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Rosenberg et al.

[11] **3,853,082**

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[54] **MECHANICAL RETRIEVER**

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy,** Washington, D.C.

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[52] **U.S. Cl.** ..... **114/51,** 254/197, 294/83 R

[51] **Int. Cl.** **B63c 7/20**

[58] **Field of Search** ..... 212/77; 114/51, 50, 16.4, 114/16.5, 16.6, 16.7, 16.8; 294/82 R, 83 R; 254/197, 190

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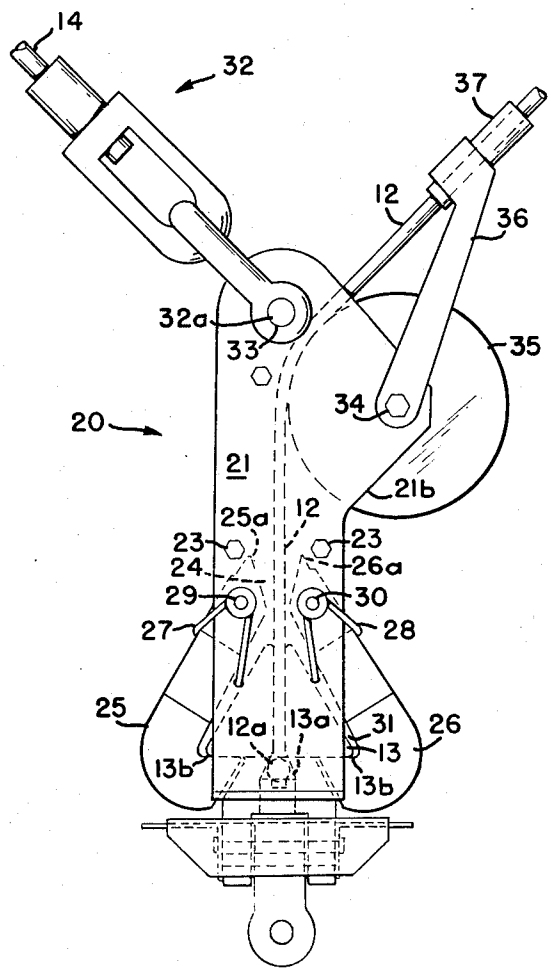
[57] **ABSTRACT**

An apparatus for attaching a hoisting cable to a sunken vessel is configured to be pulled-down onto a cone-shaped line anchor. The device is pulled down onto the line anchor when the hoisting cable and marker-buoy line are drawn in opposite directions by a pair of surface ships. Having the ships draw the hoisting cable and the marker buoy line in opposite directions prevents the cable and line from becoming entangled to allow connection to the sunken vessel and to reduce the hazard of inadvertently separating the more fragile marker-buoy line.

8 Claims, 5 Drawing Figures



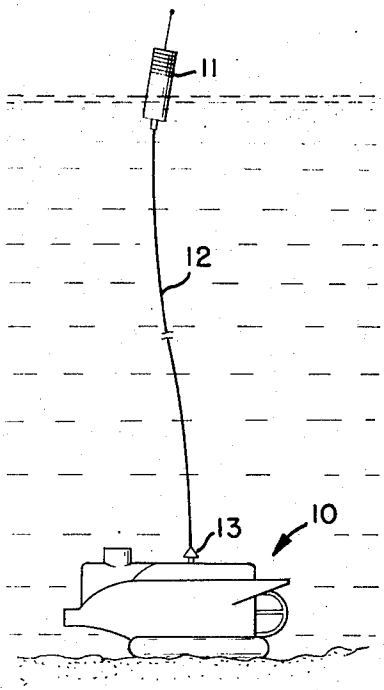


FIG. 1

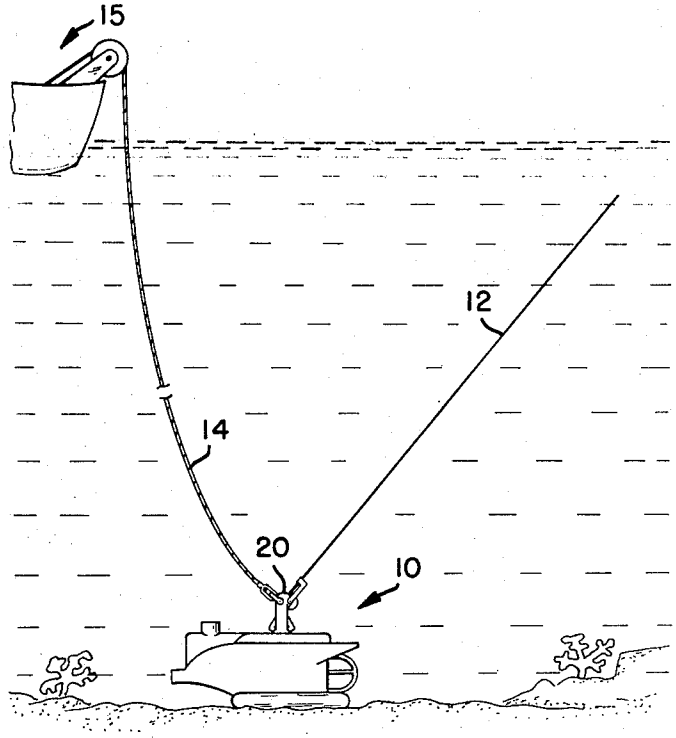


FIG. 3

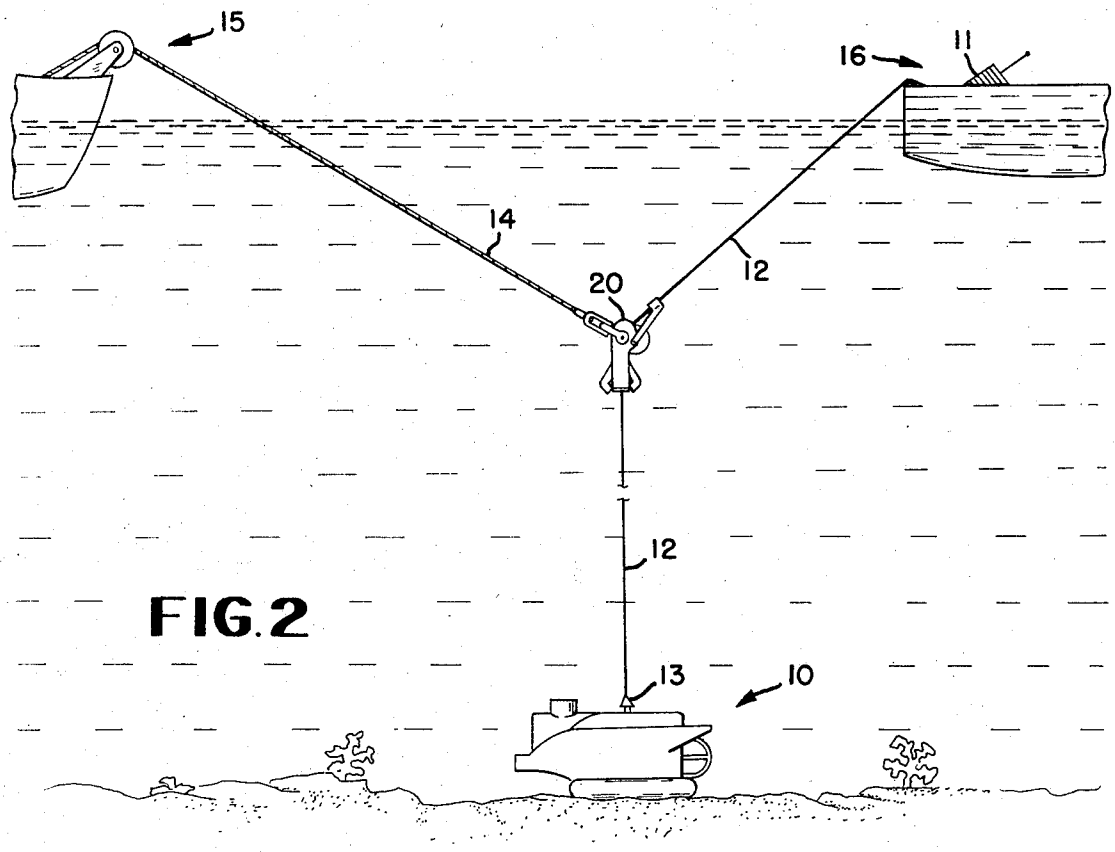
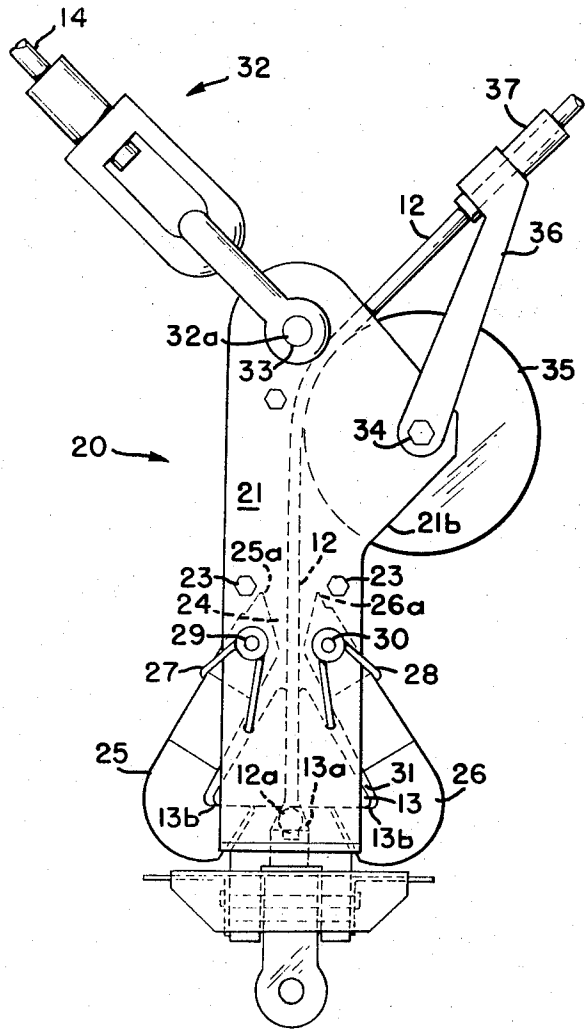


FIG. 2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32a
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21b
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25a
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13b
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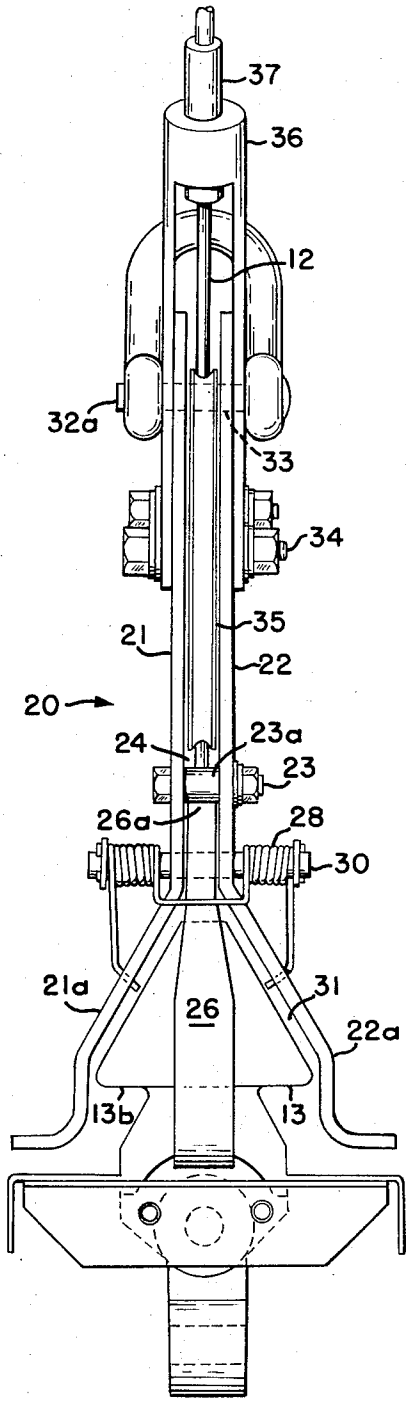
FIG. 4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32a
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13b
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FIG. 5

MECHANICAL RETRIEVER

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Recovery of sunken craft or heavy-duty salvage operations usually have relied on divers for making underwater connections to hoisting cables. Extreme depths prevent using divers and, irrespective of depth, currents, lack of visability and the weight and bulk of the hoisting cables imposed undue hazards on this type of operation. One widely advocated technique for raising sunken vessels eliminates the need for heavy duty cables by using a number of floats which, after being attached to the sunken vessel, are inflated to provide a buoying force. Here again, divers must secure the hoisting lines. The attendent hazards and diver's capabilities limit the use of floats to relatively shallow operations. Attempts to overcome these limitations have relied on a grappling mmechanism of some sort which is carried down a marker-buoy line by its own weight. All these gravity displaced mechanisms are prone to failure because the heavy-duty hoisting cable often becomes entangled with the marker-buoy line. In addition, the wire-rope hoisting cables tended to damage the fibrous marker-buoy lines and on more than one occasion, the lines were severed and the sunken vessel lost. Another recent development has assumed the form of a ponderous crawler device which inches its way down a marker-buoy line to engage a suitably shaped receptacle on the sunken vessel. Unfortunately, as in the case of the gravity deployed devices, the trailing hoisting cables become entangled with the marker-buoy line. There is no uncomplicated, reliable device for permitting the attachment of the heavy-duty hoisting cable to a sunken vessel which does not either impose an undue hazard for divers or risk entanglement with a marker-buoy line.

SUMMARY OF THE INVENTION

The present invention is directed to providing an apparatus guided by a marker-buoy line to a line anchor on a sunken vessel for securing a hoisting cable to the sunken vessel. A body member is shaped with a longitudinal channel for receiving the marker-buoy line and a connector portion is formed to engage the line anchor when a sufficient downward force is exerted. The hoisting cable is coupled to a first member disposed on one side of the body member and, journaled onto the opposite side of the body member, a second member is configured to orient the marker-buoy line in a direction diverging from the hoisting cable. The second member is further configured to ensure the exertion of a sufficient downward force as the hoisting cable and the marker-buoy line are pulled in opposite directions to ensure the securing of the hoisting cable to the sunken vessel.

It is a prime object of the invention to provide a device for attaching a hoisting cable onto a sunken vessel.

Another object is to provide a securing apparatus which reduces the possibility of entangling a hoisting cable and a marker buoy line.

Still another object is to provide a securing apparatus of reduced complexity and therefore, of inherently higher reliability.

Another object is to provide a securing apparatus which is pulled downward to engage a sunken vessel as the hoisting cable and marker buoy line are drawn in opposite directions.

These and other objects of the invention will become more readily apparent from the ensuing specification when taken with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** depicts a sumbersible resting on the bottom with its emergency marker-buoy line deployed.

FIG. **2** shows the securing apparatus being pulled down onto the submersible.

FIG. **3** depicts the securing apparatus operatively engaging a line anchor on the submersible.

FIG. **4** shows a side view of the securing apparatus.

FIG. **5** shows another side of the securing apparatus depicted in FIG. **4** rotated 90°.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. **1** shows a disabled submersible **10** lying on the bottom. This condition could have been the result of power failure, damage to the propulsion motors or any one of a number of equipment failures. Since the possibility of such failures is ever attendent, most, if not all submersibles, are equipped with a buoyant marker buoy **11** which is tethered to the submersible via a marker-buoy line **12.**

The marker-buoy line is a strong, lightweight, nylon line having a sufficient diameter and length to reach from the submersible to the marker-buoy when the submersible is at its maximum expected operational depth.

Usually the marker buoy and coiled marker-buoy line are stored outside the pressure hull of the submersible. When a submersible becomes disabled, the buoyant marker buoy is released and floats to the once on the surface a flasher and/or radio transmitter emits signals to enable the location and rescue of the submersible crew. As the marker buoy ascends, the marker buoy line is played-out through a cone-shaped line anchor **13** or the line is played out from the buoy.

Looking to FIGS. **4** and **5,** a coaxial bore **13***a* in the line anchor has a large enough diameter to allow the free passage of the marker-buoy line but has a small enough diameter to block the passage of a knot **12***a* at its bitter end. After the marker-buoy line is deployed with the marker buoy on its distal end riding on the surface, a lifeline now extends between the distressed submersible and potential rescue craft.

With the marker buoy so deployed the submersible is capable of being secured to a hoisting cable **14** by an apparatus and method of interconnection to be described below. A salvage and recovery craft **15** will raise the submersible via the cable while an auxiliary craft **16** stands by still coupled to the marker-buoy line.

A secure innerconnection between hoisting cable **14** and submersible **10** is assured by a securing apparatus **20.** A pair of side plates **21** and **22** being substantially mirror images of one another, function as the main, elongate body members and each is provided with an

outwardly flared section 21*a* or 22*a*. The flared sections are dimensioned to conform to and accommodate the aforementioned cone-shaped line anchor **13.** Several bolt and nut combinations **23** reach through aligned holes in both of the side plates and an interposed spacer 23*a* limits and defines, among other things, a longitudinal channel **24** for receiving marker-buoy line **12.** The two side plates also are spaced sufficiently to receive the inner ends of a pair of jaws **25** and **26.** Each of the spring biased jaws are pivoted about a pin **29** or **30** extending through aligned holes in the side plates and a separate biasing spring **27** or **28** urges the jaws together. Projections 25*a* and 26*a* on the innermost ends of the jaws limit the jaws' degree of rotation about their interconnected pins. The projections also ensure that jaws **25** and **26** along with sections 21*a* and 22*a* define an essentially cone-shaped cavity having dimensions slightly in excess of the dimensions of cone-shaped line anchor **13.**

A heavy-duty clevis-shackel-swivel combination **32** is swagged to hoisting cable **14.** At the upper end of the securing apparatus the combination is connected through appropriately sized aligned bores **33** formed in each of the side plates by a clevis pin 32*a*. On the opposite side of the securing apparatus in extensions 21*b* and 22*b* of the side plates a bolt **34** reaches through aligned holes to provide a rotational support for a sheave **35.** A suitable bushing is carried on the bolt to ensure that the sheave does not get pinched between the side plates thereby prevent its rotation. The sheave's outer rim has a *U*-shaped cross-sectional configuration to accommodate the marker buoy line **12,** and the sheave has a sufficient radius to locate the marker-buoy line in longitudinal channel **24** and align the line with line anchor **13.**

An outwardly reaching guide arm **36** also is journaled on bolt **34** to aid in the feeding of the marker-buoy line through the securing apparatus and to help reduce the possibility of entanglement with the hoisting cable. It has been found expedient to include a sleeve **37** having an appropriately shaped passageway to direct the marker-buoy line through the securing apparatus. Fabricating the sleeve from a material having the friction-free, corrosion resistant properties of the material commercially marketed under the trademark "TEFLON" helps ensure more trouble-free operation.

The aforedescribed apparatus is preferably fabricated from materials that are noncorrosive or at least corrosion-resistant in the harsh marine environment. However, the material chosen must be strong enough to bear the substantial load imposed by a disabled submersible. For this reason, steel has been selected and this choice necessitates that appropriate maintenance procedures must be followed, for example, repeated painting and lubrication to ensure trouble-free operation.

By the unique configuration of the securing apparatus and, in particular, the separation of the hoisting cable's point of innerconnection with respect to the location of the sheave which guides the marker buoy line, the lines are maintained separate and distinct from one another in a spaced-apart relationship. To elaborate, having the hoisting cable **14** and marker buoy line **12** as afore-described prevents their entanglement as securing apparatus **20** makes its way down to submersible **10.**

Noting in particular FIGS. **1** through **3,** the operation of the instant invention can be more thoroughly appreciated. In this regard, the distinct method of being pulled down to the submersible distinguishes this invention from contemporary devices which rely on gravity to ensure the coupling to the sunken vessel. After the marker buoy line **12** has been released as depicted in FIG. **1,** it is recovered by personnel on the surface. A securing apparatus **20** is taken in hand and the marker line is threaded through longitudinal channel **24.** Next, it is wrapped over the *U*-shaped rim of sheave **35** and through sleeve **37** and finally the end of the marker buoy line is connected to craft **16.** A clevis pin 32*a* is inserted through aligned holes **33** in the plate and a hoisting cable **14** from craft **15** is thereby attached to the securing apparatus. At this point, salvage and recovery craft **15** begins to slowly travel in one direction and, simultaneously, auxiliary craft **16** begins to move out in a direction opposite to the direction of craft **15.** With the two surface craft going in opposite directions, there is no danger of entanglement of hoisting cable **14** and marker-buoy line **12.** Since a heavy-duty hoisting cable is most likely wire rope, its abrasive surface and protruding broken wires are kept from the relatively snagable nylon marker buoy line. The danger of separating the marker-buoy line is therefore greatly reduced by using the securing apparatus in this described method. Continued, opposite travel by the surface crafts brings the securing apparatus in contact with line anchor **13.** The two surface crafts' moving in opposite directions creates a downward resultant force which is transmitted through the securing apparatus to ensure its innerconnection with submersible **10.**

To reemphasize, although the weight of the securing apparatus does tend to move it toward the disabled submersible, it is the resultant force created as the hoisting cable and the marker buoy line are pulled in opposite directions which pull the securing apparatus down onto line anchor **13.** When the downward surfaces of jaws **25** and **26** abut the upwardly exposed surface of cone-shaped line anchor **13** and the oppositely directed forces on the hoisting cable and marker-buoy line are continued, the biasing force of the biasing springs **27** and **28** are overcome and the mechanism is forced onto the line anchor. After the tips of the jaws clear the shoulders 13*b*, the jaws snap shut and engage the line anchor in cone-shaped cavity **31,** see FIG. **3.** At this point, tension on marker buoy line **12** is relaxed and recovery craft **15** commences reeling-in hoisting cable **14.** Continued reeling-in lifts the disabled submersible from the bottom and allows its recovery. The marker buoy line **12** optionally is used to guide the hoisting cable during the recovery operation or it is allowed to remain limp.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings, and, it is therefore understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than specifically described.

What is claimed is:

1. An apparatus guided by a marker buoy line joined to a line anchor on a sunken vessel and a first surface craft for securing a hoisting cable coupled to a second surface craft to the sunken vessel when the first and second surface craft move in diverging directions comprising:

a body member shaped with a longitudinal channel for receiving the marker buoy line and having a connector portion formed to engage the line anchor when a sufficient downward force is created as the first and second surface craft move in diverging directions;

a first member disposed on one side of said body member coupling the hoisting cable thereto; and

a second member journaled in the opposite side of said body member configured to orient the marker buoy line in a direction diverging from the hoisting cable and being further configured to ensure the exertion of said sufficient downward force as the hoisting cable and marker buoy line are pulled in opposite directions by the first and second surface craft to further ensure the securing of the hoisting cable to the sunken vessel.

2. An apparatus according to claim **1** in which said connector portion includes a pair of flared sections configured to accommodate the line anchor and a pair of spring-biased jaws orthogonally disposed with respect to said flared sections for engaging the line anchor when said sufficient downward force is exerted.

3. An apparatus according to claim **2** further including:

a guide member journaled in said opposite side of said body member and outwardly reaching therefrom and provided with a passageway receiving the marker buoy line to further orient it in a direction diverging from the hoisting cable.

4. An apparatus according to claim **3** in which said guide member includes a low-friction sleeve carried in said passageway to permit free travel of the marker buoy line.

5. An apparatus according to claim **4** in which said first member is a shackle-swivel combination coupling the hoisting cable to said body member and said second member is a sheave provided with a rim sized to accommodate the marker buoy line and orient it from said longitudinal channel as the hoisting cable and marker buoy line are pulled in opposite directions.

6. An apparatus according to claim **5** in which said body member is a pair of spaced-apart elongate plates carrying the spring-biased jaws and the sheave between them.

7. An apparatus according to claim **6** in which said flared sections and said spring-biased jaws define a cone-shaped cavity having dimensions larger than said line anchor.

8. A method of attaching a hoisting cable coupled to a securing apparatus to a sunken vessel comprising:

passing a marker buoy line joined to the sunken vessel through a channel in the securing apparatus;

directing the marker buoy line in a direction diverging from the hoisting cable;

pulling the hoisting cable and marker buoy line in opposite directions to force the securing apparatus down the marker buoy line and toward the sunken vessel; and

engaging a line anchor on the sunken vessel by reason of the pulling in opposite directions to attach the hoisting cable on the sunken vessel.

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