

Oct. 10, 1944.

J. B. BARNETT

2,359,964

SALVAGING APPARATUS

Filed Sept. 23, 1942

2 Sheets-Sheet 1

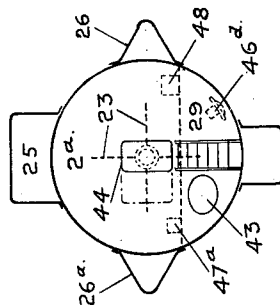
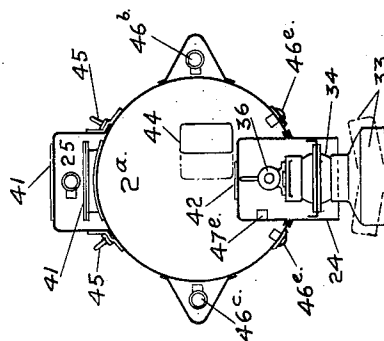
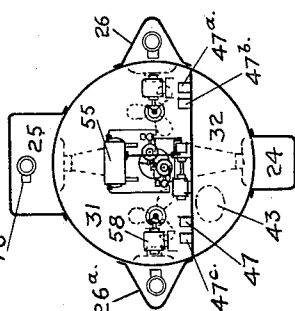
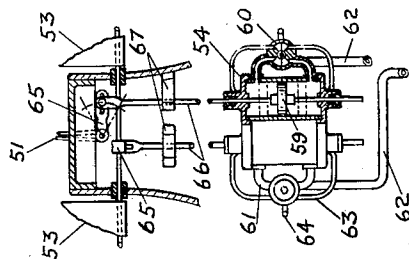
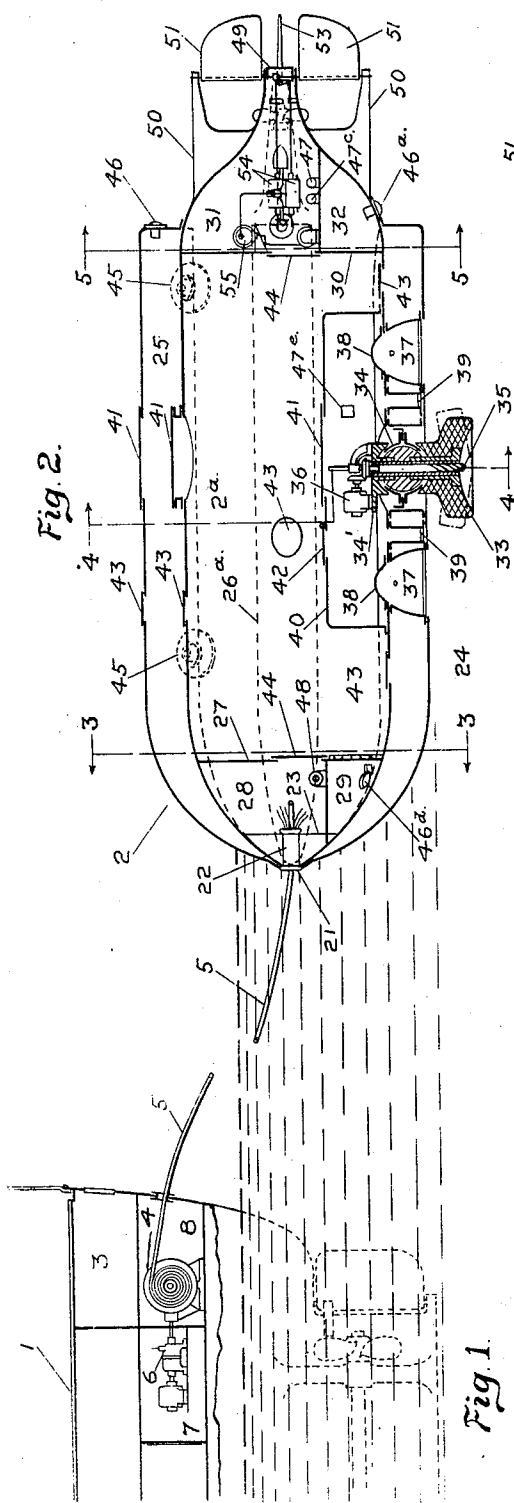


Fig. 6.

Fig. 5.

Fig. 4.

Fig. 3.

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2 Sheets-Sheet 2

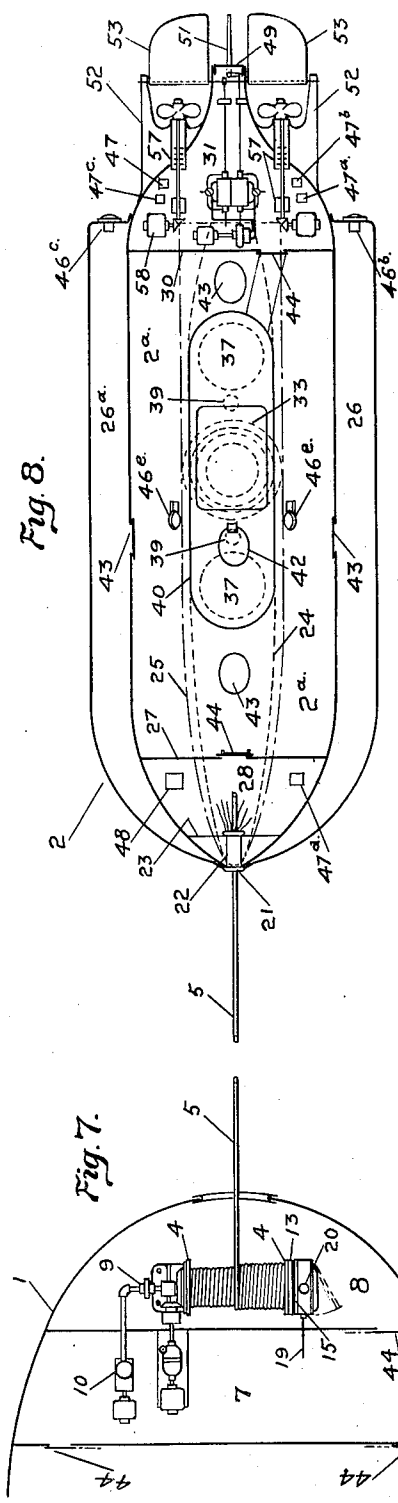


Fig. 8.

Fig. 7.

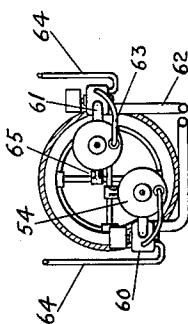


Fig. 9.

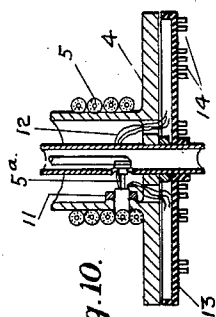


Fig. 10.

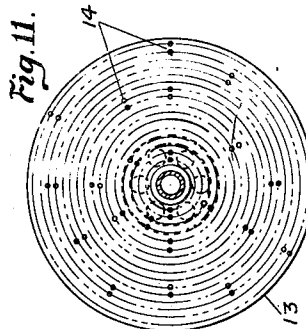


Fig. 11.

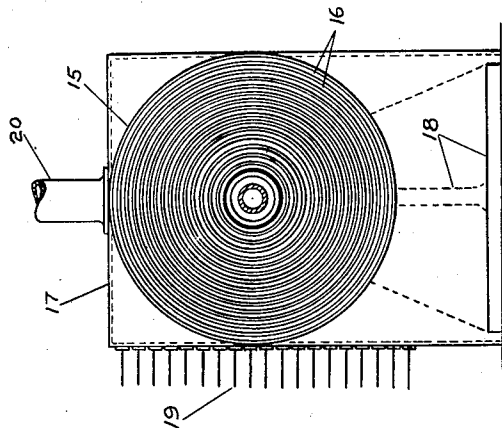


Fig. 12.

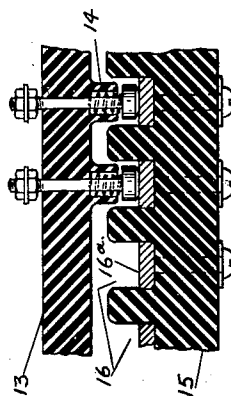


Fig. 13.

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UNITED STATES PATENT OFFICE

2,359,964

SALVAGING APPARATUS

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Application September 23, 1942, Serial No. 459,423

10 Claims. (Cl. 61—69)

This invention is an improvement in salvaging apparatus, and particularly for the salvaging of submarines and other vessels, particularly steel vessels, and other objects of magnetizable metal. The invention, while principally designed for the salvaging of injured or sunken vessels, may be used also for the capture or destruction of enemy craft, and especially steel craft.

The invention relates, primarily, to a camel, pontoon or caisson, and which, for convenience, will be hereafter referred to as a "pontoon," and which contains within itself the principal elements for its operation; but which is controlled in its movement and in its functions by an operator on a mother ship or tender, which will hereinafter be designated as the "tender."

The pontoon does not need the services of a diver, or even an attendant within the pontoon itself, except under very special circumstances when for special reasons the services of a diver may be advisable.

The pontoon is not limited to any particular size, or the equipment to any particular type. It is designed to perform, under the control of the operator on the tender, certain definite functions; but the means for controlling these functions are, as far as possible, standard equipment.

The tender may serve a single pontoon, or several of them, as circumstances may require. If more than one is in use, they may all operate on the same submerged vessel; or some may operate on one, and others on another. Each pontoon is independent of every other, although all may be used on the same salvaging operation; but all are dependent on the operator and power devices on the tender.

Each pontoon is fitted with ballast tanks, which are under the control of the operator on the tender, and are used to lower, raise, adjust or trim the pontoon; and each pontoon is fitted with propelling means, and steering mechanism, which devices also are controlled from the tender. And, preferably, each pontoon carries means for attaching the same to the object being worked on; and with means for lighting the area under inspection; and with means for inspecting the lighted area.

The surface ship or tender is preferably provided with space for caring for a number of pontoons; and with means for placing them in the water and removing them therefrom. The tender should also have proper means for providing the ballast tanks with necessary air under pressure, and with means for supplying current to

the various electrical appliances. It also should have control and indicator panels, and all necessary apparatus and appliances for the necessary operation and control of the pontoons.

Referring to the accompanying drawings, the several figures illustrate the preferred embodiment of my invention.

Fig. 1 is a sectional side elevation of the after part of the control vessel or tender;

Fig. 2 is a sectional side elevation of the pontoon;

Fig. 3 is a cross sectional end elevation of the pontoon on the line 3—3, Fig. 2;

Fig. 4 is a cross sectional view and end elevation of the pontoon on line 4—4, Fig. 2;

Fig. 5 is a cross section end elevation of the pontoon on the line 5—5, Fig. 2;

Fig. 6 is an enlarged view of the steering mechanism, shown generally in Figs. 5 and 8, and looking toward the stern of the pontoon;

Fig. 7 is a sectional plan view of Fig. 1;

Fig. 8 is a sectional plan view of Fig. 2;

Fig. 9 is an enlarged sectional end view of the steering mechanism, as shown in Fig. 6;

Fig. 10 is a sectional side elevation of one end of the cable reel;

Fig. 11 is an end view of the control plate shown in Fig. 10;

Fig. 12 is a side elevation of the junction box, showing the stationary control plate which cooperates with the plate of Fig. 10;

Fig. 13 is an enlarged sectional view showing a portion of Figs. 11 and 12 when in contact.

The difficulties in salvaging sunken ships of any kind or in capturing or destroying undersea enemy vessels under any conditions, are obvious. With my invention, the conditions under which such operations are conducted are much simplified. The pontoon, which constitutes the main feature of the invention, is largely automatic in its operations, in that it functions without a diver, or even an attendant, except the operator on the tender. This tender may be kept close by the scene of operations, or be maintained at some distance therefrom as circumstances dictate. Therefore, the pontoon can be operated in position, or under circumstances, entirely impossible where an attendant is in or near the pontoon during its operation.

Referring to the accompanying drawings, the several figures are more or less diagrammatic. Well known features are either merely outlined, or otherwise indicated. No attempt has been made to show the wiring from the tender to the

various motors and other electrical devices on the pontoon; or the air supply connections to those parts operated by compressed air. And, the indicating devices, which show the position and condition of the several operating devices on the pontoon, are ordinary so-called "tell-tale" contrivances which are more or less familiar to every navigator, and found on all modern ships.

The surface ship or "tender" is best shown in Figs. 1 and 7, and is marked 1; while the "pontoon" is best illustrated in Figs. 2 and 8, and is marked 2. The tender may be any vessel of proper size, speed, and equipment. The vessel is provided with space (not shown) sufficient to store the pontoons. A proper lifting crane or cranes are also necessary. In the after part of the vessel is shown a control room 3, in which are to be located such control panels, observation board, and operating apparatus as may be necessary for the proper control and operation of the several pontoons which are in use. Another chamber, marked 8, shown as located beneath the control room 3, but which may in fact be at any convenient place, holds the winding reel 4 for the cable 5. This cable contains the air hose for supplying compressed air to the pontoons in use, and the several electrical conductors for carrying current to the motors, and signals to the operator. It is intended primarily for supplying power to the pontoons, but obviously would be of sufficient strength to serve as a towing cable at slow speeds or in emergencies.

At a convenient place, as in an adjoining room 7, is a power driven speed reducing gear 6 for operating the reel to wind the cable, and such other mechanism as required can readily be placed there. A motor driven air compressor 10 (Fig. 7) supplies air to the hose 5^a of the cable 5.

As shown best in Fig. 10, the hose 5^a is carried through the center of the reel 4, and air is supplied thereto through a suitable coupling 9 (Fig. 7). This hose is coupled to the reel in any approved manner; but is here shown secured to the hub of the reel at the point 11 (Fig. 10). Any other suitable arrangement of course could be used. From this point, the hose 5^a becomes a part of the cable 5. This cable, as stated above, also carries the electrical conductors for current from the tender to all pontoons in use, and also the necessary devices by which the operator governs the pontoons, and indicating wires from the pontoons to the observation panels in the control room of the tender.

These wires are indicated generally by the character 12 (Fig. 10). Inasmuch as there are a number of circuits for each pontoon, all of which must be completed through cable 5; and since the reel must rotate as it winds and unwinds the cable, some provision must be made for completing the several circuits from the source of current through some rotating part on the reel. This may be effected in any convenient manner, but the means here provided are illustrated and shown best in Figs. 10 to 13.

Inasmuch as there must be two conductors from the tender for each motor, light, or other translating device on the pontoon, and two for every signal or indicator on the observation board on the tender; all of these conductors must form a part of or be carried by the cable 5, or be gathered together in a supplemental cable

of their own. As here shown, all form a part of the cable 5.

Since all circuits must be completed through the reel, the situation requires that there shall be a number of contacts between the electrical supply line or lines and the several conductors of the cable. This may be accomplished in various ways; but in this instance, it is effected through a movable insulating member 13, mounted, to rotate with the reel. This member carries spring contacts 14 in as many pairs as may be necessary to supply current to all of the motors, and signaling devices carried by any one pontoon.

These movable contacts make circuit with other controls on the companion stationary insulating plate 15 (Figs. 12 and 13). While these also may be of any suitable form, plate 15 is shown as provided with a series of circular grooves 16, each having thereon a circular metal plate 16^a (Fig. 13).

A stationary terminal box 17, mounted about the reel bearing support or bracket 18, contains the insulating sheet 15, having the grooves 16 and annular contact plate 16^a, to each of which one of the conductors 19 is connected. The plate 13 carries the spring controls 14 pressed to the plate 16^a so that as plate 13 rotates with the reel 4, the electrical circuits are completed from the source of supply, through wires 19 (Fig. 12), stationary circular plate 16^a; movable controls 14; thence through the several wires of cable 5 to the individual motors, and other electrical apparatus on the pontoon. Wires from the terminal box 17 are carried to the apparatus in the control room 3 through the wiring trunk 20.

The end of cable 5, which leads to the pontoon 2, enters the same at one end, preferably the bow, through a suitable opening, as the hawser 21 into a suitable coupling 22. At this point a proper reinforcing member 23 is provided, and thence wires are distributed as circumstances require.

The pontoons may be used at great depths, and therefore must be of such strength as to withstand the water pressure at the maximum depths at which they may be used.

The pontoon

The camel, caisson or pontoon, herein termed the "pontoon," is designated generally by the character 2; and of course, as said above, must be sufficiently strong to withstand the maximum pressure for which the apparatus is designed. This device, shown in top and bottom plan views, respectively, in Figs. 2 and 8, and in section in Figs. 3, 4, and 5, is illustrated in normal position when in the water. It is to be fitted when in this position, and normally stands with the parts as represented.

The central portion of the pontoon comprises the main ballast tank or chamber 2^a. Attached to the outside of the pontoon 2 are several, here shown as four, supplemental or auxiliary chambers, numbered respectively 24, 25, 26 and 26^a. Of these, that numbered 24 may be referred to as the keel of the structure, and contains certain rather heavy pieces of apparatus, to be hereafter referred to and described in detail; the upper one, 25, serves as a ballast chamber, and is of a size to approximately counterbalance the weight of the parts or elements normally contained in chamber 24. The chambers 26 and 26^a are substantially alike, and run along the sides of the pontoon. These also are used as

ballast tanks, and by filling one or the other thereof, as determined by the operator on the tender, may rotate the pontoon more or less on its horizontal axis, as the operator prefers, the direction of the turning effort depending on which of the two chambers is filled.

A bulkhead 27 in the front part of the pontoon, as the same is viewed in Figs. 2 and 8, forms within the same a chamber 28, and a supplemental trimming or small ballast tank 29. The chamber 28, as here shown, is used as a distributing space for the air supply and the electrical wiring; while the small trimming or ballast tank is to be used as will be hereafter described.

The bulkhead 30, in the rear of the pontoon, forms a chamber 31, which holds the driving and steering mechanism, also to be hereafter more fully described, and another trimming or small ballast tank 32, also to be used, as hereafter to be more fully explained.

Water-tight manhole covers are provided wherever necessary to afford ready access to the pontoon itself and to the several chambers thereof. Thus, covers 41 and 43 (Figs. 2 and 8) are arranged in the top of the pontoon proper 2, and also in the top of the upper ballast tank 25, and the top of auxiliary chamber 24 within the pontoon. Chambers 26 and 26^a have similar manholes and covers 43. Likewise chambers 28 and 31 are provided with similar openings and covers 44. In fact, such manholes and proper covers therefor are arranged wherever necessary.

Parts 45 (Figs. 2 and 4) attached to the body of the pontoon itself, are merely hooks or eyes with which lifting devices may be attached when it becomes necessary to lift the pontoon from the water, or replace it therein. Each pontoon has as many such hooks, or equivalent devices, as may be regarded as necessary.

Working parts of chamber 24

Vital parts of the structure, which are here shown as arranged in chamber 24, are approximately counterbalanced by the water contained in the opposite chamber 25. These are the magnet 33; flood lights 37—38, here shown mounted one on either side of the magnet 33; television reading or scanning elements or eyes 39, 39, one each between the magnet 33 and one or the other flood lights 37—38. These elements will now be referred to in detail, and their functions set forth at length.

Magnet.—The magnet, here numbered 33, is intended to be an electromagnet element of relatively great power, such as are in common use for lifting heavy loads of iron, steel, and other magnetic materials. It is the element principally relied on to lift, shift, or straighten the sunken vessel in the first instance. A number of these magnets, one or more for each pontoon are employed, and their lifting power is very great. Each magnet is carried on a swivel bearing 34, which is mounted with a tight fit in the wall of the chamber 24. It is here shown as mounted in the inner wall of that structure, but this is a matter of choice. As thus mounted, the magnet can so attach itself to the vessel to be salvaged as to control firmly therewith by adjusting itself as shown in broken lines Figs. 2 and 4.

Mounted on the swivel 34, and arranged to move therewith, is a bracket 34'. The bracket has firmly mounted thereon, and intended to move therewith, a drilling machine 35, which is

driven by an electric motor 36, also mounted on and secured to the bracket 34'. The object of this arrangement is to drill directly through the wall of the steel or iron vessel to which the magnet holds the pontoon. The pontoon 2 is thus held in place against the vessel to be salvaged, while the drill may quickly and accurately perforate the wall of the vessel. As shown, the drill is connected with the magnet, but this is not essential.

The swivel permits the magnet to seat itself on the structure being salvaged and firmly hold the pontoon in place, even though the magnet may not be in the exact plane of the surface of the vessel being worked on. This is more clearly illustrated in Fig. 4, where the magnet 33 is shown in broken lines in its adjusted position. All parts are to be suitably packed to make water-tight joints, as will be readily understood.

Flood-lights.—Lights, such as the flood lights 37—38, also are placed in the vicinity of the magnet 33; and, as here shown, one on either side thereof. While this exact arrangement is more or less arbitrary, it is rather necessary that the lights be in the general locality of the magnet, for their main purpose is to light up this general area so that it may be inspected by the operator on the tender by means to be yet described. The lighting arrangement too should be water-tight, and the construction should be such as to make the lamps accessible from the interior of the pontoon for inspection and replacement, as by making the inner part of the casing removable, as at 38.

The illumination should be sufficient to enable the operator on the tender to inspect the area to which the magnet is to be applied, so that he may judge the situation accurately, and move the apparatus as circumstances require.

These lamps, like all other parts of the pontoon, are controlled and supplied with current from the tender through the general cable 5.

Television.—Between the magnet and the flood-lights, or at least in proximity to these elements, so-called television "eyes" as the elements, 39, are arranged. These also are electrically connected with the tender, and arranged to indicate on the observation panels thereof the spot and condition of the surface at the place or spot which is lighted and to which the magnet is to be attached. By this arrangement of lights, and television devices to scan the lighted area, it is possible for the attendant on the tender to inspect the surface of the vessel being salvaged before performing any operation with the boring machine; and if the location is not satisfactory, the pontoon as a whole may be moved to another position.

The drilling machine may or may not be used; but by mounting it on the bearing for the magnet, it is always adjusted with the magnet itself.

Cover.—Over this group of elements; namely, the drill, the lamps, and the television eyes, and within the pontoon 2, is a rectangular, water-tight cover 40, which protects these elements. To provide ready access to the interior of the space thus covered, the cover is provided with manholes, such as 41 and 42, as heretofore explained.

Sea valves

Each of the several ballast tanks or chambers is provided with a sea valve of any suitable construction, such, for instance, as the well known

Kingston valves, all of which are provided with motors, preferably electric motors, and controlled from the tender. These are preferably standard equipment, and therefore need not be described in detail, or illustrated, except in a broad sense. For instance, the tank or chamber 25 is provided with the sea valve 46 (Fig. 2), operated by a motor 47 (Fig. 8) in the after compartment; the sea valve 46^a in the trimming or ballast tank or chamber 32, is operated by the motor 47^a (Fig. 5); the sea valve 46^b in the tank 26, by the motor 47^b, the sea valve 46^c in the ballast tank or chamber 26^a, by the motor 47^c (Fig. 5); the sea valve 46^d, in the trimming or ballast tank 29, by the motor 47^d (Fig. 3). The main tank 2 is shown provided with two sea valves 46^e (Fig. 4) operated by the motor 47^e (Fig. 4). But if and when needed water may be supplied directly by the pump 48 (Fig. 2), located in compartment 28, from one tank to the other, as controlled electrically from the tender. All of the several tanks may be emptied in the usual manner at the will of the operator by apparatus controlled from the tender.

Propelling and steering

The after part of the pontoon, the part forming the compartment 31 is shaped off somewhat as shown, to a relatively blunt end 49, in which the propelling and steering mechanism is mounted. Two struts 50, 50 in the vertical plane (Fig. 2) support the rudder post to which the rudders 51, 51 are mounted and secured. Other struts 52, 52 in the horizontal plane (Fig. 8) support a horizontal post which passes through the nose 49, and supports the horizontal rudders 53, 53. The necessary stuffing boxes are of course provided to insure a water-tight mounting of these posts.

Regular hydraulic rudder operating mechanism is provided within the chamber 31. This is illustrated, as far as is necessary by the reference character 54 supplied with fluid from the tank 55, or some other convenient source. This is standard equipment, and therefore need not be described in detail. The hydraulic motors are controlled from the tender; and indicators, such as are commonly used on shipboard, used to show the operator where the rudders stand at any given moment. Inasmuch as this construction is well known, and its operation here is the same as on board ship, it need not be further described. Of course, since both vertical and horizontal rudders are necessary, two operating mechanisms are provided.

This mechanism is shown in detail, as far as is necessary, in Figs. 6 and 9. Two hydraulic cylinders 54, 54 are used, one for each of the two pairs of rudders. These are shown generally in Figs. 2, 5 and 8, and more in detail in Figs. 6 and 9. One cylinder 54 is illustrated as in section, in Fig. 6. Within the cylinder is a piston 59. This is for shifting rudders 51, 51; companion cylinder 54 is provided with a similar piston for operating rudders 53, 53. Valves 60, one for each cylinder, control the flow of liquid to and from the cylinders. Pipes 61 supply fluid to one side or the other of the cylinder, depending on the position of valve 60, through pipes 62; pipes 63 serve as bleeder or escape pipes from one side or the other of the cylinder, and pipe 64 is the return pipe to the supply tank.

Tillers 65, one for each pair of rudders, are shifted by pistons 59 through tiller rods 66, 66 moving in proper guides 67, 67. As stated, the

steering mechanism is under the control of the operator on the tender; and proper and well known signals indicate the position of the several parts.

Propellers

Inasmuch as the pontoons will often have to be propelled for limited distances, propellers are provided for effecting their movement. Two such propellers may be used together, or alone; and rotated, one in one direction and the other in the opposite direction, as circumstances demand. As here shown, the struts 52, heretofore described, carry bearings 57, 57 through which the propeller shafts pass, and which are driven each by its own motor 58, 58 (Fig. 8). These motors, like all others carried by the pontoon, are controlled by the operator on the tender.

Operation

No detailed or prolonged statement of operation is necessary. When a vessel to be salvaged, or an enemy vessel attacked, the mother vessel or tender is brought to the vicinity, and the pontoon submerged by the operator, through his control over the several compartments of the pontoon. The admission of water will cause the pontoon to submerge, while its expulsion by air pressure will permit it to rise. Well known detectors are employed to generally indicate the position of the vessel; the flood lights of the pontoon are turned on, and the magnet energized to attach the pontoon to the vessel. Or, if the pontoon is not in the called for position, as shown by the television apparatus, it is moved by energizing one or both of the propeller motors, and shifted; and, if necessary, rotated on its axis by controlling the ballast tanks, as heretofore explained. The magnet is then energized. If more than one pontoon is used, each in turn is located and positioned until as many are in place as are to be used.

It is contemplated that the magnets shall be very powerful lifting magnets, such as are in common use for raising and transporting large bodies of iron and steel. By attaching the magnets, one or more, and energizing the same, as described, a very great lifting effort is possible; so that with certain vessels it may be possible to move, or possibly even lift, the same by this means alone. If necessary, the drills may be used to make holes in the submerged vessel, and other pontoons attached, or raising devices applied, as in any ordinary salvaging apparatus.

The cable 5 is of considerable length, so that the tender can be kept close at hand or placed away more distantly, as circumstances require. The cable should have sufficient strength to tow or move the pontoon; but is not intended for use for heavy lifting operations.

Control panels and observation boards, one each for each pontoon, are on the tender, so that by operating the switches on the control panels, and observing the signals, and the viewing apparatus on the observation boards, control of the pontoons is readily secured.

The use of ballast tanks, and of so-called "trimming" tanks is so well known in the salvaging of vessels, that the manner of operation and make of control do not need to be described in detail.

Having described the principle of my invention, what I claim is:

1. In a salvaging apparatus, the combination of an approximately water-tight pontoon, an annular electromagnet to engage and adhere to the

structure being worked on, a swiveled support for the electromagnet by means of which the magnet shall accurately contact the structure being worked on, and a drilling machine on the swiveled support having a drill approximately concentric with the annular electromagnet.

2. In a salvaging apparatus, the combination of an approximately water-tight pontoon, an annular electromagnet to engage and adhere to the structure being worked on, a swiveled support for the electromagnet by means of which the magnet shall be able to accurately contact the structure being worked on, a bracket on the swiveled support, a drilling machine mounted on the bracket with the drill thereof approximately concentric with the annular electromagnet.

3. In a salvaging apparatus, the combination of an approximately water-tight elongated pontoon, means for admitting water to and expelling it from the pontoon so as to adjust it to various depths of water, a chamber on one side of the pontoon which is to be regarded as the under side, means carried in the chamber for engaging and holding the pontoon to a structure to be worked on, another approximately water-tight chamber on the side of the pontoon approximately opposite the first mentioned chamber, means for admitting water to and expelling the same from the last mentioned chamber to counterbalance the weight of the engaging and holding devices in the first mentioned chamber, a plurality of additional elongated approximately water-tight chambers at least one arranged on either side of the pontoon between the first and second chambers, and means for admitting water to and expelling it from each of these last mentioned chambers independently so as to shift the center of gravity of the pontoon and cause it to revolve more or less on its longitudinal axis so as to bring the engaging and holding means into proper relation with respect to the structure to be worked on.

4. In a salvaging apparatus, the combination of an approximately water-tight elongated pontoon, means within the pontoon for propelling the pontoon through the water, means carried by the pontoon for engaging and holding the same in proximity to the structure being worked on, and means within the pontoon for rotating the pontoon on its longitudinal axis so as to bring the engaging and holding means into position to engage and hold to the structure being worked on.

5. In a salvaging apparatus, the combination of an approximately water-tight elongated pontoon, electromagnetic means carried by the pontoon for holding the same in contact with the structure being worked on, means for rotating the pontoon on its elongated axis for bringing the holding means to the desired position with

respect to the surface to be worked on, lighting means on the pontoon adjacent the electromagnetic holding means for lighting the surface adjacent the electromagnet, and a television apparatus also carried by the pontoon also adjacent the electromagnetic holding means by means of which a distant operator can inspect the surface of the structure under investigation.

6. In a salvaging apparatus, the combination of an approximately water-tight pontoon, means for propelling the pontoon through the water, magnetic means carried by the pontoon for holding the pontoon in contact with the vessel being salvaged, a universal mounting for the magnet so that the magnet can adjust itself in contact with the vessel being worked on, a drilling machine mounted on and adapted to move with the universal mounting for the magnet, substantially as described.

7. In a salvaging apparatus, the combination of an elongated approximately water-tight pontoon, means for propelling the pontoon through the water, means for effecting the rotation of the pontoon on approximately its longitudinal axis, means carried by the pontoon for holding the same in contact with the vessel to be salvaged, a universal bearing for the holding means, so that the holding means may adjust itself to the surface of the vessel being worked on, means for lighting the surface being worked on, and means for inspecting the lighted area.

8. In a salvaging apparatus, the combination of an elongated pontoon, an implement chamber in one side of the pontoon, another chamber approximately opposite the implement chamber with means for admitting water to and expelling it from the same so as to counterbalance the implement chamber, and other chambers with means for admitting water to and expelling it from the same so as to effect rotation of the pontoon on its elongated axis, and thus locate the implement chamber with respect to the structure being worked on.

9. In a salvaging apparatus, the combination of an approximately water-tight elongated pontoon, means carried by the pontoon for engaging and holding the same to a structure to be worked on, and means within the pontoon for rotating the same on its longitudinal axis to bring the engaging and holding means to the desired position.

10. In a salvaging apparatus, the combination of an approximately water-tight elongated pontoon, electromagnetic means carried by the pontoon for engaging and holding the pontoon to a structure of magnetic material to be worked on, and means within the pontoon for rotating the same on its longitudinal axis to bring the electromagnetic engaging and holding means to the desired position.

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