

[54] **HELO RECOVERY SYSTEM TONGS**

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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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[51] Int. Cl. ....B66c 1/62

[58] Field of Search ....294/66 R, 86 R, 103 R, 294/104, 106, 110 R; 114/51

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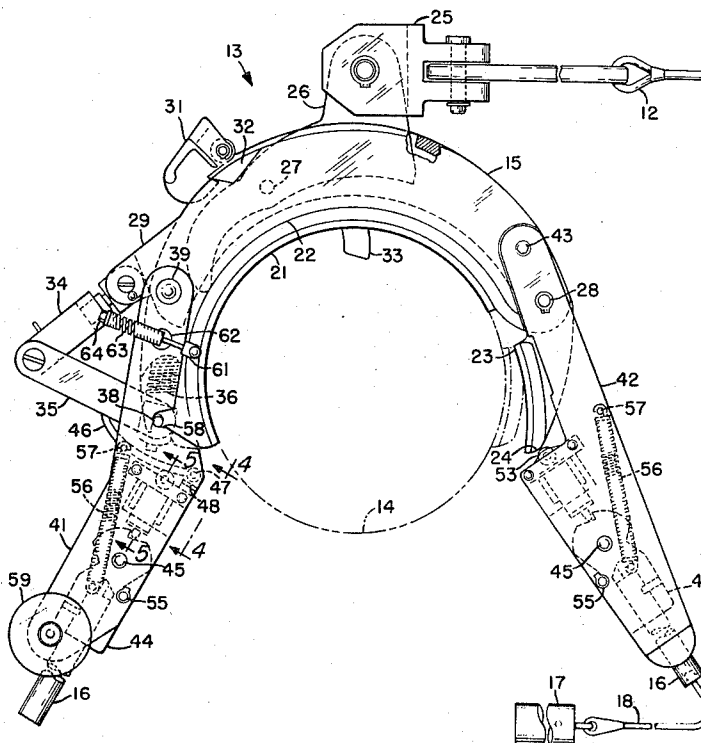
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[57] **ABSTRACT**

An aerial recovery system to retrieve cylindrical objects floating on the surface of the water includes a spring biased tong assembly which grips the cylindrical body when lowered from an aircraft. The tong assembly is characterized by guide legs which center the tong assembly over the object to be recovered. A retraction mechanism is also provided to retract the guide legs once the object has been gripped. Additionally, automatic release means are incorporated in the tongs to release the recovered object when it is lowered to a deck of a ship.

**10 Claims, 8 Drawing Figures**



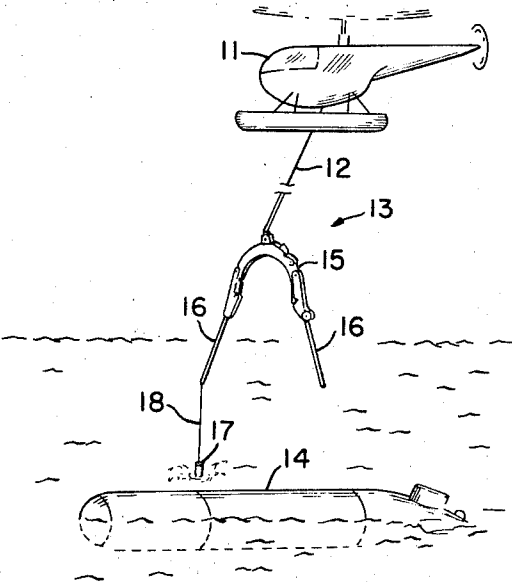


FIG. 1

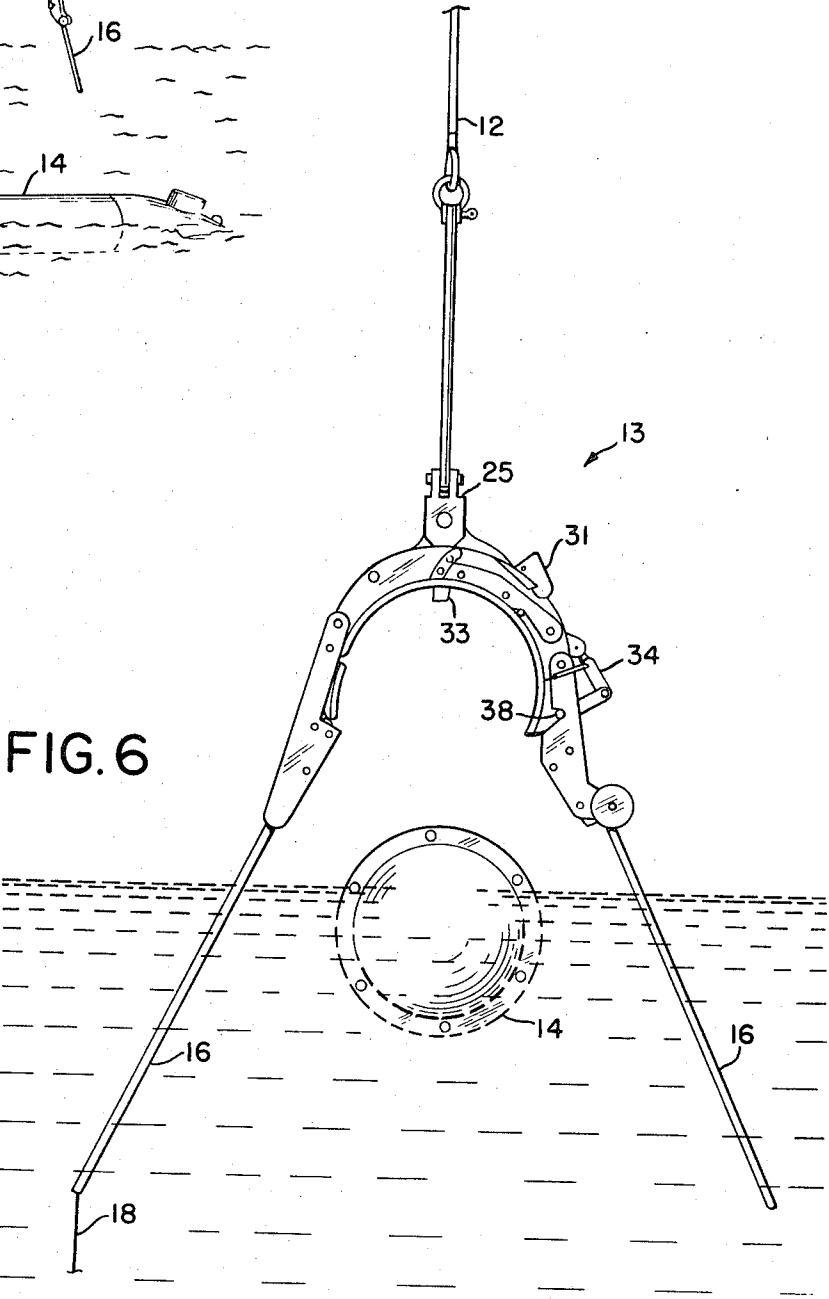


FIG. 6

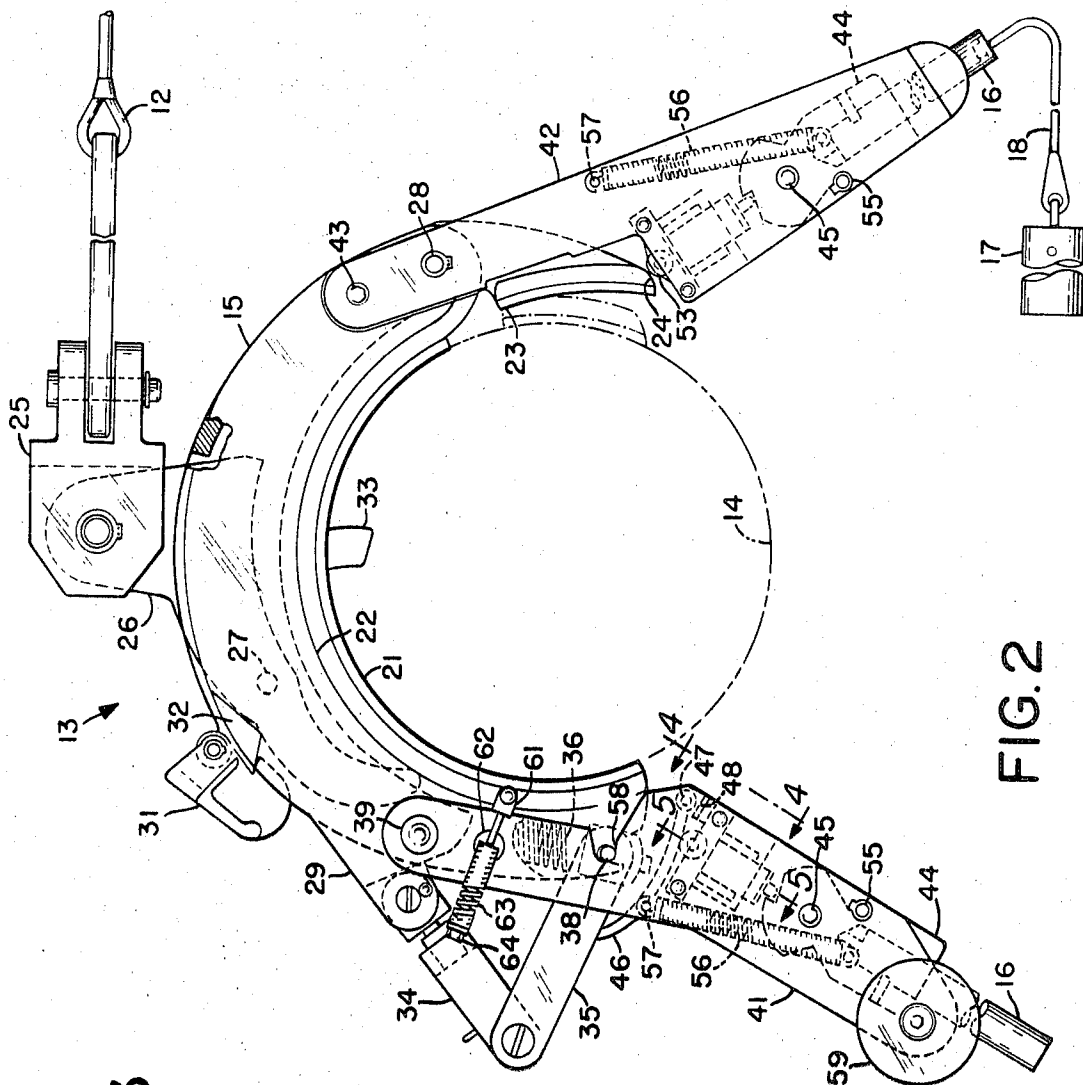


FIG. 2

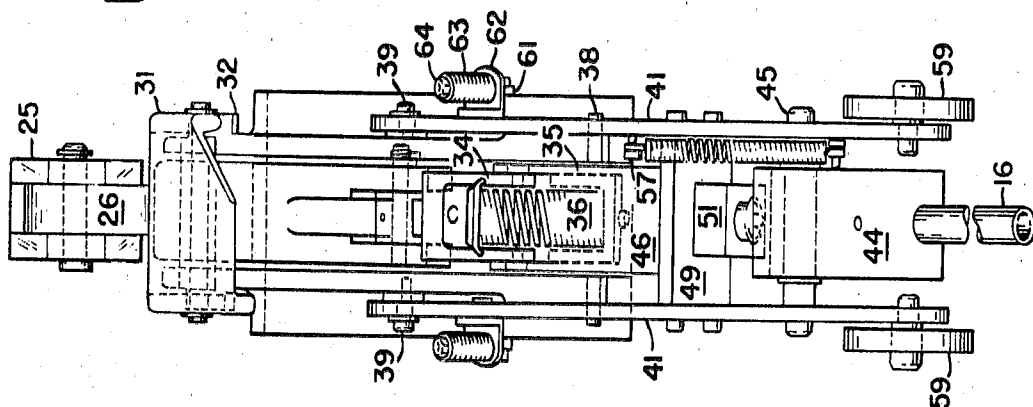


FIG. 3

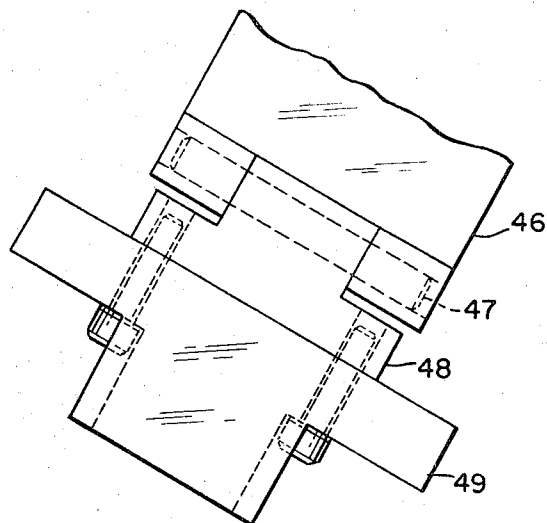


FIG. 4

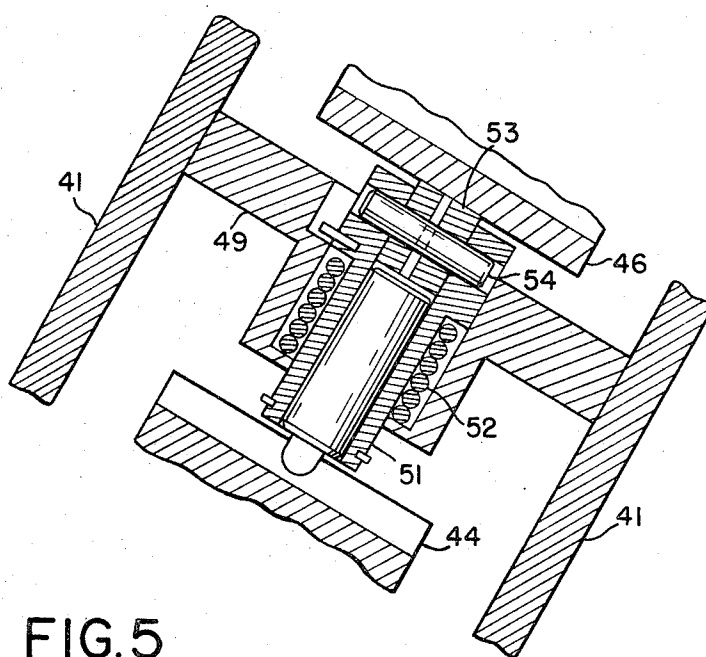
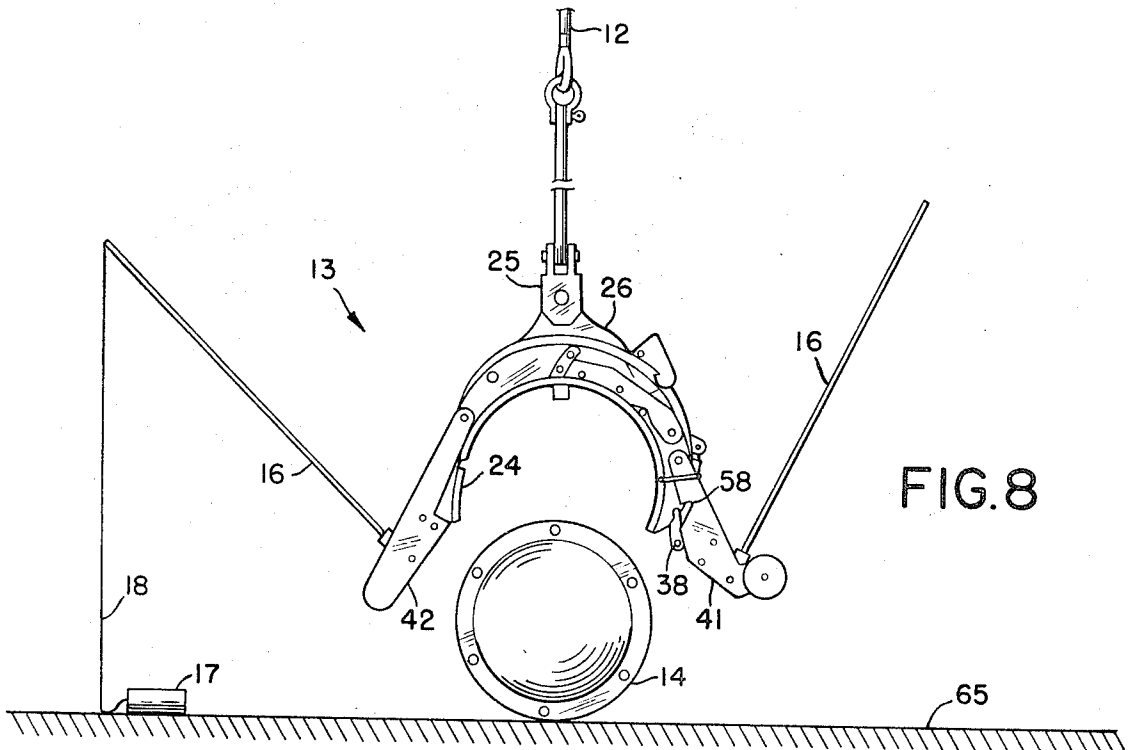
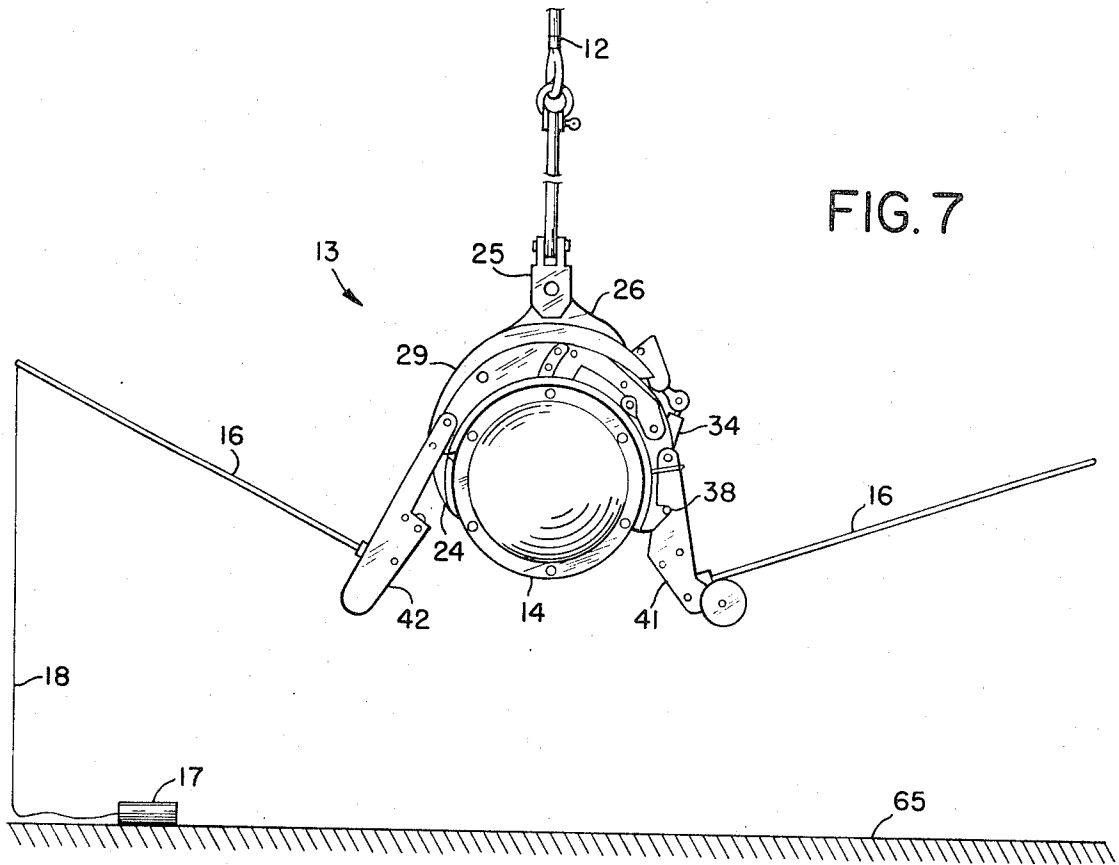


FIG. 5



## HELO RECOVERY SYSTEM TONGS

## 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 therefore.

## 1. Field of the Invention

This invention pertains to a marine salvage device. More particularly, this invention pertains to a marine salvage device for recovery of floating objects. In still greater particularity, this invention pertains to the recovery of floating cylindrical objects. By way of further description but not by way of limitation thereto, this invention pertains to a device for the recovery of torpedoes floating on the surface of the water and incorporates automatic latching means and automatic load release means.

## 2. Description of the Prior Art

In the recovery of torpedoes in the prior art, conventional surface salvage techniques have been employed with limited success. In modern naval exercises, a great many practice torpedoes are frequently employed. Although the cost of these practice units is not so great as pukka torpedoes, none the less, they are complex instruments and expensive if lost. Because of the inefficiencies connected with the aforementioned salvage techniques, a great many practice torpedoes are not recovered following major naval exercises, particularly those of the antisubmarine warfare type.

Aerial support vehicles accompanying a fleet on naval exercises have aided greatly in the recovery of these practice ordnance devices. That is, the aerial vehicle may locate the torpedo floating on the surface and mark it for surface salvage crew to collect at a later time. Also, in some instances, personnel have been deployed from the aircraft and have attached suitable hoisting lines to the practice torpedo such that the aircraft itself was able to recover the device. Of course, such operations are hazardous and time consuming and require the use of highly trained personnel.

Consequently, a need has long been felt by naval forces to have a system which will permit recovery of the practice torpedoes from aircraft without the assistance of either surface salvage ships or personnel deployed from the aircraft.

## SUMMARY OF THE INVENTION

The system of the invention includes a torpedo gripping tong which is lowered to the surface of the water. Two guide legs extend divergently downward from the end of the tongs and serve to guide the tongs and the floating torpedo into a mating relationship. When the tongs engage the torpedo, a spring release mechanism causes the tongs to clamp the torpedo. The tongs are retained in the clamped position by an overcenter catch. Retracting means extend the divergent arms upwardly when the tongs have engaged the torpedo in order to facilitate lowering the torpedo to a fixed surface such as the deck of a support ship. The tongs also incorporate a release mechanism such as to release the grip on the captured torpedo when a contact is made with a rigid surface. The system of the invention also includes a drag weight attached to the tongs so as to stabilize their movement when capturing and releasing the practice torpedo.

## STATEMENT OF THE OBJECTS OF THE INVENTION

It is an object of this invention to provide an improved marine salvage system.

Another object of this invention is to provide a marine salvage system which is deployable from aircraft.

Another object of this invention is to provide a system for recovering cylindrically shaped objects floating on the surface of a body of water.

A still further object of this invention is to provide a salvage system for recovering cylindrical objects from the surface of a body of water from an aircraft including self-actuated attachment and release mechanisms.

A still further object of the present invention is to provide a system whereby floating torpedoes may be recovered by rotary wing aircraft.

Another object of the present invention is to provide a torpedo recovery and handling mechanism which permits torpedoes to be recovered from the surface of the water without the use of personnel either in the water or at the return site.

Still another object of the present invention is to provide a torpedo engaging tool having self-retracting guide legs to facilitate cooperative action between the torpedo engaging member and the torpedo.

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 is a perspective view showing the device of the invention in operational environment;

FIG. 2 is a front elevational view of the device of the invention;

FIG. 3 is a side elevational view of the device of the invention;

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 2;

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 2;

FIG. 6 is a front elevational view showing the device in operation;

FIG. 7 is a view taken similar to FIG. 6 showing the device of the invention gripping the torpedo; and

FIG. 8 is a front view of the invention showing the release of the torpedo.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, an aircraft 11 is shown having list cable 12 depending downwardly therefrom. A tong assembly 13 according to the invention is attached to lift cable 12 to be deployed in a position to engage a torpedo 14 floating on the surface. Although a rotary wing aircraft is shown, it should be understood that other types of aircraft as well as surface vessels may be used in the system of the invention. For example, lighter than aircraft having either rigid or semirigid hulls may be used to good advantage with the system of the invention.

As shown, tong assembly 13 has an arcuate body portion 15 having tubular extension arms 16 depending downwardly and divergently outwardly therefrom. Extension arms 16, which may be made of aluminum or other thin wall tubing, serve to guide the body portion 15 into contact with torpedo 14 in a manner to be more

completely explained herein. A weight 17 is attached to the outward end of one extension arm 16 by means of a suitable lightweight line 18. In this fashion, weight 17 depends downwardly from extension arm 16 and provides stabilization for the tong assembly 13 as it approaches the surface of the water or the fixed deck at which the torpedo will be unloaded. Again, this will become more clear as the description of the invention proceeds.

Referring to FIGS. 2 and 3, the tong assembly of the invention will be described in greater detail. As may be seen, body portion 15 does not grip torpedo 14 directly. Instead, a belting 21 supported on a suitable curved plate 22 comprises most of the torpedo engaging surface. However, a smaller gripping portion comprising a short length of webbing 23 supported on a gripping plate 24 also engages the side of torpedo 14 and provides clamping retention within the tong assembly 13, as will be made clear as the explanation of the device of the invention proceeds.

Similarly, line 12 does not fasten directly to body portion 15 but rather is attached to a suitable shackle 25 which in turn is pivotally attached to a center hanger 26 which is pivotally supported on body member 15 by means of a transverse pivot 27. A similar pivot 28 provides pivoting support for a center member 29 which carries gripping plate 24 and belt 23 into pivotal engagement with torpedo 14.

Center member 29 is held in the illustrated solid line position by suitable latch means which, in the illustrated preferred embodiment, comprises a catch 31 carried on center member 29 so as to engage a suitably shaped detent 32 which is affixedly attached to body portion 15. Catch 31 is released by a load sensing means, such as trigger mechanism 33, when the tong assembly 13 is in contact with torpedo 14.

Those familiar with the article handling arts will observe that, as thus far described, the device of the invention differs only in small detail from conventional tongs used to handle cylindrical objects such as large diameter pipe. For example, the device thus far described may be considered essentially the same as that shown in U. S. Pat. No. 3,479,078 issued on Nov. 18, 1969 to J. T. Doty for "Automatic Latch and Locking Tongs." Because such tongs are relatively well known in the article handling arts further description of conventional features incorporated therein is not deemed necessary or desirable in the description of applicant's invention.

In the devices of the prior art, center member 29 carries gripping plate 24 and webbed gripping surface 23 into pivotal contact with the gripped article by means of a spring which urges center member 29 about pivot 28 when latch 31 is released by trigger mechanism 33. However, for aerial lifts of floating torpedoes this system has proven less than desirable. As may be readily perceived, this inadequacy of the prior art springs has to do with the dynamic nature of the torpedo recovery in comparison to the relatively static and controlled environment of article handling for which such devices were designed. That is, the movement of aircraft 11 imposes dynamic loads on the clamping mechanism as torpedo 14 is lifted and moved through the water and air in its recovery operational sequence which are too great for a spring biased tong to contain.

To overcome such disadvantages of the prior art and to provide positive gripping of torpedo 14 and im-

proved overcenter clamping and locking means is incorporated into tong assembly 13.

As shown, this overcenter and spring linkage comprises an upper link 34 pivotally joined to center member 29 and to lower link 35. Lower link 35, in turn, is attached to a spring yoke 38 which provides a lower anchorage for spring 36 which is connected to center member 29.

When catch 31 is released, spring 36 presses center member 29 arcuately upwardly so as to pivot about pivot 28 and force gripping plate 24, carrying webbing 23 therewith, into engagement with torpedo 14. This movement of center member 29 causes links 34 and 35 to straighten and go into an overcenter position. Should torpedo 14 attempt to escape the grip of gripping plate 24 so as to urge center member 29 downwardly against the spring action of spring 36 overcenter links 34 and 35 are biased against plate 22 or other suitable fixed surface and thereby prevent center member 29 from coming downwardly and releasing torpedo 14. Although the illustrated configuration for links 34 and 35 have proven quite satisfactory in developmental models, other overcenter mechanisms may, of course, be employed if desired. Such modification is well within the purview of those skilled in the mechanical and marine engineering arts.

As previously suggested in connection with FIG. 1, tong assembly 13 is guided into engagement with torpedo 14 by means of extension arms 16 which depend divergently downward therefrom. As will be noted with reference to FIG. 2, divergent arms 16 do not attach directly to body member 15 but, rather, to extensions carried thereon. Extension 41 is a pivoted extension and pivots with respect to body member 15 about pivot axles 39 carried on either side thereof. As may be seen, pivot extension 41 comprises two plates one or either side of body member 15 (as best seen in FIG. 3). These plates are held in unitary relationship by means of various axles and other structure extending therethrough which will be presently described. Of course, if desired, pivot extension 41 may be made of a piece of preformed stock material such as a U channel and thereby have additional rigidity.

The extension on the other side of body member 15 is a fixed extension 42 and depends rigidly downwardly from body member 15 and is secured thereto by passing over pivot axle 28 and being attached to the side of body member 15 by suitable threaded fasteners 43. Of course, if desired, fixed extension 42 may be welded or otherwise made rigid with respect to body member 15.

Extension arms 16, rather than attach directly to pivot extension 41 and fixed extension 42, are carried in pivoted carriers 44 which, in turn, pivot on suitably disposed pivot axles 45 which extend through pivoted extension 41 and fixed extension 42 respectively. It should be noted that in order to facilitate handling within aircraft 11, extension arms 16 are removably secured in pivoted carrier 44. This removable attachment of arms 16 to pivoted carrier 44 may be made of any of several known techniques. For example, a bayonet means, threaded fastening means, set screw retention means, or their known equipments may be used.

The means to lock extension arms 16 in their downward position during torpedo engagement and to retract arms 16 in response to torpedo engagement will now be described with reference to FIGS. 2 and 3. In order for the retraction of arms 16 to be triggered by

torpedo engagement, it is necessary that the release mechanism be responsive to some moving part which is displaced during torpedo engagement. For the arm mounted on pivotal extension 41, it is convenient that this movable portion be part of the overcenter linkage. As a consequence, the position of lower link 35 is used to actuate the retraction mechanism. As shown in FIGS. 2 and 3, a curved paddle 46 is in contact with lower link 35.

Referring now to FIG. 4, it will be seen that paddle 46 is carried on a suitable pivot 47 which in turn passes through a support 48 which is secured to a bracket 49. As may be best seen in FIG. 3, bracket 49 is secured between the sides of pivoted extension 41 by means of threadable fasteners extending therethrough.

Referring now to FIG. 5 which is a section taken along lines 5—5 of FIG. 2, it will be seen that a plunger 51 is also carried within bracket 49 and engages a suitable detent and pivoted carrier 44 to hold it in the downward or illustrated position. Plunger 51 is biased by a spring 52 toward a retracted position which would free plunger 51. Plunger 51 carries rollers 53 by means of roller axle 54 inserted through the end thereof which does not engage pivoted carrier 44. Rollers 53, in turn, engage paddle 46 and force it into engagement with lower link 35. Rollers 53 provide a rolling friction contact with paddle 46 and are superior to a sliding type of follower arrangement.

It may be seen, referring again to FIG. 2, that when trigger mechanism 33 releases center member 29, paddle 46 will be permitted to pivot in an upward direction determined by the position of lower link 35. This pivoting action permits plunger 51 to rise under the influence of spring 52 to withdraw the end from pivoted carrier 44. Pivoted carrier 44 is then pivotally retracted from its position against stop 55 to an upward position by the influence of a tensioned spring 56. As may be seen, spring 56 extends from a suitable attachment point on pivoted carrier 44 to a pin 57 retained in the inner side of pivoted extension 41.

The retraction of the other extension arm 16 is provided in the same fashion except that rollers 53 engage pivoted gripping plate 24 directly and respond to the movement of center member 29 in the same fashion as previously described with respect to paddle 46. As may be seen, paddle 46, rollers 53 and associated structure comprise sensing means to detect the open and closed condition of tong assembly 13 for control of extension arms 16.

When extension arms 16 are retracted, the tong assembly 13 may be more conveniently carried and set down on a deck of a support ship or barge so as to deposit torpedo 14 thereon.

The arrangement providing for the release of torpedo 14 will now be described. Again referring to FIGS. 2 and 3, it will be observed that spring yoke 38 is retained in a suitably configured notch 58 in pivoted extension 41. Also, on the outermost end of pivoted extension 41 a pair of casters 59 are mounted. The corresponding outermost end of fixed extension 42 is made with a friction improving surface such as may be imparted by knurling or placement of a synthetic rubber compound thereon.

Pivotal extension 41 is spring biased into the illustrated position by means of an eye bolt 61 having its eye pivotally attached to body member 15 and the shank of which passes through a spring pivot 62 and has

a biasing spring 63 retained thereon by a suitable fastening means, such as nut 64. As will be obvious to those having skills in marine engineering, springs 63 must be strong enough to resist compression by forces of the magnitude of the weight of tong assembly 13, so as to prevent accidental release of spring yoke 38, but be readily compressible by forces of the magnitude of the combined weight of tong assembly 13 and the object engaged thereby, torpedo 14. As the tong assembly 13 with the torpedo 14 gripped thereby is lowered to a solid surface, such as a deck of a ship, the end of extension 42 grips the surface while casters 59 move pivoted extension 41 outwardly about pivot axle 39 against the biasing action of spring 63.

This pivoted movement of extension 41 permits spring yoke 38 to slide out of slot 58. The moving of spring yoke 38 from its illustrated position in slot 58 relieves the spring pressure from center member 29 and moves to the end of lower link 35 further downwardly to take it from its overcentered position. With the spring tension thus removed, overcenter linkage 34 and 35 are restored to their free position and torpedo 14 may drop free of tong assembly 13 by forcing center member 29 to pivot about pivot 28.

It should be obvious to those versed in the marine engineering arts that the aforescribed structure must be made from a suitably durable material to resist the corrosive action of the saltwater and mechanical strain to which it is subjected. It should be noted that stainless steel and bronze as well as other highly corrosive resistant materials may be used in the fabrication of this device. The longevity of models placed in service is also improved by the use of certain spray lubricant and corrosion resistant materials which are also well known in the art.

#### MODE OF OPERATION

Although the foregoing description of the structure of the system of the invention is believed sufficient to permit one to make and use the system of the invention, the invention will be more thoroughly understood by careful consideration of the preferred mode of operation.

Referring to FIGS. 6 through 8, which show tong assembly 13 in three sequential stages of operation, the mode of operation of the system of the invention will now be described.

Referring to FIG. 6, it will be seen that tong assembly 13 is illustrated as being lowered over torpedo 14. Extension arms 16 extend downwardly on either side of torpedo 14 and have successfully guided tong assembly 13 to a centered position with respect thereto. It will be observed that the tongs are illustrated in their open position with overcenter linkage shown exposed and catch 31 engaging its mating detent and trigger 33 extending downwardly so as to be engaged by torpedo 14.

Referring now to FIG. 7, it will be seen that the catch has been released and the torpedo 14 has been gripped by gripping plate 24 so as to be held within tong assembly 13. In this configuration, center member 29 has pivoted upward to become visible and center hanger 26 has also been extended so as to provide a central pickup point for line 12 thereby keeping the assembly vertical and centered above the torpedo 14. It will also be noted that overcenter linkage 34 has moved from the position illustrated in FIG. 6 and as previously described in connection with FIGS. 2 and 3 to provide gripping and



locking engagement for torpedo 14. FIG. 7 shows the torpedo as it is about to be lowered to a solid deck indicated generally at 65. It will be observed that spring yoke 38 is still positioned within notch 58 on pivoted extension 41. Weight 17 has come to rest on deck 65 and has stabilized the torpedo and tong assembly from rotary, or twisting, movement about line 12.

As the aircraft 11 continues to lower the captured torpedo 14 from the position shown in FIG. 7, it will be obvious that fixed extension 42 will strike deck 65 and that torpedo 14 will pivot about the end thereof so as to bring casters 59 into contact with deck 65. As previously noted, continued lowering causes pivoted extension 41 to be pivoted outwardly about pivot 39 by the actions of casters 59 on deck 65.

Referring now to FIG. 8, it will be seen that pivoted extension 41 has moved outwardly so as to let spring yoke 38 slip from notch 58 and thereby release center member 29 which is pushed aside by the weight of torpedo 14. Torpedo 14 thereby freed of tong assembly drops the short distance, on the order of 3 or 4 inches, to deck 65. Thus freed of its payload, torpedo 14, aircraft 11 is free to recover tong assembly 13 and land. Alternatively, of course, tong assembly 13 may be reset within aircraft 11 and aircraft 11 used to recover additional torpedoes before landing.

Although described in connection to recovering marine torpedoes it should be obvious that the device of the invention may be used to recover other cylindrical objects floating on the surface of the water. Likewise, the tong assembly of the invention may be used in conjunction with surface vessels instead of aircraft.

The foregoing description taken together with the appended claims constitutes a disclosure such as to enable a person skilled in the mechanical and marine engineering arts having the benefit of the teachings contained herein to make and use the invention. Further, the structure herein described meets the aforesaid objects of the invention, and generally constitutes a meritorious advance in the marine arts unobvious to such skilled artisans not having the benefit of these teachings.

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. A marine salvage system for recovery of an object floating on the surface of a body of water comprising: a pair of pivoted tong members shaped to conform to the contours of the floating object; spring means effectively connected between the individual tong members comprising said tong pair for resiliently biasing said tongs in a closed or object gripping configuration; overcenter linkage means effectively connected between the individual tong members for lockably securing said tong means in a closed or gripping position; and latch means connected between the individual tong members so as to hold said tong members in an open position against the biasing force of said spring means for selectively releasing said individual tong members and permitting them to close about said floating object under the influence of

said spring means and lock thereabout under the influence of said overcenter linkage means, whereby said floating object may be lifted from the water by said tongs.

2. A marine salvage system according to claim 1 further including:

fixed extension means rigidly attached to one tong member to extend downwardly and outwardly in relation to the opening of said tong pair for providing a rigid member to assist placing the tongs over the floating object and in positioning the tongs during unloading;

pivoted extension means attached to the same tong member as said fixed extension means in such a manner as to pivot in relation thereto and positioned on the opposite side of said tong for cooperation with said fixed extension in guiding said tongs into engagement with said floating object;

notch means in said pivoted extension means shaped for retention of one end of said spring means in a compressed condition in one position thereof and release of said spring means in another position thereof;

resilient biasing means connected between said pivoted extension means and said tong member to which it is attached for resiliently biasing said pivoted extension means toward said tong member so as to position said notch means to hold said spring means in a compressed condition.

3. A marine salvage system according to claim 2 in which said resilient biasing means exerts a force which is large in respect to the mass of the tong assembly but is small in relation to the mass of said tong assembly together with the object to be gripped thereby.

4. A marine salvage system according to claim 3 further including caster means attached to the outermost end of the aforesaid pivoted extension means for cooperating with said fixed extension means when said assembly is lowered onto a fixed surface so as to move said pivoted extension means outwardly and thereby release the aforesaid spring means from the aforesaid notch means.

5. A marine salvage system according to claim 2 further comprising extension arm means retractably mounted on said fixed and pivoted extension means and extending downward and divergently outward therefrom for assisting said fixed and pivoted extension means in guiding the aforesaid tong members into engagement with the object to be grasped thereby.

6. A marine salvage system according to claim 5 further including:

pivoted carrier means mounted on said fixed and pivoted extension means and configured so as to receive said extension arm means for pivotal retraction of said extension arms;

retraction spring means connected between said pivoted carrier means and said extension means for biasing said pivoted carrier means into a retracted position; and

carrier latch means effectively connected to said extension means and engaging said pivoted carrier means for locking said pivoted carrier means and said extension arm means carried thereby in a downward position.

7. A marine salvage system according to claim 6 in which said carrier latch means includes:

plunger means engaging detent means in said pivoted carrier means for locking said pivoted carrier against the retraction bias of said retraction spring means;

plunger spring means effectively connected between the aforesaid pivoted and fixed extension means for biasing said plunger to a position where it is withdrawn from the detent is said pivoted carrier means; and

sensing means connected between said plunger means and a moving part which is actuated by the aforesaid latch means for permitting said plunger means to move in response to said plunger spring means,

whereby said pivoted carrier means and the extension arms carried thereby are retracted upon release of the aforesaid tong means by the aforesaid latch means.

8. A marine salvage system according to claim 7 in which said sensing means includes:

paddle means pivotally mounted on the aforesaid pivoted extension means and in contact with the aforesaid overcenter linkage means for sensing movement of said overcenter linkage means; and

roller means mounted on said plunger means to rollingly engage said paddle means for holding said plunger in engagement with said pivoted carrier in one position of the aforesaid overcenter linkage and for releasing said plunger in another position of said overcenter linkage.

9. A marine salvage system according to claim 7 in which said sensing means includes roller means mounted on said plunger and rollingly engaging one of the aforesaid tong members for holding said plunger in contact with said pivoted carrier in the position of said tong member corresponding to the open condition and for releasing said plunger in the position corresponding to the closed or clamped position.

10. Recovery tongs for use in an aerial recovery system for retrieving an object floating on the ocean and dropping the object on a deck comprising:

a pair of pivoted, arcuate tongs for gripping an object, one tong being stationary and the other tong being movable between open, cocked, and closed, grip positions;

an overcenter lever assembly mounted between the tongs for locking the movable tong in the closed, grip position;

a latch for locking the movable tong in the open cocked position, and a trigger extending within the tongs and actuable by pressure of the object for leasing the latch so that the tongs will close to grip the object;

a pair of spaced apart extensions, one fixed to one arcuate end of the stationary tong and one pivotally mounted on the other arcuate end of the stationary tong, the pivoted extension having a wheel mounted at its bottom end so that the pivoted extension will roll on a deck so as to pivot from an inward position to an outward position;

the pivoted extension having a shaped notch therein, and the overcenter level assembly having a pin engageable within said shaped notch and being engaged with the pivoted arms are in their inward position for retaining the movable tong in a closed position, being disengaged when the pivoted arms are forced to an outward position so as to release the movable tong to an open position;

a pair of extension arms;

a spring-biased, pivoted carrier mounted on each of said pair of extensions and each receiving and retaining one of said pair of extension arms, each spring-biased, pivoted carrier being pivotable between a down position where the extension arms guide the object to the tongs and up position, each pivoted carrier having a depression therein;

a spring plunger mounted adjacent each pivoted carrier and lockable within the depression of a respective pivoted carrier for cocking the pivoted carrier and extension arm retained therein in a down position;

sensing means connected to said spring plungers and sensing the movement of said pivoted arcuate tongs for moving said spring plunger from said depressions,

whereby said extension arms will move from the down position to a retracted position when the object is gripped by said pair of pivoted arcuate tong means.

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