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(56) Related Art
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US 4293264
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ABSTRACT

The rotating mechanism of the present invention includes:

a rotatable shaft;

a first crank arm, wherein one end of the first crank arm is fixedly connected to the shaft;

a second crank arm, wherein one end of the second crank arm is rotatably connected to the shaft;

a first hydraulic or pneumatic cylinder interconnecting the two crank arms, and spaced apart from the shaft, whereby contraction or expansion of the first hydraulic or pneumatic cylinder enables the angular distance between the crank arms to be varied; and

a second hydraulic or pneumatic cylinder connecting the second crank arm to a support;

wherein the second crank arm is the closer of the two crank arms to the support.

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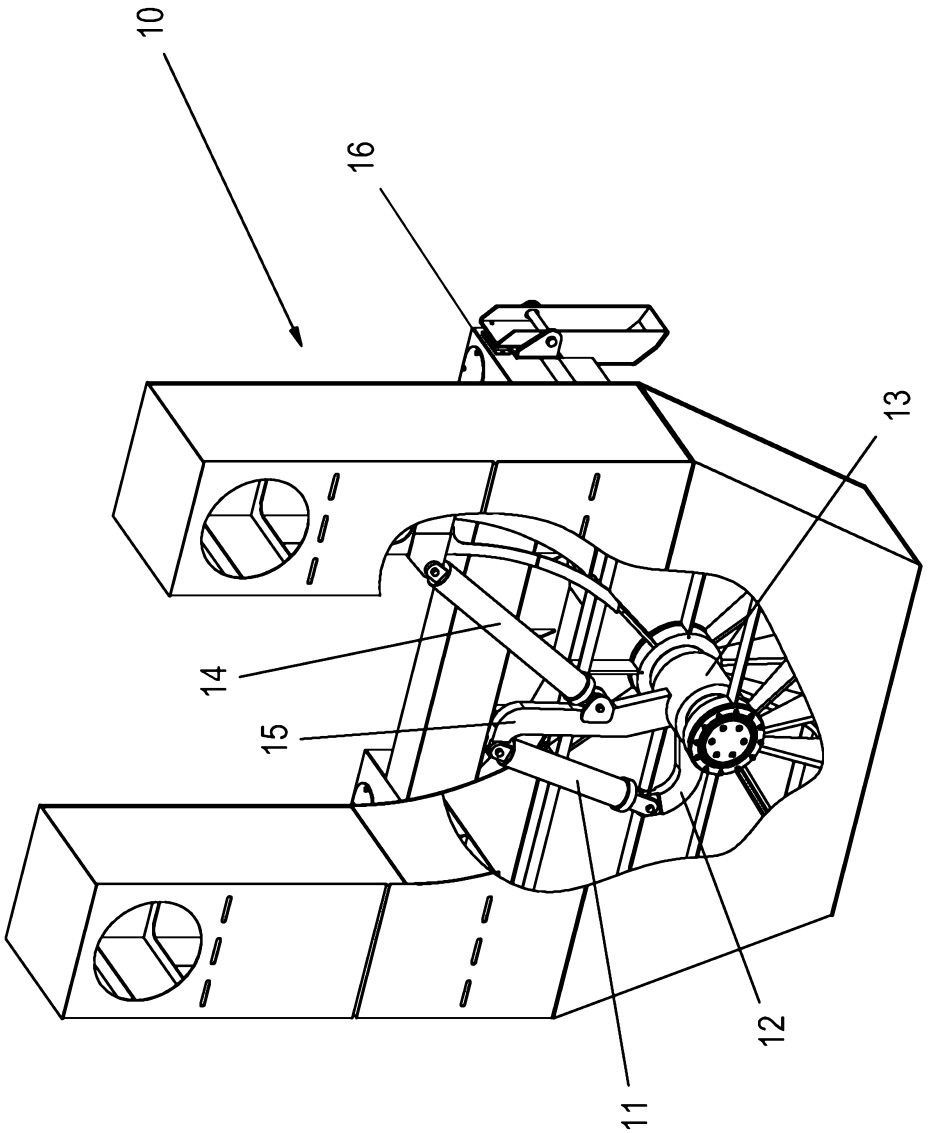

FIGURE 1

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ROTATING MECHANISM

TECHNICAL FIELD

[0001] The present invention relates generally to a mechanism for rotating a shaft, and has particular application to container-handling equipment, where the containers are being used for the handling of bulk materials, such as ore, coal, grain, fluids etc., for shipping/transport purposes. More particularly, the present invention relates to a means for rotating a cargo or shipping container. For example, the cargo-handling apparatus may include at least one end compartment(s), each of which has a container support arm, mounted thereon, to engage and then rotate a cargo or shipping container, and wherein the rotating mechanism of the present invention enables the container to be rotated.

BACKGROUND TO THE INVENTION

[0002] For many years, bulk materials have been loaded into the holds of ships by the use of conveyors. However, conveyors have disadvantages in that they cannot be used to load efficiently, or have restricted loading mechanisms which cannot deliver material to a desired location. In general, conveyor systems are expensive, require set-up time and are complex to handle. For this reason, it is preferred to use cargo containers of the type that are hoisted and located by the use of gantry cantilevered cranes. Container systems provide many advantages, including the ability to load and off-load such containers from various transport means, including flat-bed trucks and rail cars. Another benefit is that the bulk material within the containers is protected from the environment (by being protected from environmental exposure) and, in turn, the environment is protected from the bulk material (*i.e.* contamination by loss of the container contents).

[0003] Container-handling apparatus is used to move a cargo container from one location to another (*e.g.* from a flat deck rail car, on which it has been transported, or from a wharf, to an unloading position above the cargo hold of a ship), and to rotate the container so that its payload is discharged (for example, into the cargo hold of a ship). Standard cargo-handling apparatus can be used. However, the Applicant's ROTAINER® container-handling apparatus is particularly suitable for use. The Applicant's ROTAINER® container-handling apparatus is described in International (PCT) Application No. PCT/AU2010/001337 (entitled “Apparatus for handling containers”), the disclosure of which is incorporated herein by reference.

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[0004] The arms of the container-handling apparatus, which engage with a shipping or cargo container to hold and then rotate the container, may be rotated by means of a rotatable shaft assembly, with a crank arm or similar mechanism being used to rotate the shaft. However, present hydraulically powered crank arm mechanisms can provide only a limited degree of rotation. Once the shaft is rotated beyond a certain point, the hydraulic cylinder will come in contact with and interfere with the rotation of the shaft.

SUMMARY OF THE INVENTION

[0005] The invention relates to a rotating mechanism including:
- a rotatable shaft;
- a first crank arm, wherein one end of the first crank arm is fixedly connected to the shaft;
- a second crank arm, wherein one end of the second crank arm is rotatably connected to the shaft;
- a first hydraulic or pneumatic cylinder interconnecting the two crank arms, and spaced apart from the shaft, whereby contraction or expansion of the first piston enables the angular distance between the crank arms to be varied; and
- a second hydraulic or pneumatic cylinder connecting the second crank arm to a support;

wherein the second crank arm is the closer of the two crank arms to the support.

[0006] Preferably, both cylinders are hydraulic cylinders, but an alternative option is to utilise pneumatic (compressed air) cylinders.

[0007] The rotating mechanism enables the rotatable shaft to be rotated up to approximately 180 degrees. In a preferred embodiment, the maximum rotation is approximately 180 degrees.

[0008] Preferably, the rotating mechanism forms part of container-handling apparatus for rotating cargo or shipping containers. The rotating mechanism may, for example, be mounted in or on an end compartment or arm of the cargo-handling apparatus.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an implementation of the invention and, together with the description, serve to explain the advantages and principles of the invention. In the drawings:

Figure 1 is a perspective view of an end compartment and corresponding container support arm of container-rotating apparatus (*e.g.* the Applicant's ROTAINER® container-handling apparatus), with a cut-out to reveal a rotating mechanism according to the present invention mounted within that end compartment;

Figure 2 is a side view of the rotating mechanism of **Figure 1** mounted within an end compartment of the container-rotating apparatus (with the external wall of that end compartment removed);

Figure 3 is a top view of the end compartment and corresponding container support arm of **Figure 1**, minus the end compartment's removable cover [in use, a removable cover (not shown in **Figure 3**) will cover the aperture shown in the central top portion of the end compartment]; and

Figure 4 is a perspective view of the end compartment and corresponding container support arm of the container-rotating apparatus.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[00010] The following detailed description of the invention refers to the accompanying drawings. Although the description includes an exemplary embodiment, other embodiments are possible, and changes may be made to the embodiment described without departing from the spirit and scope of the invention. Wherever possible, the same reference numbers will be used throughout the drawings and the following description to refer to the same and like parts. Dimensions of certain of the parts shown in the drawings may have been modified and/or exaggerated for the purposes of clarity or illustration.

[00011] The rotating mechanism of the present invention is particularly suitable for use in container-handling equipment, where the containers are being used for the handling of bulk materials, such as ore, coal, grain, fluids etc., for shipping/transport purposes. More particularly, the rotating mechanism of the present invention can be utilised in apparatus for rotating cargo or shipping containers.

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[00012] In a particularly preferred embodiment, as illustrated in **Figures 1 to 4**, a rotating mechanism according to the present invention will be included in each of the two end compartments of the Applicant's ROTAINER® container-handling apparatus (as described in International (PCT) Application No. PCT/AU2010/001337).

[00013] Turning now to the drawings, there is illustrated in **Figures 1 to 4** an end compartment 10 of an arm of cargo-handling apparatus. Generally, there will be two arms, each with an end compartment 10, at either end of container-handling apparatus of the ROTAINER® type. A rotating mechanism according to the present invention will be mounted inside each end compartment 10 of the arms of the cargo-handling apparatus. The rotating mechanism is preferably hydraulically powered. Hydraulic power for the mechanism can, for example, be supplied by an hydraulic power pack mounted on the cargo-handling apparatus, or from a reach stacker, forklift or similar (used in conjunction with the container-handling apparatus). Motive power can be supplied by any convenient or appropriate means - for example, an on-board petrol or diesel generator or an electric motor drawing electrical supply from a crane (from which the container-handling apparatus is suspended).

[00014] In a preferred embodiment, the rotating mechanism uses hydraulic power to rotate a cargo or shipping container. The rotating mechanism allows for a greater degree of rotation than would a conventional crank arm assembly having only a single crank arm. In particular, the rotating mechanism of the present invention allows an open-top container to be rotated up to approximately 180 degrees, so as to discharge the payload (*e.g.* bulk goods such as ore) from the container.

[00015] There are two hydraulic cylinders 11 and 14 and two crank arms 12 and 15. The first crank arm 12 is fixedly connected to a rotatable shaft 13, so that the degree of rotation of this first crank arm 12 will determine the degree of rotation of the shaft 13. The first crank arm 12 and shaft 13 may be manufactured as a single item/part, or the first crank arm 12 can (for example) be welded to the shaft 13.

[00016] The second crank arm 15 is rotatably connected to shaft 13, *e.g.* by means of a sleeve surrounding at least a portion of the shaft 13. The sleeve is rotatable independently of the shaft itself. The sleeve has a slot in it to accommodate the first crank arm 12, thus allowing the first crank arm 12 to move independently of the second crank arm 15. In this embodiment, the second crank arm 15 is fixedly connected to the shaft's sleeve. The second crank arm 15 and the sleeve may be manufactured as a single item/part, or the second crank arm 15 can (for example) be welded to the sleeve.

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[00017] Accordingly, one end of each of the crank arms 12 and 15 connects to the shaft 13, either directly or via a sleeve for the shaft. The first hydraulic cylinder 11 interconnects the other end of each of the crank arms 12 and 15, and (by its contraction or expansion) enables the angular distance between the crank arms to be varied.

[00018] The second crank arm 15 is powered by the second hydraulic cylinder 14. One end of the second hydraulic cylinder 14 connects to crank arm 15, and the other end of second hydraulic cylinder 14 connects to a support (for example, an interior surface of the end compartment 10). As shown in **Figures 1 and 2**, the point of connection of the second hydraulic cylinder 14 to the second crank arm 15 may, for example, be at an intermediate location on the crank arm, rather than toward either end of the crank arm.

[00019] The operation of the rotating mechanism will now be described. The first hydraulic cylinder 11 (single-stage, double-acting) extends under hydraulic power to rotate the first crank arm 12. Crank arm 12 is mechanically connected, via the rotatable shaft 13, to a support surface within the end compartment 10 of the container-handling apparatus. Once the first hydraulic cylinder 11 has reached a pre-determined extension, hydraulic power is re-directed to the second hydraulic cylinder 14 (also single-stage, double-acting) to extend that cylinder. This rotates the second, larger crank arm 15, which in turn rotates items 11 (the first hydraulic cylinder), 12 (the first, smaller crank arm) and 15 (the shaft).

[00020] A container support arm 16 is mounted on each end compartment 10 of the container-handling apparatus (*e.g.* by means of a commercially available locking device or off-the-shelf coupling, such as a TAS coupling - manufactured by Tas-Schäfer). The container support arms 16 (one on each end compartment of the container-handling apparatus) are used to engage and then rotate cargo or shipping containers. The rotatable shaft 15 interconnects each end compartment 10 to its respective container support arm 16, and thereby rotates the container.

[00021] At a pre-determined extension of second hydraulic cylinder 14, the container has reached its maximum rotation. The sequence is then reversed and the container is rotated back, under hydraulic power, to its original upright condition.

[00022] In a preferred embodiment, the first crank arm 12 is smaller and moves at a greater speed than the second crank arm 15, which is larger, more powerful and slower moving.

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[00023] Hydraulic interlocks are provided to ensure the mechanism provides controlled rotation throughout the sequence.

[00024] Throughout this specification, except where the context requires otherwise due to express language or necessary implication, the word "comprising" is used in the sense of "including", *i.e.* the features specified may be associated with further features (whether or not specifically mentioned) in various embodiments of the invention.

[00025] While specific embodiments of the invention have been described, it should be appreciated that various modifications and variations can be made without departing from the principles and scope of the invention.

[00026] For example, pneumatic (compressed air) cylinders can be used as an alternative to the hydraulically powered system described in the preferred embodiment above.

[00027] Although the invention has been described with respect to cargo-handling apparatus for rotating cargo or shipping containers, the rotating mechanism may be similarly used in any apparatus or equipment where a rotatable shaft is able to be driven by a crank arm mechanism.

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CLAIMS

1. A rotating mechanism including:

a rotatable shaft;

a first crank arm, wherein one end of the first crank arm is fixedly connected to the shaft;

a second crank arm, wherein one end of the second crank arm is rotatably connected to the shaft;

a first hydraulic or pneumatic cylinder interconnecting the two crank arms, and spaced apart from the shaft, whereby contraction or expansion of the first hydraulic or pneumatic cylinder enables the angular distance between the crank arms to be varied; and

a second hydraulic or pneumatic cylinder connecting the second crank arm to a support;

wherein the second crank arm is the closer of the two crank arms to the support.

2. A rotating mechanism according to Claim 1, wherein the first and second cylinders are hydraulic cylinders.

3. A rotating mechanism according to Claim 1, wherein the first and second cylinders are pneumatic cylinders.

4. A rotating mechanism according any one of Claims 1 to 3, wherein the second crank arm is fixedly connected to a sleeve for the rotatable shaft, which sleeve is rotatable independently of the shaft itself.

5. A rotating mechanism according to Claim 4, wherein the sleeve has a slot to accommodate the first crank arm, to enable the first crank arm to move independently of the second crank arm.

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6. A rotating mechanism according to any one of Claims 1 to 5, which enables the rotatable shaft to be rotated up to approximately 180 degrees.

7. A rotating mechanism according to Claim 6, wherein the maximum rotation of the rotatable shaft is approximately 180 degrees.

8. A rotating mechanism according to any one of Claims 1 to 7, which forms part of cargo-handling apparatus for rotating cargo or shipping containers.

9. A rotating mechanism according to Claim 8, which is mounted in or on each end compartment or arm of the cargo-handling apparatus.

10. A rotating mechanism according to Claim 9, wherein the cargo-handling apparatus includes at least one end compartment(s), each of which has a container support arm, mounted thereon, to engage and then rotate a cargo or shipping container, and wherein the rotatable shaft interconnects each end compartment with its respective container support arm, to thereby rotate the container.

11. A rotating mechanism according to any one of Claims 8 to 10, which enables the container to be rotated up to approximately 180 degrees.

12. A rotating mechanism according to Claim 11, wherein the maximum rotation of the container is approximately 180 degrees.

13. A rotating mechanism, substantially as described herein and with reference to the accompanying drawings.

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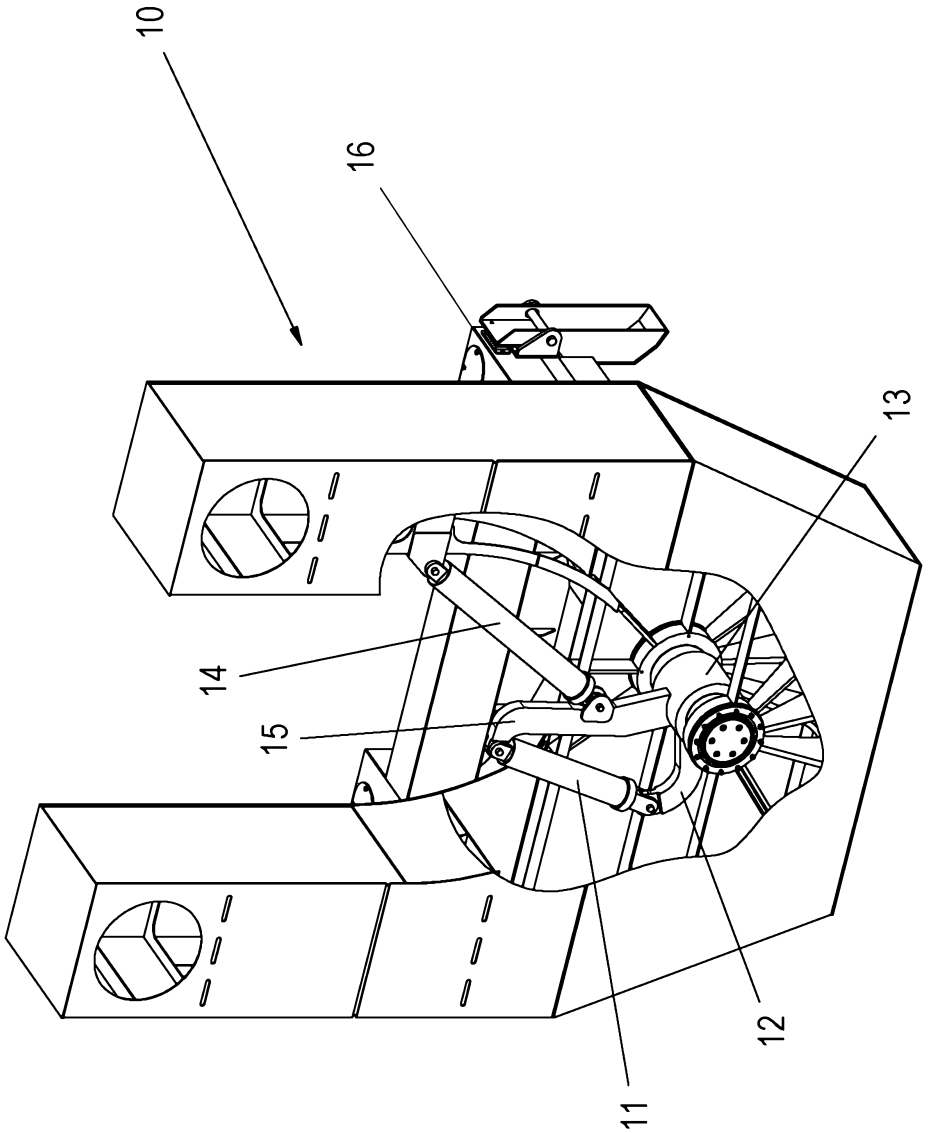

FIGURE 1

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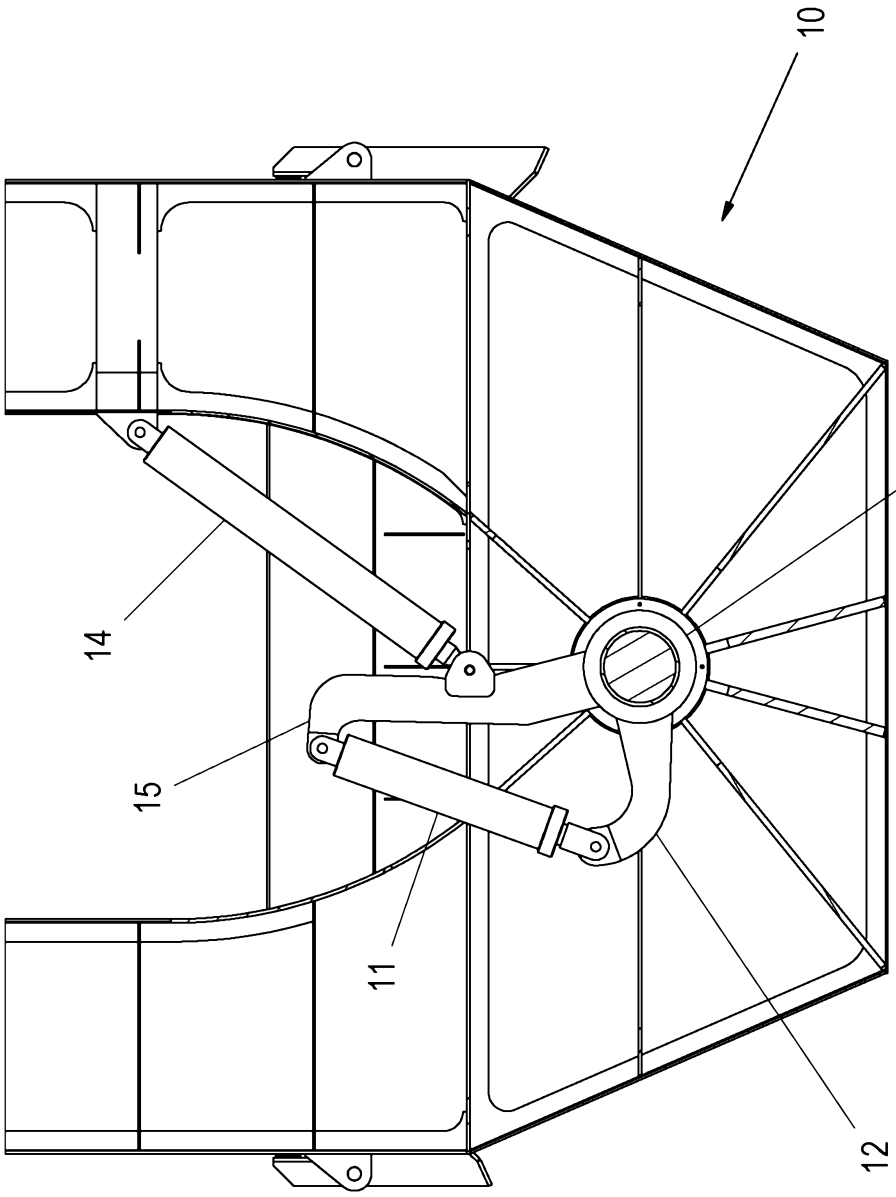

FIGURE 2

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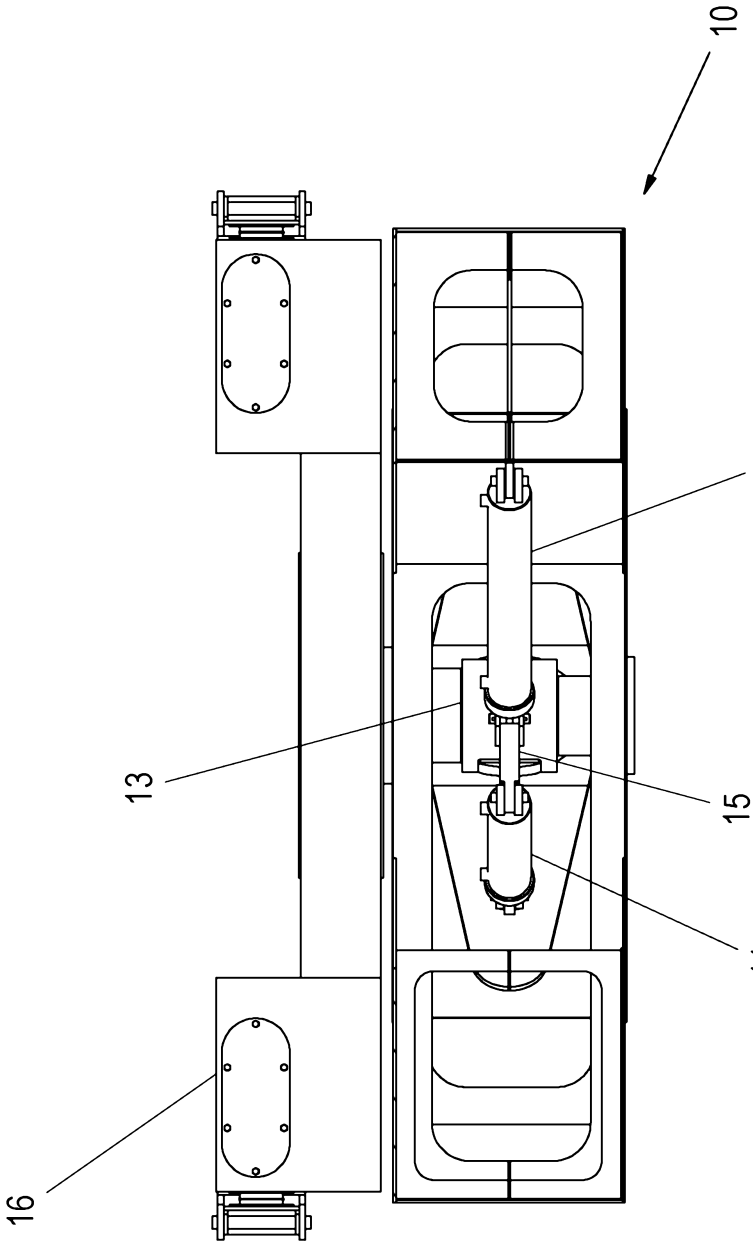

FIGURE 3

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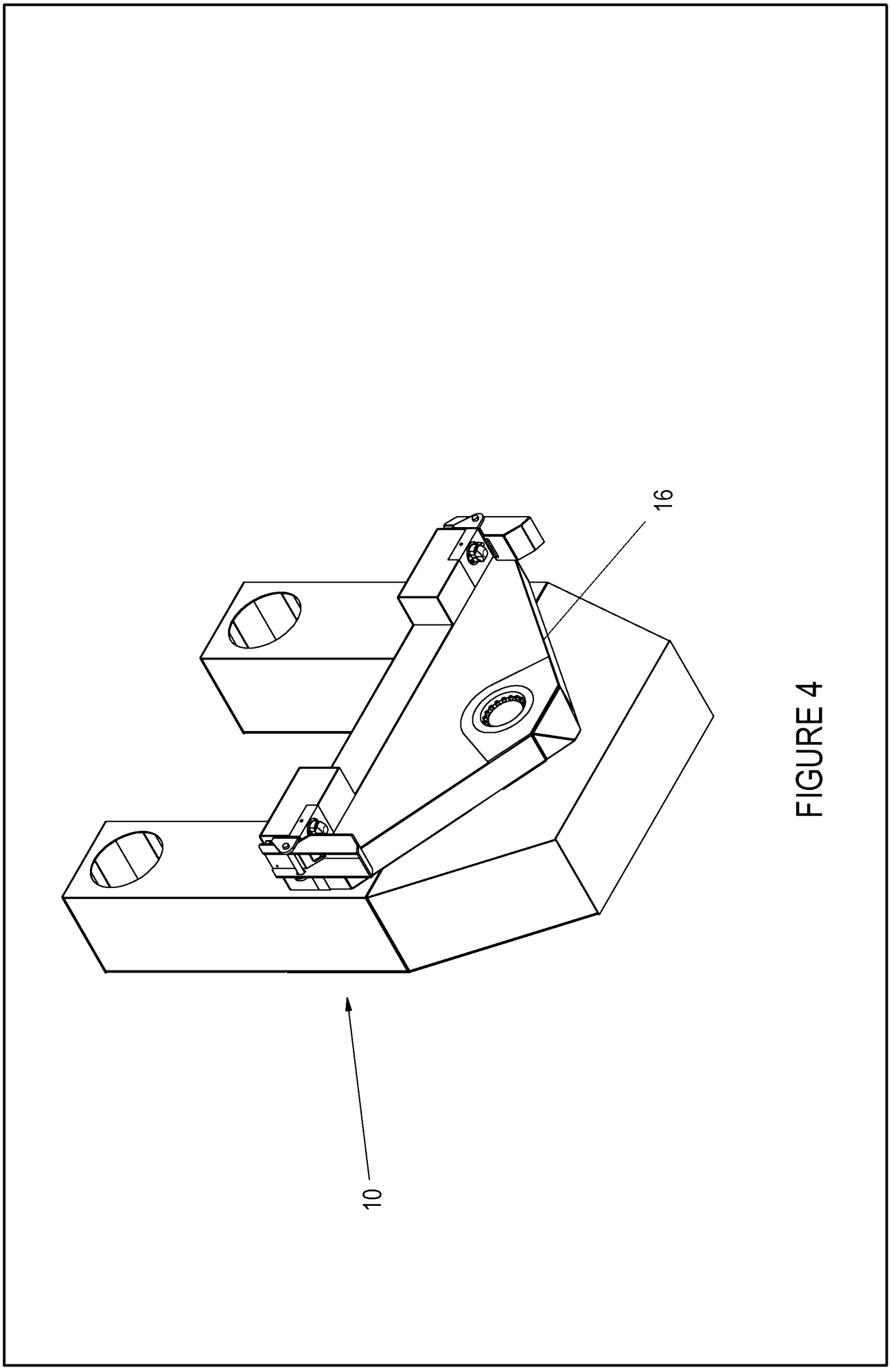

FIGURE 4