United States Patent

Mangold

[15] **3,675,960**

[45] **July 11, 1972**

[54] SELF LEVELING SPREADER FRAME

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[22] Filed: **April 1, 1970**

[21] Appl. No.: **24,701**

[52] **U.S. Cl.** .....**294/81 SF,** 294/67 R

[51] **Int. Cl.** **B66c 1/10**

[58] **Field of Search** .....294/81 SF, 67 R, 67 AA

[56] **References Cited**

UNITED STATES PATENTS

3,164,406	1/1965	Barry	294/81 SF
3,191,983	6/1965	Gaglione	294/81 SF

Primary Examiner—Richard E. Aegerter

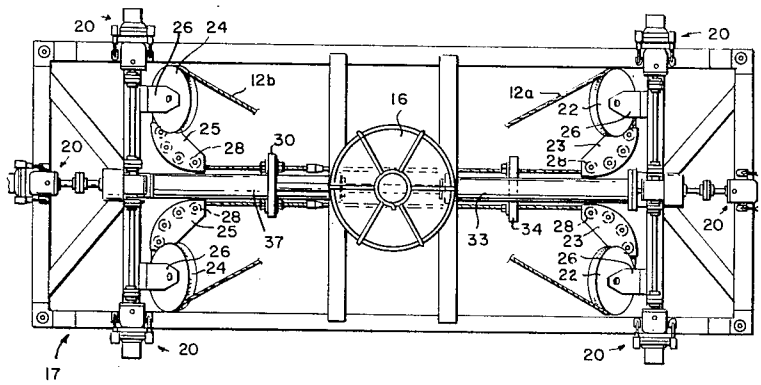
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[57] **ABSTRACT**

A sling assembly of four cables which are mounted in rectangular array about four pivot sheaves supports a spreader frame for use in fastening to containers or other loads to be hoisted. A set of two of the cables at one longitudinal end of the spreader frame are secured to a piston rod of a first hydraulic cylinder. The set of two remaining cables at the other longitudinal end of the spreader frame are secured to the piston rod of a second hydraulic cylinder. A hydraulic control circuit connects the cylinders with a source of pressurized fluid and interconnects the rod side and rear side of each respective cylinder. The spreader frame is leveled by opening a valve to release fluid from the rear side of the cylinder which has its piston rod secured to the cables supporting the high side of the spreader frame so that the weight of the container will retract the piston rod allowing the container to be leveled.

5 Claims, 4 Drawing Figures



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SHEET 1 OF 2

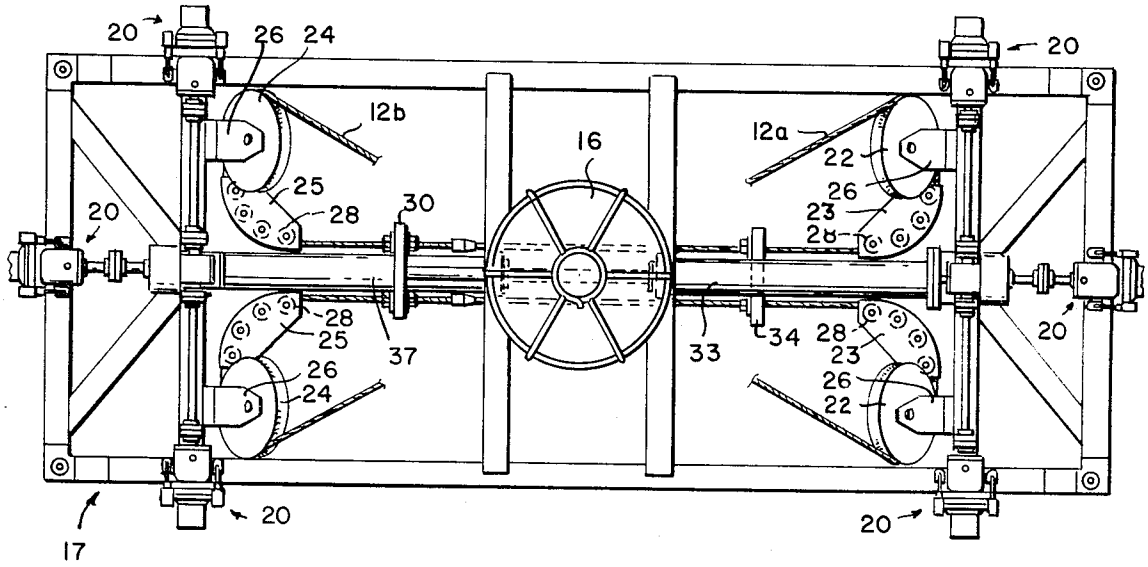


FIG. 1

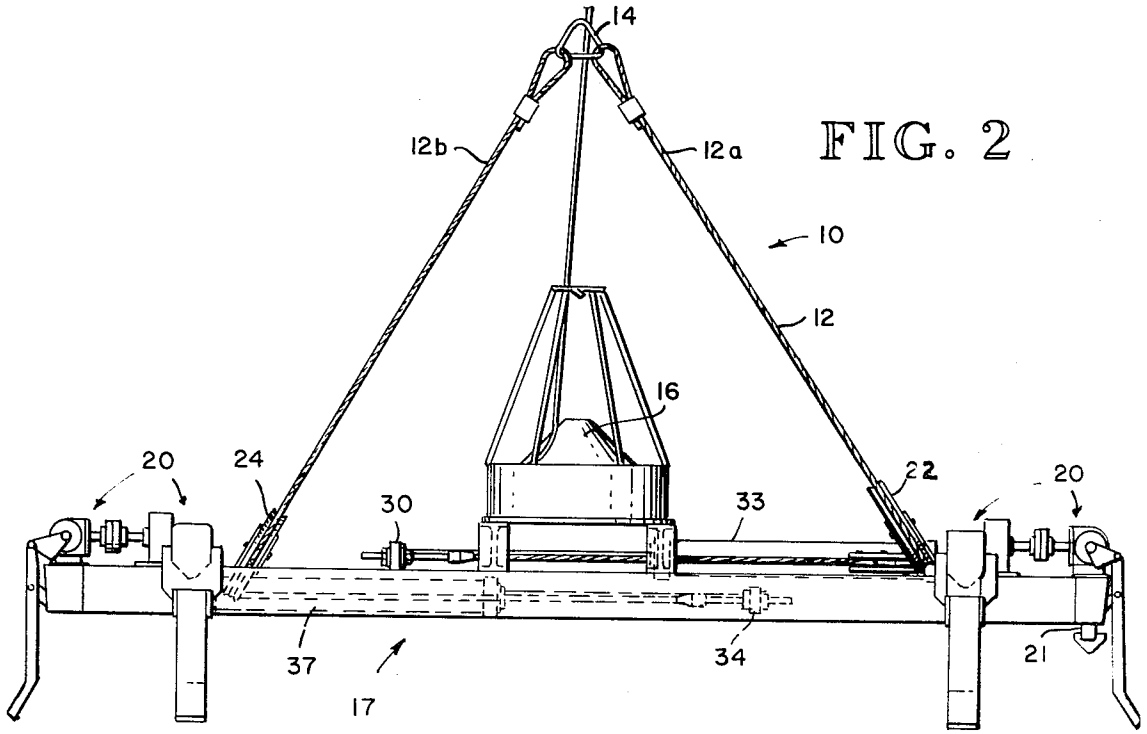


FIG. 2

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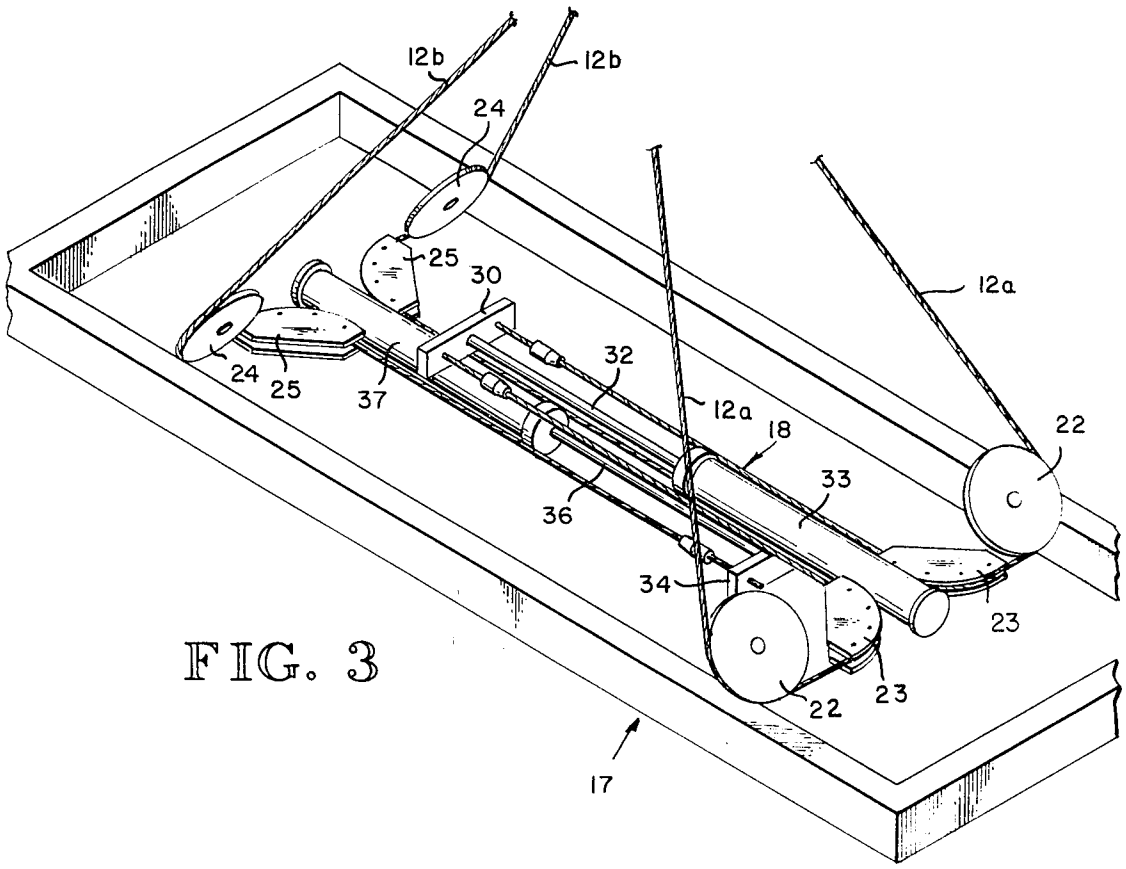


FIG. 3

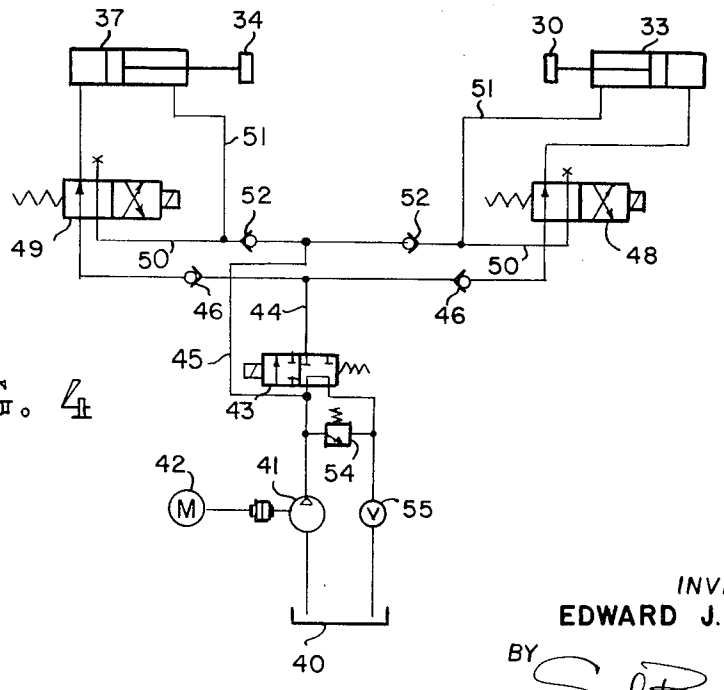


FIG. 4

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SELF LEVELING SPREADER FRAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to hoisting devices and in particular relates to single-point suspension hoists having provision for leveling the load when suspended therefrom.

2. Description of the Prior Art

As is often the case cargo containers or other loads are seldom loaded uniformly so that the center of gravity of the load will correspond with the geometrical center of the container. When the loading is not uniform the container lifted by the spreader frame, customarily used with a single-point suspension hoist, will assume a canted position which causes the handling of the container to be more difficult.

Various techniques have been employed to reposition or relevel the container while suspended from the spreader frame. One such technique is shown in the U.S. Pat. to Wilkie, No. 3,413,028. In this patent a device separate from the spreader frame is used to position various cables suspending the spreader frame from the leveling device. This technique requires an additional piece of equipment and requires a heavy-duty drive motor to position the cables which increases the cost of the equipment.

A second technique is shown in the U.S. Pat. to Gaglione, No. 3,191,983. In this patent the free ends of four sling cables are secured to a sliding block which is reciprocably mounted on the top of a spreader frame and is positioned by a single hydraulic cylinder and piston. This type of unit while less complicated than the device shown in the Wilkie patent still requires a heavy-duty drive motor to produce sufficient hydraulic pressure to rotate the spreader frame into the horizontal position since it is necessary to simultaneously extend and retract the cables.

SUMMARY OF THE INVENTION

The present invention employs leveling means that is secured on the spreader frame for adjusting the length of selected cables on a sling assembly. In a four cable sling assembly the set of two cables supporting the higher longitudinal end of the spreader frame, assuming the spreader frame is canted due to the weight of a suspended nonuniformly loaded container, are extended using the weight of the container to reposition the cables. In the preferred form separate means are used to control both longitudinally spaced sets of cables so that either end of the spreader frame which happens to be the high end is lowered by extending the respective set of cables supporting that end. As the weight of the container is used to extend the respective sets of cables the power requirements of the drive unit to position the ends of the cable is very low.

Another advantage is obtained by interconnecting opposite ends, that is, the head or rear end and the rod end, of the cylinders used in the preferred embodiment to position the ends of the sets of cables so that the hydraulic fluid trapped therein is moved from one end of the cylinder to the other thus reducing the need for replenishing this supply of fluid. The hydraulic control components are also quite simple and inexpensive to manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of a hoisting unit embodying the principles of the invention.

FIG. **2** is a side elevation of the hoisting unit shown in FIG. **1**.

FIG. **3** is an isometric of the hoisting unit shown in FIG. **1**.

FIG. **4** is a schematic hydraulic circuit illustrating the controls for operating the hoisting unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A hoisting unit is identified in general by the reference character **10** and includes a sling assembly **12** having four cables divided generally into longitudinally spaced sets of cables **12***a* and **12***b*. The upper ends of the cables are secured to a ring **14** which, as is well known in the art, may be engaged by a single-point hoisting hook (not shown). In a manner to be described, the cables support a spreader frame **17** which is provided with spreader frame aligners **20** and twist locks **21** the details of which are not essential to an understanding of the present invention. It should be understood, of course, that other forms of spreader frames may be employed while still embodying the principles of the invention.

The cables of one longitudinal set of cables **12***a* are entrained about pivot sheaves **22** and knuckle sheaves **23**. The opposite set of cables **12***b* are entrained about pivot sheaves **24** and knuckle sheaves **25**. The pivot sheaves are rotatably secured on brackets **26** that are fixed to the spreader frame **17**. Each knuckle sheave includes a plurality of rollers **28**, shown in dotted lines in FIG. **1**, that guide the cables into a substantially horizontal position. The free ends of the set of cables **12***a* are secured in a block **30** which is secured on the end of a piston rod **32**. The piston rod **32** extends in a conventional manner from a hydraulic cylinder **33** which is secured to the top of the spreader frame. The opposite set of cables **12***b* have their free ends secured to a block **34** which is fixed to the end of a piston rod **36**. The piston rod **36** also extends from a conventional hydraulic cylinder **37** which is secured to the spreader frame. As is readily apparent, the lengths of the sets of cables **12***a* and **12***b* are readily varied by extending and retracting the respective piston rods **32** and **36**. Assuming both piston rods are extended their full length and the spreader frame is level, as in the initial condition, retraction of one of the piston rods will lower an end of the spreader frame by extending that respective set of cables. The frame may be releveled after the container is removed by again extending the retracted piston rod. As will be explained in detail herein below the spreader frame is leveled when a container is suspended therefrom by extending the set of cables on the high side of the spreader frame.

The operation of the cylinders **33** and **37** and their respective piston rods is best shown by the circuit in FIG. **4**. Hydraulic fluid from a reservoir **40** is pressurized by a pump **41**, powered by motor **42**, through a conventional two position relevel valve **43** to a main line **44** and a recirculating line **45**. Pressurized fluid in the main line **44** branches and passes through check valves **46**, thence through conventional type two position level valves **48** and **49** to the respective cylinders **33** and **37**. The valves **48** and **49** are spring biased into the positions shown in the schematic with the pressurized fluid in the main line **44** introduced into the cylinders at the head end of the pistons to extend the piston rods. When energized, each valve is similarly operated to shift into a position directing fluid from the head end of the cylinder to be recirculated through the respective lines **50** and **51** to the opposite end of the cylinder. In this manner only the quantity of fluid represented by the larger volume in the cylinders on the head ends of the cylinders need be made up or disposed of as the piston rods are extended and retracted. With reference to the cylinder **33**, for example, it being understood that the cylinder **37** is operated in the same manner, energization of the solenoid to move the valve **48** to the left removes the pressure source of fluid from the cylinder so that the weight of the container will retract the piston rod **32** forcing fluid from the head end of the cylinder in the cylinder **33** through the valve **48** to line **50**, then through line **51** back to the rod end of the cylinder **33**. Excess fluid passes through check valve **52**, line **45**, and back pressure valve **55** to the reservoir **40**. As is conventional a relief valve **54** is provided.

In a typical operation the piston rods of both cylinders are fully extended at their initial setting prior to loading a container on the spreader frame. To simultaneously extend the piston rods relevel valve **43** is energized to be shifted to the right passing pressurized fluid into the head end of each cylinder. Since the area of the piston in the head end of the cylinder is greater than the area of the piston in the rod end of

the cylinder pressure will build up in the rod ends of the cylinders to a value greater than the pressure in the line **44** so that the fluid from each cylinder is circulated through line **51**, through the check valves **52**, then to recirculating line **45**, and back into the primary line **44** upstream of relevel valve **43**. As there is no weight acting on the spreader frame the pressure requirements are very small. Extending the piston rods shortens the free lengths of both sets of sling cables **12***a* and **12***b*. After a container is secured to the spreader frame having a load center of gravity offset from its geometrical center, the spreader frame will tilt. The operator relevels the spreader frame and its suspended container by energizing the level valve associated with the set of cables supporting the higher end of the spreader frame. This allows that piston rod to be retracted and lengthens the set of sling cables on such higher end which in turn lowers the end of the spreader frame to a level position. The amount of retraction is controlled by the operator.

In the preferred embodiment the typical loading of the hoist unit may be a twenty long ton container whose center of gravity may be up to 4 feet away from the geometrical lengthwise center. However, by increasing or decreasing the cylinder rod length and the hydraulic component sizes, these valves can be changed.

While the preferred form of the invention has been shown and described, it should be understood that changes in the details will be readily apparent to those skilled in the art. Accordingly the invention is not to be limited to the embodiment disclosed but is to be determined solely by the scope and proper interpretation of the claims appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for handling loads from a single point of suspension including a spreader frame having means for securing the spreader frame to the cargo and at least four cables for suspending said spreader frame from said single point, the improvements comprising

leveling means secured to the spreader frame for adjusting the length of selected ones of said cables for positioning the load in a predetermined disposition, said leveling means being powered by the weight of the cargo suspended from the spreader frame and including at least two hydraulic cylinders and piston rods with said cylinders fixed to the spreader frame, said piston rods being fixed to opposite longitudinally spaced pairs of said cables whereby extension and retraction of said piston rods varies the effective lengths of said pairs of cables.

2. The apparatus defined by claim **1**, wherein said four cables are entrained around sheaves secured adjacent four corners equidistantly spaced from the center of the spreader frame and wherein hydraulic control means are provided for selectively positioning said piston rods under the force of the weight of the cargo acting through said cables.

3. The apparatus defined by claim **2**, wherein said hydraulic control means includes a regenerative fluid circuit coupled to said cylinders for recirculating the fluid to opposite ends of the cylinders.

4. The apparatus defined by claim **1**, wherein said leveling means includes an hydraulic circuit having valve means operable to release fluid from the ends of said hydraulic cylinders pressurized by the weight of the cargo acting through the cables so as to move said piston rods and lengthen the effective length of the cables attached thereto to lower an end of the cargo to establish a horizontal disposition.

5. The apparatus defined by claim **4**, including means interconnecting the opposite ends of said cylinders together so that fluid from one end of the cylinders may be moved to the opposite end, and further including releveling valve means for directing fluid under pressure to the ends of the cylinders opposite the piston rods to extend the piston rods when the load is removed.

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