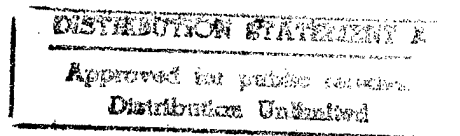


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NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
CODE OCCC3
ARLINGTON VA 22217-5660



UNCLASSIFIED

19961004 176

1 Navy Case No. 76034

2
3 SIMULATED SUSPENDED MINE RETRIEVAL SYSTEM

4
5 STATEMENT OF GOVERNMENT INTEREST

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

10
11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The present invention generally relates to a system used in
14 a retrieval process. More particularly the system is used in
15 retrieving a deployed simulated mine wherein the mine is
16 comprised of a buoy attached to an anchor by a tether.

17 (2) Description of the Prior Art

18 The Navy has sponsored numerous simulated minefield
19 installations and retrievals to support both submarine and
20 surface ship mine avoidance training exercises. The mines used
21 in these simulations following recovery are used in future
22 operations. The mines are deployed by attaching a spherical
23 buoy, called a target, to an anchor with a tether. The prior
24 art retrieval process is accomplished by either sending divers
25 down to attach a cable to the target, attaching a surface buoy
26 and cable above the target, or placing an acoustic release at

1 the lower end of the tether near the anchor. All of these
2 procedures have serious problems associated with them. The
3 diving method presents risks to human life, is extremely time
4 consuming for a large minefield, and is limited to 130 ft.
5 depths if the divers are using scuba equipment. The surface
6 buoy procedure is not acceptable in many exercises because the
7 ships using the minefield can become entangled. Acoustic
8 releases, which acoustically disengage the anchor from the
9 remainder of the system upon command, are expensive and put at
10 risk of loss at sea when operated.

11 12 SUMMARY OF THE INVENTION

13 Accordingly, it is a general purpose and object of the
14 present invention to provide an improved system for use in
15 retrieving simulated mines deployed underwater. It is a further
16 object that the system does not require personnel to be present
17 in the water. A still further object is that the system
18 obviates the use of surface buoys. Another object is the
19 elimination of acoustic releases now sometimes in use. In
20 addition, other objects are that the system be relatively
21 inexpensive, efficient and easy to operate without requiring
22 the use of highly trained personnel.

23 These objects are accomplished with the present invention
24 by providing a system, towed from the rear of a vessel, that
25 captures the simulated mine. The system has a first component
26 that captures the simulated mine by encircling a tether line

1 that is present in the simulated mine and a second component
2 that signals to the vessel that the capture has been made. The
3 vessel is then stopped and the simulated mine is hoisted aboard.
4

5 BRIEF DESCRIPTION OF THE DRAWINGS

6 For a more complete understanding of the present invention
7 and the advantages thereof, reference is now made to the
8 following description of the preferred embodiment taken in
9 conjunction with the accompanying drawings in which:

10 FIG. 1 shows an operational arrangement of a simulated
11 suspended mine retrieval system in accordance with the present
12 invention;

13 FIG. 2 is an enlarged view of a spring loading shackle
14 which forms a component of the simulated suspended mine
15 retrieval system of FIG. 1; and

16 FIGS. 3A, 3B, and 3C show sequential operations of the
17 simulated mine retrieval system of FIG. 1.
18

19 DESCRIPTION OF THE PREFERRED EMBODIMENT

20 Refer now to FIG. 1 where there is shown a towing vessel
21 10 having a winch 12 to adjust the length of an electro-
22 mechanical tow cable 14 that is drawn over a pulley 16. The
23 electro-mechanical tow cable 14 has a fairing 18. A waterproof
24 load cell 20 for measuring tension is attached to the electro-
25 mechanical tow cable 14 at the end of the electro-mechanical tow
26 cable that is away from the winch 12. The tensile loads at the

1 end of the electro-mechanical tow cable 14 are sent electrically
2 up the electro-mechanical tow cable 14 and displayed aboard the
3 vessel 10. An additional two separate cables 22 are attached at
4 one end to the load cell 20. The other end of each of the
5 cables 22 are attached to two respective Lateral Force Devices
6 (LFDS) 24. The two LFDS 24 are then connected to one another by
7 two connecting cables 26 having a spring loaded locking shackle
8 28 connected to the connecting cables 26 at the ends of the
9 connecting cables 26 away from the LFDS 24.

10 Additionally shown in FIG. 1 is a simulated suspended mine
11 30 comprised of an anchor 32 a tether line 34 and spherical buoy
12 36. The tether line 34 is of a length to keep the spherical
13 buoy below the surface of the water 38 a distance to have the
14 buoy, if it were armed, do optimum damage.

15 Refer now to FIG. 2 for a description of the spring loaded
16 locking shackle 28. The spring loaded locking shackle 28 is
17 comprised of a substantially U-shaped bar 40 having a locking
18 arm 42 with a torsion spring 44 affixed to one leg of the U-
19 shaped bar 40 by a nut and bolt arrangement 46 so that the
20 locking arm 42 is held in abutment with the inner portion of the
21 other leg of the U-shaped bar 40. The outer portions of the
22 legs of the U-shaped bar 40 are connected to respective fittings
23 48 by a nut and bolt arrangement 50. The fittings 48 have
24 respective connecting cables 26 affixed to them.

25 Referring now to FIGS. 3A, 3B, and 3C there is shown the
26 retrieval operation of the inventive system.

1 In FIG. 3A there is shown that when the suspended simulated
2 mine 30 is approached, the tether line 34 attaching the buoy 36
3 to the anchor 32 contacts either the spring loaded locking
4 shackle 28 directly or one of the two connecting cables 26.
5 When contacting one of the two connecting cables 26 the tether
6 line 34 will slide toward the center to the spring loaded
7 locking shackle. Anywhere the tether line makes contact between
8 the two LFD's 24, the spring loaded locking shackle 28 will
9 seize the tether line 34.

10 In FIG. 3B there is shown that upon capture of the
11 simulated mine 30 in the locking shackle 28, the tension
12 measured on the load cell 20 will increase drastically, and the
13 ship is then directed to stop.

14 FIG. 3C then shows the simulated mine 30 being hoisted on
15 board the ship for use in future exercises. This procedure is
16 repeated for each of the simulated mines 30 in the field.

17 Computer programs have been written to determine the length
18 of the tow cable 14 that should be deployed to achieve a certain
19 depth in the water column, based on tow cable diameter, tow
20 cable weight, ship speed, and drag forces caused by objects
21 attached to the tow cable. A plot of depth vs. ship speed can
22 be created to give the approximate depth of the locking shackle
23 28 as it is towed through the water. A simulated suspended
24 minefield (not shown) can be retrieved by towing the locking
25 shackle 28 and its associated system through the area where the
26 field has been placed, with the locking shackle 28 10-20 feet

1 deeper than the depth of the suspended spherical buoy 36. The
2 tension measured on the load cell will be fairly constant during
3 towing prior to capture and as mentioned previously will
4 drastically increase upon capture of the simulated mine 30.

5 There has therefore been described a system for retrieving
6 simulated suspended mines 30 without using divers, surface
7 buoys, or acoustic releases. The amount of time consumed by
8 operation of this system over that of preparing for diving,
9 having divers search for the simulated mine, and attaching a
10 cable to the simulated mine 30 is greatly reduced. The
11 elimination of acoustic releases from the simulated mine reduces
12 equipment costs and the elimination of surface buoys reduces the
13 risk of a ship becoming entangled and thereby damaged. The
14 equipment used in this invention is relatively inexpensive and
15 both safe and easy to operate.

16 It will be understood that various changes in the details,
17 materials, steps and arrangement of parts, which have been
18 herein described and illustrated in order to explain the nature
19 of the invention, may be made by those skilled in the art within
20 the principle and scope of the invention.

21

Navy Case No. 76034

SIMULATED SUSPENDED MINE RETRIEVAL SYSTEM

ABSTRACT OF THE DISCLOSURE

A simulated suspended mine retrieval system is described. It snares a simulated suspended mine at sea that is comprised of an anchor, a buoy and a tether connecting the anchor and buoy. The retrieval system has a cable connected to a loop for snaring the simulated suspended mine. In operation the retrieval system is towed from a vessel and the loop passes over the mine and strikes the tether. When this happens the loop has a shackling arrangement that snares the tether and is of such a size that it cannot slip over the mine. This enables the simulated suspended mine to be hoisted upon the towing vessel.

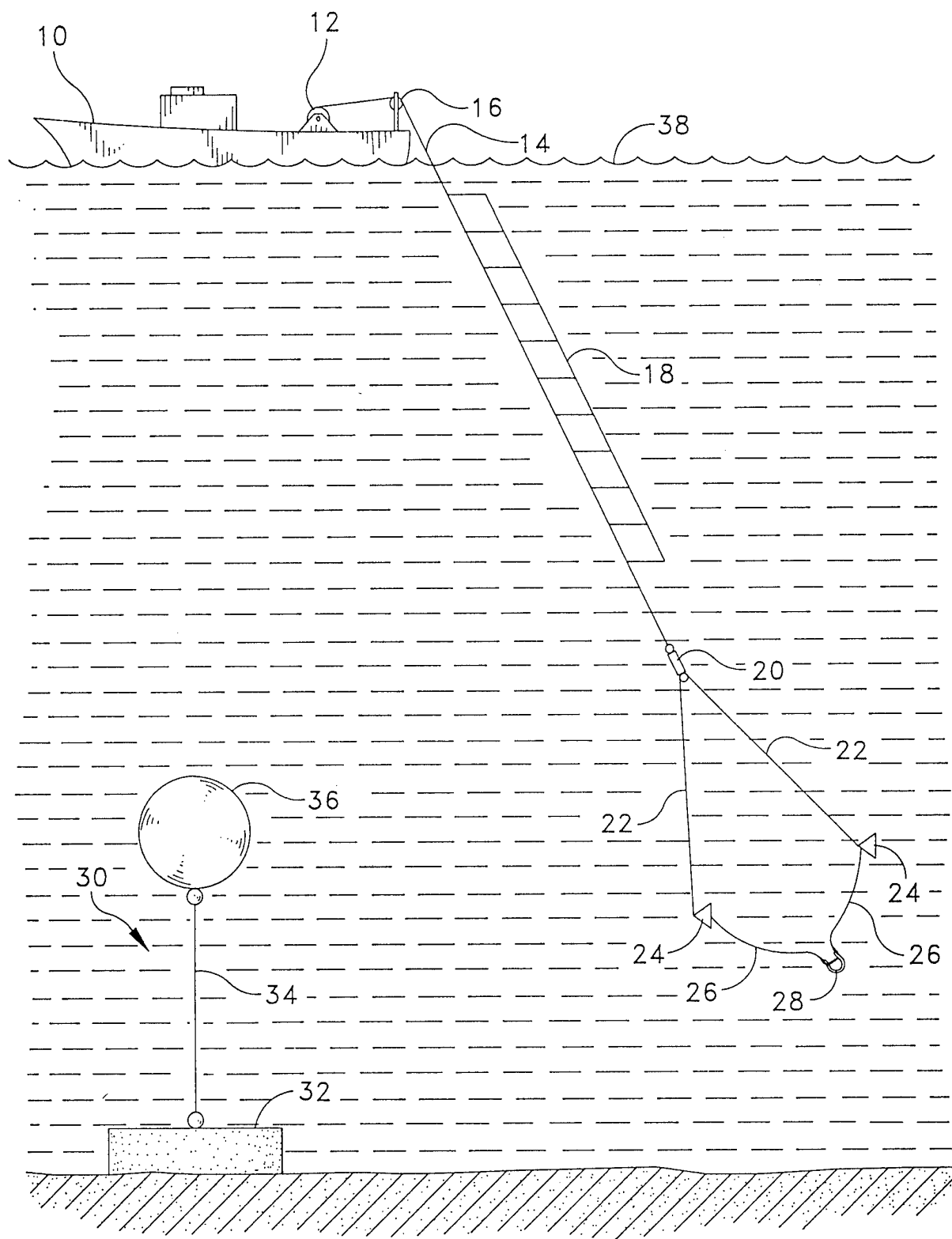


FIG. 1

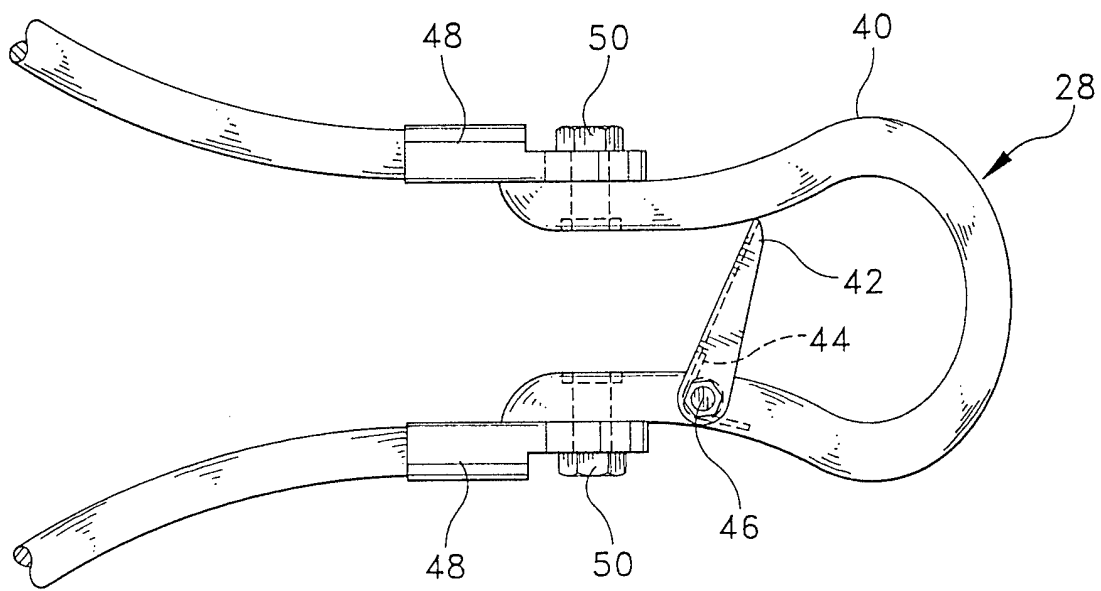


FIG. 2

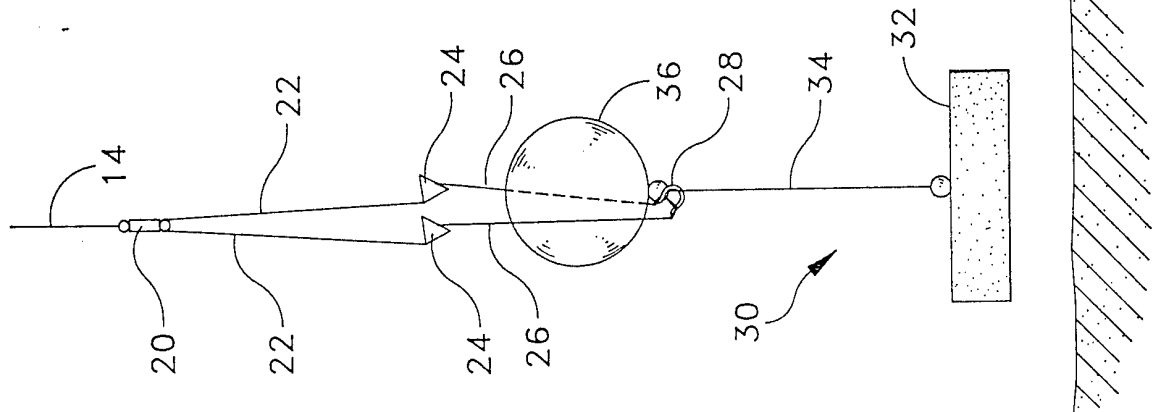


FIG. 3C

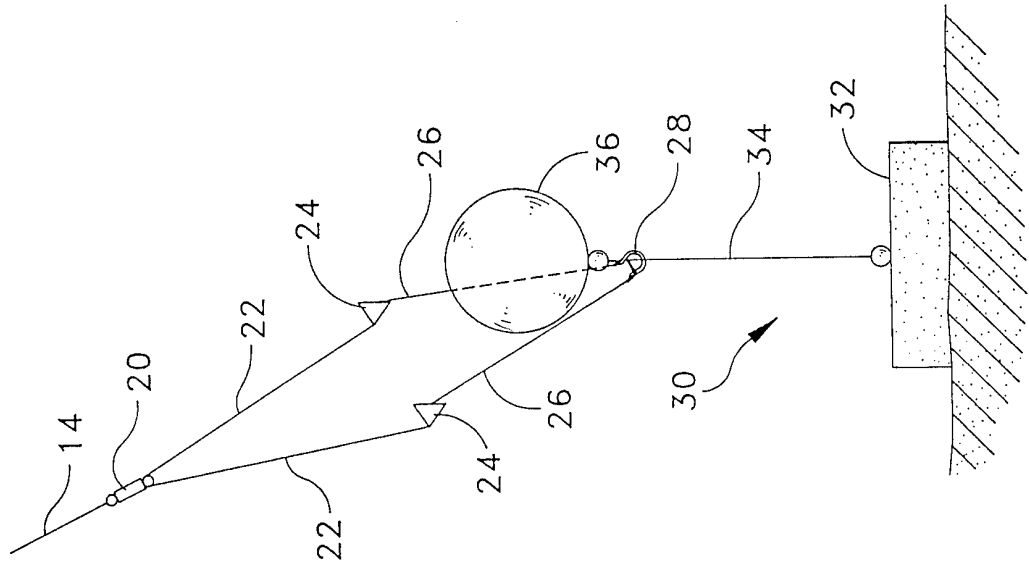


FIG. 3B

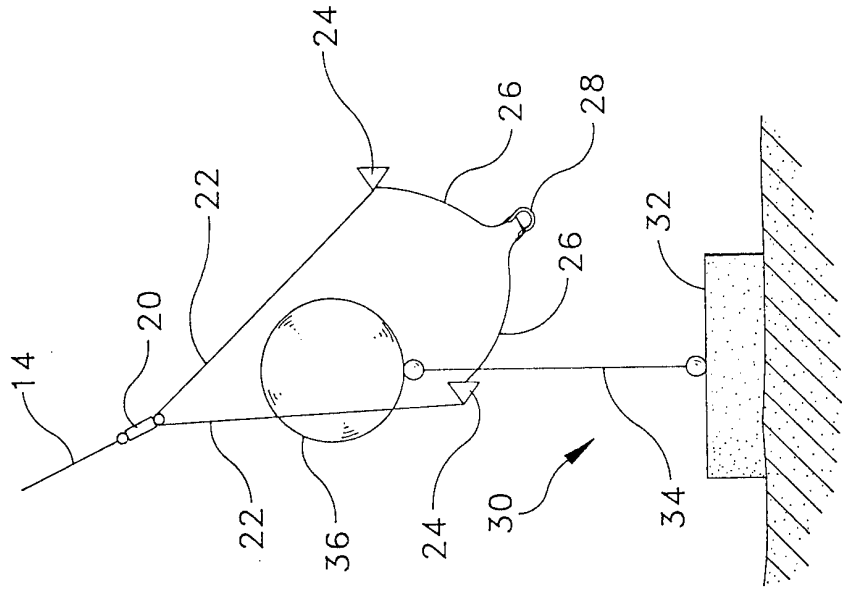


FIG. 3A