Aug. 26, 1969 J. LOVELL 3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Filed April 24, 1968 5 Sheets-Sheet 1

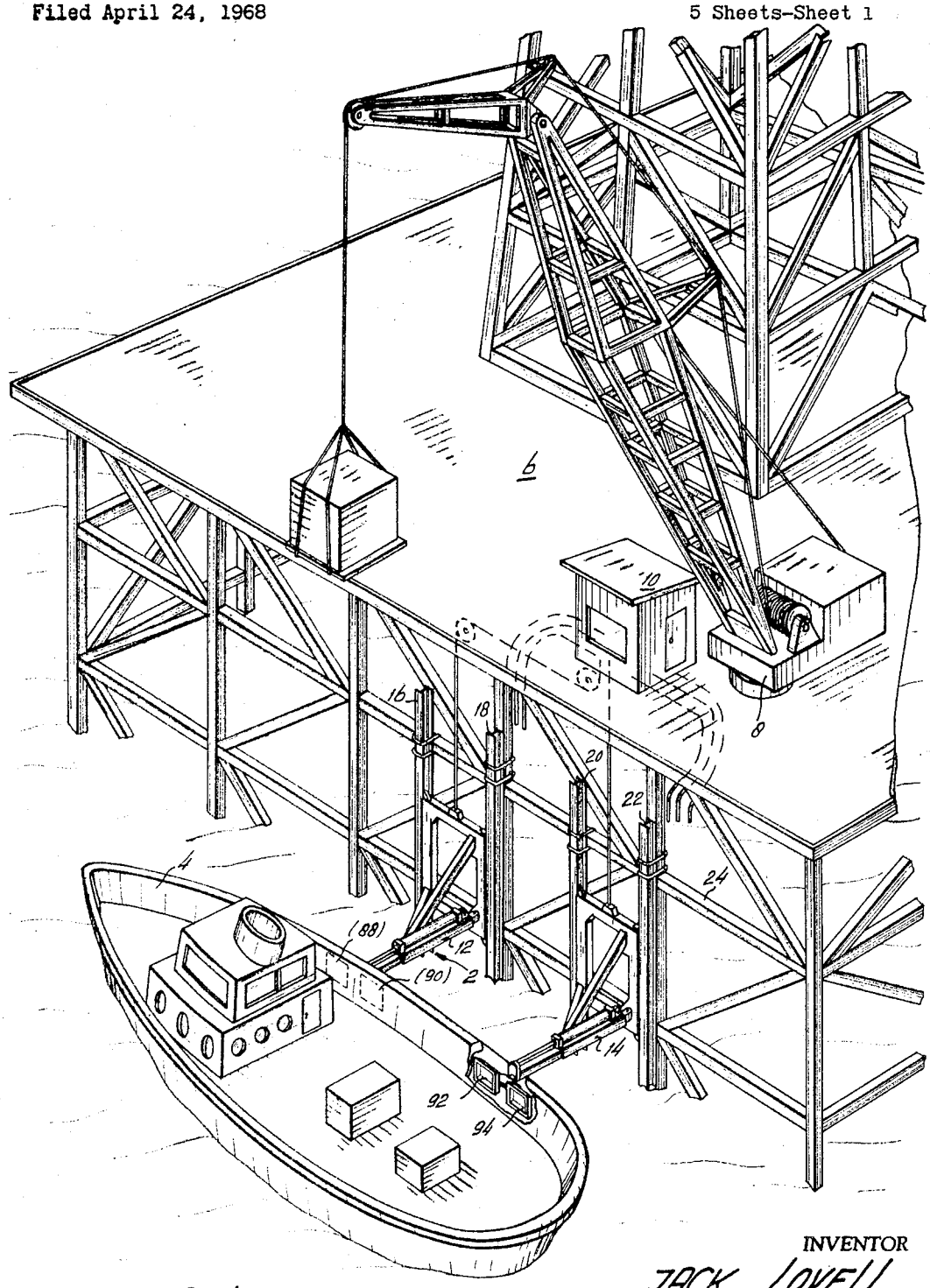

FIG. 1

INVENTOR
JACK LOVELL

BY Semmes and Semmes

ATTORNEYS

Aug. 26, 1969 J. LOVELL 3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Filed April 24, 1968 5 Sheets-Sheet 2

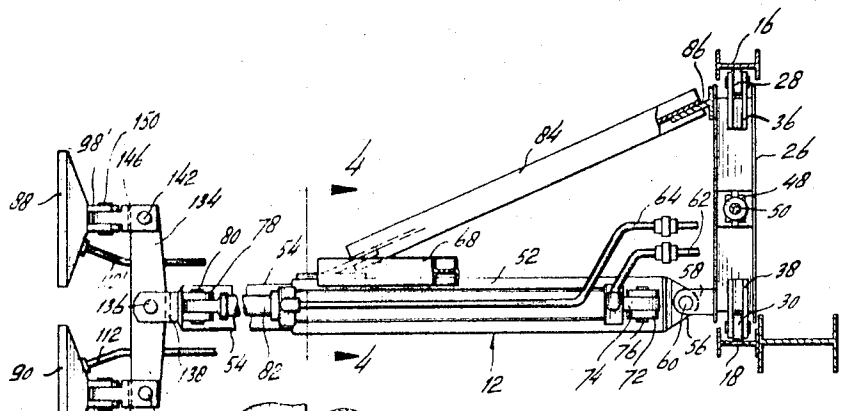

FIG. 2

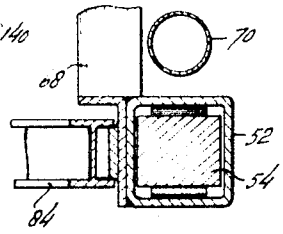

FIG. 4

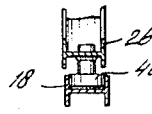

FIG. 5

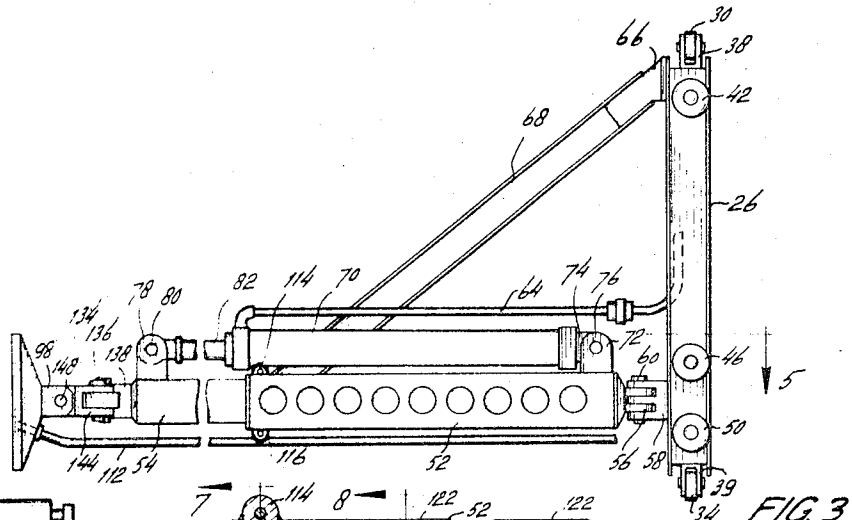

FIG. 3

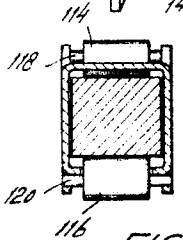

FIG. 7

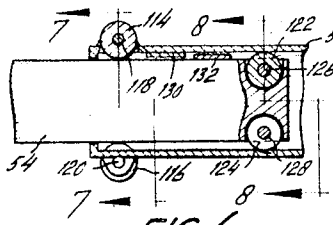

FIG. 6

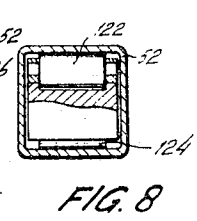

FIG. 8

INVENTOR

JACK LOVELL

BY Semmes and Semmes

ATTORNEYS

Aug. 26, 1969 J. LOVELL 3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Filed April 24, 1968 5 Sheets-Sheet 3

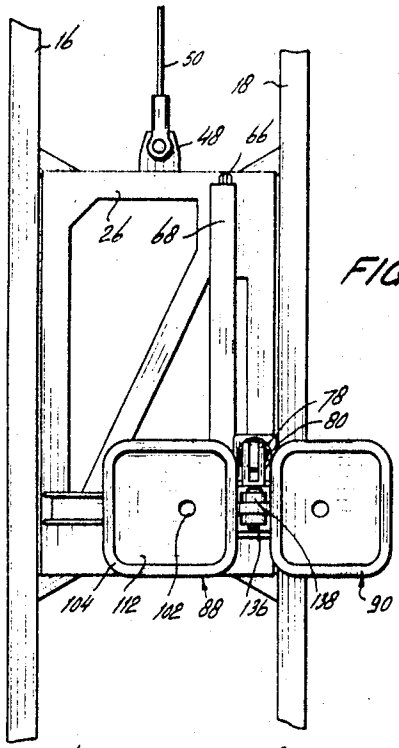

FIG. 9

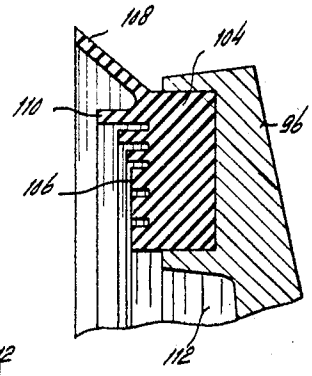

FIG. 12

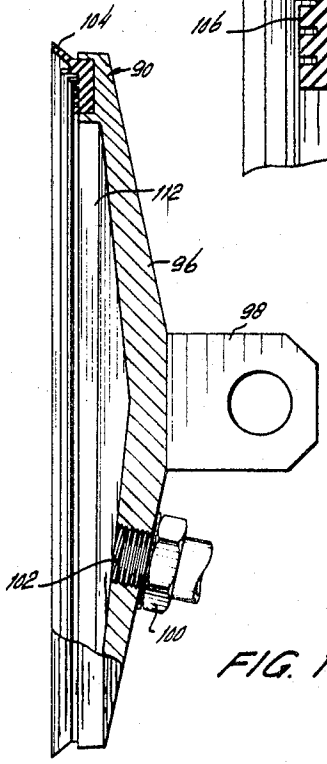

FIG. 11

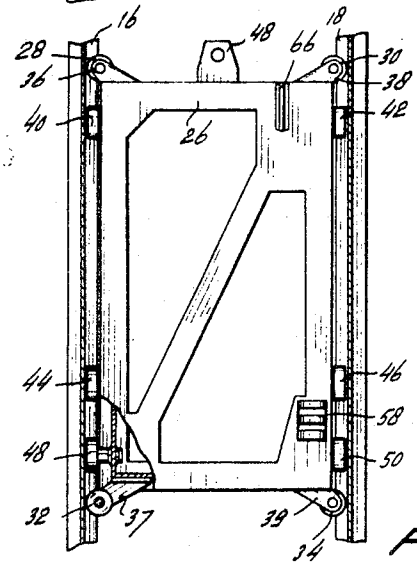

FIG. 10

INVENTOR
JACK LOVELL

BY Semmes and Semmes
ATTORNEYS

Aug. 26, 1969 J. LOVELL 3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Filed April 24, 1968 5 Sheets-Sheet 4

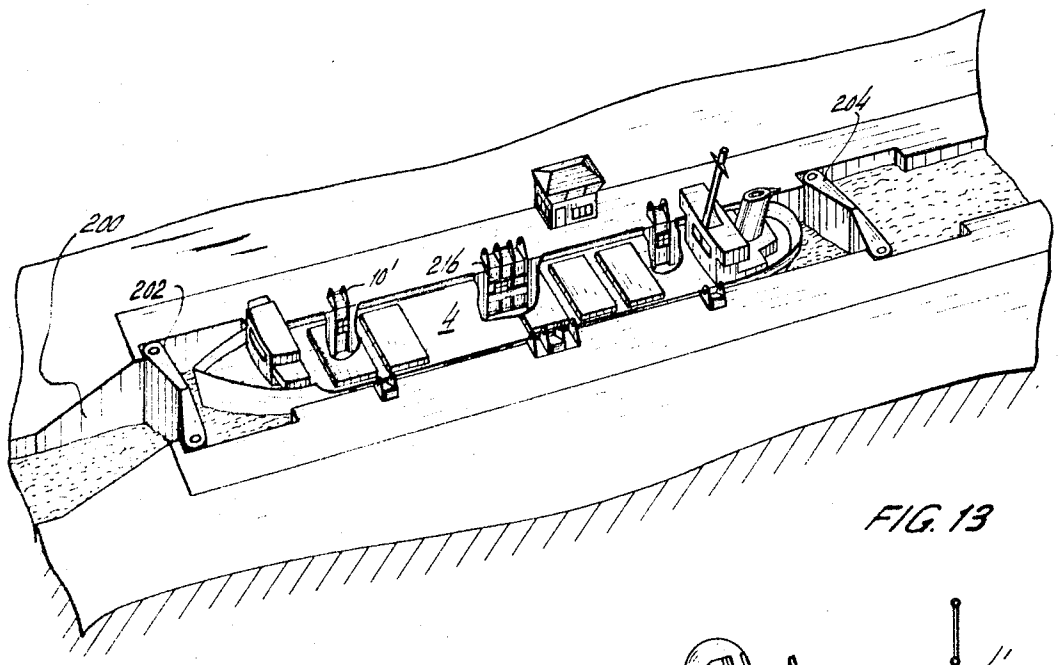

FIG. 13

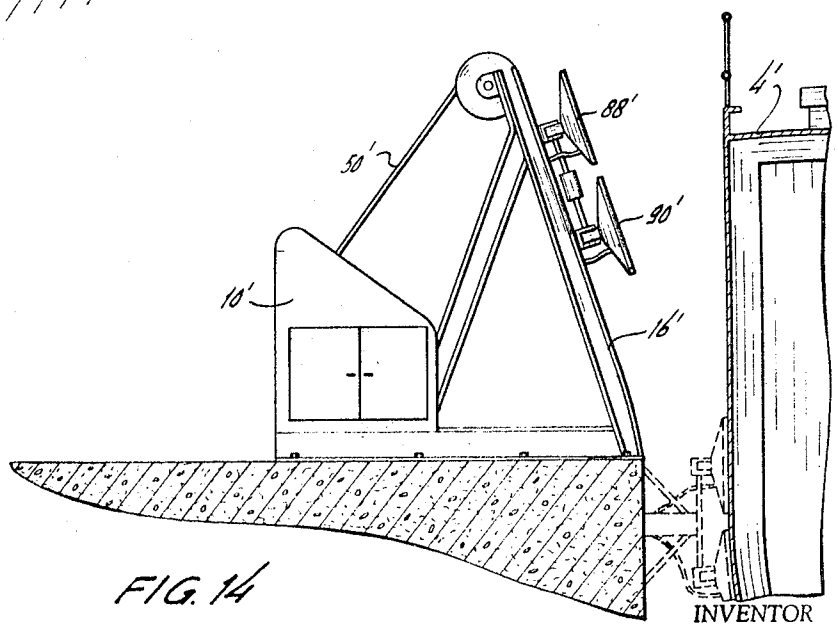

FIG. 14

INVENTOR
JACK LOVELL
BY Semmes and Semmes
ATTORNEYS

Aug. 26, 1969 J. LOVELL 3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Filed April 24, 1968 5 Sheets-Sheet 5

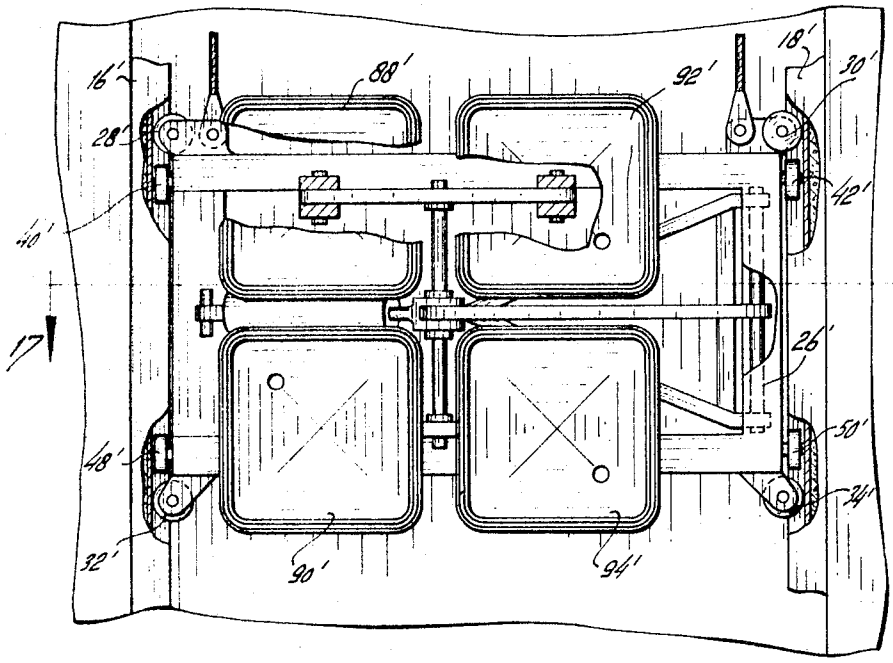

FIG. 15

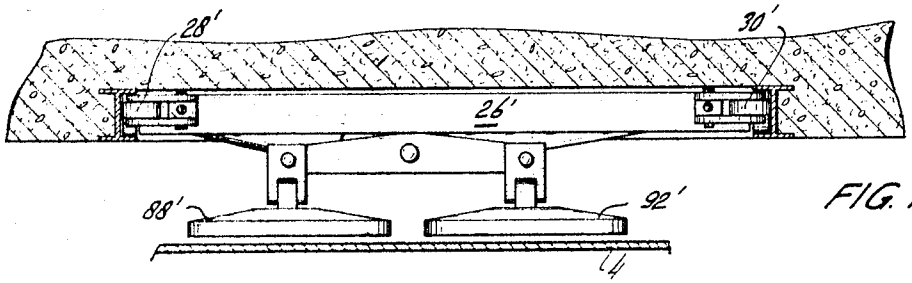

FIG. 16

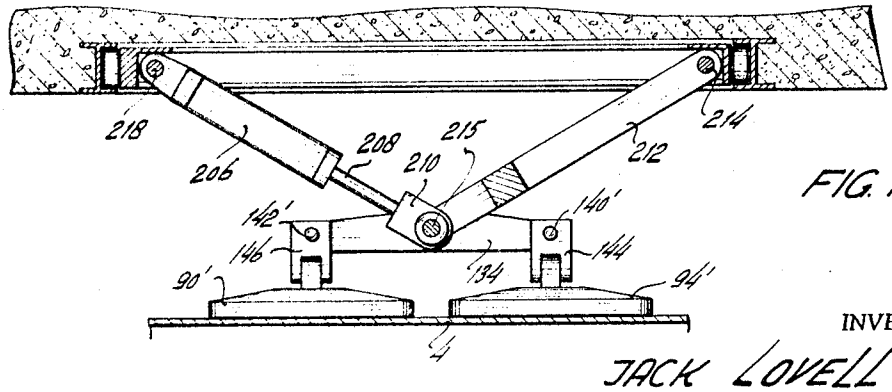

FIG. 17

INVENTOR

JACK LOVELL

BY Semmes and Semmes

ATTORNEYS

United States Patent Office 3,463,114
Patented Aug. 26, 1969

3,463,114

METHOD FOR MANEUVERING A VESSEL WITH RESPECT TO ITS STATION

Jack Lovell, McLean, Va., assignor to The Stanwick Corporation, Washington, D.C., a corporation of Delaware

Filed Apr. 24, 1968, Ser. No. 723,855
Int. Cl. B63b 21/00, 21/50
U.S. Cl. 114—230 5 Claims

ABSTRACT OF THE DISCLOSURE

Method for maneuvering a vessel with respect to its station, particularly a method for fending the vessel horizontally and vertically with respect to a rigid station, such as an offshore oil well drilling platform. According to the method an extensible boom and suctorial cup assembly mounted upon a station is used to draw a vacuum upon integral portion of a maneuvering vessel freeboard. The boom is raised and lowered in horizontal alignment with the maneuvering vessel prior to drawing of the vacuum and is supported for free vertical movement corresponding to boat action after drawing the vacuum. The boom is telescoped with respect to the station, so as to control movement of the vessel about the station through the boom.

CROSS-REFERENCE TO RELATED APPLICATIONS

None.

BACKGROUND OF THE INVENTION

Field of the invention

A great deal of difficulty has been experienced in maneuvering a work boat with respect to a station such as an offshore drilling rig. This difficulty is compounded when the working platform of the rig is considerably elevated with respect to sea level. The distances involved preclude ready use of conventional fending devices. As a result, injury both to the rig and to the work boat is such that offshore drilling rigs prefer service and resupply via the less accident prone method of helicopter.

An effective method for fending a work boat with respect to its station, such as a canal lock or offshore drilling rig in any type of sea has not been devised. A primay requirement of such a method would be its capability of horizontal and vertical flexibility, so as to permit movement of the work boat vertically with the sea and horizontally with respect to an offshore oil rig and enable servicing by a crane or the like. A secondary requirement would be in the rigidness and reliability of the fending so as to preclude injury to its station. Additional requirements of the method reside in its capability of quick, remote-controlled disengagement from the vessel, as well as the capability of absorbing shock.

Description of the prior art

Assignee of the present invention has obtained the following patents issued on related methods and devices: Method and Apparatus for Maneuvering Ships (Pat. No. 3,322,091); Ship Maneuvering Method (Pat .No. 3,345,971).

According to both methods, an extensible boom with a suctorial cup is used to position or maneuver one vessel with respect to another. A vacuum is drawn within the cup and through the boom, the cup being placed against the freeboard of a vessel being maneuvered. In the 3,322,091 patent the telescoping boom and cup may

be mounted upon a tug, the cup being attached to the freeboard of a larger vessel. In the 3,345,971 patent the extensible boom and suctorial cup include a resupply conduit for the supply of gasoline or the like via pumping through a conduit extending through the extensible boom and cup. Neither patent teaches modes of vertically adjusting the entire boom assembly, of employing a plurality of suctorial cups at spaced positions on the freeboard of the vessel being maneuvered, of positioning the device on a rigid station or of shock absorbing the device with respect to the vessel being maneuvered.

SUMMARY OF THE INVENTION

Applicant's method for station keeping involves a plurality of extensible boom and suctorial cup devices, so as to position or fend a work boat with respect to its station. Once the vacuum is drawn through the boom and the suctorial cups, the boom is released vertically so as to be movable with respect to swells in the sea and corresponding movement of the work boat. Maneuvering is terminated by breaking of the vacuum, resulting in a disengagement of the extensible boom with the vessel being maneuvered. Refinements of the method consist in pneumatically shock absorbing the boom assembly, supporting the boom for free vertical movement, while limiting lateral movement of the boom, with respect to its station.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a work boat being maneuvered with respect to an offshore drilling rig by a pair of extensible booms;

FIG. 2 is a top plan, partially in section, showing a single extensible boom and suctorial cup assembly;

FIG. 3 is a side elevation of the assembly;

FIG. 4 is a sectional view, taken along section line 4—4 of FIG. 2;

FIG. 5 is a sectional view taken along section line 5—5 of FIG. 3;

FIG. 6 is a fragmentary vertical section of the telescoping boom end fitting within its housing;

FIG. 7 is a sectional view taken along section line 7—7 of FIG. 6;

FIG. 8 is a sectional view taken along section line 8—8 of FIG. 6;

FIG. 9 is a front elevation of the vertically movable steel truck **26** supporting boom and suctorial cup elements **88** and **90**;

FIG. 10 is a like front elevation with the extensible boom and suctorial cups removed;

FIG. 11 is an enlarged side elevation, partially in section, showing the dish **96** and skirt **104** defining vacuum chamber **112** in the suctorial cup assembly;

FIG. 12 is an enlarged fragmentary section of the suctorial cup skirt element;

FIG. 13 is a fragmentary perspective, showing installation of a proposed station keeping device within a canal lock so as to assist in locking of the vessel;

FIG. 14 is a fragmentary end elevation, showing the FIG. 13 device wherein the truck **26** containing suctorial cups **88'**, **90'**, **92'** and **94'** is lifted above the lock upon inclined tracks **16'** and **18'** when not in use, tracks **16'** and **16** being set or recessed within the concrete lock walls when parallel to the vessel freeboard;

FIG. 15 is a fragmentary front elevation of truck **26'** containing the suctorial cups;

FIG. 16 is a fragmentary top plan thereof with the suctorial cups in retracted position; and

FIG. 17 is a top plan thereof with the suctorial cups in extended freeboard engaging position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1, a station keeping device generally designated as **2** is shown vertically movably positioned in offshore drilling rig platform **6** by means of vertical channels or tracks **16, 18, 20** and **22** secured to the rig superstructure **24.**

The station keeping device includes a pair of like extensible boom assemblies **12** and **14** having at their respective ends suctorial cups **88, 90, 92–94** engaging the freeboard of work boat vessel **4.**

A suggested assembly for carrying out the method is illustrated in FIGS. 2, 3, 9 and 10 as comprising truck **26** vertically movable in tracks **16** and **18** by means of radially extending rollers **28, 30, 32** and **34** mounted respectively in radially extending arms **36, 37, 38** and **39,** secured at the corners of the truck assembly **26.** Additionally, top rollers **40, 42,** lower middle rollers **44, 46** and bottom rollers **48, 50** may be positioned at the truck sides at right angles to the corner rollers **28, 30, 32** and **34.** Rollers **40, 42, 46, 48** and **50** engage the interior walls of track or channels **16** and **18.**

The extensible boom assembly **12** is more particularly illustrated in FIGS. 2 and 3, as comprising housing **52** secured pivotably at one end to truck **26** by means of ears **56** engaging lugs **58** and secured thereto by means of pin **60.** Extensible piston rod **54** is supported rotatably within the housing **52** by means of outer rollers **114** and **116** mounted, respectively, upon pins **118** and **120** supported in housing **52** and inner rollers **122** and **124** secured on piston **54** inner end by means of pins **126** and **128.** Stops or lugs **130** and **132** secured respectively to the interior wall of housing **52** and the exterior of piston **54** may be positioned for limiting horizontal extensibility of rod **54.**

A pneumatic shock absorber assembly housing **70** supplied by air line **64** includes extensible piston rod **82** secured to piston **54** by means of ear **78** and pin **80** at one end and secured to housing **52** by means of ears **72, 74** and pin **76** at the other end. Piston rod **54** is extended horizontally by means of hydraulic fluid fed through supply line **62.**

Piston rod **54,** as illustrated in FIGS. 2 and 3, terminates in clevis assembly **138** which movably supports yoke **134** by means of pin **136.** At either end of yoke **134,** suctorial cups **88** and **90** are universally mounted by means of brackets **144** and **146,** secured by identical pins **140** and **142.** The cups **88** and **90** include rear brackets **98** and **98'** secured respectively to brackets **144** and **146** by pins **148** and **150.**

Each suctorial cup consists of dish **96,** outer or peripheral rubber or neoprene skirt **104** defining an inner vacuum chamber **112,** vacuum being drawn through interiorally threaded conduit **102** by means of vacuum fitting **100** to which the vacuum lines **112** and **112'** may be secured. Skirt **104** may include inner serrations **106,** middle flange **110** and outer peripherally extending flange **108,** the serrations and flanges enabling the cup to seal with respect to the irregularities of the work boat freeboard.

The boom may be rigidized with respect to truck **26** by means of vertically extending strut **68,** secured to the truck by means of lug **66,** and laterally extending strut **84,** secured to truck **26** by means of lug **86.**

In FIG. 1 control house **10** is generally illustrated as including a winch, such as a 5,000 pound constant tension winch used to position vertically the extensible booms **12** and **14** prior to engagement of the work boat freeboard and drawing of the vacuum. Drawing of the vacuum through the cup assembly may be accomplished by a ten horsepower 177 cubic foot per minute 29 inches mercury vacuum device having a 15 cubic foot vacuum tank. The hydraulic system for extending and retracting piston rods **54** may include a 5 g.p.m. at 1,500 p.s.i., two to three gallon piston accumulator for shock absorption. A steel lifting cable **50** may be secured to truck **26** by means of bracket **48** for lifting of the assembly prior to drawing of the vacuum.

The suctorial cups may be approximately 4 square feet, each developing 10 p.s.i. (5 p.s.i.a.) vacuum. Such a suctorial head would have a holding capability of 5,760 pounds or assuming that two extensible booms with four cups were employed a total of 23,040 pounds for four cups in a direction transverse to the work boat keel. Holding capability parallel to the boat keep would be approximately 80% based on the friction force developed between the suctorial cup and the boat hull. In a proposed extensible boom assembly, as illustrated in FIGS. 2 and 3, the boom assembly may be eight feet retracted, eleven feet in its holding position and twelve feet in its extended position.

In operation, work boat **4** would achieve its station with the booms **12** and **14** in retracted position. The booms would be vertically adjusted by movement of trucks **26** by cables **50** and the individual piston rods **54** extended hydraulically to contact the work boat freeboard. Vacuum would be drawn through the cups **88, 90, 92** and **94,** the vacuum system operating continuously to hold a 5 p.s.i. to 14.7 p.s.i. vacuum on the work boat. Winch **50** could be automatically disengaged by a device for sensing the drawn vacuum. As the booms **12** and **14** are extended hydraulically to eleven feet in length, two hydraulic accumulators could be cut into the circuit, one at each end of the hydraulic rams **12** and **14** to give an air spring load absorption. Disengagement of the suctorial cups could be instantly accomplished by breaking the vacuum through control lines **112.** Disengagement due to overload would be automatic as the work boat could break away from the cups without power failure by simply breaking the vacuum at seal **104.**

According to the FIGS. 13–17 adaptation truck **26'** front is lifted vertically by means of cables **50'** extending to a power winch with housing **10'.** The entire truck is shown in stowed position in FIG. 14. The mid ships truck **26'** includes a horizontal track **216,** attached to cable **50',** which enables the truck **26'** to travel horizontally approximately 40 feet in order to position the ship and start the ship in motion.

Truck **26'** is essentially similarly constructed as in the basic device with radially extending track engaging wheels **28', 30', 32'** and **34',** as well as top rollers **40'** and **42'** and bottom rollers **48'** and **50'.** The individual suctorial cups are mounted upon a pair of identical yokes **134'** to which gate **212** is attached by means of pins **214** and **215.** A hydraulic power assembly **206** is connected to truck **26** by means of pin **218** and includes piston **208,** having an end clevis **210,** engaging pin **215.** As the hydraulic cylinder is actuated so as to distend piston **208,** the entire yoke **134** is distend outwardly of the lock wall and against the vessel freeboard **4,** as illustrated in FIG. 17.

As suggested in FIG. 13, twenty-four suctorial cups may be employed, twelve on each side of the vessel. In such an arrangement each truck could develop a force capability of 54,000 pounds transverse to the lock, three such trucks developing a force capability of 162,000 pounds transverse to the lock on each side of the vessel, based upon the use of 3 foot square suctorial paths. Conventional commercial vacuum hydraulic systems and hydraulic winches may be employed. There is no necessity for reduction in the lock width, inasmuch as individual rails **16'** and **18'** are recessed in the concrete walls. It is estimated that an operation cycle would be one minute consisting of fifteen seconds to lower the truck on the rail to position opposite the freeboard, fifteen seconds to gate the cups onto the freeboard, as illustrated in FIG. 17, fifteen seconds to effect vacuum attachment and fifteen seconds for inspection.

Manifestly, the extensible boom and vertically movable truck assemblies may be varied, for example by mounting on a vessel, without departing from the spirit and scope of invention.

I claim:

1. Method for maneuvering a vessel with respect to its station comprising the steps of:

(A) horizontally telescoping a rigid boom and suctorial cup, which is mounted upon the boom end for universal movement, with respect to said station, so as to contact said vessel;

(B) raising and lowering said boom in horizontal alignment with said vessel;

(C) differentiating pressure between ambient and an integral portion of said vessel which is in contact with said station by means of said rigid boom and suctorial cup by drawing a vacuum through said suctorial cup;

(D) supporting said boom for free vertical movement corresponding to boat action, as said vacuum is drawn;

(E) shock absorbing said boom by fluid means; and

(F) controlling movement of said integral portion of said vessel about said station through said boom.

2. Method for maneuvering a vessel with respect to its station as in claim 1, including distending said boom with respect to said station.

3. Method for maneuvering a vessel with respect to its station as in claim 2, including drawing a vacuum within a plurality of spaced integral portions of said vessel in contact with said station via a plurality of rigid booms.

4. Method for maneuvering a vessel with respect to its station as in claim 3, including limiting lateral movement of said boom within said station, while supporting said boom for free vertical movement.

5. Method for maneuvering a vessel with respect to its station as in claim 4, including breaking said vacuum as a termination of controlling movement of said vessel.

References Cited

UNITED STATES PATENTS

2,920,597	1/1960	Dick	114—230
3,322,091	5/1967	Stanwick	114—235

FOREIGN PATENTS

797,653	7/1958	Great Britain.

TRYGVE M. BLIX, Primary Examiner