

Sept. 17, 1968

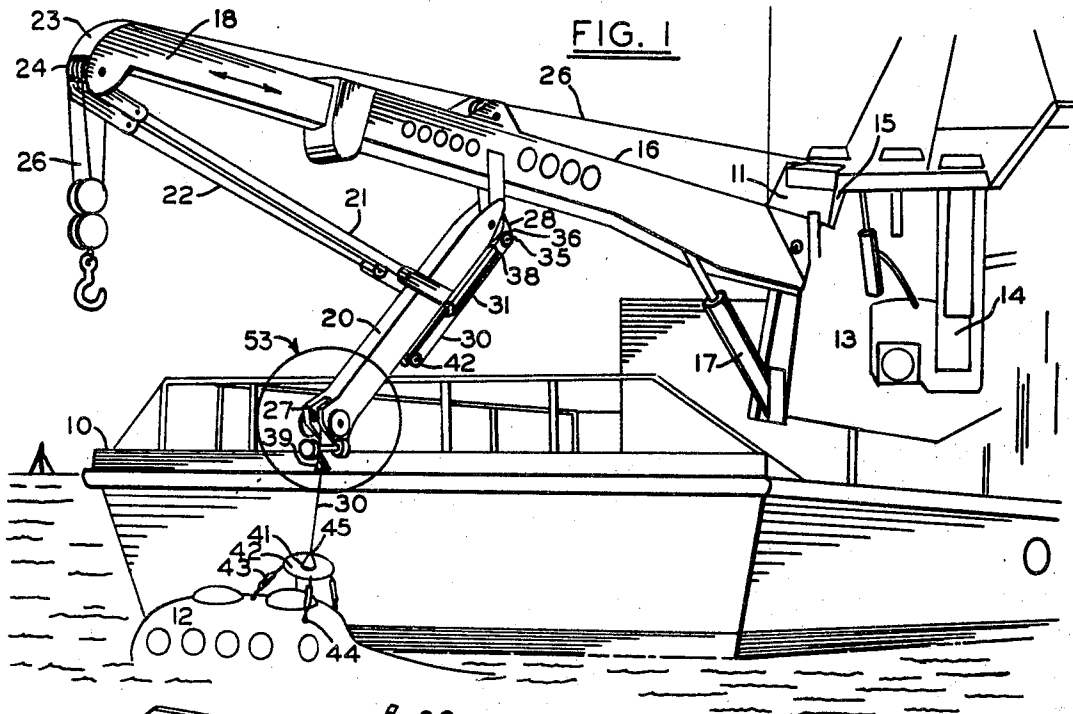
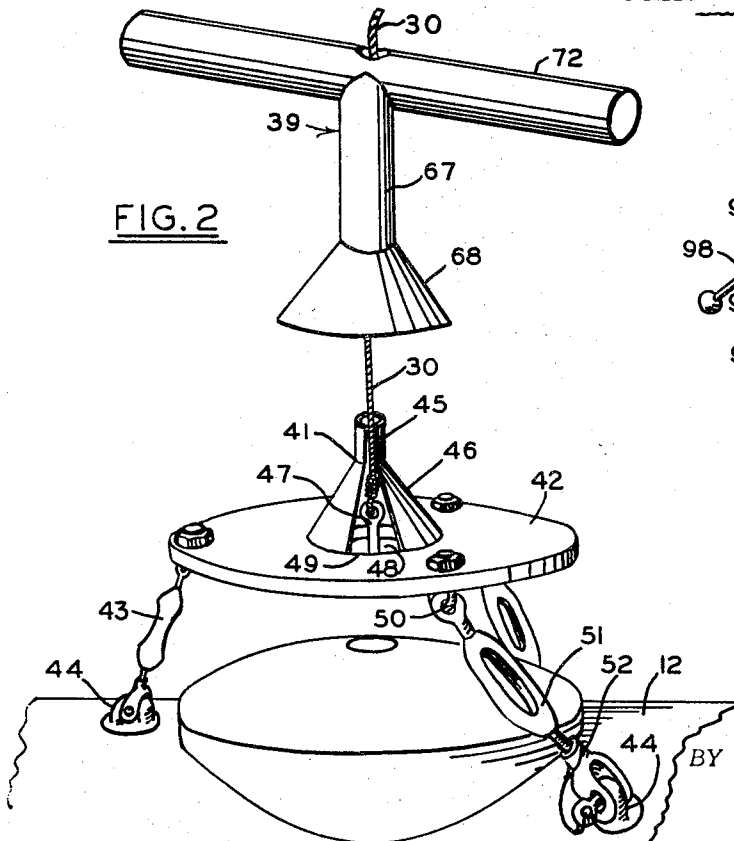
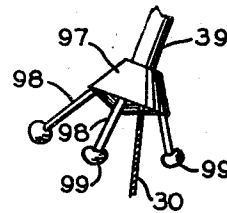
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3,401,804

CRANE

Original Filed Oct. 23, 1965

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3a

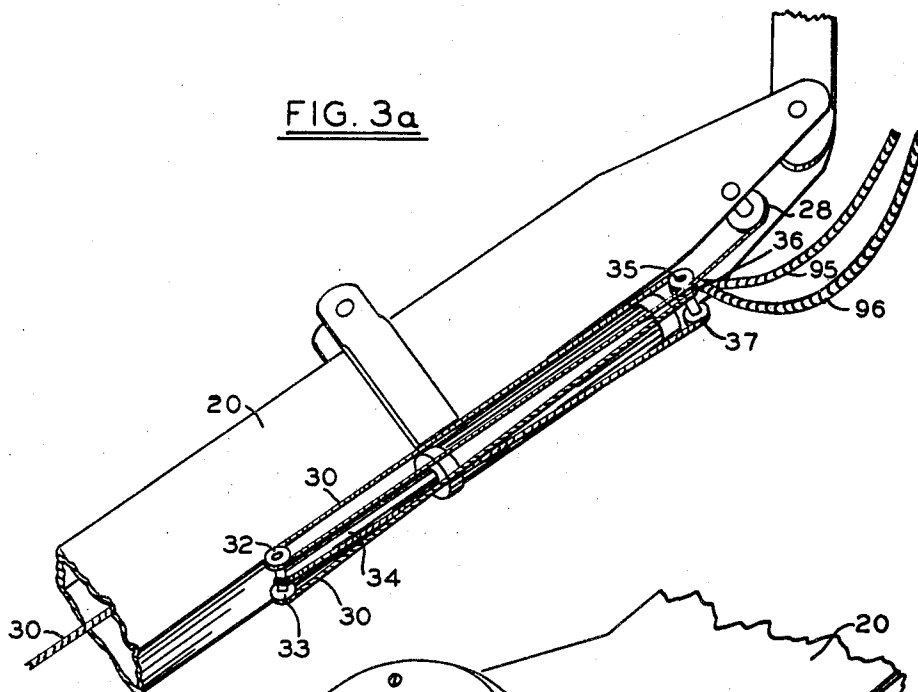
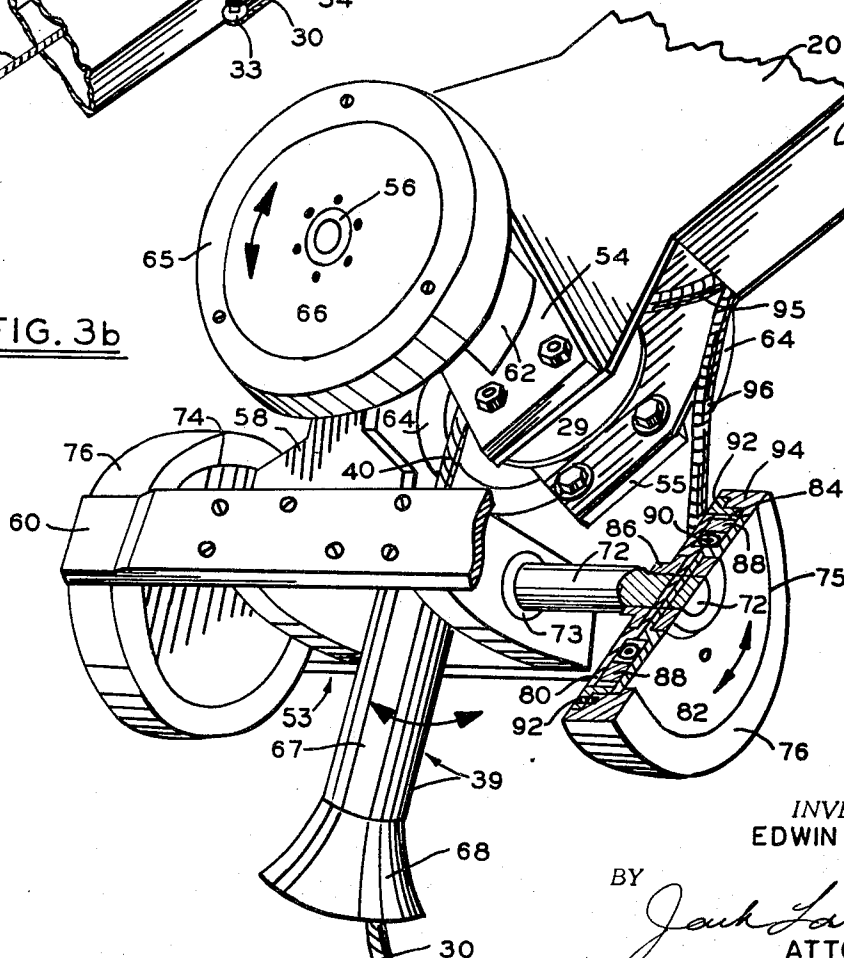


FIG. 3b



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3,401,804
CRANE

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Continuation of application Ser. No. 504,265, Oct. 23, 1965. This application Sept. 7, 1967, Ser. No. 666,219
7 Claims. (Cl. 212—58)

ABSTRACT OF THE DISCLOSURE

An improvement in a crane which is particularly valuable for use aboard ships for controllably constraining the swaying of a load. The improvement consists of a gimballed load adapter and controllable braking means for constraining the movement of the adapter, the load adapter including means for guiding a painter.

This application is a continuation of Ser. No. 504,265, filed Oct. 23, 1965, now abandoned.

This invention relates to cranes, particularly cranes for use aboard ships attending divers and to an improvement on a crane for transferring a load to and from the water.

Weather has practically no effect on the environment of a diver working on the ocean floor; but it presents major problems to any attending ships or craft trying to stay on station and to service the divers. In the nature of such work, various loads frequently are lifted from the water to the deck of the tender and other loads are lowered into the water from the deck of the tender.

According to the practice of the prior art, such loads are attached to the end of a cable strung from tackle on the end of a derrick boom and literally swung inboard or outboard. The swinging of loads on the end of a cable can build up into destructive oscillations when the system resonates with the motion of the tender. In the transfer of manned vehicles, such as diving chambers and the like, it is important that this swinging be either eliminated or at least controlled to a substantial degree by the crane operator.

It is an object of this invention to provide positive control of the oscillation of a load while retaining the basic flexibility of the cable-hoisting system.

It is a further object of the invention to provide a removable attachment for a crane by which positive control and snubbing of loads may be effected.

It is still a further object of the invention to provide an attachment with which a hydraulic crane can reach into the water for a load in spite of adverse weather conditions.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

A feature of the invention is a jib or arm hinged at its upper end to the crane boom and having a load adapter connected to its lower end.

Another feature of the invention is an hydraulically tensioned painter and pulleys for guiding it to the center of the tip of the jib whereby a load may be drawn to the tip of the jib, and quickly and reliably fixed thereto.

A still further feature of the invention is a gimballed load adapter including means for guiding a painter, and having controllable brakes on each of two axes to damp and control motion of the load.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

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FIG. 1 is a sketch showing a tender lifting a load with a crane modified in accordance with the invention, FIG. 2 is an enlarged view of the means of attachment to the load,

FIGS. 3a and 3b are enlarged views of the proximal and distal ends respectively of the jib shown in FIG. 1 showing details of embodiments of the invention, FIGURE 3b showing a cut-away isometric view of the gimbal of the invention, the same including the load adapter and controllable braking means of the invention.

FIG. 4 is a sketch showing an alternative attachment for the apparatus of FIG. 3b.

According to the invention, an improvement is provided in a crane of the type comprising a boom and means for elevating the boom, the improvement comprising (a) a jib pivotally connected to the boom; (b) means connected to the jib for pivotally raising and lowering same with respect to the boom; (c) a gimbal connected to the jib, the same having mounted thereon a load adapter including means for guiding a painter, and (d) controllable braking means for constraining the movement of the load adapter with respect to the jib. Preferably, the gimbal also has controllable braking means associated with it for constraining its movement with respect to the jib. Preferably, the load adapter forms a part of a two-axis gimbal while the controllable braking means comprises separately controllable brakes on each of said axes. Preferably, a hydraulically-actuated tackle is mounted upon the jib as a tensioning and fast reeving mean for the painter.

Referring to FIG. 1, a tender 10 equipped with a crane 11 is shown lifting a load 12 using the invention. The crane is a common type of hydraulic crane. The crane body 13 carries a diesel prime mover 14, an operator station 15, hydraulic pumps, and power drives to train the crane body, elevate the boom 16 with a ram 17, extend and retract the stinger 18, and operate winches and other apparatus. The boom 16 is hinged to the body and elevates about an elevation axis which is perpendicular to the train axis and to the elevation plane which contains both the train axis and the boom axis. The stinger 18 of the boom 16 telescopes along the boom axis into the boom 16 and extends under the control of a second hydraulic ram, not shown. The crane is modified according to the invention by jib 20 which is shown also in partial detail in FIGS. 3a and 3b. The jib is hinged at its proximal (upper as shown) end to the boom 16 and is pivoted by a pair of struts 21, 22 hinged to both the jib 20 and to the end 23 of the stinger 18, comprising a means for raising and lowering same with respect to the jib. The tackle 24 which is attached to the end 23 of the stinger 18 and the cable 26 which extends from it to a winch, not shown, remain available for use and are not modified in the invention when using a crane of the telescoping stinger type.

Pulleys 27, 28, 29 turning in the jib 20 guide a painter 30, which passes through the jib 20. The jib is of welded box beam construction. An hydraulic tackle actuator 31 is fastened to the inboard side of the jib and carries five pulleys, two 32 and 33 are movable with the ram 34 and 35, 36 and 37 journaled to the cylinder 38. The painter is threaded over these pulleys, with one end attached to the ram 34 whereby an extension of the ram by two feet take up 10 feet of slack in the line. This provides an exceptionally fast reeving means for the painter. The other end of the painter passes through the load adapter 39 which is a part of the gimbal 53, into the mating lifting fitting 41 of a spreader 42 having shackles 43 which may be fixed to the lifting eyes 44 of the load 12. The fitting 41 has a guide pin 45 which fits into the adapter 39 and a flared base 46. The pin and base are both slotted, the former to pass the painter 30, the latter to

pass the hook 47. The hook engages a bar 48 which is tack-welded to the bottom of spreader plate 42 to bridge the central hole 49.

Each shackle is illustrated as comprising an eyebolt 50 by which it is attached to the spreader, a turnbuckle 51, and a device 52 by which it attaches to a lifting eye 44.

To lift a load the painter is first attached and pulled in, to position the load directly below the adapter 39. Action of the hydraulic tackle actuator 31 holds even tension in the painter 30 notwithstanding wave action moving both crane and load. Keeping tension on the cable, the jib is lowered, and the load lifted until the spreader 42 mates with the adapter 39 whereupon the load may be lifted with the normal flexibility of the painter replaced by the controllable flexibility of the gimbaled damper, controllably braked load adapter as shown in FIG. 3b and as hereinafter described.

The gimbal 53 is, as shown in FIG. 3b, attached to the distal end of the jib 20 by mounting plates 54, 55. The plates stiffen the end of the jib and support axles for the guide pulleys 27, 29. On each mounting plate is carried a bushing, not shown, in which turns a shaft 56 fastened to the extension 58 of the gimbal 53. Also carried on the mounting plates 54, 55 on spacers 62 are brakes 64, 65. The brake-shoe mechanism 66 is fastened to the shaft 56.

Passing through the center of gimbal 53 is the load adapter 39, which has a tube portion 67 comprising means for guiding a painter 30. The tube portion 67 has an axial bore sufficient to accommodate the painter 30 and guide pin 45. A flare attachment 68 is screwed onto the lower end of the tube 67 to protect the painter 30, guide the insertion of the pin 45, and to provide a broader base for mating with the spreader. The other end of the tube 67 is fastened to shaft 72 forming T-shaped load adapter 39 journaled in bushings 73 in the gimbal 53. At each end of the shaft 72 is a brake assembly 74, 75 the drum portion of which is fastened to the gimbal 53. The adapter 39, so constrained, pivots about an axis, the direction of which is at right angles to the direction of the axis of rotation of the gimbal 53 on the shaft 56, also at right angles to the direction of the elevation axis of the crane, and ordinarily also substantially perpendicular to the train axis of the crane. The brake assemblies 64, 65 and 74, 75 comprise a controllable braking means for constraining the movement of the load adapter 39 with respect to the jib 20.

Brake assemblies which have been found to be suitable for the invention are Hayes type aircraft brakes obtainable from the Goodrich Rubber Co., Part No. G2-122. As shown in the sectioned brake 75, the actuating mechanism is retained between two disked steel plates 80, 82 and the brake drum 84. The plates 80, 82 are fastened together and to the axle by a flange 86. A peripheral chain of brake blocks 88 is pressed out by an expandable neoprene hydraulic tube 90, and returned by leaf springs (not shown) slotted into the plates 80, 82.

The drums are designed to be fastened at ears 92 to a wheel. Adapter rings 94 receive the fastenings intended for a wheel, and also provide for connection to the gimbal 53 and mounting plates 54, 55, as the case may be, substantially as shown. The brakes on the two axes are independently controllable by the crane operator, and independently connected to hydraulic lines by the flexible hoses 95 and 96.

FIG. 4 represents an alternative flare attachment 97 for the adapter 39. Equipped with stiff tripod legs 98 with rubber feet 99, it gives a broader base of contact with a load. Two embodiments of the adapter 39 are disclosed and have been described above. Other arrangements will be apparent to persons skilled in the art. The flare attachment 68 conveniently mates with a lifting dome forming a sort of ball and socket connection between the load and the flare attachment. Alternatively, the flare

attachment may terminate with a cylindrical portion mating into a cylindrical recess in the load or vice versa. The combination of flared attachment and lifting fitting as shown in FIG. 2 provides essentially a third (vertical) gimbal axis. While the lifting dome is captive in the flare attachment, friction between the dome and flare is controlled by the tension in the painter. Reducing tension in the painter permits rotation of the load about a vertical axis as desired.

In operation, the load is snubbed tight in mating connection with the load adapter 39 by pull on the painter 30, and the lift is commenced with the brakes 64, 65 and 74, 75 released. Since the gimbal 53 permits the load adapter 39 and load 12 to turn in any direction, the load adapter 39 will align so that there is no bending force exerted on the load. The load is free to hang with its center of gravity directly below the center of the shaft 72. As the waves rock the tender 10 and as the crane 11 moves the load, oscillations may tend to build up. The crane operator by gently applying the brakes in proper relation to any swing built up, can damp the swing without applying damaging forces to the load.

It will be noted that he has independent control over side to side and back and forth swinging. Thus the invention may be used to steady a load.

It may also be used to position a load. If it is desired to position a load in a particular orientation, such as parallel to the deck, and its center of gravity normally causes it to tilt, the desired orientation may be achieved by swinging the load to the desired position, first on one axis, then on the next and catching it with the brakes at the proper angle on each. For positioning, particularly, independent control of the two axes is a practical necessity.

In particular, it will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained, and since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

While the invention has been illustrated as an attachment to a particular type of hydraulic crane, specifically a Bucyrus-Erie model H5 having a telescoping stinger, it will be apparent that with appropriate modifications, it may be applied to an hydraulic back-hoe, to other hydraulic cranes and to other cranes.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In a crane of the type comprising a boom and a telescoping stinger, means for training and elevating said boom, and means for extending said stinger, the improvement comprising, a jib having a proximal and a distal end, said proximal end being hinged to said boom to pivot in the elevation plane of said boom, a member connected to said jib at a point intermediate its proximal and distal ends and to said stinger, the connecting points for said member being so selected that extension and retraction of said stinger effectively controls the pivoting of said jib, a gimbal pivotally connected to said distal end so as to pivot on a first axis perpendicular to said elevation plane, a load adapter pivotally connected to said gimbal to pivot about a second axis perpendicular to said first axis and normally horizontal, said adapter having cable clearance to guide a painter passing there-through, and diverging at its distal end to provide a broad mating base of contact for a load, hydraulically actuated tackle fastened to said boom and connected to take up slack in said painter and apply tension thereto, controllable brake means to constrain the pivoting of said

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gimbal on said first axis, and controllable brake means for constraining the pivoting of said adapter on said second axis.

2. In a crane having a boom and means for elevating the boom, the improvement comprising:

- (a) a jib pivotally connected to the boom;
- (b) means connected to the jib for pivotally raising and lowering same with respect to the boom;
- (c) a gimbal connected to the jib;
- (d) a load adapter mounted upon said gimbal, said load adapter including means for guiding a painter, and
- (e) controllable braking means for constraining the movement of said load adapter with respect to said jib.

3. The improvement in a crane as defined in claim 2 wherein the gimbal is a two-axis gimbal and wherein said controllable braking means are separately controllable on each of the axes.

4. The improvement in a crane as defined in claim 2, further including a hydraulically-actuated tackle and associated ram mounted upon said jib and connected to the painter as a tensioning and fast reeving means.

5. The improvement in a crane as defined in claim 2 wherein said means specified in (c) comprises a telescoping stinger and at least one strut hinged to said jib and to said stinger, whereby extension and retraction of said stinger produces a pivoting of said jib to raise and lower same with respect to the boom.

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6. In a crane having a boom and means for elevating the boom, the improvements comprising:

- (a) a jib having a proximal end and a distal end, the proximal end being pivotally attached to the boom;
- (b) means connected to the jib for pivotally raising and lowering the distal end thereof with respect to the boom;
- (c) a gimbaled load adapter connected to the distal end of said jib, said load adapter including means for guiding a painter, and
- (d) controllable braking means for constraining the movement of said load adapter with respect to said jib.

7. In a crane having a boom and means for elevating the boom, the improvement comprising a gimbaled load adapter, said load adapter including means for guiding a painter, and controllable braking means for constraining the movement of said load adapter.

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Notice of Adverse Decision in Interference

In Interference No. 96,837 involving Patent No. 3,401,804, E. A. Link, CRANE, final judgment adverse to the patentee was rendered May 12, 1971, as to claims 2, 3, 6 and 7.

[Official Gazette May 21, 1974.]