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Jones

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[54] **OUTRIGGER JACK ASSEMBLY**

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[52] **U.S. Cl.** ..... **254/86 R**, 254/103, 212/145

[51] **Int. Cl.** **B60s 9/02**

[58] **Field of Search** ..... 254/103, 86 R; 248/14; 212/145

[56] **References Cited**

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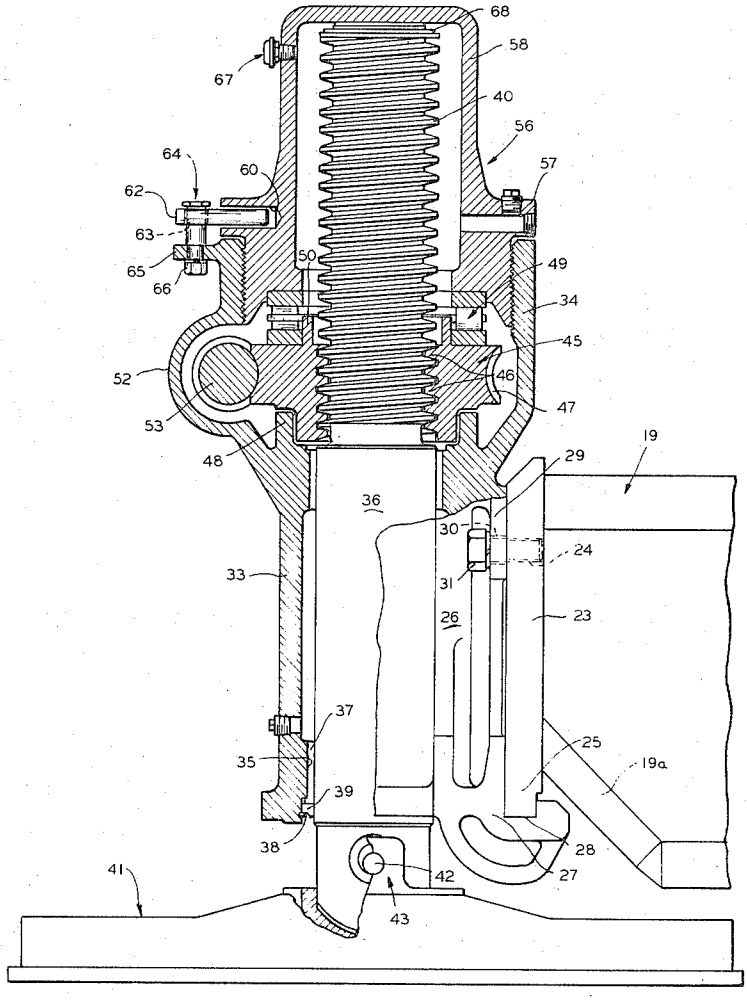
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[57] **ABSTRACT**

Material handling apparatus is hereby provided with a plurality of laterally extendable outriggers for increasing the stability of the apparatus. Each outrigger includes a beam which is provided at each end with a vertically adjustable jacking mechanism. Each jack includes a vertical shaft which has a screw thread at its upper end and carries a ground engaging float at its lower end. The threaded end of the shaft is received in an internally threaded drive ring which has a worm gear on its exterior. A hydraulic motor drives a worm that meshes with the worm gear to extend and retract the shaft, and thus raise and lower the float. The combination of the screw thread on the vertical shaft and the worm drive mechanism results in the jack being locked when the motor is off and thus avoids slipping in the jack mechanism under load.

6 Claims, 4 Drawing Figures



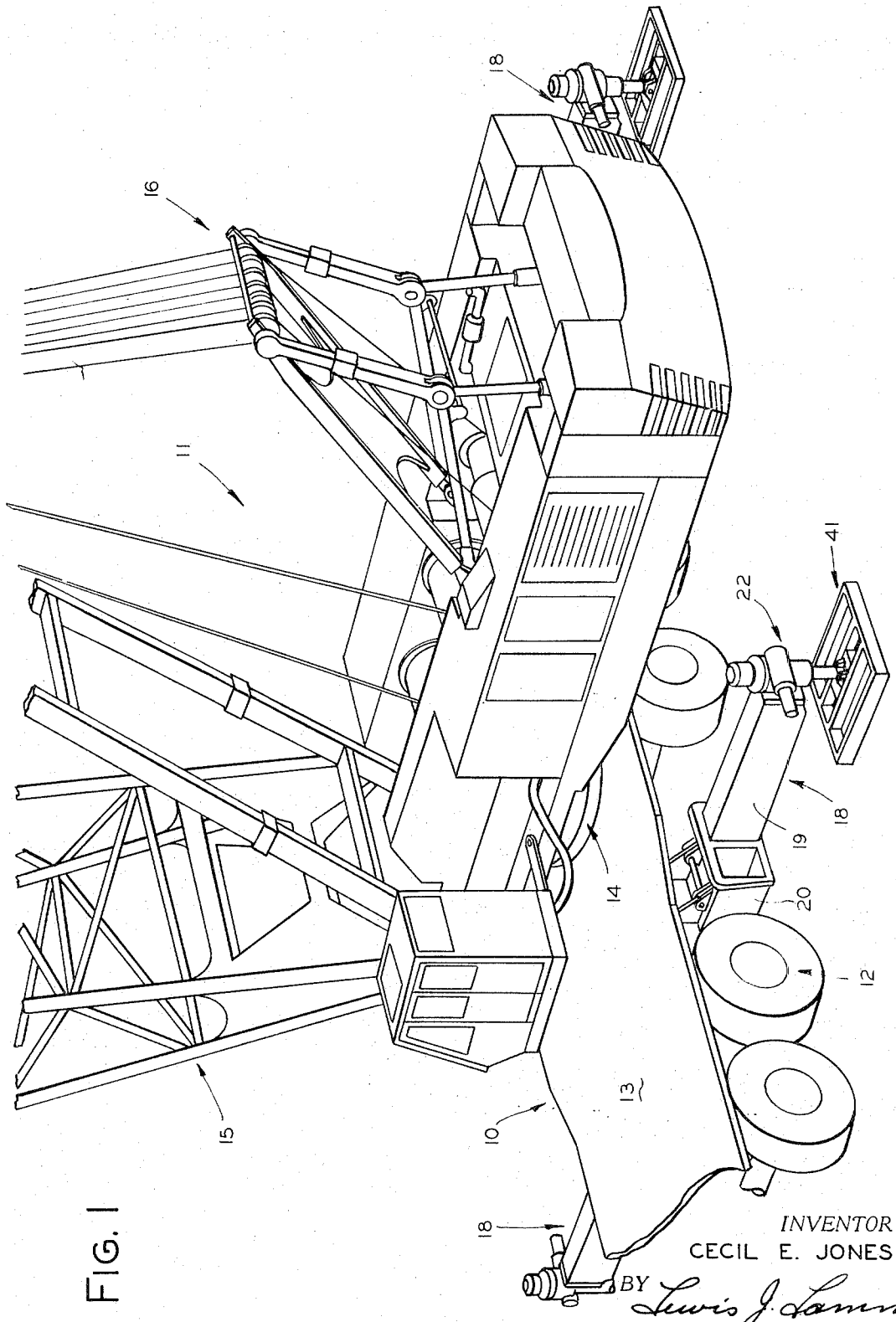


FIG. 1

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FIG. 2

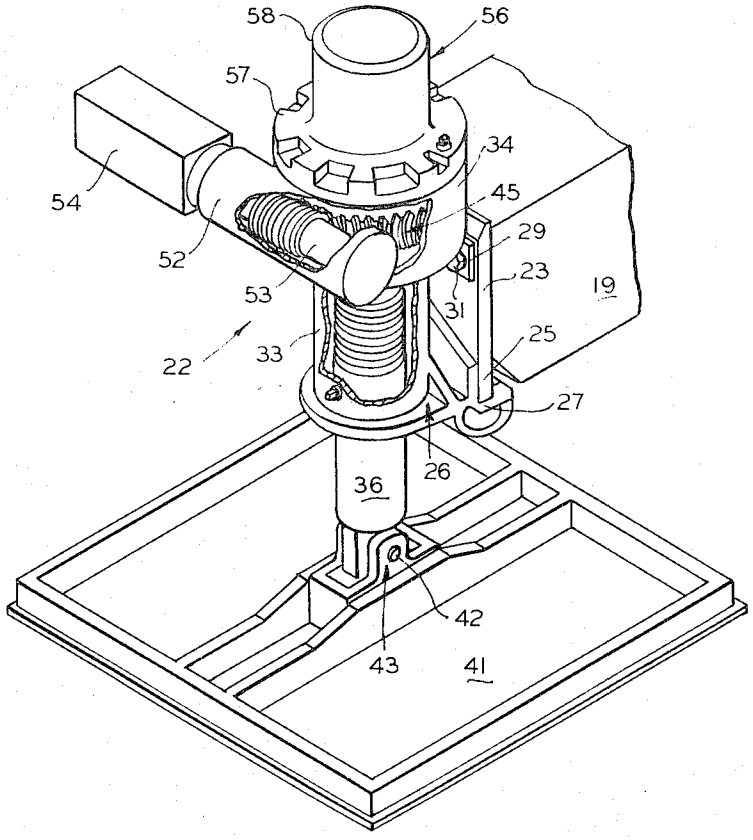
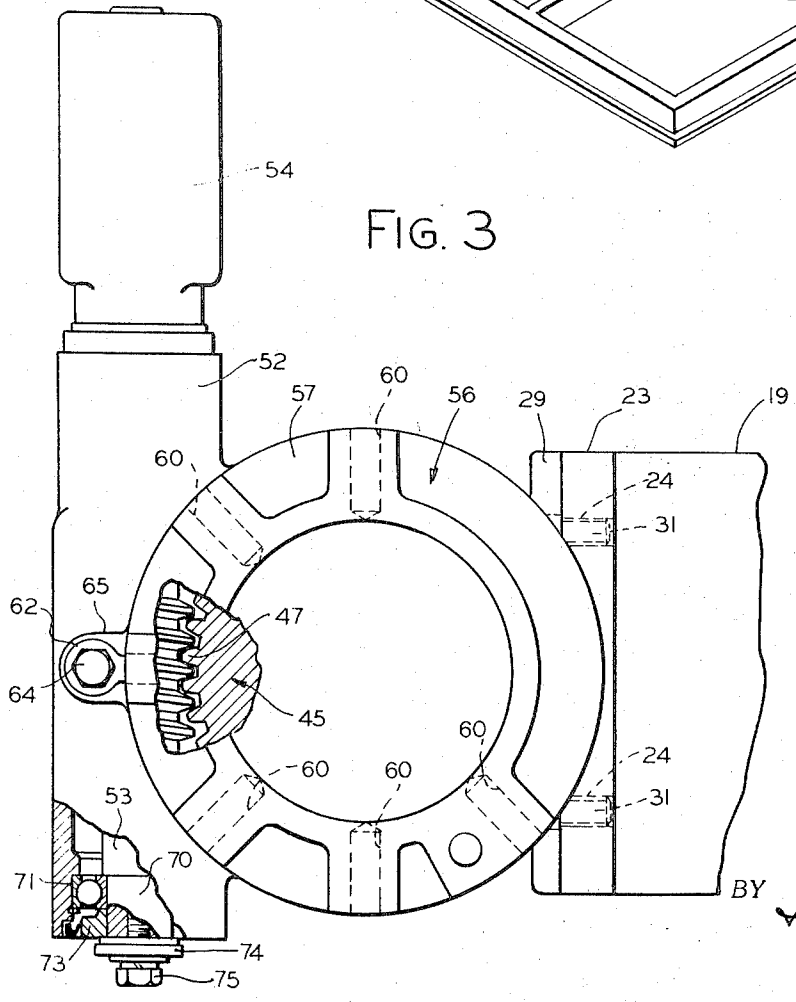
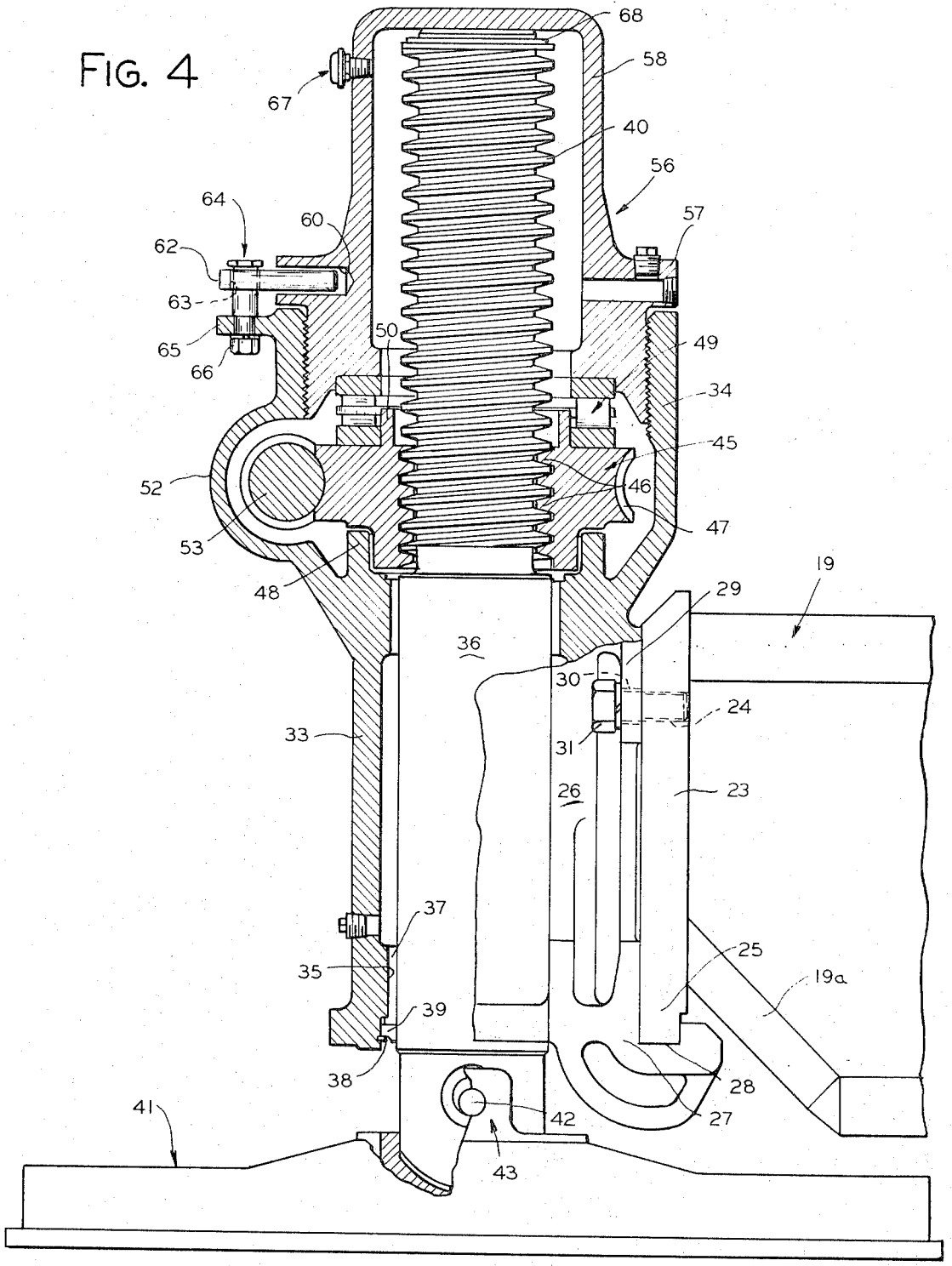


FIG. 3



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FIG. 4



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OUTRIGGER JACK ASSEMBLY

FIELD OF INVENTION

The present invention relates to apparatus for stabilizing large material handling apparatus such as cranes, drag lines and the like, and more particularly relates to outrigger systems for large mobile material handling apparatuus.

A mobile crane is designed to support a load at a maximum distance from the crane equal to the length of the boom on the crane. If the crane is mobile (that is if it is carried by a vehicle) when a large load is supported at a substantial distance from the vehicle, the vehicle and crane may become unstable and tip. Outriggers are frequently used to provide stability and to increase the tipping circle of the crane and thereby stabilize the combination of crane and vehicle. Normally, the outrigger extends outwardly from the vehicle and includes downwardly projecting feet or members for engaging the ground to provide the additional lateral support for the vehicle.

BACKGROUND OF THE INVENTION

Normally outriggers are provided at the end of beams which are extendable relative to the vehicle, and hydraulic cylinder and piston rod units are attached to the distal end of the beam for extending and retracting a ground engaging member called a float to support the beam and thus stabilize the vehicle. The axis of the hydraulic cylinder and piston rod unit has a vertical orientation so that by applying pressurized fluid to one working face of the piston the rod is extended and the float engages the ground, and by applying pressurized fluid to the other working face of the piston (usually the face to which the rod is attached) the rod and the fluid are retracted or raised.

The fluid system of the hydrulic cylinder and piston rod units on outriggers are subjected to great stresses as the crane shift weight and moves in position. For example, considering only one outrigger extending in a direction opposite to the one in which the boom is working, if the load is delivered and the lift force released, the center of gravity of the crane plus its load shifts dramatically and large force is transmitted to those outriggers extending to the opposite side of the vehicle. This change in force may be transmitted as an impulse to the hydraulic system of the supporting cylinder and piston rod unit directly, thereby causing impulses of force on the seals of the hydraulic system.

With age and continued usuage, the hydraulic systems for the outriggers develop leakage and the hydraulic cylinder and piston rod units thereby lose their ability to support a load. Further, when large impulses of force are applied to a leaky hydraulic system, the piston rod slips causing unstable conditons.

SUMMARY OF THE INVENTION

In the present invention the distal end of each outrigger for a large mobile crane is provided with a jack which includes a vertical shaft fettered at its upper end and carrying a float at its lower end. The threaded end of the shaft is received in an internally threaded drive ring which has an external worm gear.

A hydraulic motor drives a worm shaft that meshes with the worm gear on the drive ring to extend and retract the float. The combination of the threaded vertical shaft and worm drive mechanism causes the jack to lock when the motor is not running and isolates the motor from any force shock experience by the threaded vertical shaft.

It is an object of the present invention to provide a better control over the extending and retracting of the floats on outriggers used for leveling a vehicle and crane combination.

It is another object of the present invention to provide an outrigger system which is rigid and has a minimum of instability on sudden changes of load.

It is a further object of the present invention to provide an outrigger drive that is irreversible and thereby maintains the outrigger jack in position when power is disconnected.

Other features and advantages of the present invention will be apparent to persons skilled in the art from the following detailed description of the preferred embodiment accompanied by the attached drawing wherein identical reference numbers will refer to like parts in the various views.

GENERAL DESCRIPTION OF THE INVENTION

FIG. 1 is a perspective view of a large mobile crane incorporating the present invention with portions of the boom broken away,

FIG. 2 is a perspective view of an outrigger jack according to the present invention,

FIG. 3 is a plane view of the jack of FIG. 2 with portions broken away to show its interior and

FIG. 4 is a side elevational view of the jack of FIG. 2 with portions broken away to show its interior.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, reference numeral 10 generally designates a large mobile material handling apparatus, only a portion of which is seen in the drawing. The apparatus includes a crane generally designated 11 mounted on a wheeled vehicle 12. The vehicle 12 includes a horizontal flat bed 13 on which the crane superstructure is mounted by means of a slew ring 14. The slew ring 14 is provided with bearings to provide rotation of the superstructure about a vertical axis.

Crane superstructure includes a boom generally designated by reference numeral 15, part of which is broken away, which is pivotally mounted to the superstructure for rotation about a horizontal axis to raise and lower the boom. The boom 15 may be elevated by any appropriate means such as a cable assembly which may include a gantry partially shown at 16.

The vehicle 12 is provided with four (three of which are shown) outriggers generally designated by reference numeral 18 which extend laterally of the vehicle from beneath the bed 13. Two outriggers are on either side of the vehicle, with the first two being on one side of the axis of rotation of the superstructure, and the other two outriggers being located to the rear of that axis.

Each of the outriggers 18 is similar in structure and operation so that only one of them need be described for complete understanding of the invention.

Each outrigger includes the beam 19 which is received telescopically within a housing 20 and is fitted at a distal end with a jacking apparatus generally designated by reference 22. The beam 19 may be extended and retracted by means of a hydraulic cylinder and piston rod not shown.

Referring to FIGS. 2 through 4, the jacking apparatus 22 will now be described in greater detail.

The distal end of the beam 19 is provided with a vertical end plate 23. At the upper portion of the end plate 23 there are two internally threaded apertures 24, and the bottom of the end plate 23 extends beneath the upturned portion 19A of the beam 19 to form a transverse flange or ledge 25 (see FIG. 4).

The jack includes a lower casting generally designated by reference numeral 26 which includes a horizontally elongated cradle 27 defining a slot 28 (thus shown in FIG. 4) for receiving the flange 25 of the beam end plate 23. The casting 26 also includes an upper transverse flange 29 provided with a pair of clearance apertures 30 which align with threaded apertures 24 of the end plate 23 when the jack is assembled in relation with that end plate. A pair of bolts 31 then secure the flange 29 of the housing 26 to the end plate 23. The casting 26 also includes a geneally cylindrical housing 33 and an upper cup shaped housing 34 integral therewith. The housing 33 defines a central bore terminating in a lower machined cylindrical surface 35. A vertical shaft 36 is received in the cylindrical housing 33, and a bushing 37 interposed between the shaft 36 and machined surface 35 centers the shaft 36. An annular retainer ring 38 received in the groove in the base of the housing 33 holds an annular rod wiper 39 against the lower smooth surface of the shaft 36 to prevent the accumulation of particles of dirt thereon.

The upper end of the shaft 36 is provided with a machine screw 40 and a float 41 pivotally connected to the lower end of the shaft 36 by means of a trasverse pin 42. The float 41 is provided with the central trunnion 43 which receives the pin 42.

Housed within the cup shaped portion 34 of the casting 26 is a drive ring 45 having an interior machined thread portion 46 in threaded engagement with the threads 40 of the shaft 36 and an exterior worm gear 47. The drive ring 45 is centered by means of an annular pedestal 48 formed integrally in the casting 26. An annular roller bearing 49 centered on the upper collar 50 of the drive ring 45 is interposed between the upper surface of the drive and a cap on the jack housing which will be described presently. Thus, the drive ring is adapted for rotation about the axis of the shaft 36.

Referring now to FIG. 2, an elongated housing 52 is integrally formed as a part of a casting 26 adjacent the cup shaped upper portion 34 thereof. The axis of the elongated housing 52 is horizontal. A worm shaft 53 is rotatably mounted in the elongated housing 52 and the worm 53 meshes with the worm gear 47 on the drive ring 45. A hydraulic motor 54 drives the worm 53 and this hydraulic motor is energized by means of two hydraulic lines (not shown) extending along the beam 19. Means such as an electric motor may be also used to drive the worm 53 in place of the hydraulic motor 54, but the hydraulic motor is preferred because it gives a dependable source of energy and hydraulic energy is normally available in cranes of this type to energize various hydraulic cylinders.

Referring now to FIG. 4, the upper interior wall of the cup shaped housing portion 34 is internally threaded to receive a cap generally designated 56, which includes a peripheral flange 57 and an upper housing member 58 having the form of an inverted cup. When the vertical shaft 36 is retracted, the threaded portion 40 of the shaft 36 is withdrawn into the upper housing 58 of the cap 56.

The flange 57 is provided with a plurality of radial inwardly extending apertures deisgnated 60 in FIG. 3 and spaced angularly about the center of the annular flange 57. Each of the aperture 60 is adapted to receive an eye bolt 62 provided with an outer aperture 63 for receiving a transverse shoulder bolt 64. The shouler bolt 64, when it is inserted in the eye bolt 62, also extends through an aperture flange 65 appended to the cup shaped portion 34 of the casting 26, and is secured thereto by the means of anut 66. To achieve the proper adjustment of the cap 58 in the cup shaped portion 34 of th housing, the cap is first tightened to remove all clearance, then it is backed off not less than the distance between the adjacent corners of the radial apertures 60, and not more than twice the distance between theseholes. Then the eye bolt 62 and the shoulder bolt 64 are attached, and this will yield the proper running clearance for limiting retraction of the shaft 36.

On the bottom side of the top wall of the cap 56 there is provided a stop 68 to engage the shaft 36 in its most retracted position. The cylindrical housing 58 of the cap 56 is provided with a breather 67 to equalize air pressure with the cap 56.

Referring now to the lower left hand portion of FIG. 3, the distal end of the worm 53 is reduced as shown at 70 and it is rotatably mounted by means of the bearing 71 to the far end of the housing 52. A spacer 73 is located at the end of the reduced portion 70 of the shaft 53 to hold the bearing 71 in place. An adjusting nut 74 is held against the spacer 73 by means of a bolt 75 threaded into the reduced portion 70 of the shaft 53.

OPERATION

When the hydraulic motor 54 is actuated in one direction, the worm 53 turns by its axis to rotate the drive ring 45 through worm gear 47. As the drive ring 45 is rotated, its internal threads raise or lower the shaft 36, depending on the direction of rotation of the drive ring. By virtue of threading the upper portion 40 of the shaft 36 and the mechanical advantage provided by the worm drive, once the float 41 is lowered to engage the ground and the hydraulic motor 54 turned off, it is an irreversible drive and therefore forces on the float 41 will not cause slippage of the shaft 36. Furthermore, force shocks experienced by the float 41 are not transmitted directly to a hydraulic system, as was experienced in prior systems using a cylinder and piston rod unit to lower the float. The pulsation of hydraulic pressure is thereby avoided with its attendant deterioration of seal rings.

Having thus described in detail the preferred embodiment of the invention, persons skilled in the art will be able to modify certain of the structure that has been illustrated and to substitute equivalent elements for these which have been disclosed, and it is, therefore, intended that all modifications and substitutions be covered as they are embraced within the spirit and scope of the appended claims.

I claim:

1. Jack construction for use in conjunction with an outrigger beam of a crane comprising,

an end plate secured in vertical position to the outer end of the beam and having a transverse flange at

the bottom thereof extending downwardly below the immediately adjacent portion of the beam,

housing means having a transverse slot at a first and lower portion thereof receiving said flange on the beam end plate and a second portion above the first portion fitted to the beam end plate, means detachably securing said second portion and thereby the housing means to the beam end plate,

a threaded vertical shaft in the housing means vertically reciprocable through the lower end of the housing means, a float pivotally mounted on the lower end of the shaft,

a drive ring surrounding said shaft and having an interior gear in mesh with the threads on the shaft, and having an exterior worm gear,

a worm in mesh with the exterior worm gear on the drive ring, and

motor means for driving the worm.

2. Jack construction according to claim **1** wherein the jack construction is adapted for use with a crane having a hydraulic source of energy, and

the motor means for driving said worm is hydraulically operated and operably connected with the hydraulic source of energy in the crane.

3. Jack construction for use in conjunction with an outrigger beam of a crane, comprising,

housing means detachably mounted on the end of said beam,

the housing means including a vertical portion immediately adjacent and connected to the end of the beam and a horizontal portion extending from the vertical portion,

a shaft mounted in the vertical portion for vertical reciprocation therein, and including a lower smooth portion extendable downwardly out of the housing means, and an upper threaded portion,

a float pivotally mounted on the lower end of the shaft,

a drive ring in the housing means having an interior threaded portion in mesh with the threads on the shaft, and having an exterior worm gear,

a horizontal shaft in the horizontal portion of the housing means and having a worm thereon in mesh with said exterior worm gear, and

motor means in said horizontal portion of the housing operative for driving said horizontal shaft,

said housing means being substantially and effectively closed, and enclosing said drive ring, said horizontal shaft, said motor means, and said vertical shaft except the lower end of the latter upon extension of that shaft downwardly through the lower end of the housing means.

4. Jack construction according to claim **3** and including sealing means in the lower end of the vertical portion of the housing means for sealingly engaging the lower smooth portion of the vertical shaft, and the housing means also being effective for enclosing the lower smooth portion of the vertical shaft except that part thereof that is extended from the housing means.

5. Jack construction for use in conjunction with an outrigger beam of a crane, comprising, housing means including a vertical portion and a horizontal portion,

the vertical portion of the housing means including a lower cylindrical housing detachably secured to the end of the beam and including an upper cup shaped housing integral therewith,

a vertical shaft in said vertical portion of the housing means, and having a lower end extendable downwardly through the housing means, and having an upper threaded portion extending above the lower cylindrical housing,

a drive ring positioned in the upper cup shaped housing and having interior thread in mesh with the threaded portion of the vertical shaft, and having an exterior worm gear,

a worm shaft in the horizontal portion of the housing means in mesh with the exterior gear on the drive ring,

motor means in the horizontal portion of the housing means operatively connected with the worm shaft for driving the latter,

the vertical portion of the housing means also including an inverted cup shaped cap threadedly secured in the cup shape portion of the lower cylindrical housing and thereby being capable of vertical adjustment, and enclosing the upper end of the vertical shaft and forming, between itself and the lower cylindrical housing and the upper cup shaped housing, an enclosed space within the housing means,

said inverted cup shaped cap having a stop element on its top wall,

said cap having a plurality of angularly distributed apertures opening radially outwardly, and the cup shaped housing having detachable locking means insertable into a selected one of said radial apertures for locking the cap in vertically adjusted position.

6. Jack construction according to claim **5** wherein the lower cylindrical housing has an annular pedestal extending upwardly into the cup shaped housing,

said drive ring has an annular lower extension surrounding the vertical shaft and positioned in the pedestal, whereby the pedestal centers the drive ring,

and the construction also includes annular bearing means interposed between drive ring and the inverted cup shaped cap.

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