Nov. 8, 1955 M. W. ANSELL 2,723,153

AUTOMATIC CLAMP FOR RAISING SHIPS AND OTHER OBJECTS

Filed Nov. 12, 1954 2 Sheets-Sheet 1

FIG-1

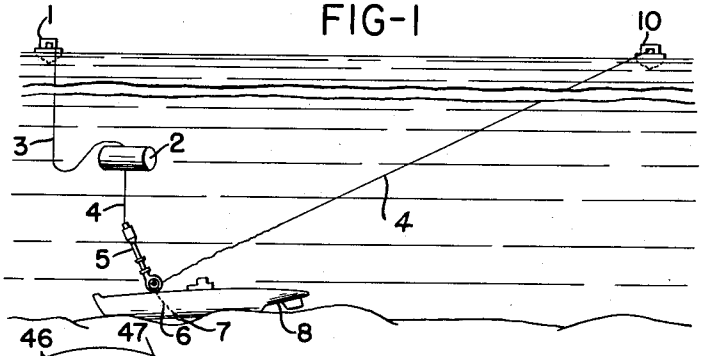


FIG-2

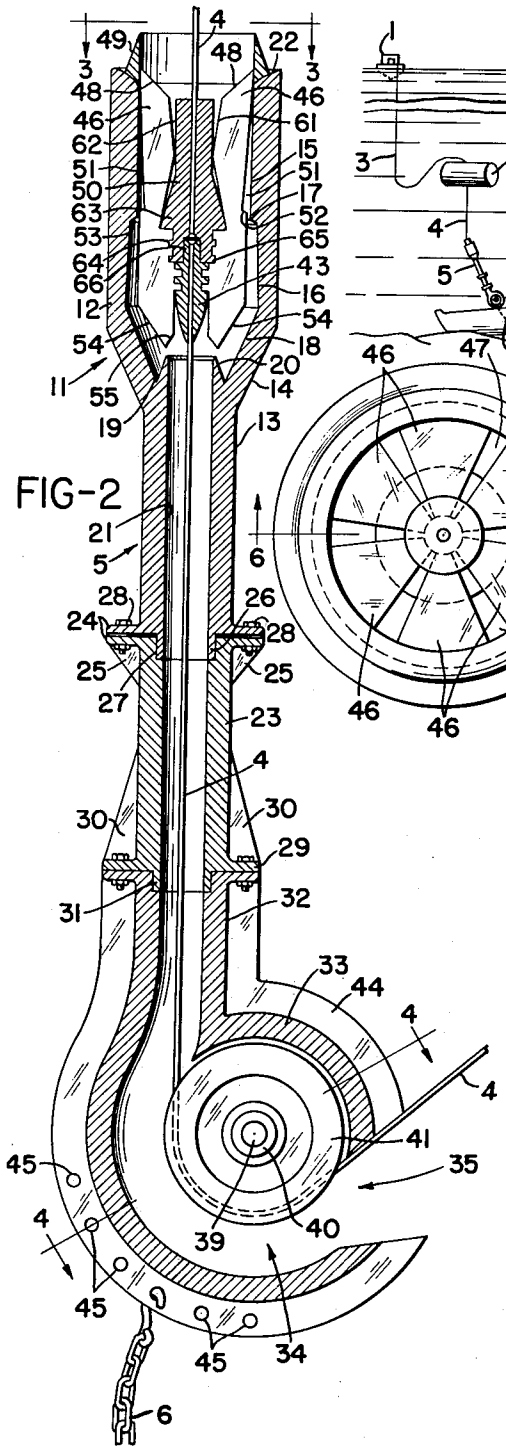
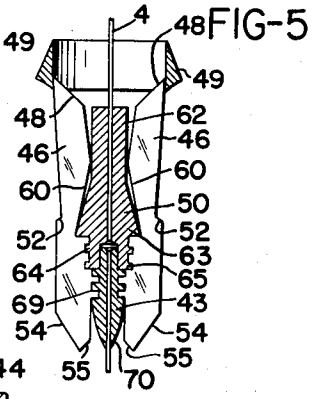


FIG-3

FIG-5



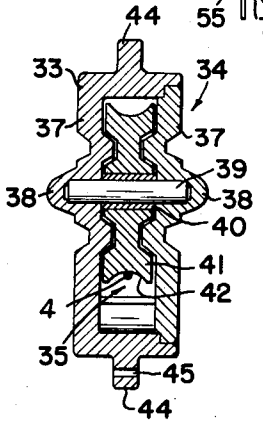


FIG-4

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AUTOMATIC CLAMP FOR RAISING SHIPS AND OTHER OBJECTS

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FIG-6

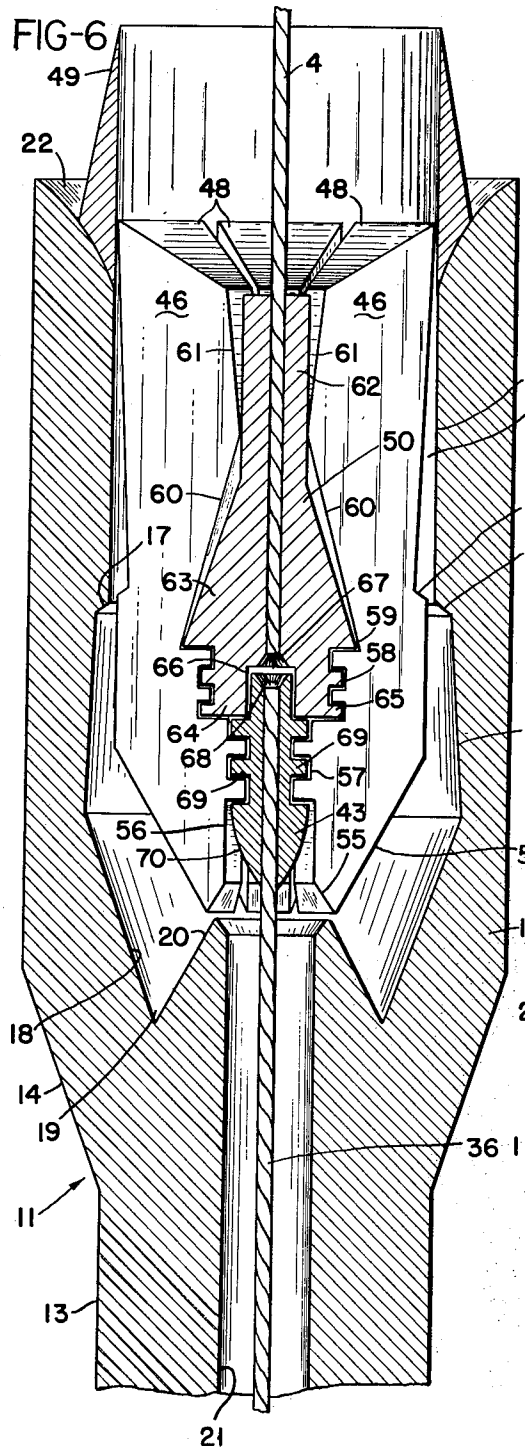
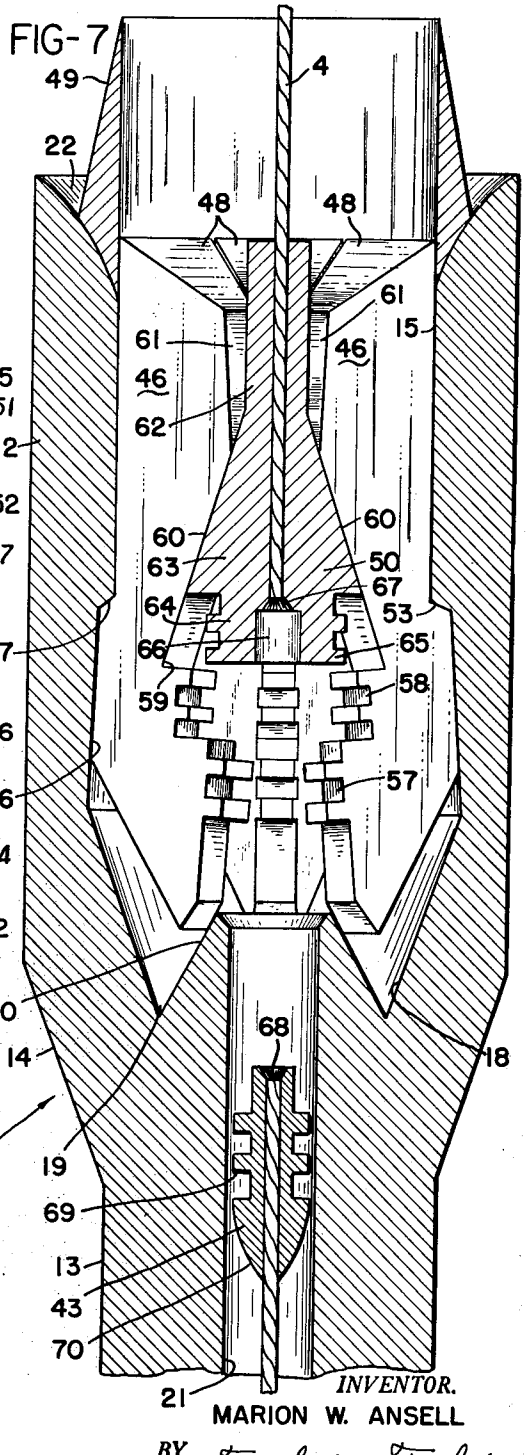


FIG-7



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United States Patent Office 2,723,153 Patented Nov. 8, 1955

2,723,153

AUTOMATIC CLAMP FOR RAISING SHIPS AND OTHER OBJECTS

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Application November 12, 1954, Serial No. 468,226

11 Claims. (Cl. 294—66)

The present invention relates to apparatus for raising sunken ships. It is a most difficult task to raise sunken hulks as the diver must handle heavy lifting cables at the bottom of the ocean and attach the same onto the sunken boat. Often this work is accompanied by rough seas, swift undercurrents, deep water and shifting location of the hulk. Sunken ships represent extremely heavy objects, particularly when fully loaded, which requires a strong grip at the point of contact, that will hold under heavy pull and swaying effects.

The main difficulty in raising ships, apart from the necessary limitations of action by the diver, is that the cable from the pneumatic lifting tank or tanks to the hook that is attached to the wreck is of a non-adjustable length so that it requires considerable maneuvering of the tank to bring the hook opposite the wreck and divers have lost their lives in attempting to apply the hook when the cable was either too taut or too slack. Moreover, the structures to which these lifting cables and hook elements are attached are often cumbersome and hard to handle by the limited operations of the diver, particularly when working at extreme depths of water.

The primary object of the invention is to simplify the apparatus for raising sunken ships and to make the apparatus more wieldable and controllable by the divers.

Another object is to provide ship raising apparatus which will reduce the manipulation hazards to the diver and is adapted readily to be controlled, even to the greatest depths and in the case of heavy ships.

Still another object is to provide apparatus which permits the maximum adjustability of the length of the lifting cable between the pneumatic tank and the ship being lifted so that the diver will have the greatest opportunity to bring the lifting cable in line with the point of contact at which the sunken ship is to be grasped.

The above objects are attained, in brief, by providing a two-part detachable clamping link in the length of the cable, in which the main part of the cable is attached to the interior parts of the link, while the outer part of the link constitutes the member to which the hooks are attached.

This outer portion of the link may comprise a casing from which lifting chains extend and terminate in hooks for grappling the ship, while the interior parts of the link constitute a multi-sectioned expansible element which, when in an unexpanded condition, can be readily received by the interior of the casing, but by the removal of a so-called shuttle, these sections or segments to which the lifting cable is indirectly secured are caused to move outwardly against the interior surface of the casing and there to be locked in place so as to secure the lifting cable to the casing after the latter has been fastened to the sunken ship.

This clamping operation between the two parts of the link by the removal of the shuttle is performed after the diver has left the vicinity of the sunken vessel, so that there is little or no opportunity for accidents to occur when dealing with these very heavy lift forces.

Other objects and features will be apparent as the specification is perused in connection with the accompanying drawings, in which:

Figure 1 is a diagrammatic view of the improved ship raiser or two-part detachable clamping link, and showing the manner of its use;

Figure 2 is a vertical section of the improved ship raising clamp after the inner and outer links have been brought together preparatory to causing the inner link to expand against the outer link.

Figure 3 is an end view of the clamp or two-part link, looking in the direction of the arrows at line 3—3 in Figure 2;

Figure 4 is a sectional view of the pulley structure, somewhat diminished, taken along the line 4—4 in Figure 2;

Figure 5 is a view, partly in section and partly in elevation, of the inner portion of the two-part link which can be lowered or otherwise inserted by the diver into the outer or casing portion of the link after the latter has been secured to the wreck;

Figure 6 is a vertical sectional view of the upper portion of the clamping device, somewhat enlarged, and taken along the line 6—6 in Figure 3; this figure shows the holding shuttle in place; while

Figure 7 is a view similar to Figure 5 but with the shuttle disengaged and the remaining inner parts in clamping relation with respect to the casing preparatory to applying lifting force to the automatic clamp.

Referring more particularly to Fig. 1, reference character 1 designates a vessel having on board large air compressors for supplying a pneumatic tank 2, shown as being submerged, with air. An airline 3 connects the vessel 1 with the tank. One or more lifting cables 4 are connected between the tank 2 and the two-part link or automatic clamp 5 which constitutes the subject of the present invention. The link 5 is attached by a chain 6 and a hook 7 to the keel of a sunken ship 8.

From the lower end of the link 5 there is a cable 9 which extends to the windlass of a second ship 10 which is positioned a substantial distance from the pneumatic tank 2 and the vessel below. The purpose of the vessel 10 and its cable will be explained hereinafter.

As shown more particularly in Figs. 2 and 6, the adjustable clamp is formed as a two-part link in which the outer part is constituted of a cylindrical casing 11, itself formed of three parts bolted together in alignment, which will be described presently. The inner part of the two-part link is illustrated in detail in Fig. 5 and, in general, comprises the mechanism by which the cable 4 which is attached to the pneumatic tank 2 is made fast to the casing 11, and through the casing to the sunken ship, as will also be explained hereinafter.

The outer casing portion of the two-part link, as shown in Fig. 2, comprises the cylindrical member 11 described hereinafter, which is formed of an upper section 12 and a lower section 13, tapered as at 14. The interior portion of the upper section 11 is bored out to different diameters, the smaller diameter being indicated at 15, and the larger diameter at 16, with a chamfered edge 17 between the bores in between. The bore 16 terminates in a tapered portion 18 which has a V-shaped circular recess 19 at the bottom to leave an upstanding lip 20. A bore of constant diameter 21 is provided through the shank portion 13 of the casing. The upper end of the casing terminates in an outwardly flared edge 22 that preferably conforms slightly to a curve.

Extending in line with the shank portion 13 and constituting an extension thereof, there is a tubular member 23 bolted or otherwise secured to the lower edge of the casing. In order to assure rigidity at the joint, each of the casing portions 13 and 23 at the abutting edges, is

provided with an outwardly extending flange 24 with diagonal ribs 25, if desired, to reinforce the strength of these flanges.

The shank portion 13 may be provided with a circular tongue 26 which fits into a corresponding recess 27 in the member 23 so that the two members 13 and 23 can be securely bolted, as indicated at 28, to carry the lifting effect of the casing, as will be described hereinafter.

The lower end of the tubular member 23 is provided with an outwardly extending flange 29 and strengthening ribs 30, also a circular tongue 31 which fits into a circular recess of the lowermost portion 32 of the casing. The latter has a bore of which the entrance portion is in line with the bore 21 of the casings 23, 13 and is provided with a circular casing section 33 which constitutes a housing for a pulley and bearing indicated generally at 34 (Fig. 4).

The housing 33 is closed about its entire periphery except for an opening 35 through which the cable 4 extends. The top and bottom sides indicated at 37 of the housing 34 are provided with outwardly extending protuberances 38 at the center which form a fixed bearing for a shaft 39. A bushing 40 surrounds the shaft and there is a pulley 41 having a deep groove 42 which is mounted on the pulley. The latter will rotate about the shaft 39.

The cable 4 extends around the groove of the pulley, as indicated in Fig. 4, and then upwardly through the bores of the casing sections 32, 23, 13 where it is secured to a shuttle 43. Around the outside surface of the casing portions 32, 33 there is a strengthening rib 44 secured edgewise to these portions as far as the opening 35. The latter is so positioned with respect to the housing and the rib 44 that the cable 4, after leaving the groove of the pulley 41, can extend angularly upward to the windlass of the vessel 10.

Openings 45 are provided at various places along the lower part of the rib 44, these openings will receive one or more chains 6 which terminate in hooks 7 (Fig. 1) for grappling the ship. The purpose of providing a number of these openings will also be explained as the description proceeds.

The inner portion of the two-part link, shown more clearly in Fig. 5, comprises a number of segments 46, six as illustrated in Fig. 3, which extend almost the entire length of the casing portion 17 and are fitted edgewise within the casing with spaces 47 occuring between these segments (Fig. 3). The segments are tapered at the top as indicated at 48, and in order to hold them together, for reasons explained hereinafter, a circular ring 49 of triangular cross-section is employed in which the interior diameter snugly fits the outside peripheral edges of the segments when the upper edges of these segments are forced outwardly by means of a circular plug 50, the details of which will be described presently.

The outside peripheral surfaces of the segments 46 are such that when assembled and held together by the ring 49 a space 51 is left between the edges and the interior surface of the casing 17. A circular jog 52 is provided around these segments and this jog is normally positioned just above the tapered surface 17 of the casing and from that point on downward the segments have a diameter which is somewhat less than the diametral surface 16 of the casing. The segments terminate in an inwardly directed tapered portion 54 which finds its counterpart in the taper 18 of the casing and there is an upwardly positioned taper 55 at the bottom point of each segment so that the tapers 54, 55 are adapted under certain circumstances to extend into the circular recess 19.

The segments are provided with a reentrant bore 56 and there are circular grooves 57 immediately above this bore and also additional circular grooves 58 of larger diameter than the grooves 57. A circular notch 59 is provided at the inner surface of the segments which extends into an inwardly projecting taper 60 and then an outwardly extending taper 61, the latter finally merging with the tapered portion 48.

Fitted snugly within the inner surfaces of the segments 46 there is the circular plug 50 which is constituted of a portion of constant diameter, indicated at 62, and then an outwardly extending portion at 63, directly opposite the tapered portion 60 of the segments, to fit snugly into the circular notch 59. The plug terminates in a smaller diameter portion 64 having square shaped ridges 65 which snugly fit the grooves 58 of the segments. There is a circular recess 66 extending upwardly in the portion 64 and there is a small bore extending along the entire length of the plug in order to receive the cable 4. The latter is welded, as indicated at 67, to the plug at the base of the circular recess 66.

Also fitting into this recess there is the upper portion of the shuttle 43, the cable 4 passing through the length of the shuttle and being welded, as indicated at 68, to the uppermost surface of the shuttle within the circular recess 66. This shuttle is provided with circular ridges 69 which fit the circular grooves 57 of the segments and the shuttle terminates in a curved conical portion 70, approximately in line with the lower edges of the segments. The shuttle is provided with a centrally positioned bore to receive the cable 4 and, as stated hereinbefore, the latter is secured to the uppermost edge of the shuttle.

Operation

Under normal operation the inner part (Fig. 5) of the two-part link is ordinarily detached from the outer casing 13 of the link so that when the diver descends it becomes necessary for him only to attach the casing, i. e. the joined parts 13, 23, 32 to the most convenient part of the sunken vessel and this he does by connecting the chain 6 and the hooks 7. The chain 6 is placed in the proper opening 45 in the circular rib 44, which the diver contemplates would leave the casing substantially vertical when upward pressure is applied to the casing. For this reason a number of openings 45 are provided for the diver's convenience.

The pneumatic tank 2 is then caused to move downwardly by admitting water thereto in any suitable and well known manner and, finally, the cable 4 together with the inner part of the link, comes within reach of the diver who at this time is grasping the casing that had previously been secured to the ship. The diver then inserts the ring 49 into the casing, together with the clamped segments and the contained plug 50, also the shuttle 43, bringing the cable 4 down through the casing and around the pulley 41 to be attached to a cable portion 4 that previously had been laid by the second vessel 10.

Under these circumstances, the inner structure of the link is completely movable in or out of the casing since there are no clamping effects at this time exerted between the segments 46 and the interior surface of the casing 13. However, by keeping the cable 4 taut, it is possible to hold the inner part of the two-part link within the casing even in the absence at this time of any clamping effects.

The diver then signals the boat which controls the air-lifting tank and he immediately ascends. When the diver is safely aboard this boat, the vessel 1 will start to pump air into the air-lifting tank 2 to raise this tank, and at the same time the vessel 10 will pull on the cable 4 to cause the shuttle 43 to first pull downwardly and thereby to drag the segments 46 downwardly, causing the circular jog 52 to clear the shoulder in the larger diameter portion 16 of the casing, at which time the segments tend to spread outwardly at the bottom to fill this portion of the casing indicated at 16, so that the jog 52 is now completely locked against the shoulder or taper 53 and the segments are intimately secured to the casing.

The plug 50 remains tightly contained within the segments as the lower portions spread outwardly with

respect to their upper portions so that pulling up on the cable 4 will cause the plug 50 at the tapered surface 63 to further spread out the segments and to cause them to clamp rigidly against the inner surfaces of the casing at the shoulder 53.

The manner in which the shuttle first moves the segments 46 downwardly by applying pressure at the ridges 69 and the grooves 57 which, in turn, causes these segments to slide along the tapered surface 63 of the plug 50, thereby expanding the segments, is shown more clearly in Figs. 6 and 7. In Fig. 6 it will be noted that the segmental unit, including the contained plug and shuttle, are readily removable out of the casing except, of course, for any restraining pull on the cable 4 so that there is no locking action between the circular protuberance 52 of the unit and the corresponding shoulder 53 of the casing.

Contrasting this condition and position of the elements as shown in Fig. 6 with the position shown in Fig. 7, it will be noted that when the shuttle 43 is first moved downwardly by pulling on the cable 4 which, in turn, causes the lower parts of the segments 46 to move outwardly along the taper of the plug, the shuttle is completely released from the segments at the grooves 57 which move outwardly and the shuttle is then free to be moved through the bore 21 around the pulley 40 and eventually arrives at the windlass on the vessel 10 (Fig. 1).

When air is caused to displace the water in the tank 2 and thereby give the latter a lifting buoyancy, the upward pull on the cable 4 causes the taper of the plug 50 continually to press the segments 46 outwardly to assure a positive locking effect at the shoulder 53 of the casing. It is also apparent that as these segments move outwardly, due to the outward pressure of the plug 63, the ridges 65 of the plug are released from the circular grooves 58 which permits the plug 50 to move slightly upward with respect to the segments and thereby according a greater outward pressure to the segments to increase the friction effect between the segments and the interior surface of the casing.

Thus, the inner or segmental unit is secured to the casing when the shuttle 43 is removed, as shown in Fig. 7, and an upward pull is exerted on the plug 50 by the cable 4, not only by the positive locking effect at the shoulder 53, but also by considerable friction effects between the outer edge surfaces of the segments and the immediately adjacent interior surface of the casing.

The apparatus is ready to be used over again by simply retrieving the shuttle and placing the same within its circular grooves 57, the entire unit including the segments being held together by the ring 49.

Instead of inserting the segments 46, the plug 50 and the shuttle 43 as a unit and held together by the ring 49 into the interior of the casing after the latter has been secured to the ship or other object to be lifted, the diver can, if he so desires, assemble all of the parts together in the casing before attachment is made to the ship at the chain 6 and the hooks 7. This will usually be a little more difficult under normal circumstances but it can be accomplished.

It will be noted that at the time downward pressure is exerted on the shuttle 43 and the latter is eventually removed from the multi-sectioned unit upon expansion of the elements of this unit, the diver is usually safe on board one of the vessels so that there are little or no hazards attached to the job of putting the ship raising device in place and attaching to the sunken hull. Moreover, the permissible movement between the segmental unit and the casing until the various pulls have been exercised on the cable 4 greatly facilitates the last-minute adjustments by the diver in positioning the casing with respect to the ship to be raised. In fact, if desired, as explained hereinbefore, the casing may be completely detached from the segmental unit until after the casing has been attached to the ship at the chain 6, and thereafter the diver can conveniently position the segmental unit within the casing.

All of the parts of the apparatus, including the casing, segments, the plug, shuttle and the pulley member, are of rugged construction and yet not too heavy for manipulation by one or two divers working together. The speed with which the two-part link, which includes the casing and the movable segmental unit, can be attached to the sunken ship and placed in position for a lift by the pneumatic tank is considerable so that divers can normally work at greater depths when utilizing lifting devices of the character described.

It will be understood that various modifications and arrangements in structure could be made without departing from the spirit of my invention and, accordingly, I desire to comprehend such modifications and substitutions of equivalents as may be considered to come within the scope of the appended claims.

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

1. Ship raising apparatus comprising a hollow casing adapted to be secured to a sunken ship, a plurality of segmental members arranged edgewise within said casing and stopping short of the center of the casing to leave an opening, a tapered plug in the upper portion of said opening adapted to bear against the inner edges of the segments to force them outwardly when a pull is exerted on the plug, and means for locking the outer edges of the segments to said casing when the segments have been forced outwardly by said plug.

2. Ship raising apparatus comprising a two-part link, the parts of which can be separated from one another, one of the parts comprising a hollow casing which is adapted to be attached to the sunken ship, the other part comprising a unit formed of a plurality of segments nested edgewise within the casing, a protuberance formed around the outer peripheral surfaces of the segments and a corresponding shoulder provided on the interior surface of the casing, and means for forcing the segments outwardly against the casing when a pull is exercised on the inner part of the link and to cause the protuberance of the segments to lock against the shoulder of the casing and thereby join the two parts of the link rigidly together during the pulling operation.

3. Ship raising apparatus comprising a two-part link, the parts of which can be separated from one another, one of the parts comprising a hollow casing which is adapted to be attached to the sunken ship, the other part comprising a unit formed of a plurality of segments nested edgewise within the casing, a protuberance formed around the outer peripheral surfaces of the segments and a corresponding shoulder provided on the interior surface of the casing, and means for forcing the segments outwardly against the casing when a pull is exercised on the inner part of the link and to cause the protuberance of the segments to lock against the shoulder of the casing and thereby join the two parts of the link rigidly together during the pulling operation, said means comprising a plug extending along the inner surfaces of said segments and having a tapered surface, said inner surfaces of the segments having correspondingly tapered surfaces, a lifting cable secured to said plug so that as a lifting effect is applied to the plug the tapered surface of the plug reacts against the tapered surfaces of the segments to expand and force the latter outwardly against the inner surface of the casing.

4. Ship raising apparatus comprising a clamping mechanism carried by a pull cable, said mechanism being adapted to be secured to a sunken ship, said mechanism including a hollow casing and a plurality of segmental members nested together in the casing and stopping short of the center to leave an opening which receives a plug, said plug being secured to the pull cable, a shuttle contained within the lower portion of the opening left by said segmental members and attached to a release cable, and

means whereby when the release cable is pulled to disengage the shuttle from said members, and an upward pull is applied to said plug, said members are forced outwardly against said casing to lock said members with respect to the casing and the outward movement of said members releases the shuttle.

5. Ship raising apparatus comprising a hollow casing adapted to be secured to a sunken ship, a detachable unit within the casing carrying a lifting cable, said unit including a plurality of segmental members nested together but stopping short of the center to leave an opening, a plug in said opening, said members being adapted to move through a limited distance within the casing, said lifting cable being secured to said plug, a shuttle adapted to move longitudinally of said casing and contained within the opening formed by said segmental members, said shuttle serving to move the segmental members with respect to the plug, said plug and the adjacent faces of the segmental members being tapered so that the relative movement causes the segmental members to expand outwardly and to contact by friction the interior surface of the casing, whereby said members and the casing are locked together.

6. Ship raising apparatus comprising a hollow casing adapted to be secured to a sunken ship, a detachable unit within the casing carrying a lifting cable, said unit including a plurality of segmental members nested together but stopping short of the center to leave an opening, a plug in said opening, said members being adapted to move through a limited distance within the casing, said lifting cable being secured to said plug, a shuttle adapted to move longitudinally of said casing and contained within the opening formed by said segmental members, said shuttle serving to move the segmental members with respect to the plug, said plug and the adjacent faces of the segmental members being tapered so that the relative movement causes the segmental members to expand outwardly and to to contact by friction the interior surface of the casing, whereby said members and the casing are locked together, and means for providing a positive lock between the segmental members and the casing, said last-mentioned means comprising a protuberance provided on the outer surface of the segmental members and a corresponding shoulder on the interior surface of the casing so that when said members are expanded outwardly the said protuberance is forced against the shoulder of the casing and forms a positive lock from movement between the members and the casing in the longitudinal direction.

7. Ship raising apparatus comprising a hollow casing adapted to be secured to a sunken ship, a detachable unit within the casing carrying a lifting cable, said unit including a plurality of segmental members nested together but stopping short of the center to leave an opening, a plug in said opening, said members being adapted to move through a limited distance within the casing, said lifting cable being secured to said plug, a shuttle adapted to move longitudinally of said casing and contained within the opening formed by said segmental members, said shuttle serving to move the segmental members with respect to the plug, said plug and the adjacent faces of the segmental members being tapered so that the relative movement causes the segmental members to expand outwardly and to contact by friction the interior surface of the casing, whereby said members and the casing are locked together, means for providing a positive lock between the segmental members and the casing, said last-mentioned means comprising a protuberance provided on the outer surface of the segmental members and a corresponding shoulder on the interior surface of the casing so that when said members are expanded outwardly the said protuberance is forced against the shoulder of the casing and forms a positive lock from movement between the members and the casing in the longitudinal direction, and means for bringing the protuberance on said segmental members in line with the shoulder of the casing, said last-mentioned means comprising a shuttle contained within the bore formed by the inner surfaces of the segmental members and adapted to move the segmental members a limited distance with respect to the casing to bring said protuberance and shoulder into line, whereby said shuttle is released entirely from the unit as the segmental members are caused to expand and the lock between said protuberance and shoulder is effected.

8. Ship raising apparatus comprising a hollow casing adapted to be secured to a sunken ship, said casing having a peripheral shoulder on the interior, an expansible unit within said casing, said unit comprising a plurality of segments nested together and arranged edgewise, said segments having a circular protuberance which is adapted to fit against said shoulder when the segmental unit is moved with respect to the casing and is simultaneously expanded against the casing, whereby the unit and casing are locked together, an expanding device for said segments and contained therein, and a lift cable secured to said device, a shuttle contained within said segments and located below said device, said shuttle being adapted to be released from said segments simultaneously with a pulling effect on said device whereby the segmental unit is first caused to move longitudinally with respect to the casing and thereafter caused to expand against the inner surface of the casing and to be locked thereto at the position of said protuberance and shoulder.

9. Ship raising apparatus comprising a hollow cylindrical casing adapted to be secured to a sunken ship, a multi-sectioned expansible lifting unit within the casing and a lifting cable secured to said unit, said casing having a shoulder about its periphery, said unit being provided with a protuberance located a short distance above the shoulder on the casing, means for moving said unit downwardly in the casing to a position where the protuberance and shoulder are directly opposite one another, and means for expanding said unit to cause the protuberance to engage the shoulder of the casing after the casing has been attached to the sunken ship whereby the unit and casing are secured together and an upward pull on the lifting cable will raise the ship.

10. Ship raising apparatus comprising a hollow cylindrical casing adapted to be secured to a sunken ship, a multi-sectioned expansible lifting unit within the casing and a lifting cable secured to said unit, said unit including a centrally located plug having a tapered surface, said casing having a shoulder about its periphery, said unit being provided with a protuberance located a short distance above the shoulder on the casing, means for moving said unit downwardly in the casing to a position where the protuberance and shoulder are directly opposite one another, and means for expanding said unit to cause the protuberance to engage the shoulder of the casing after the casing has been attached to the sunken ship whereby the unit and casing are secured together and an upward pull on the lifting cable will raise the ship, said means for moving the unit downwardly comprising a shuttle which is detachably secured to the unit and said means which causes the unit to expand and the protuberance and shoulder to engage being constituted of a plug member having a tapered surface which cooperates with the tapered surfaces on the unit when a pull is applied to the lifting cable.

11. Ship raising apparatus comprising a hollow cylindrical casing adapted to be secured to a sunken ship, a plurality of segmental members arranged edgewise within said casing and stopping short of the center of the casing to leave an opening, a tapered plug in the upper portion of said opening adapted to bear against the inner edges of the segments to force them outwardly when a pull is exerted on the plug, the lower ends of said segments terminating in two groups of circular grooves, the groups being of different diameters, said plug having an extension provided with a plurality of circular ridges which are adapted to be received by the circular grooves of larger

diameter in the segments, a shuttle contained within the lower portion of the opening left by said segmental members and attached to a release cable, said shuttle being provided with circular ridges which are adapted to be received by the circular grooves of smaller diameter in the segments, a pull cable attached to said plug, and means whereby when the release cable and the pull cable are pulled in opposite directions the shuttle first causes the segmental members to move longitudinally of the casing and then to be disengaged from the segmental members as the tapered surface of said plug bears against the segmental members to cause them to expand outwardly and to release both the plug and the shuttle from the respective circular grooves in the segmental members.

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