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METHOD AND APPARATUS FOR PULLING ANCHORS

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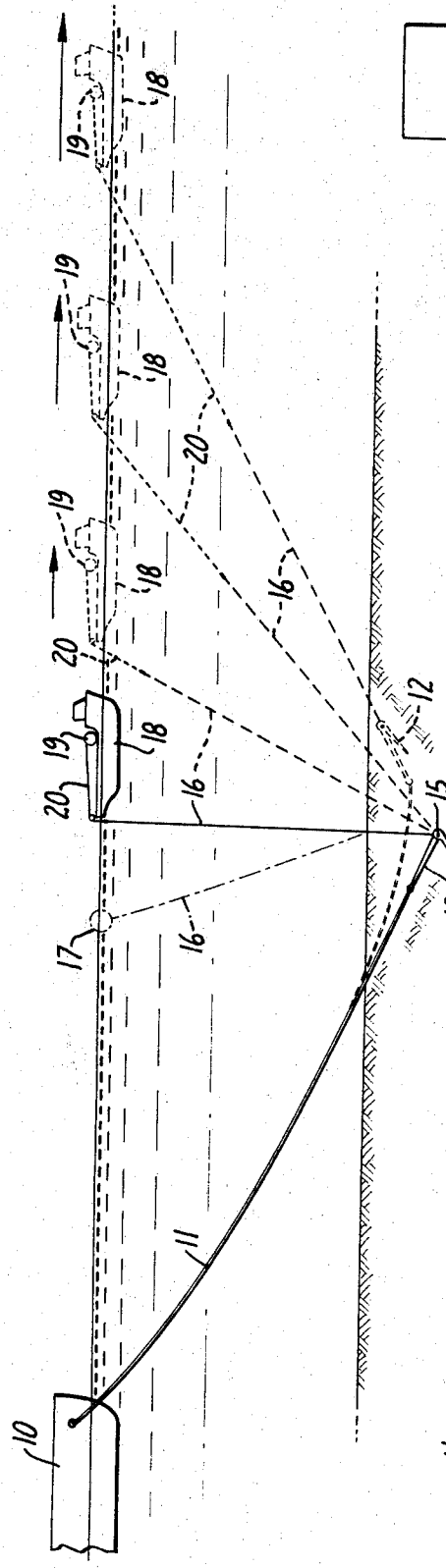


FIG. 1.

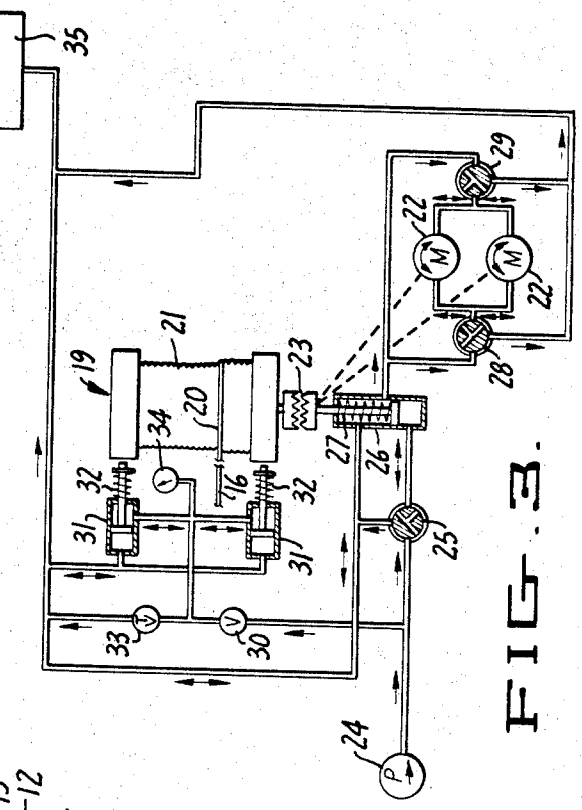


FIG. 3.

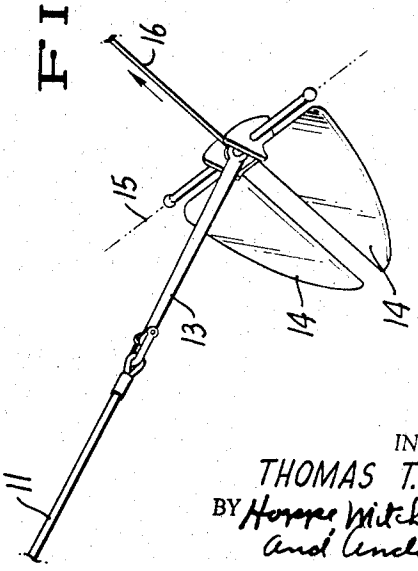


FIG. 2.

INVENTOR.
THOMAS T. LUNDE
BY Hopper, Mitchell, Muntha and Anderson
ATTORNEYS

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METHOD AND APPARATUS FOR PULLING ANCHORS

Thomas T. Lunde, 6 Locksley Ave., San Francisco, Calif. 94122

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ABSTRACT OF THE DISCLOSURE

A method and apparatus for breaking out a ship's anchor using the momentum of a small vessel to apply an adequate but controlled force to an anchor at the pivotal juncture between the anchor shank and flukes. One end of a breakout line is connected to the pivotal juncture of an anchor's shank and flukes; the other end of the line is connected to a braking device mounted upon a small vessel, which is then moved in a direction opposite that used in setting the anchor. The breakout line is payed out until the vessel develops sufficient momentum to break the anchor loose, and then a controlled braking force is applied to the line.

This invention generally relates to the art of anchoring ships, and more particularly to a method and apparatus for breaking out anchors of large ships.

It is common practice for ships to break anchor by using brute force alone. The breakout forces required are largely attributable to the weight of material above the anchor and to the shear forces required for breaking up materials in which the anchor is imbedded. Conventional methods of breaking anchor require the use of large winches capable of applying tremendous line tension. The initial cost of such equipment is high and the cost of operation is expensive. Even so, conventional methods and apparatus cannot be used if the floatation left in a loaded vessel is insufficient to resist the line pull required to free the anchor. In many instances the size of the supply vessel, and/or its ability to trim, requires that an auxiliary vessel or tug be used to break out and lift the anchor. Auxiliary vessels themselves, of course, must have sufficient floatation and pulling capacity to exert the necessary line pull.

In brief, the present invention involves the use of the momentum of a relatively small vessel or tug to break out the anchor of larger vessels. The method contemplates first securing an anchor line to the small vessel, then moving the vessel to gain speed while simultaneously paying out line, and finally applying a controlled tension to the line sufficient to break out the anchor. It is further contemplated that the tug should be moved away from the anchor in a direction opposite that used in setting the anchor. In this manner a minimum force will be required to break out the anchor when and as the line of pull is directly opposite to the anchor flukes.

One object of the present invention is to provide methods and apparatus for pulling and breaking out anchors of very large vessels by means of relatively light equipment and a small vessel.

Another object is to provide methods and apparatus for breaking out an anchor by applying a controlled tension to an anchor line and utilizing the momentum of a small vessel to pull the anchor.

A still further object of the invention is to provide relatively inexpensive apparatus for breaking loose and pulling anchors of large vessels.

Other objects of this invention will become apparent in view of the following detailed description.

In the drawings forming a part of this application,

FIG. 1 is an elevation view and a schematic drawing

showing a preferred method of the invention in pulling a ship's anchor;

FIG. 2 is a perspective view of a conventional anchor for large vessels; and

FIG. 3 is a schematic drawing of a control circuit including apparatus for applying a controlled tension to an anchor line.

Referring to FIGS. 1 and 2, there is shown a portion of a vessel **10** held at anchor by a line **11** connected to an anchor **12**. The anchor is of conventional construction comprised of a shank **13** having flukes **14** pivotally connected thereto on an axis **15** extending transverse to the shank. One end of a second line **16**, to be used in breaking out anchor **12**, is connected to the anchor on axis **15**, a retrieving buoy **17** being attached to the other end of line **16**.

A small vessel or tug **18** having a winch **19** with means for retrieving and paying out line **16**, and a connecting spool line **20**, is used for breaking out and raising anchor **12**. Winch **19** may be hydraulically powered and need be of sufficient power to lift only the anchor, its line and fittings and an adhering mudload. Details of the winch and operating equipment associated therewith are shown schematically in FIG. 3.

With reference to FIG. 3 there is shown a preferred form of apparatus for retrieving and/or applying a controlled tension to payout line **16** and spool line **20**. Winch **19** generally comprises a drum **21**, a pair of reversible hydraulic motors **22** and a clutching device **23** for selectively connecting the drum to the motors. The pressure of a fluid pressure source **24** may be applied to drive motors **22** through a connection including a control valve **25**, a clutch operating cylinder **26** having a spring release **27**, and one of two directional control valves **28** or **29**. The construction of cylinder **26** and its connection to motors **22** requires that clutch **23** be engaged before fluid pressure is transmitted on to motors **22**. Thus, the various hydraulic apparatus and connections provide a control means for sequentially actuating clutch **23** before communicating hydraulic pressure to either hydraulic motor.

The pressure of source **24** may also be applied through a valve **30** to a pair of hydraulic actuated braking cylinders **31** having spring reelases **32**. The amount of pressure applied to each cylinder **31** is controlled by adjusting the size of opening through a throttling valve **33**. The instantaneous braking pressure applied to cylinders **31** is shown on a pressure indicator **34** that is preferably scaled to show the tension in lines **16** and **20**.

Hydraulic motors **22**, clutch operating cylinder **26** and braking cylinders **31** are each provided with return line connections to an exhaust tank **35** located above the high point of this system. Directional control valves **28** and **29** alternately connect hydraulic motors **22** to tank **35** depending on the direction in which the motors are to be driven.

In operation, and for purposes of pulling anchor **12**, buoy **17** is first retrieved and removed, and the end of line **16** is connected with spool line **20**. A torque is then applied to drum **21**, taking up slack in line **16**, as shown in FIG. 1 by the solid line position of vessel **18**. This operation is accomplished by connecting pressure source **24** with the clutch operating cylinder **26** to engage clutch **23**, and then opening directional control valve **28** to pressure source **24** and valve **29** to tank **35**. During this operation, valve **30** is closed and valve **33** is open as to bleed braking cylinders **31** to tank **35**.

After line **16** has been retrieved, control valve **25** is operated to connect cylinder **26** with tank **35**, thereby declutching drum **21** from hydraulic motors **22**. Also, valve **30** is opened to apply pressure to the braking cylinders

31. Valve 33 is initially open to prevent a buildup of pressure in the cylinders, but as the tug gains the necessary speed for breaking out the anchor, valve 33 is closed, building up pressure in braking cylinders 21 as required. During this time line 20 is payed out under a controlled tension which can be observed by reference to pressure indicator 34. If the tension begins to approach the elastic limit of lines 16 or 20, the load may be diminished by opening throttling valve 33 to tank.

By the time vessel 18 reaches the broken line position shown furthest on right in FIG. 1, where line 16 is directionally opposite to flukes 14 of anchor 12, the anchor should be pulled free from the material in which imbedded. After the anchor has been broken free, lines 16 and 20 are retrieved. For this purpose, valve 30 is closed, valve 33 is opened to tank, valve 25 is operated to transmit pressure from pressure source 24 to clutch operating cylinder 26 and to hydraulic motors 22 through directional control valve 29, valve 28 being opened to tank 35.

It is to be understood that the size of vessel 18 as well as the tensile strength of lines 16 and 20 are matters of engineering design based on well-known formula. In general, it is believed that small vessels, equipped with only small capacity hydraulic motors, can be used to break out the largest of anchors.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A method for breaking out a ship's anchor secured to a line, comprising the steps: securing a tug to the line, moving the tug to gain speed while simultaneously paying out line, then applying a variable but controlled tension to said line and utilizing the momentum of the tug to pull the anchor.

2. The method of claim 1 wherein said tug is moved away from the anchor in the direction opposite to that used in setting the anchor.

3. Apparatus for breaking out a ship's anchor comprising: an auxiliary anchor-pulling line, one end of said line being secured to a ship's anchor; a power-driven tug; means mounted on said tug for retrieving and paying out said auxiliary anchor-pulling line, said means comprising a reversible fluid motor, a source of fluid pressure for driving said motor, a rotatably mounted drum, means for selectively clutching said drum to said motor, and control means for sequentially actuating said clutching means to connect said drum to said motor and then communicating said source of fluid pressure to said fluid motor; and means for applying a variable but controlled tension to said line as said line is being payed out; whereby said tug may be moved initially relative to said anchor to gain momentum and the momentum applied with a variable but controlled force in a direction opposed to the setting of said anchor.

4. The apparatus of claim 3 wherein said ship's anchor comprises a shank having flukes pivotally connected thereto on an axis transverse to said shank, said line being connected to said anchor on said axis.

5. The apparatus of claim 3 wherein said means for applying a controlled tension comprises a fluid operated braking device, a source of fluid operating pressure, means for selectively applying said source of pressure to said braking device to increase the tension in said line, and means for indicating the fluid pressure applied to said braking device.

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MILTON BUCHLER, *Primary Examiner.*

TRYGVE M. BLIX, *Assistant Examiner.*