March 5, 1946. P. P. SMITH 2,395,944

SYSTEM FOR THE PROTECTION OF VESSELS AGAINST ATTACK OF TORPEDOES

Filed March 16, 1942 3 Sheets-Sheet 1

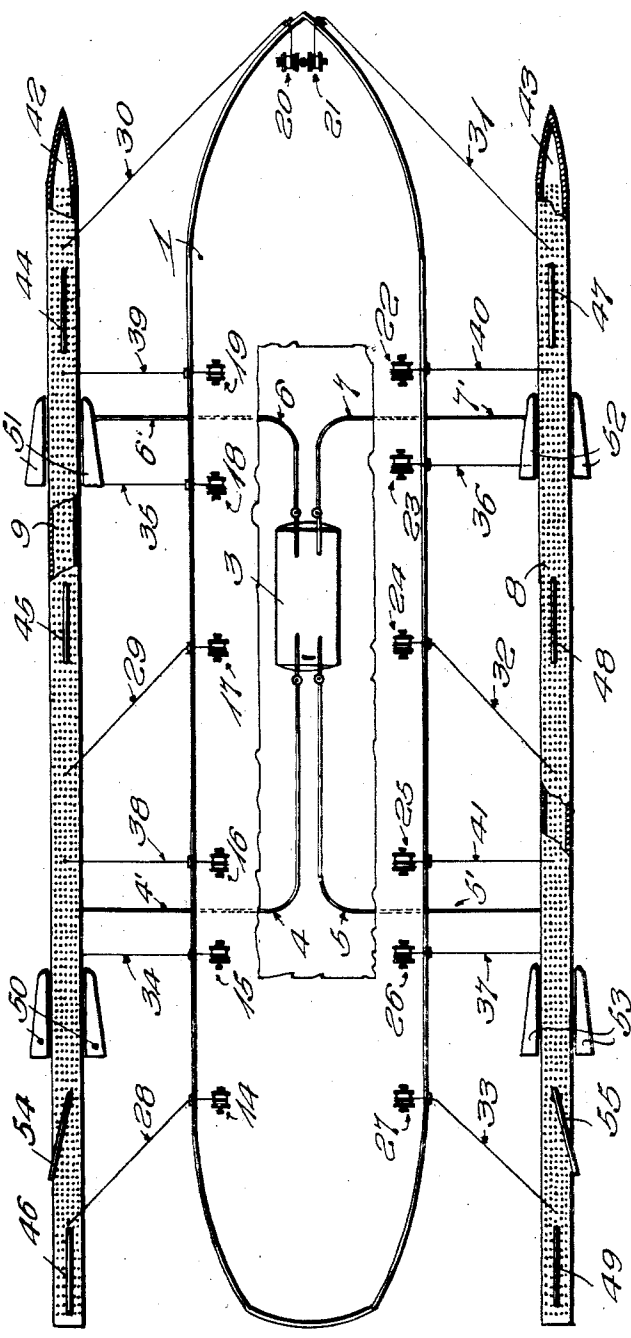

FIG. 1

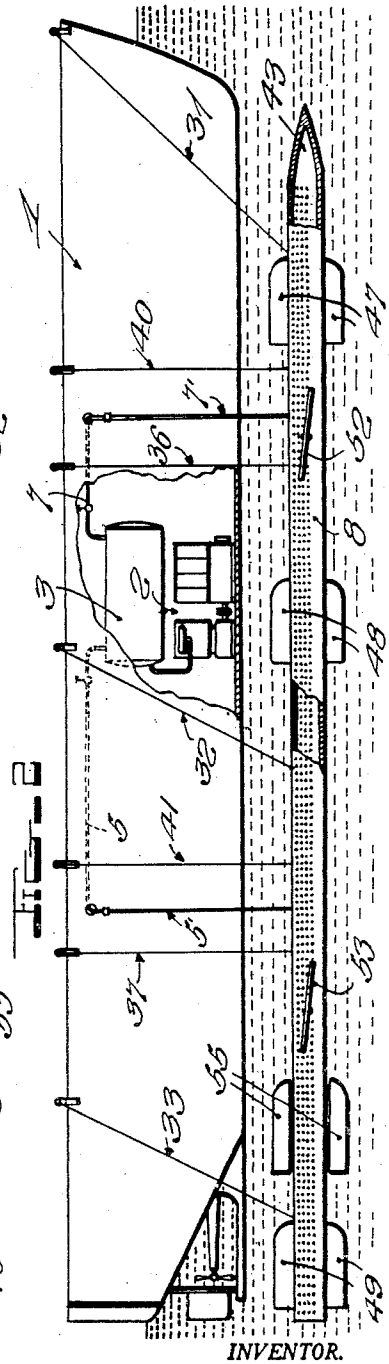

FIG. 2

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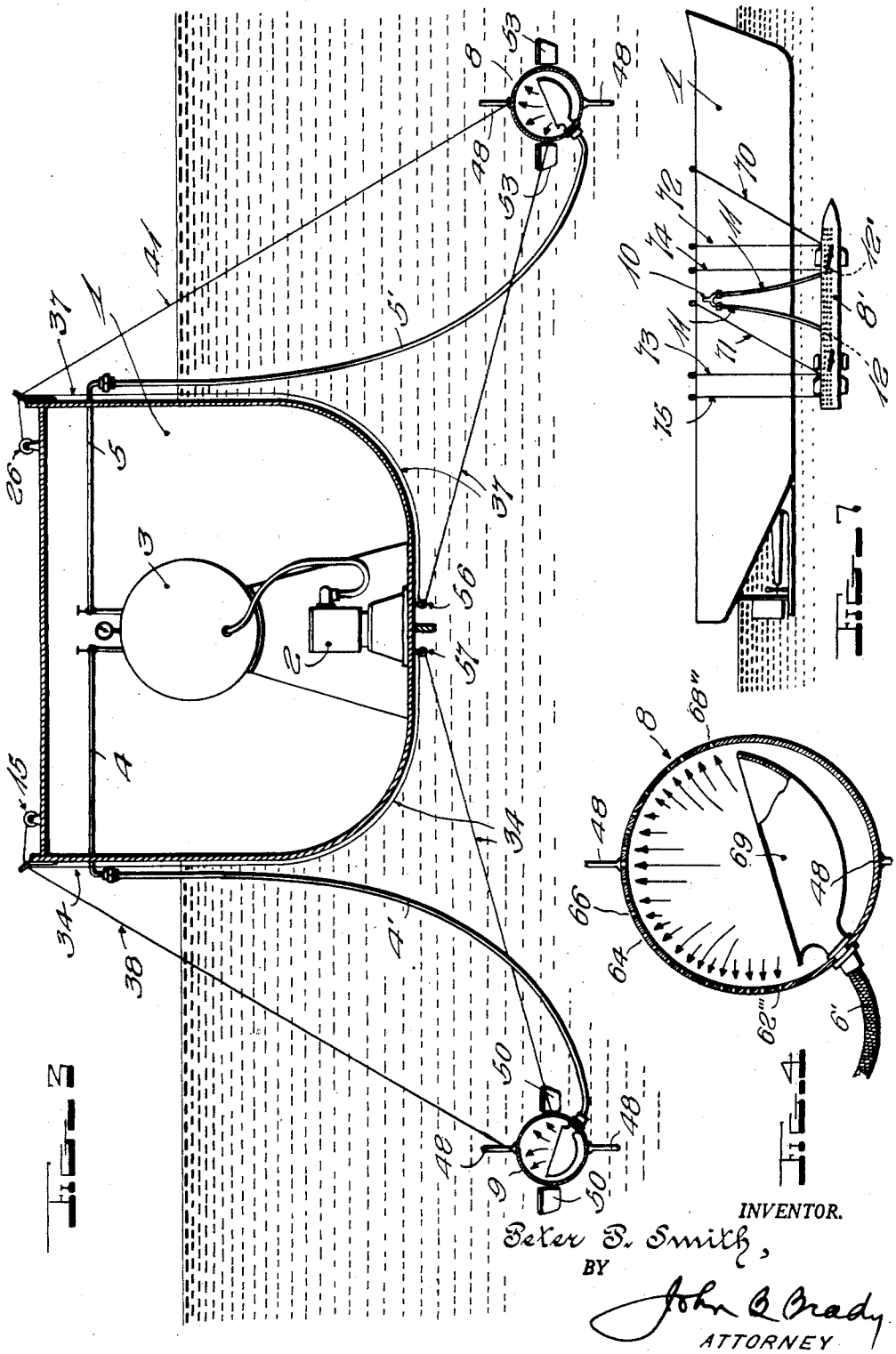
Filed March 16, 1942 3 Sheets-Sheet 2



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Filed March 16, 1942 3 Sheets-Sheet 3

FIG. 8

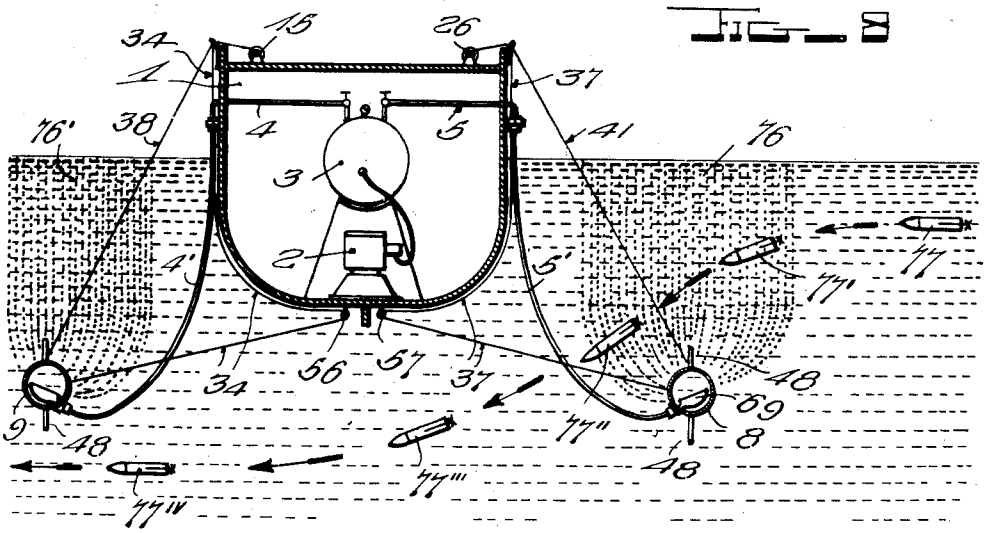

FIG. 9

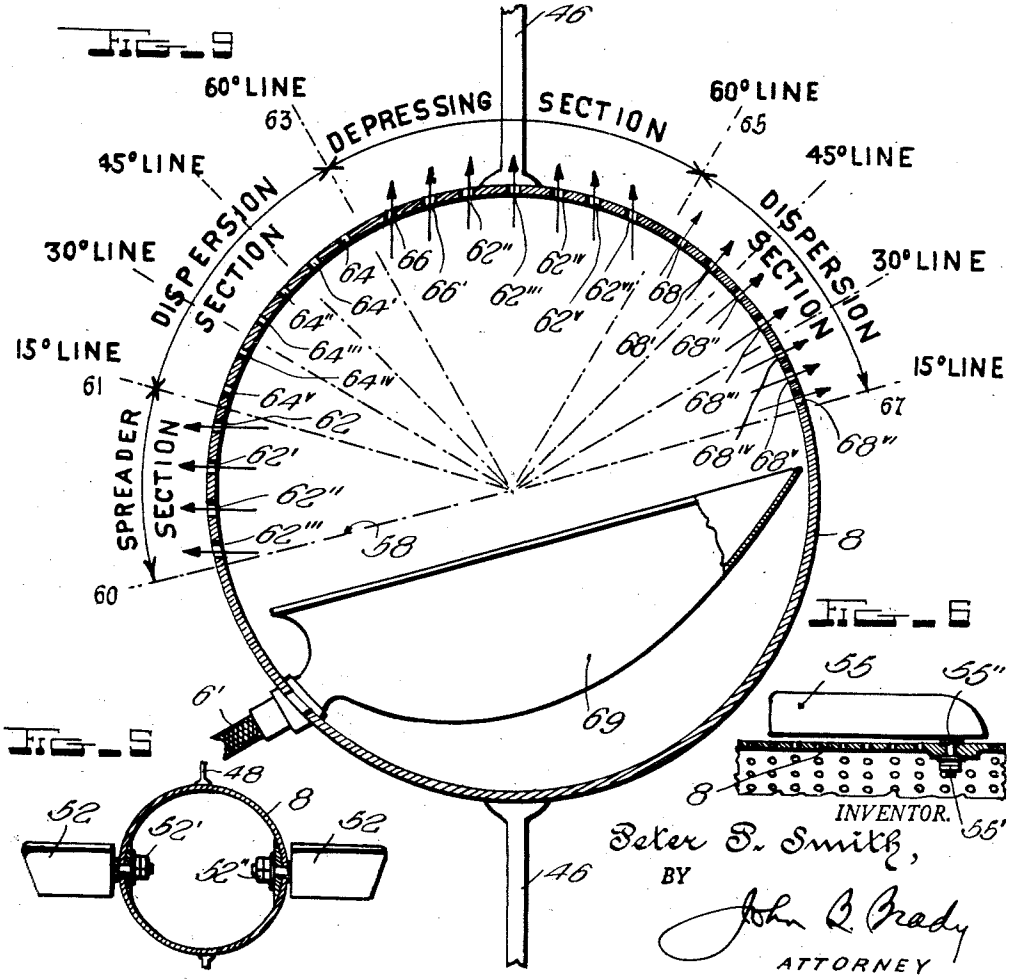

FIG. 6

FIG. 5

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UNITED STATES PATENT OFFICE

2,395,944

SYSTEM FOR THE PROTECTION OF VESSELS AGAINST ATTACK OF TORPEDOES

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Application March 16, 1942, Serial No. 434,938

15 Claims. (Cl. 114—240)

My invention relates broadly to systems for the protection of vessels from torpedo attack, and more particularly to a system for aerating the areas adjacent the hull of a vessel to deflect the course of a projectile torpedo to the extent that the torpedo passes beneath the vessel, or reduces the explosive impact established adjacent the hull of the vessel.

One of the objects of my invention is to provide a system for the protection of vessels which may be readily utilized in submarine infested waters for protection of the vessel against torpedo attack.

Another object of my invention is to provide an arrangement of tubular members extending in spacial relation to the port and starboard of the vessel for discharging compressed air into areas of the water on each side of the vessel having the effect of aerating zones adjacent the vessel within which areas an approaching torpedo may be deflected from its course to avoid striking the objective.

Still another object of my invention is to provide a construction of ship protective means which may be lowered on the port and starboard sides of the vessel in dangerous waters for aerating zones on each side of the vessel to so aerate the water that the course of a torpedo is deflected away from the hull.

A further object of my invention is to provide a practical system of protection for ships in submarine infested waters whereby protective means may be lowered into position on the port and starboard sides of the vessel when required for decreasing the density of the water on opposite sides of the vessel for deflecting the course of torpedoes aimed at the hull.

A still further object of my invention is to provide a construction of floatable protective means for the port and starboard sides of a vessel in which compressed air delivered from the vessel may be distributed through the protective means and spread at fan-like zones having the effect of spacially positioning the protective means in selected positions on the port and starboard sides of the vessel while aerating the zones on each side of the vessel for deflecting torpedoes aimed at the hull.

Another object of my invention is to provide a construction of tubular members arranged to extend in spacial relation to the port and starboard sides of the vessel where the tubular members are perforated in selected areas for distributing compressed air supplied from the vessel into zones on each side of the vessel for aerating the zones, with means associated with the tubular members for stabilizing the path of movement thereof, controlling the spacial relation from the sides of the vessel and determining the depth at which the tubular members are positioned with respect to the hull.

Other and further objects of my invention reside in the construction of tubular members and cable system for the control thereof with respect to the hull of a vessel as set forth more fully in the specification hereinafter following by referring to the accompanying drawings, in which:

Figure 1 is a plan view showing the protective system of my invention; Fig. 2 is a side elevational view illustrating the protective system of my invention; Fig. 3 is a transverse sectional view through a vessel showing the protective system of my invention applied thereto; Fig. 4 is a transverse sectional view through one of the tubular members showing the manner of delivering compressed air thereto from the vessel for distribution into the sea adjacent the vessel; Fig. 5 is a transverse sectional view through one of the tubular members illustrating the arrangement of the depth determining fins applied to opposite sides of the tubular members and showing the arrangement of the vertical stabilizer; Fig. 6 is a detailed view of one of the adjustable tiller vanes employed on the tubular members; Fig. 7 illustrates a modified form of my invention in which the tubular member is applied to the protection of a vital area of the ship and may not necessarily extend the entire length of the vessel as illustrated in Figs. 1 and 2; Fig. 8 is an explanatory view showing the operation of the system of aeration for deflecting the course of the torpedo projectile as it approaches the objective; and Fig. 9 is an enlarged transverse sectional view taken through one of the tubular members and showing the distribution of the perforations or orifices therein for effectively distributing compressed air delivered from the vessel for determining the depth at which the tubular member functions with respect to the hull of the vessel, the spacial relation of the tubular member with respect to the side of the vessel, and the extent of the aerated zone which is created in the sea adjacent each side of the vessel for protection against torpedo attack.

My invention is directed to setting up at a predetermined distance from the vessel, an aerated section in consequence of which in the event that the torpedo detonates through contact with the hull, the force of the explosion is cushioned due to this extended aerated section, as it permits of

the force of the explosion being expended in a large measure through this less dense medium, whereas heretofore it was expended through the less dense section or hull of the boat. The establishment of the aerated zones adjacent opposite sides of the hull of the vessel has the effect of reducing the velocity of the torpedo because there is less bite for the propeller screw of the torpedo on the aerated sea. This reduction in velocity reduces the impact at which the torpedo, if not wholly deflected, may strike the objective. The torpedo accordingly may not detonate. Moreover, by reducing the velocity of the torpedo because of the aerated zone established on each side of the vessel, the penetration of a torpedo which may under some circumstances be defective, may be reduced to a sufficient extent to prevent serious damage or to permit quick repairs to be made. Moreover, because the speed of the torpedo is reduced from the time of entrance to the time of exit through the aerated section during which time the vessel continues at its normal rate of speed, in the event that deflection might not be complete, yet this relative change of velocity would permit of the torpedo passing beyond the stern of the vessel rather than coming in contact with the vessel. The aerated zone has the effect of deflecting the torpedo from its course because of the reduced density of the supporting medium and the tendency of the torpedo to drop by gravity action to such an extent that the torpedo passes harmlessly beneath the hull.

Referring to the drawings in detail, reference character 1 indicates generally the hull of a vessel to be protected against submarine attack. The vessel includes the installation of an air compressor system represented at 2 containing an equalization tank 3 from which compressed air distributing lines 4, 5, 6 and 7 extend. These compressed air distributing lines extend adjacent opposite sides of the hull and have coupled therewith the flexible extension pipe lines indicated at 4', 5', 6' and 7'. The flexible extensions connect with outlets arranged within the tubular members 8 and 9, which in the form of my invention illustrated in Figs. 1–6, may extend substantially the entire length of the vessel. However as shown in Fig. 7, these tubular members may be foreshortened and serve as protector means for the vital part of the vessel such as the amidship section as represented in Fig. 7. That is to say, in the arrangement illustrated in Fig. 7 a shortened tubular member 8' is positioned adjacent one side of the vessel at that section of the vessel which is vulnerable to submarine attack in a position where the hull may not be protected by compartments, or in a position where serious damage might be caused to the propulsion machinery. Compressed air is supplied to the shortened tubular member 8' through a dual supply line extending from distributing pipe 10 to which is connected the twin flexible pressure distribution hose or conduit indicated at 11. The purpose of the twin pressure distribution hose is to supply compressed air at spaced intervals along the tubular member 8' at 12 and 12' so that in the event of fouling of one distribution line, a supply of compressed air is assured through the other distribution line. A similar arrangement of depth control cables and power drag line cables for towing the tubular members adjacent the port or starboard sides of the vessel are provided in the arrangment illustrated in Fig. 7 as in the arrangement illustrated in Figs. 1–6. That is, the vessel is provided with control winches spaced at intervals along the vessel in suitable positions below deck as represented for example at 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27. These control winches may be power driven and each serve to coil the cable which extends between the vessel and the tubular members 8 and 9. Cables 28 29 and 30 and 31, 32 and 33 serve as power drag lines for towing the tubular members 9 and 8 with respect to the vessel 1. The effective lengths of the cables 28, 29 and 30 are controlled by winches 14, 17 and 20 respectively. The effective lengths of the cables 31, 32 and 33 are controlled by the winches 21, 24 and 27, respectively. The depth control cables for controlling the depth at which the tubular members 9 and 8 operate below the hull of the vessel are represented at 34, 35, 36 and 37. These depth control cables 34 and 35 extend from winches 15 and 18 and connect to tubular member 9; the depth control cables 36 and 37 extend from winches 23 and 26 and connect to tubular member 8. By adjusting the winches 15 and 18 and 36 and 37, the depth at which the tubular members operate below the hull may be controlled. The special relation of the tubular members 9 and 8 with respect to the opposite sides of the hull is controlled by distance determining cables 38 and 39 extending from winches 16 and 19 respectively, to tubular member 9, and by distance determining cables 40 and 41 extending from winches 22 and 25 to tubular member 8. The winches 16, 19, 22 and 25 when adjusted, enable the tubular members 9 and 8 to be spread at substantial distances from the hull of the vessel or brought to a closer position with respect to the hull. To insure proper maneuvering of the tubular member, I provide sets of fins and vanes located in various positions along the length of the tubular members. Each tubular member is streamlined as represented generally at 42 and 43 to cut down head resistance as much as possible. The tubular members are stabilized and prevented from rotating in the sea by means of sets of stabilizer vanes shown at 44, 45 and 46 on tubular member 9, and at 47, 48 and 49 on tubular member 8.

In order to operate the tubular members at a selected depth below the hull of the vessel, sets of depth determining fins are provided at spaced intervals along the tubular members. I have indicated the depth determining fins at 50 and 51 on tubular member 9; and at 52 and 53 on tubular member 8. These sets of depth determining fins are adjustable as represented in Fig. 5 and may be set for any particular level by means of adjustment and locking screws 52' and 52'' to enable the tubular members to seek a normal operating level below the hull of the vessel for a predetermined speed of propulsion through the water.

The spacial relation of the tubular members with respect to the sides of the hull of the vessel is controlled by the sets of tiller vanes 54 and 55 carried by the tubular members 9 and 8, respectively. As represented in Fig. 6, the tiller vanes are each adjustable in angular position by means of the nut and lock nut combination illustrated at 55'. The tubular member 8 may be provided with ratchet teeth formed in the tubular member 8 at 55'' to enable the tiller vane to be set in a selected angular position and locked therein against displacement arising from the force of the sea water in the course of travel of the tubular member. The tiller vanes 54 and 55 may be set in a selected angular position to control the spacial relation of the tubular members with re-

spect to the hull of the vessel for a predetermined propulsion speed of the vessel.

The hull of the vessel is provided adjacent the bottom thereof with guide members such as eyelets or anti-friction bearing mounted pulleys represented at 56 and 57 in Fig. 3. These guide members serve to control the path of movement of the depth control cables 8, 36 and 37 which connect to the sides of the tubular member 8 adjacent the hull of the vessel; while the guide means 57 serve to guide depth control cables 34 and 35 which connect to the side of tubular member 9 adjacent the hull of the vessel. These depth control cables extend upwardly through suitable guides around the exterior of the hull of the vessel terminating in the winches as heretofore explained. In Fig. 3 I have represented depth control cables 34 and 37 passing around 57 and 56, respectively, and connected to winches 15 and 26, respectively. I have shown the distance determining cables 41 and 38 connected to tubular members 8 and 9, respectively and extending to the winches aboard the vessel as heretofore explained.

In order to insure the proper distribution of compressed air from the air compressor system aboard the vessel to the tubular members through the flexible pipe lines 4', 5', 6' and 7', I form the tubular members in the shape of streamlined drums which are partially buoyant due to the sustained compressed air supply continuously furnished from the vessel. The tubular members have orifices arranged in a portion of its upper surface. I have represented the distribution of these orifices more clearly in Fig. 9. On the side of the tubular member 9 adjacent the hull of the vessel, the orifices extend below the transverse axis of the tubular member 9, whereas on the side of the tubular member remote from the hull, the orifices terminate above the transverse axis of the tubular member. That is to say, the orifices are confined above the diametric line indicated at 58 in Fig. 9. The orifices are distributed in a very special manner to insure the proper discharge of the compressed air. That is to say, in the 15° zone between limits 60 and 61 the orifices are drilled parallel to the horizontal axis so that air is forced from the tubular member in the direction of the hull of the vessel, thereby tending to maneuver or force the tubular member away from the hull of the vessel to proper spacial relation. The horizontally drilled orifices are represented at 62, 62', 62'' and 62'''. In the succeeding section between the 15° line and the 60° line that is between limits 61 and 63 the orifices are radially disposed as represented at 64, 64', 64'', 64''', 64^{iv}, and 64^{v} constituting a dispersion section for spreading the compressed air in a fan-like sweep for aerating the sea water between the tubular member and the hull of the vessel. In the upper portion of the tubular member between the limits 63 and 65, orifices are drilled parallel to the vertical axis of the tubular member as represented at 66, 66', 66'', 66''', 66^{iv}, 66^{v}, and 66^{vi}. These orifices permit the discharge of air upwardly for aerating the sea above the tubular member and also exerting a depressing force which assists in the submergence of the tubular member to the desired navigating depth below the hull of the vessel. I have indicated the portion of the tubular member extending between the limits between 63 and 65 as the depressing section. The section of the tubular member 9 which extends between limits 65 and 67 constitutes a dispersion section for compressed air for aerating the sea water beyond the position of the tubular member. The orifices in this section are indicated at 68, 68', 68'', 68''', 68^{iv}, 68^{v}, 68^{vi}, as extending radially for discharging compressed air in a fan-like stream outwardly from the tubular member 9 throughout the area extending from the 15° line to the 60° line, shown in Fig. 9.

In order to insure the effective discharge of the compressed air supplied from the pipe lines which extend from the vessel, I provide shaped discharge nozzles 69 connected to the pressure supply pipes for directing the compressed air upwardly within the tubular member 9.

As heretofore pointed out in the arrangement shown in Fig. 7, tow cables represented at 70 and 71 may extend between the vessel and a tubular member of shortened length for protecting the vital portions of the ship. The distance determining cables 72 and 73 are arranged in a similar manner as heretofore explained and the depth control cables 74 and 75 are arranged in a manner similar to the disposition of the depth control cables 34, 35, 41 and 36, heretofore described.

The tubular members are initially lowered into position by suitable derrick arrangements carried by the sides of the ship permitting the tubular members to be hoisted and stowed when the ship is not in dangerous waters. For this purpose the tubular members may be constructed in sections which may be readily assembled when necessary for use.

In Fig. 8 I have illustrated the theory involved in the system of my invention in which the sea is aerated in the area designated at 76 and 76'. This aerated zone extends toward the vessel, from the orifices in the tubular members and in an upward direction and also outwardly remote from the vessel, establishing a continuous area of rarefied density. The torpedo, represented at 77, aimed at the objective encounters the area 76 of the less dense medium and its propeller failing to get its usual full grip on solid water due to the aerating, now drops and passes under the hull. The position of the tubular members may be accurately controlled by extension or retraction of the depth control and distance determining cables as heretofore explained.

I have described my invention in certain preferred embodiments but I realize that modifications may be made and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. Apparatus for protecting vessels from torpedo attacks, comprising in combination with the hull of a vessel a pair of floatable tubular members extending longitudinally of the vessel in spaced relation to the port and starboard thereof, means for generating compressed air on the vessel, means for delivering the compressed air to each of said tubular members, said tubular members being perforated on the upper sides thereof for spreading air under pressure in fan-like zones, and means for maneuvering said tubular members in spacial relation to the hull of the vessel.

2. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for deliv-

ering compressed medium from said compressor to said tubular members, and means carried by each of said tubular members for maneuvering said tubular members in spacial relation to the port and starboard sides of the hull.

3. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, vertical stabilizer vanes connected with each of said tubular members for guiding said tubular members in paths spaced from opposite sides of the hull, and tiller vanes carried by each of said tubular members for continuously heading said tubular members in spacial relation to the hull of the vessel.

4. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, vertically extending stabilizer vanes connected with each of said tubular members, depth determining fins carried by said tubular members for guiding said tubular members in positions below the hull, tiller vanes carried by said tubular members for continuously heading said tubular members away from the vessel, and means interconnecting said tubular members with the hull for limiting the spacial relation of the tubular members with respect to the hull.

5. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, vertically extending stabilizer vanes carried by said tubular members, tiller vanes carried by said tubular members and extending at an acute angle to the longitudinal axis of the tubular members, and cables interconnecting said tubular members with the hull of the vessel.

6. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, the perforated tubular members operating to direct the discharge of air toward said vessel, upwardly with respect to the vessel and outwardly with respect to the vessel, and means for maintaining the spacial relation of said tubular members and the hull both with respect to the depth and distance thereof from the hull of the vessel.

7. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, the perforated portion of each of said tubular members extending below the center on the side of said tubular member adjacent said vessel and terminating above the center on the side of said tubular member remote from the vessel, and means for determining the spacial position of said tubular member with respect to the hull of the vessel.

8. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, the perforated portion of each of said tubular members extending below the center on the side of said tubular member adjacent said vessel and terminating above the center on the side of said tubular member remote form the vessel, and adjustable cables interconnecting said tubular members with said vessel for limiting the position of said tubular members with respect to the hull of the vessel.

9. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, the perforated portion of each of said tubular members extending below the center on the side of said tubular member adjacent said vessel and terminating above the center on the side of said tubular member remote from the vessel, and adjustable cables extensible and retractible from the hull of the vessel for limiting the spacial position of said tubular members both with respect to distance from the hull and depth beneath the hull from which the compressed medium is discharged.

10. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, vanes projecting from said tubular members for preventing rotation of said tubular members with respect to the hull of the vessel, and extensible and retractible cables disposed between the hull of the vessel and the tubular members for limiting both the distance and depth of the tubular members with respect to the hull of the vessel.

11. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, angularly disposed vanes carried by said tubular members and adjustable in position for guiding said tubular members with respect to the hull, and extensible and retractible cables interconnecting said tubular members with the hull for limiting the depth and distance at which said tubular members operate with respect to the hull.

12. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof,

a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, adjustable depth determining fins mounted on opposite sides of said tubular members and extensible and retractible cables interconnecting said tubular members with said hull for limiting the depth at which said tubular members operate both with respect to the sides of the vessel and the depth below the vessel.

13. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, cable guide means located adjacent the bottom of the hull and adjacent the top of the hull, cables extending through said guide means, means for extending or retracting said cables, connections for the said cables and said tubular members, and means for guiding said tubular members in spacial relation both as to distance from said hull and depth below the hull according to the movement of the ship.

14. Apparatus for protecting vessels from torpedo attack, comprising in combination with the hull of the vessel, tubular members extending in spaced relation to the port and starboard of the vessel and perforated in selected portions thereof, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members, cable guide means located adjacent the bottom of the hull and adjacent the top of the hull, cables extending through said guide means, winch control means for selectively extending or retracting said cables through said cable guide means, connections between said cables and said tubular members, and means for guiding said tubular members in spacial relation both as to distance from said hull and depth below the hull according to the movement of the ship.

15. Apparatus for protecting vessels from torpedo attack comprising in combination with the hull of the vessel streamlined tubular members extending in spaced relation to both port and starboard of the vessel, said tubular members including orifices directed toward the vessel and directed upwardly with respect to the vessel and directed outwardly with respect to the vessel, a compressor on said vessel, means for delivering compressed medium from said compressor to said tubular members for discharge through the orifices therein, means for controlling the direction of travel of said tubular members according to the course of the vessel, and adjustable cables extending at spaced intervals between said vessel and said tubular members for limiting the spacial relation of said tubular members with respect to the sides of the hull and the depth beneath the hull.

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