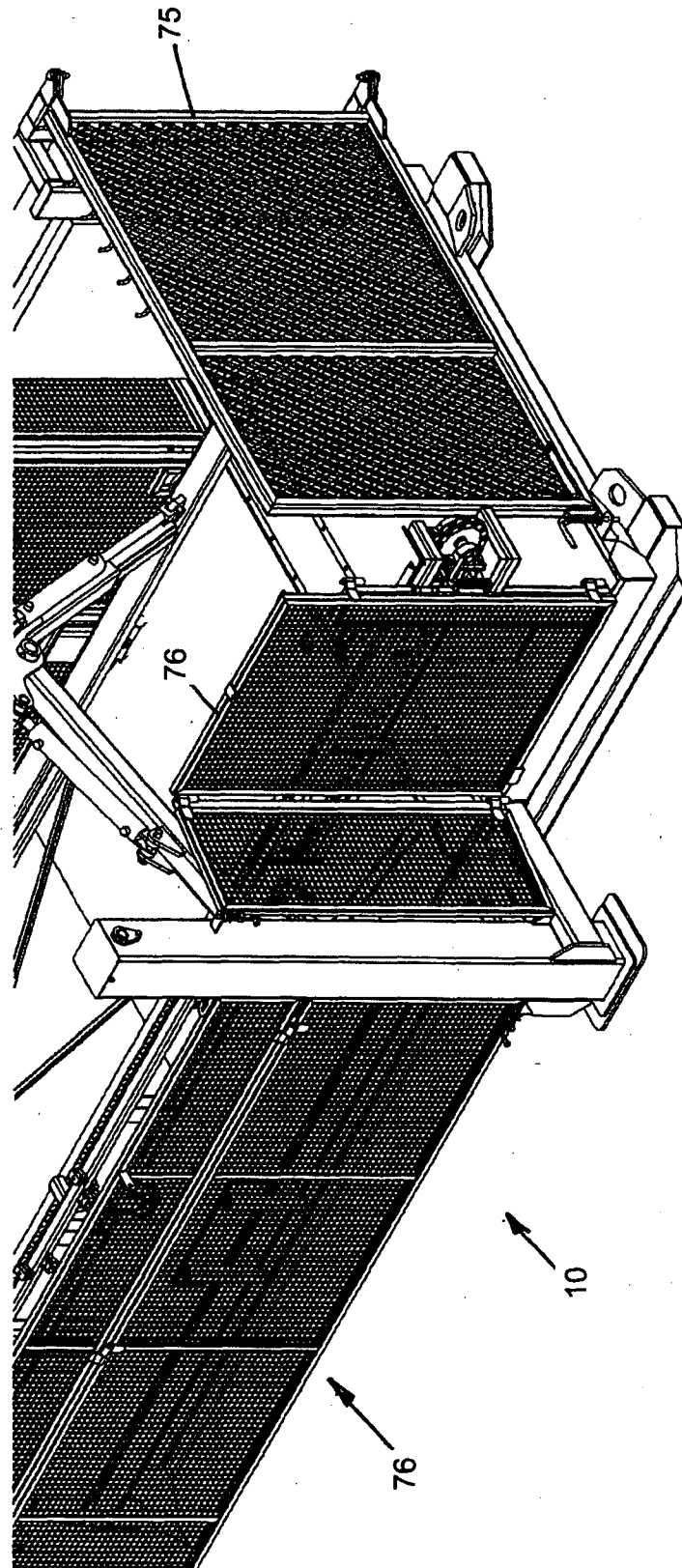


Figure 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2013/000353

A. CLASSIFICATION OF SUBJECT MATTER

E21B 19/15 (2006.01) E21B 19/20 (2006.01) B65G 17/06 (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)

WPI, EPODOC: IPC and CPC E21B19/LOW, B65G17/LOW, B65G43/LOW, B65G17/06/LOW, B65G17/38/LOW, B65G17/46/LOW with key words CONVEY, CHAIN, ROLL, WHEEL, ENDLESS, TRANSFER, DELIVER, PIPE, SHAFT, TUBE, CASING, OBSTRUCT, STOP, LIMIT, PREVENT, SLIP, RELATIVE, MOVE, TRAVEL, CONTINUE, FREE

Espace: IPC B65G17/LOW with key words ("CONVEYOR CHAIN") AND (ROLLER OR WHEEL OR PLATE OR SPROCKET) & Google Patents: with key words "CONVEYOR CHAIN WITH METAL PLATE"

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	

 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	"&" 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
7 May 2013

Date of mailing of the international search report
07 May 2013

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INTERNATIONAL SEARCH REPORT

International application No.

C (Continuation).

DOCUMENTS CONSIDERED TO BE RELEVANT

PCT/AU2013/000353

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3706347 A (BROWN) 19 December 1972 Figures 1-3, 4A, 4B, 8-10, 13 and column 9 lines 52-59, column 4 line 53 – column 5 line 24	1-5, 12-18
Y	Figures 1-3, 4A, 4B and column 4 lines 16-24	6-9
X	DE 3007278 A1 (BECKER PRUNTE GMBH) 03 September 1981 Figures 1, 2, abstract and English language machine translation retrieved from EPO website	1, 5-12
Y	JP 2008007288 A (INOUE NOBORU) 17 January 2008 Figures 1, 6-9, 11 and English language machine translation retrieved from JPO website	6-9
A	US 4684314 A (LUTH) 04 August 1987 Figures 1-4, column 4 lines 33-56, column 7 lines 39-46 and column 8 lines 12-49	
A	WO 2007/079286 A2 (POP'S LAYDOWN SERVICE, L.L.C.) 12 July 2007 Figures 1, 2, 4, 9, 10, page 9 lines 4-9 and lines 18-22, page 10 lines 25-29 and page 11 lines 15-31	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2013/000353

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
US 3706347 A	19 Dec 1972	US 3706347 A	19 Dec 1972
		US 3780883 A	25 Dec 1973
		US 3792783 A	19 Feb 1974
		US 3916500 A	04 Nov 1975
DE 3007278 A1	03 Sep 1981	DE 3007278 A1	03 Sep 1981
JP 2008007288 A	17 Jan 2008	JP 2008007288 A	17 Jan 2008
US 4684314 A	04 Aug 1987	None	
WO 2007/079286 A2	12 Jul 2007	US 2007114113 A1	24 May 2007
		US 7614492 B2	10 Nov 2009
		WO 2007079286 A2	12 Jul 2007

End of Annex

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

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