July 14, 1931. L. Y. SPEAR 1,814,642

RESCUE SUBMARINE

Filed Sept. 1, 1928 2 Sheets-Sheet 1

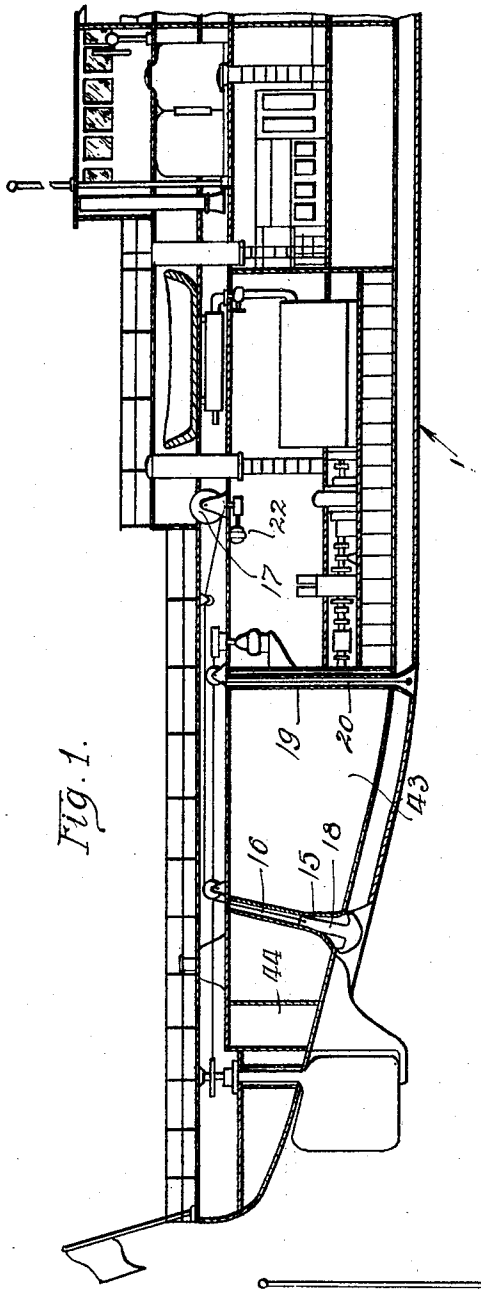


Fig. 1.

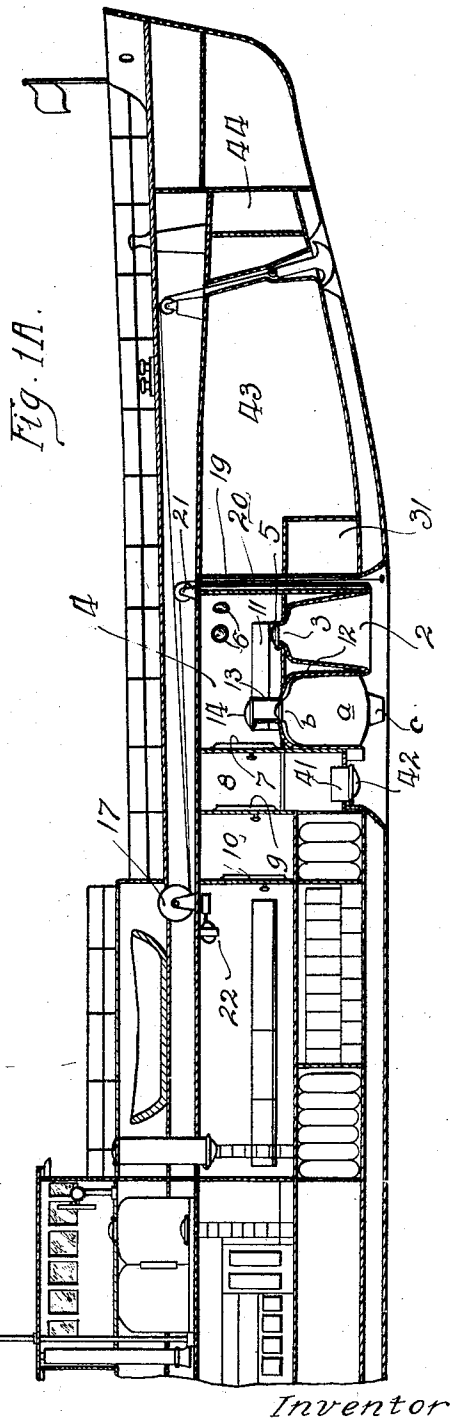


Fig. 1A.

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Filed Sept. 1, 1928 2 Sheets-Sheet 2

Fig. 2.

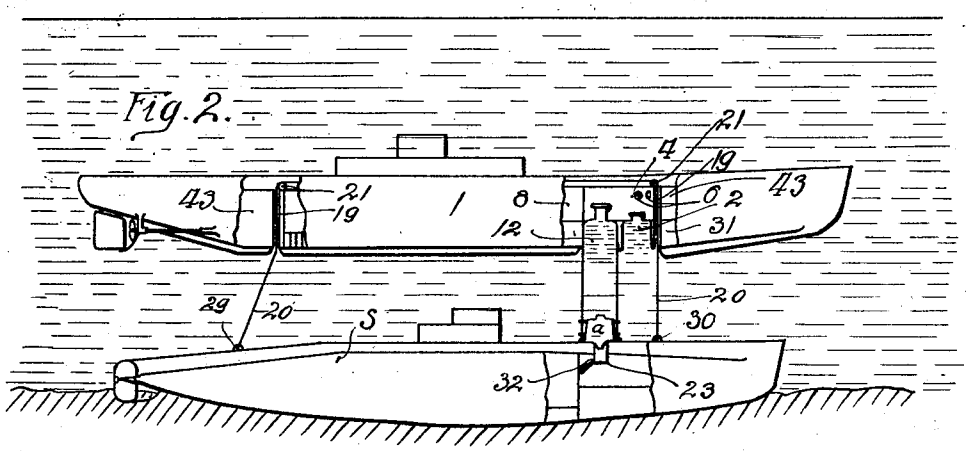


Fig. 3.

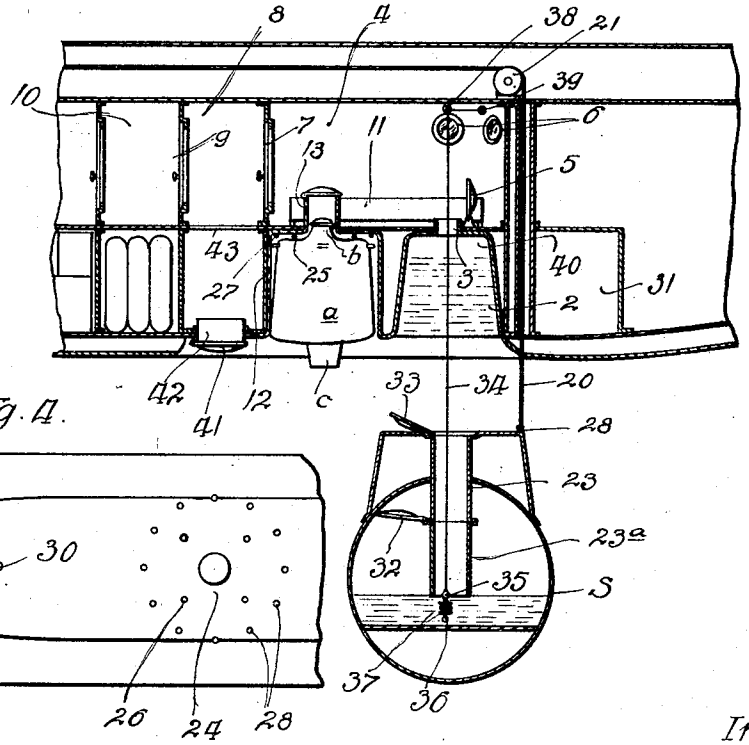


Fig. 4.

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UNITED STATES PATENT OFFICE

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RESCUE SUBMARINE

Application filed September 1, 1928. Serial No. 303,513.

This invention relates to submarine boats, and more particularly to a submarine boat specially adapted for rescuing men from a second submarine boat which has become disabled due to collision or other causes and is unable to rise to the surface.

Most submarine boats are equipped with escape hatches which allow the outer hatch to be opened with the vessel submerged with equal pressure inside and outside of the submarine. In the vicinity of this hatch are fitted air locks which allow the crew to breathe, although the compartment below the access hatch trunk may be filled with water. This is an effective means of escape if the submarine boat is in shallow water and the entrapped men are not under great pressure, but if the pressure is excessive, the man attempting to escape from a submarine, if he is not drowned by the time he reaches the surface, will be affected by the sudden reduction in pressure, causing caisson disease otherwise known as the "bends". It is, therefore, not practicable for the men to escape from the submarine by means of the access hatch when the submarine is submerged at an appreciable depth such that relatively high pressure obtains. To render it possible for the men to safely escape from a submarine boat at an appreciable depth, I provide means whereby the men, in effecting their escape, are subjected to the relatively high pressure of the water for but a short length of time and enter into an air pocket under approximately the same pressure at which they left the disabled submarine, the men passing from this air pocket into decompression tanks in which the pressure is gradually reduced to approximately atmospheric pressure, that is, to the pressure in the living compartment of the submarine. This provides means whereby the men are totally submerged in the water for but a short period of time thus avoiding any danger of drowning, and also provides means whereby the pressure to which the men are subjected can be gradually reduced thus avoiding the injurious effect resulting from a sudden lowering of the pressure which causes the "bends" or caisson disease previously referred to and sometimes has fatal results.

For rescuing men from a disabled submarine boat at depths at which it would be dangerous to subject the men to the water pressure, I employ rescue cars or tanks by means of which the men are transferred from the disabled boat to the rescue submarine. The rescue submarine is provided with a suitable chamber for reception of the rescue tanks.

In accordance with my invention, I provide a rescue submarine boat which is provided with a rescue chamber and a tank chamber adjacent thereto, each chamber being open at its bottom and communicating with an upper compartment through a hatch opening, this upper compartment having access to decompression chambers and means being provided for effecting a fluid tight closure of the hatch opening and between the upper compartment and the decompression chambers. This rescue submarine boat is anchored or moored directly over the disabled submarine boat with one of the lower compartments referred to in alignment with the access hatch thereof.

In rescuing men at depths at which it is safe to subject the men to the water pressure, the rescue boat is moored in position adjacent and above the disabled boat. The hatch cover of the latter boat is then opened permitting water to flow into the compartment thereof, until it seals the inner end of the hatch trunk, this water compressing the air in the upper portion of the compartment until the air pressure counterbalances the water pressure.

The men then escape through the hatch and pass upwardly through the relatively narrow or thin layer of water between the two boats into the rescue chamber, from which they enter into the upper compartment and pass from there into the decompression chambers. This provides a very simple and highly efficient method for rescuing men entrapped in a disabled submarine boat at depths at which the men can safely be subjected to the water pressure.

At greater depths, at which it would be unsafe to expose the men to the water pres-

sure, rescue tanks or cars are used. The rescue boat is moved in position with the tank chamber aligned with the escape hatch of the disabled boat. A tank is then lowered from this chamber and seated upon the escape hatch trunk of the disabled boat. The men then enter this car which is then raised into the tank chamber of the rescue boat and the men pass from the tank into the rescue compartment from which they pass through the decompression tanks into the living quarters of the rescue submarine. Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figs. 1 and 1A are a longitudinal sectional view of a rescue submarine boat constructed in accordance with my invention;

Fig. 2 is a side view of a rescue submarine boat constructed in accordance with my invention in position to effect rescue of men from a disabled submarine boat by means of a rescue tank, the two boats being partly broken away;

Fig. 3 is a fragmentary sectional view of my rescue submarine and a disabled service submarine boat, showing the use of the rescue chamber;

Fig. 4 is a fragmentary plan view of a service submarine having attachments for mooring my rescue submarine and guide lines thereto.

In accordance with my invention, I provide a submarine boat 1 which is generally of known construction. This boat is provided with a rescue chamber 2 which opens through the bottom of the hull of the boat, this chamber being of substantially cylindrical shape. The chamber 2 is provided through its top wall with a hatch opening 3 giving access to an upper rescue compartment 4. A hatch cover or door 5 is provided for effecting a fluid tight closure of the hatch opening 3. The upper compartment 4 is provided with suitable port lights 6 and with an opening closed by a door 7 of suitable type, this opening giving access to a diving compartment 8 which may also be provided with one or more port lights. Diving chamber 8 communicates, by means of doors 9, with decompression chambers 10 which communicate with the living quarters of the boat, in a known manner.

Air may be supplied to the chambers 10 from suitable air compressors within the hull of the boat, and air may also be supplied to the compartment 4 from the air compressors or from an air tank 11, or in any other suitable manner.

A tank chamber 12 opens through the bottom of the hull, adjacent rescue chamber 2. Chamber 12 communicates with compartment 4 through a hatch trunk 13 provided with a suitable cover 14. The tank chamber is intended for use with a rescue tank *a* provided with upper and lower trunks *b* and *c* having removable closures or covers. The trunk *b* is adapted to fit into trunk 13 of chamber 12, as illustrated, to permit the men to escape from the tank into compartment 4. Trunk *c* of the tank is adapted to fit into the escape hatch trunk of a disabled submarine boat, with the tank seating upon the outer end of the trunk, to permit the men in such boat to enter the tank. The tank *a* is also provided with guide eyes for reception of guide lines attached to the rescue submarine and the disabled submarine, in a suitable manner. This tank is capable of accommodating twenty or more men. A tank of this type is disclosed in the copending application of Hugo E. Grieshaber for rescue buoy, filed April 2, 1928, Serial Number 266,541, and it is not thought necessary to illustrate or describe this tank in detail herein. Hatch trunk 13 is also intended for use with a suitable rescue car of a diameter to fit into such trunk and having a flange and associated gasket adapted to seat against the lower end of the trunk and form a tight closure therewith. Such a rescue car is disclosed in my copending application for rescue submarine, filed February 20, 1928, Serial Number 255,684.

This car is preferably provided with two guide eyes disposed for reception of guide lines, as disclosed in my copending application for rescue car, filed February 20, 1928, Serial No. 255,682.

The boat 1 is provided, adjacent the bow and the stern thereof, with anchor compartments 15 through which pass chains or cables 16 windable upon suitable drums 17, above the hull of the boat, such drums having means associated therewith for winding the cables onto and off of the drums. The cables 16 are secured to anchors 18 of suitable type.

Boat 1 is further provided with hawse pipes 19 spaced from the anchor compartments forward and aft thereof. The forward hawse pipe is adjacent and forward of rescue chamber 2. Mooring lines 20 pass through the hawse pipes and over guide pulleys 21 onto winding drums (not shown) disposed alongside the drums 17 for winding the anchor chains or cables. These drums are rotated in desired direction, through suitable gearing, by electric motors 22 disposed within the main engine compartment and the living quarters of the boat. In my copending application for rescue submarine, above identified, I have disclosed a similar arrangement of two winding drums side by side for winding and unwinding two lines, independently, and it is not thought necessary to illustrate or describe such an arrangement in detail herein, it being sufficient to note that the mooring lines are wound onto and off of their drums independently of each other and of the anchor cables or chains.

My rescue submarine boat is intended to

be used with a service submarine boat S of known type provided with one or more escape hatch trunks 23. Boat S is preferably provided with two eyes 24 secured to the superstructure beyond trunk 23 and at diametrically opposite points thereof. These eyes are adapted for securement thereto of the lower ends of a pair of guide lines for a one man rescue car, the upper ends of these lines being secured to eyes 25 at the top of tank chamber 12.

Four eyes 26 are secured to the superstructure of boat S equidistant from the hatch trunk thereof and are disposed to have the lower ends of guide lines for the tank *a* secured thereto, the upper ends of these lines being secured to eyes 27 at the top of the tank compartment. A series of mooring attachments 28 are secured to the boat S concentric with hatch 23, the distance between each of these attachments and the axis of trunk 23 corresponding to the distance between the forward hawse pipe 20 and the axis of rescue chamber 2. Boat S is further provided with an after mooring attachment 29 and a forward mooring attachment 30.

When using the tank system for rescuing the men from the disabled boat S, the rescue ship is brought into position as nearly parallel to the boat S as is practicable, and both of the anchors 18 are then dropped. The rescue ship is then trimmed and hauled down to the anchors. The divers first make telephone connection to the disabled boat and attend to the immediate physical needs of the survivors. The divers then secure both of the mooring lines 20 to the fittings 29 and 30, and also secure the guide lines to the fittings 26 or 24, as the case may be, these guide lines being previously passed through the eyes on the car and secured to the corresponding fittings in the tank chamber. The anchors 18 are then housed and positive buoyancy is imparted to the rescue ship which is then maneuvered by means of the mooring lines and regulation of buoyancy so as to bring the tank chamber into substantial alignment with the hatch trunk 23.

Hatch trunk 23 is flooded either by a diver, or from within the disabled boat, suitably arranged valves being provided for this purpose and the trunk having both inner and outer covers, and the outer cover is then opened or removed, in a suitable manner. The car is then lowered into position to seat upon the outer end of the hatch trunk and the trunk is drained, the car being held tightly seated by the water pressure. The men in the disabled boat then open the door at the lower end of the tank and pass into the same, closing and securing the door. Before lowering the tank it is ballasted, by suitable weights, the total weight of which is greater than the weight of the men the tank can contain. This imparts negative buoyancy to the tank which sinks and is directed to the hatch trunk of the disabled boat as previously described. When the men open the lower door of the tank the weights are removed and the tank thus has positive buoyancy imparted to it. After the men have entered the tank and closed the lower door thereof, if any men remain in the compartment of the disabled boat, they close the lower hatch trunk door and flood the hatch trunk. This equalizes the pressure on the tank and, due to its positive buoyancy, the tank rises and is directed by the guide lines into the tank chamber 12, the men entering compartment 4 from the tank as previously described. When all of the men remaining in the compartment of the disabled boat enter the tank, the compartment is flooded, to equalize the pressure on the tank, by means of a valve operated either by the diver or by the last man leaving the compartment.

If desired a line can be secured, in any suitable manner, to the tank for raising it into the chamber of the rescue ship, in the event that the tank should have negative buoyancy. After all of the survivors on the disabled boat have been rescued, the diver releases the guide lines and returns to the rescue ship. Salvage operations may then be started, the rescue ship being preferably provided with suitable apparatus and exterior connections for salvage purposes.

I prefer to rescue the men from the disabled boat without the use of tanks, by what I term my "pressure system", when this can be done. By using the rescue chamber 2 and disposing the rescue ship a short distance above boat S, the men are subjected to the pressure of the water for but a short period of time. This system can, therefore, be employed at relatively great depths.

When using the "pressure system" the bow anchor of the rescue ship is dropped on the downstream side of the hatch, of the disabled boat, which is to be used. The ship is then trimmed and hauled down to the anchor. After the immediate physical needs of the men of boat S have been attended to, the diver secures the bow mooring line 20 to that fitting 28, on the upstream side of the boat S, which is most nearly in line with the center of hatch trunk 23 and the center of rescue chamber 2. Positive buoyancy in excess of the weight of the men to be rescued is then imparted to the rescue ship causing it to rise and head into the tide. By means of the mooring line 20 and a special ballast tank 31, the rescue ship is brought into position above and adjacent the boat S with rescue chamber 2 in substantial alignment with hatch trunk 23.

When the rescue submarine 1 is moored in proper position a diver descends therefrom to the submarine S and notifies the occupants of the compartment with which the

trunk hatch 23 communicates of this fact. An extension 23*a* is preferably secured on the inner end of hatch trunk 23, in a suitable manner, after opening of the inner hatch cover 32. An extensible hatch trunk of this character is disclosed in the copending application of Hugo E. Grieshaber for escape hatch for submarines, filed May 7, 1928, Serial Number 275,730, and need not be described herein in detail. The compartment is then flooded permitting the water to fill the space within the compartment of the disabled submarine to the lower end of trunk extension 23*a*, it being understood that the air entrapped in the compartment is compressed by the water as it rises and air under pressure may be admitted into the compartment above the water from the air compressor, if still in operation, or from flasks or tanks provided for this purpose. The outer hatch door or cover 33 is then opened, the men in the compartment being but partially submerged in the water. After the door 33 has been opened a cable 34 is lowered through the hatch trunk 23, this cable being held taut by suitable weights 35 and 36 secured to the lower end thereof. The cable also carries a suitable signal lamp 37 to which electric current may be supplied by wires within the cable 34, or in any other suitable manner. The cable passes through a suitable support, such as a pulley or eye member 38 and then passes through a suitable stuffing box 39 through the wall of chamber 4. This cable may be raised and lowered in any suitable manner, as by being wound on to and off of a drum (not shown) within the ship 1, suitable mechanism being provided for rotating this drum in desired direction.

After the rescue ship 1 has been properly moored in the manner described and before hatch 33 has been opened, air under pressure is forced into chamber 4 and flows through the hatch opening 3 into chamber 2 forcing the water out of this chamber so as to provide an air pocket 40 in the chamber above the water. The cable 34 is then lowered and the light 37 passes through the hatch trunk 23—23*a*, the illumination of the water within the submarine S serving as a signal to indicate to the men in the compartment of this submarine that all is in readiness for their rescue. The men then leave the compartment one at a time by means of the access hatch trunk 23—23*a* and either swim or climb upwardly along the cable 34 into the compartment 2. As the pressure within the compartment 2 and the compartment 4 is substantially equal to the water pressure at the depth of the submarine S, no injurious effects are suffered by the men due to a sudden lowering in the pressure to which they have been subjected. By having the boat 1 closely adjacent the boat S, the men are subjected to high pressure in the water for but a short period of time and all danger of drowning is eliminated. From the chamber 2 the men pass through the hatch opening 3 into the upper compartment 4 from which they pass through the diving compartment 8, having the same pressure as compartment 4 and into the decompression tanks 10, the pressure in these decompression tanks being, at this time, equal to the pressure in the compartments 2 and 8. After the men have all been rescued from the disabled submarine, they remain in the decompression tanks 10, the pressure of which is gradually diminished.

By gradually diminishing the pressure in the decompression tanks 10 to approximately atmospheric pressure, the rescued men suffer no injurious effects and may then pass from the tanks 10 directly into the living compartment of the rescue submarine. The cable 34 is effective not only as a signalling device but also serves as a guide to direct the men into the chamber 2, and is particularly valuable in the case of men who, for any reason, are unable to swim.

Under ordinary conditions, when the submarine 1 is not being used for rescue purposes, the scuttle covers or doors 4 and 15, as well as cover 41 of hatch trunk 42 of the diving compartment 8, are secured closed.

The diving compartment includes a platform 43 for convenience of the divers operating from such compartment. It will be noted that the diving compartment and the tank chamber and rescue chamber are all positioned closely adjacent each other forming a group or unit. This is advantageous, as the divers can quickly descend from and return to such compartment during the rescue operations, avoiding loss of time, which is frequently a vital consideration. Also, if the rescue work is started with the tank, and it is found that the "pressure system" can be employed, or vice versa, the rescue chamber or the tank chamber, as the case may be, can be quickly brought into alignment with the hatch of the disabled boat without extended maneuvering of the rescue ship.

The rescue ship is, generally, of known construction and is provided with the usual living compartments, main engine compartment, battery compartment, storage and fuel compartments, etc. This ship also is provided with ballast tanks 43, trim tanks 44, and the special ballast tank 31 previously referred to.

What I claim is:

1. In a submarine boat, two juxtaposed chambers opening through the bottom of the hull, a rescue compartment above the chambers and communicating therewith, removable closures between said compartment and the chambers, a diving compartment communicating with said rescue compartment and having a hatch opening through the bottom of the hull, a removable closure for said

opening, said diving compartment being disposed closely adjacent one of said chambers, a decompression tank communicating with the diving compartment and with the interior of the ship, and removable closures for said tank.

2. In a submarine boat, a chamber opening through the bottom of the hull, a rescue compartment above the chamber and communicating therewith, a removable closure between the compartment and the chamber, a diving compartment communicating with the rescue compartment and opening through the bottom of the hull adjacent said chamber, a decompression tank communicating with the diving compartment and with the interior of the boat, and removable closures for said tank.

3. In a submarine boat, a chamber opening through the bottom of the hull, a rescue compartment above the chamber and communicating therewith, a removable closure between the chamber and the compartment, a decompression tank communicating with the interior of the boat, a diving compartment between and communicating with the tank and the rescue compartment and opening through the bottom of the hull, and removable closures for said tank.

4. In a submarine boat, a chamber opening through the bottom of the hull, a rescue compartment above the chamber and communicating therewith, a removable closure between the chamber and the compartment, a decompression tank communicating with the interior of the boat, a diving compartment between and communicating with the tank and the rescue compartment and opening through the bottom of the hull, said compartments and the tank being disposed in juxtaposed relation and aligned lengthwise of the hull, and removable closures for said tank.

In witness whereof, I hereunto subscribe my name this 8th day of August, 1928.

LAWRENCE Y. SPEAR.