Sept. 27, 1927. 1,643,733

P. C. WOOD

SUBMARINE LIFTING DEVICE

Filed Sept. 22, 1926 2 Sheets-Sheet 1

Fig. 1.

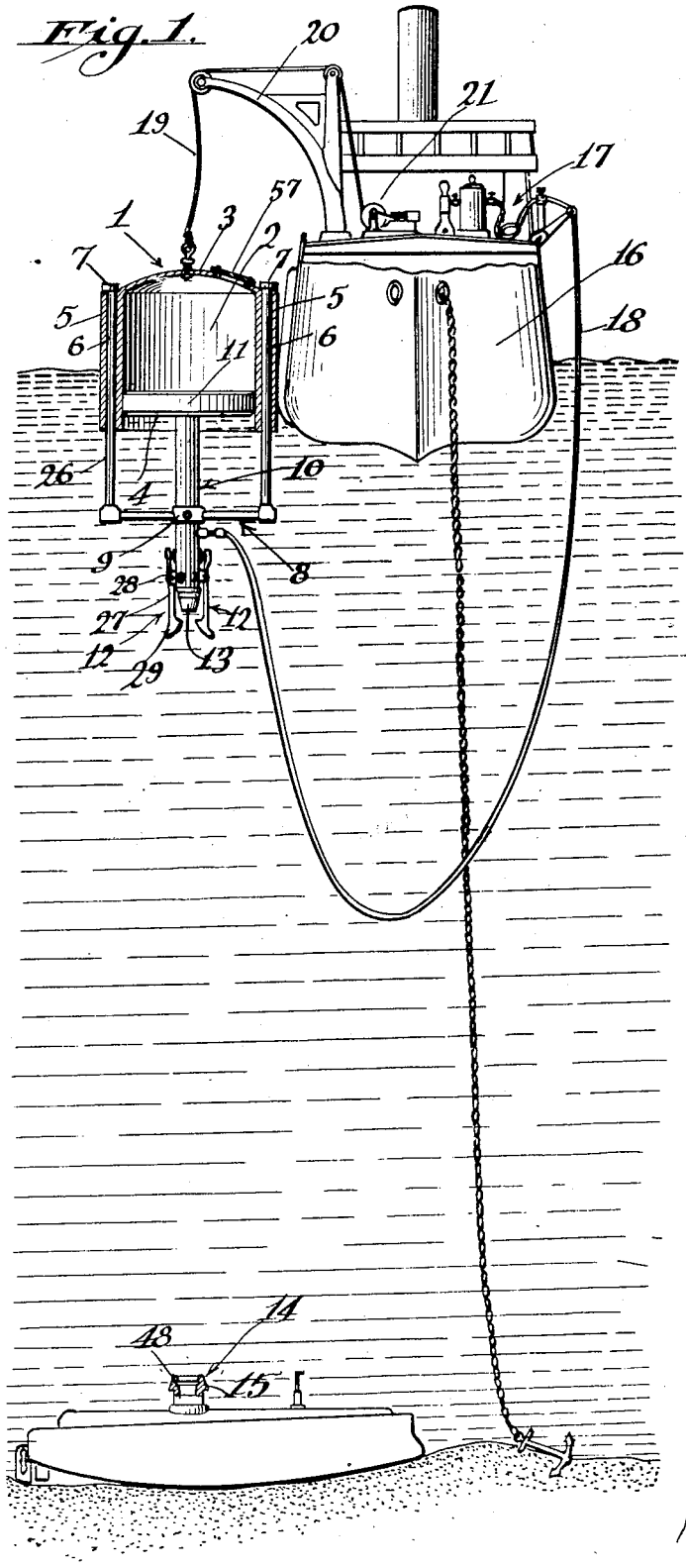



Fig. 2

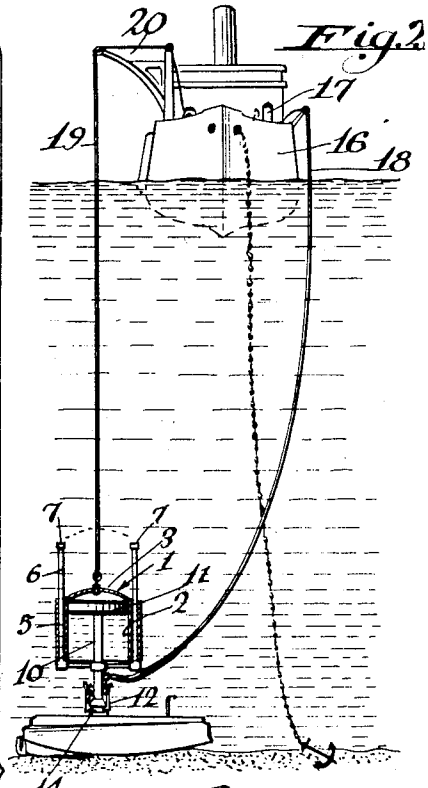
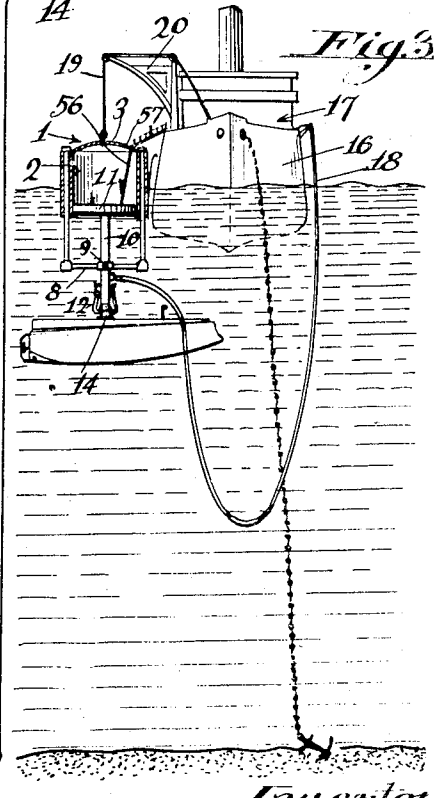



Fig. 3




Witness:
H. C. Hall

Inventor
Philip C. Wood
by Hazard and Miller
Attorneys

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Fig. 4.

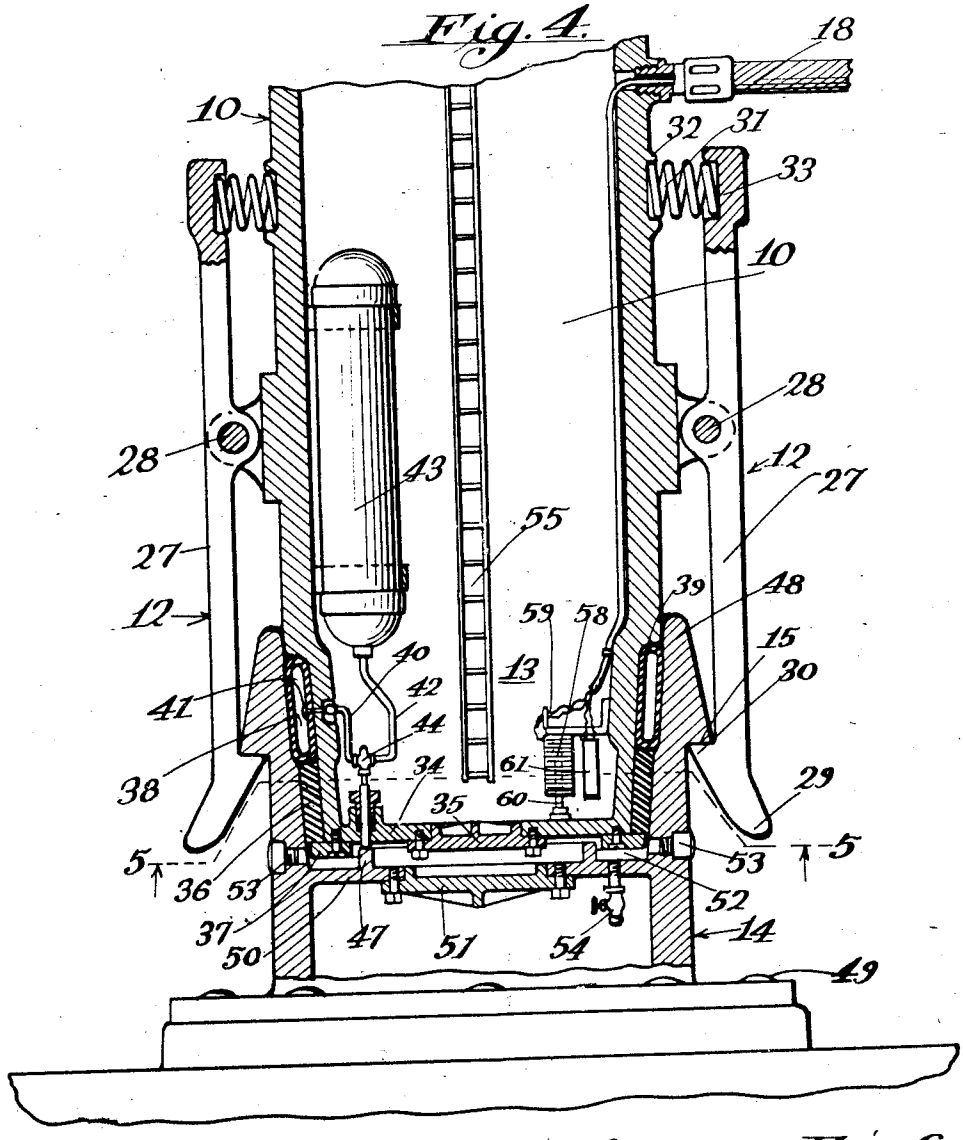



Fig. 5.

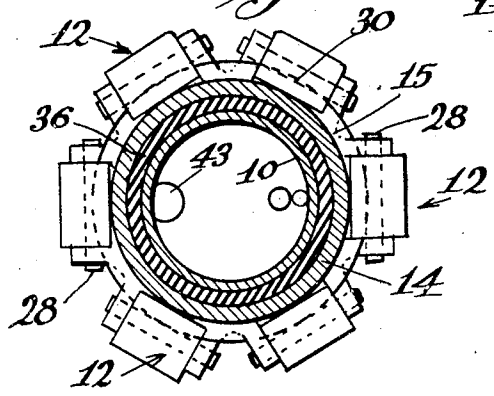
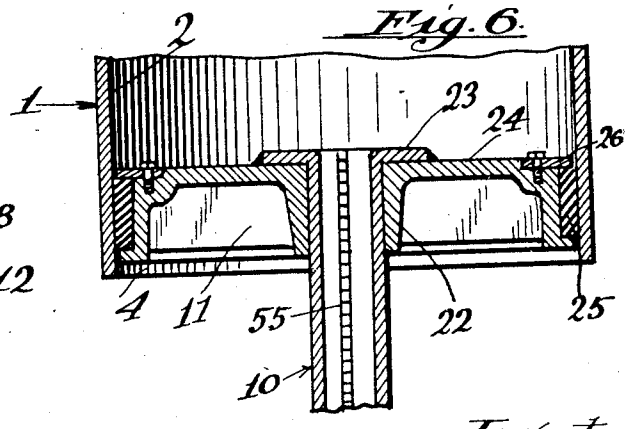



Fig. 6.




Inventor
Philip C. Wood
by Hazard and Miller
Attorneys

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# UNITED STATES PATENT OFFICE.

PHILIP C. WOOD, OF JOHNSTONVILLE, CALIFORNIA.

## SUBMARINE LIFTING DEVICE.

Application filed September 22, 1926. Serial No. 137,078.

My invention is a submarine lifting device adapted to lift a submarine by means of a sinkable caisson which by means of grapples engages the submarine and by inflating the caisson with air floats the submarine to the surface.

An object of my invention is the construction of a submarine lifting device by which a single large caisson with a grappling device connected thereto may be sunk, the grappling device engaging a special fitting on the submarine and by the inflation of the caisson with air the submarine is elevated to a position slightly below the surface of the water.

A more specific object of my invention is forming a caisson with a piston and a tubular plunger fitted therein, the plunger being suitably guided and having the grappling tongs on the lower end thereof and a hose pipe or the like is connected from a workship to the hollow caisson preferably through the plunger and thus allowing air to be let out of the caisson to sink same and to be pumped therein to raise the caisson with the submarine caught by the grapples.

Another object of my invention is connecting the caisson direct with hoisting cables connected to the workship so that an additional lift by said ship may be given if necessary.

A further object is to provide a substantially water-tight connection between the plunger and a special fitting on the submarine so that when the same is raised to a position slightly below the surface that the crew may escape from the submarine through the tubular plunger into the caisson and out to the work vessel.

A detail feature of my invention is in providing a self-centering plunger which will center the grapples to grip the fitting on the supbmarine and having an automatic device for inflating a tubular flexible packing with air to make a water-tight seal between the plunger and the fitting on the submarine. I also provide signal means between the surface and the submarine.

My invention will be more readily understood from the following description and drawings, in which;

Figure 1 is a perspective view with the caisson in vertical section, showing the relative position of my appliance before sinking to grapple a submarine;

Fig. 2 is a perspective view with the caisson in section, showing the submarine caught by the grapples and before inflation of the caisson with air;

Fig. 3 is another perspective view with the caisson in section, showing a later step of the process with the caisson inflated and the submarine raised to a position close to the surface and with the crew escaping therefrom;

Fig. 4 is a vertical section through the lower part of the plunger and the submarine fitting, showing the internal mechanism of the plunger in elevation;

Fig. 5 is a horizontal section of Fig. 4 on the line 5—5 in the direction of the arrows;

Fig. 6 is a vertical section through the upper part of the tubular plunger and the piston therefor.

Referring first to the illustrations of Figs. 1, 2 and 3, my submarine lifting device has a caisson which is designated generally by the numeral 1, this caisson having preferably cylindrical vertical walls 2, a top closure 3 and being open at the bottom 4. A plurality of guideways 5 are formed on the sides of the caisson, these being illustrated as directly opposite and a plurality of guide bars 6 slide therein, these having heads 7 to prevent their downward movement. A heavy spider 8 is connected to the lower ends of the guide bars and has a tubular collar 9 centered in said spider. A heavy tubular plunger 10 is fixed to said collar and at its upper end has a heavy piston 11 secured thereto, the piston sliding internally of the walls of the casing.

A plurality of grappling hooks 12 are secured to the lower end of the tubular plunger, this plunger having a plug type of end 13 which is adapted to fit internally of the grappling fitting 14 mounted on the submarine, this fitting having an annular shoulder 15 integral therewith over which the grapples engage as hereunder set forth. The workship 16 is provided with an air compressor equipment designated by the numeral 17 from which a hose 18 extends to the caisson, being preferably connected to the lower end of the tubular plunger. A lifting cable 19 is secured to the top of the caisson and passes over a derrick 20 on the work vessel, being operated by a winch or the like 21.

The detail construction of the piston is substantially as follows, having reference to Fig. 6. This piston 11 has a heavy in-

ternal flange 22 through which the tubular plunger 10 extends, this plunger having a head 23 at the top and being secured to the wall 24 of the piston in any suitable manner. The piston is provided with a heavy packing of suitable material 25 held in place by a ring 26.

The details of the lower end of the plunger and its connection to the submarine fitting are substantially as follows, having reference to Figs. 4 and 5:

The grapples 12 comprise heavy lever arms 27 centrally pivoted on pivot pins 28, the lower end of the grappling hooks having an outward inclination as indicated by the numeral 29 and having a hook 30 on the inner side. Heavy coil springs 31 positioned between sockets 32 in the tubular plunger and recesses 33 in the upper end of the grappling levers, press the hooks of said levers towards each other. The plug end 13 has a closed lower end 34 with a man hole plate 35 attached thereto by bolts on the under-surface. A heavy ring packing 36 slightly tapered is held in place by a ring 37 secured to the bottom of the plunger and an expandible tubular packing 38 of flexible material such as rubber is secured around the tapered plug end of the plunger and fits against a shoulder 39.

An inlet air pipe 40 is connected through a duct 41 to the hollow expandible packing and this has a lead pipe 42 to a compressed air tank 43, there being a control valve 44 in the pipe 42 actuated by a stem 45 which projects downwardly through a packing structure 46 in the bottom of the tubular plunger and is adapted to engage an upstanding ring 47 on the submarine fitting.

The submarine fitting designated generally by the numeral 14 as above mentioned has a shoulder 15. As will be seen by the drawings, the fitting on the submarine is tubular, having an upstanding part 48 with internally tapered surfaces to conform with the taper of the packing 36 and the expandible hollow packing 38. This fitting is securely fastened to the submarine by means of bolts 49 or the like and has a partition 50 therein with a manhole 51, the bolts for the manhole being on the submarine side.

It will be seen from Fig. 4 that when the plunger and the fitting are secured together there is a space 52 and check valves 53 are connected to this space to allow the water trapped in the fitting to pass out therethrough but to prevent the inlet of water. A drain pipe 54 leads from this space to the submarine and is controlled by a valve.

It will be noted that the lower manhole 51 is larger than the upper manhole 35 so that when the plug end of the tubular plunger is connected to the submarine fitting and the submarine drawn up close to the surface that the crew of the submarine may open such manholes and climb into the interior of the tubular plunger and mount the ladder 55 therein to the floor of the piston. They may then pass out a ladder 56 inserted through the manhole 57 in the top of the caisson and be taken aboard the work vessel.

The signalling arrangement comprises a solenoid or similar device 58 secured to the lower end of the tubular plunger, this connection being illustrated by a bracket 59, the solenoid having an armature 60 positioned to tap on the closed end 34 of the tubular plunger, the taps to be governed according to recognized signals and to be interpreted by the crew of the submarine. A telephone transmitter 61 is secured adjacent the closed end 34 of the tubular plunger and would detect answering signals given in the submarine by tapping on the submarine fitting.

The general method of using my submarine lifting device is substantially as follows:

When the device is inflated with air as shown in Fig. 1, such air driving the piston downwardly, the caisson would be self-floating, having considerable buoyancy. The expelling of the air by allowing same to flow out of the caisson, preferably back through the hose 18 will allow the piston to rise and the buoyancy of the casing would be decreased to such an extent that same will sink to the bottom and may be gradually lowered by the cable 19 controlled from the work vessel. When the plug end of the tubular plunger engages the central portion of the submarine fitting the plunger is guided therein and the grappling levers are forced over the shoulder 15 on the submarine fitting, becoming securely clamped in place. At the same time the packing 36 is compressed and the valve 44 actuated by the stem 45 engaging the ring 47 on the fitting, thereby allowing compressed air or the like in the tank 43 to fill the hollow expandible packing 38, thus forming a substantially leak-proof connection of the plug end of the tubular plunger and the submarine fitting.

When it is desired to raise the submarine, air is forced from the work vessel through the hose into the caisson, preferably through the tubular plunger and this forces the body of the caisson upwardly in reference to the piston. This action is continued until the buoyancy of the caisson is sufficient to lift the submarine. In some operations it may be desirable to maintain the buoyancy slightly insufficient to lift the submarine and to utilize the cable 19 for giving the additional lift and thereby control the rate of rising as desired.

When the submarine is elevated to a position close to the surface the crew may escape from the submarine in the manner above mentioned and it will be quite safe for the

crew of the work vessel to open the manhole 57 intermittently to allow the members of the crew to escape. This manhole may be arranged in the form of an air lock as is common practice in caisson work.

It will therefore be seen that by my construction I am enabled to lift a submarine by a single unitary caisson construction to communicate with the crew in the submarine and to allow the crew to escape when the caisson rises to the surface.

It is manifest that it may be desirable to change the form of the caisson and possibly to utilize a plurality of same working together, each engaging a separate fitting on the submarine. It may be necessary therefore to change my invention in general construction or in specific details. Such changes would be within the spirit of same as set forth in the description, drawings and claims.

Having described my invention, what I claim is:

1. A submarine lifting device comprising in combination a caisson having a plunger extending downwardly therefrom with grappling hooks on said plunger, a fitting on a submarine to be engaged by the lower end of the plunger and the grappling hooks, and means to inflate or deflate the caisson with air.

2. A submarine lifting device as claimed in claim 1, the fitting and the plunger having means to allow passage of the crew of the submarine into the caisson.

3. A submarine lifting device comprising in combination a caisson having a movable tubular plunger with a plug on the lower end, a submarine having a fitting with a socket to be engaged by the plug and having means to engage the grappling hooks, means to allow deflation of the caisson and the drawing of the plunger into same to allow the caisson to sink, said means allowing inflation of the caisson to increase the buoyancy to raise the submarine.

4. A submarine lifting device comprising in combination a caisson having a piston with a tubular plunger connected thereto, grappling hooks connected to the plunger, a submarine having a fitting with a socket to be engaged by the lower end of the plunger and the grappling hooks, and means to fill the caisson with air or allow emptying of same to move the piston and hence change the buoyancy of the caisson.

5. A submarine lifting device as claimed in claim 4, the submarine fitting having a manhole therein and the caisson having a manhole at its lower end registering with the manhole in the fitting, to allow passage of the crew of the submarine through the manholes, the plunger and into the caisson.

6. A submarine lifting device comprising in combination a cylindrical caisson closed at the top and open at the bottom, a piston having a tubular plunger extending downwardly below the bottom of the caisson, grappling hooks connected to the plunger, the plunger having a plug at the lower end with a hollow expandible packer on the exterior of same, a submarine having a fitting with a socket to be engaged by the plug and having shoulders to engage the grappling hooks, and means actuated by the engagement of the plunger and the fitting to force an expandible fluid into the expandible packer, and means to force the expandible fluid into the packer.

7. A submarine lifting device as claimed in claim 6, the means to force the expandible fluid into the packer comprising a tank having a compressed fluid, a pipe from said tank to the expandible packer, having a valve therein, and means actuated by the engagement of the plug and the fitting to open said valve.

8. A submarine lifting device comprising in combination a cylindrical caisson having guideways on the side, a plurality of guide bars slidable therein having a spider connected to their lower ends, a piston slidable in the caisson having a plunger connected to the spider, and grappling hooks connected to the lower end of the plunger, and means allowing inflation and deflation of the caisson with air.

9. A submarine lifting device as claimed in claim 8, having a submarine with a fitting to be engaged by said grappling hooks, and a signal means in the plunger comprising means to give a tapping sound and telephone device to receive sound from a submarine.

10. A submarine lifting device comprising in combination a cylindrical casing having a closed top and an open bottom, a piston having a tubular plunger extending through the bottom, means to guide the plunger, a plurality of grappling hooks in the form of levers pivotally connected to the plunger and spring pressed to move the hook portions together, the lower end of the plunger being closed and having a manhole therein, a fitting for a submarine having a partition, a socket formed by the fitting above the partition, a manhole in the partition, and means on the fitting to engage the hooks of the grapple.

11. A submarine lifting device as claimed in claim 10, having a fixed packing between the lower end of the plunger and the fitting, an expandible hollow packer secured to the plunger engaging the fitting, and means actuated by the engagement of the plunger and the fitting to fill the expandible packer with air.

12. A submarine lifting device as claimed in claim 10, having a solenoid with an ar-

mature positioned to strike the lower end of the plunger to give a signal, and a telephone transmitter positioned in the plunger to receive sounds from the submarine.

13. A submarine lifting device, as claimed in claim 6, the means to force the expandible fluid into the packer comprising a tank having a compressed fluid, a pipe from said tank to the expandible packer, having a valve therein, and means actuated by the engagement of the plug and the fitting to open said valve, and having outlet check valves between the plug and the fitting.

In testimony whereof I have signed my name to this specification.

P. C. WOOD.