S. LAKE.

SUBMARINE BOAT.

APPLICATION FILED DEC. 5, 1914.

1,135,537.

Patented Apr. 13, 1915.

6 SHEETS—SHEET 1.

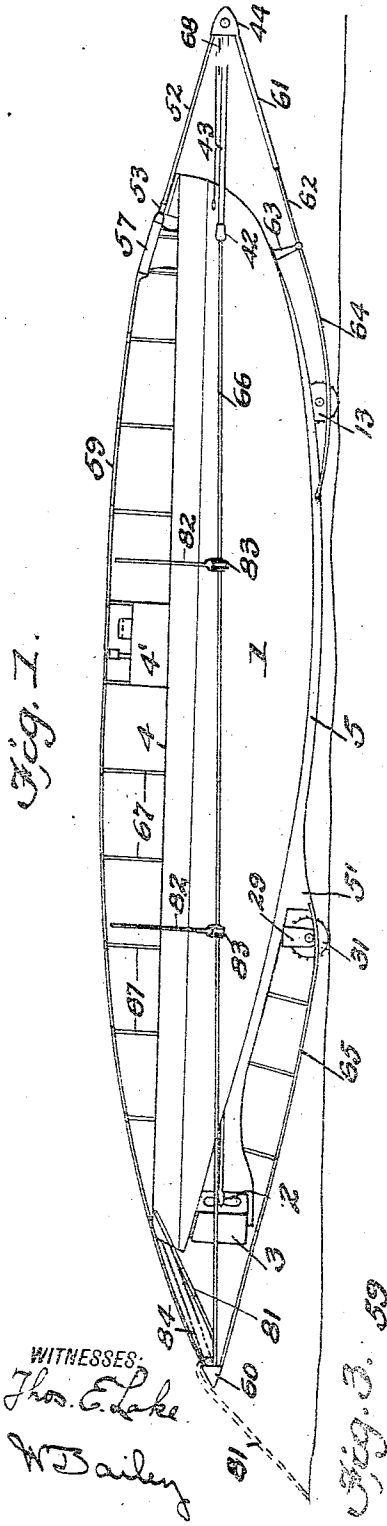


Fig. 1.

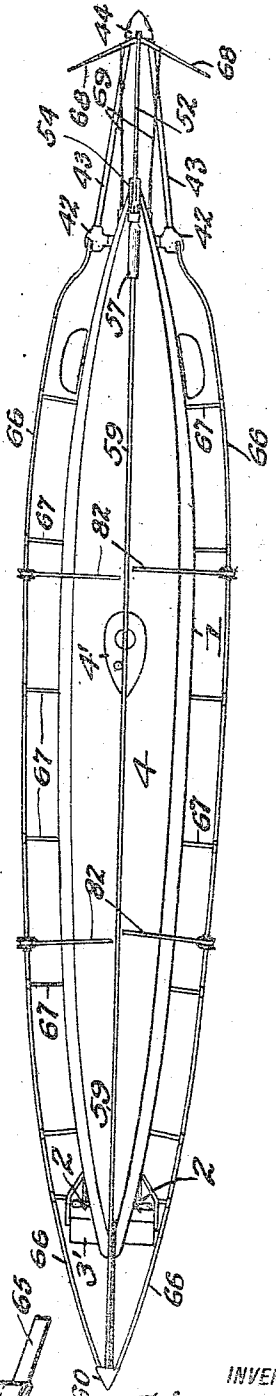


Fig. 2.

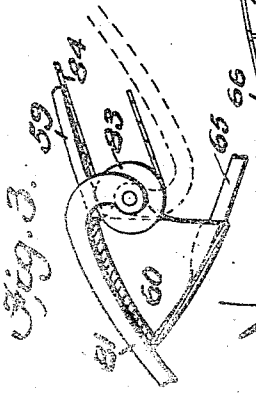


Fig. 3.

WITNESSES:

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F. B. Bailey

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6 SHEETS—SHEET 2.

Fig. 5.

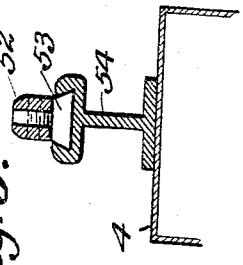



Fig. 4.




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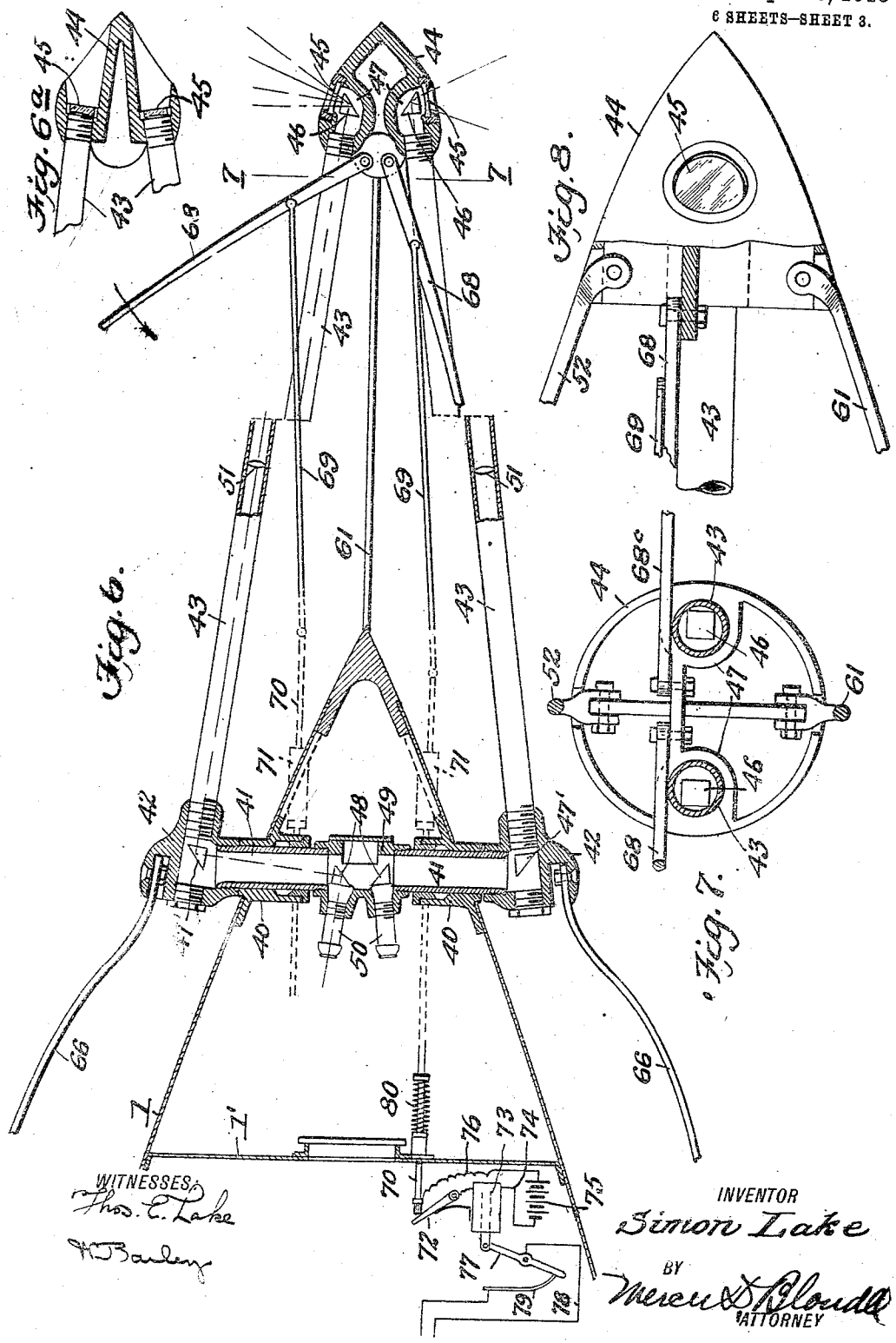
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6 SHEETS—SHEET 3.



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6 SHEETS—SHEET 4.

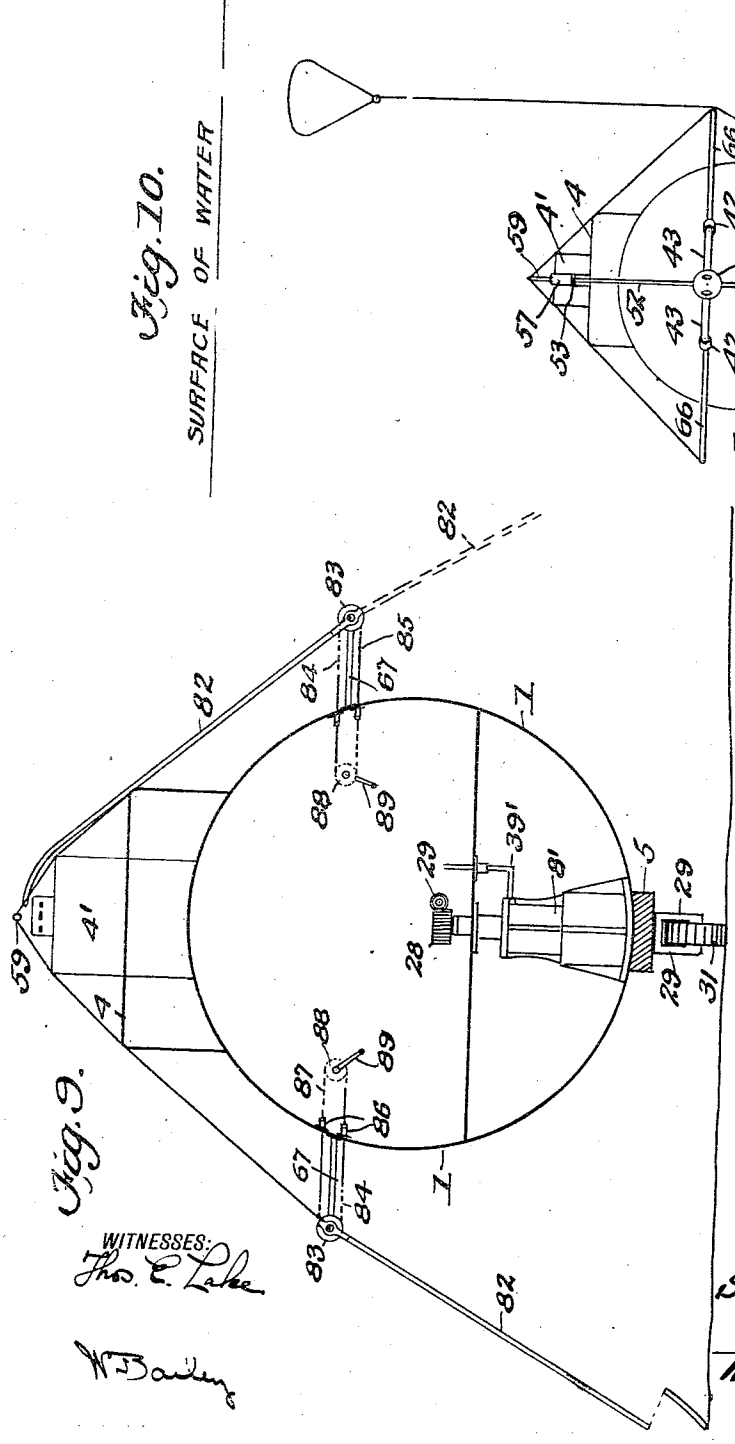



Fig. 9.




Fig. 10.

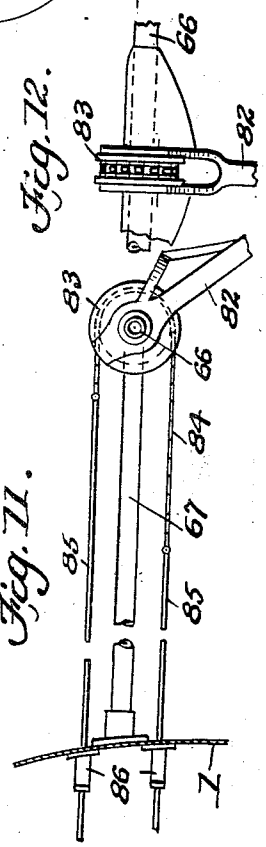



Fig. 12.

Fig. 11.

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6 SHEETS—SHEET 5.

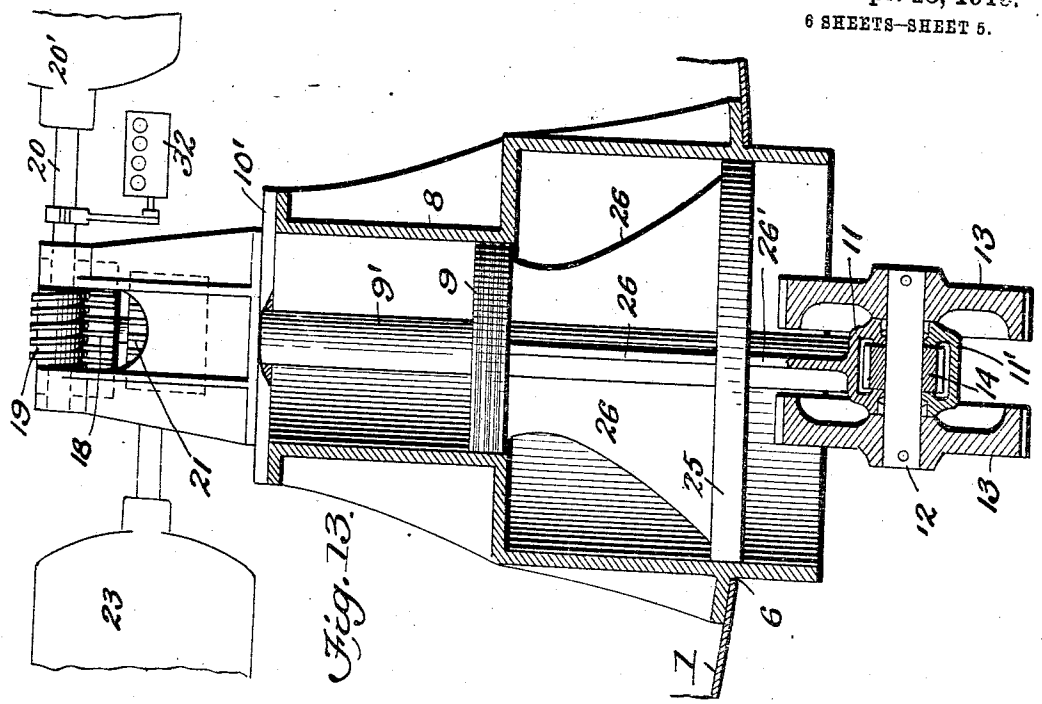



Fig. 13.

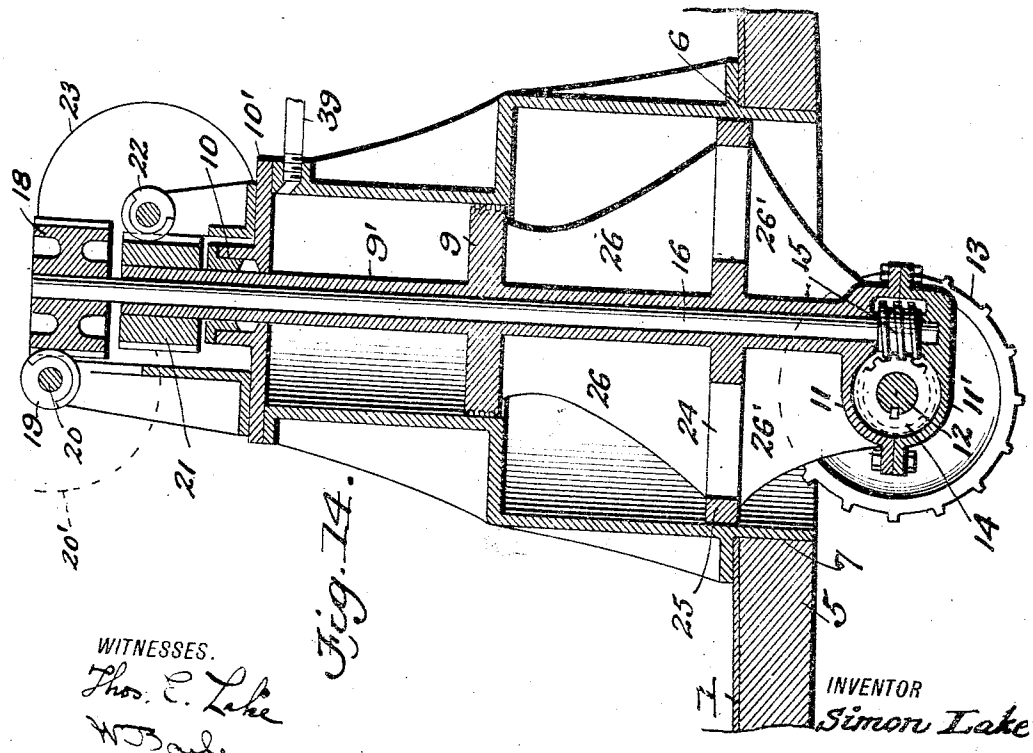



Fig. 14.

WITNESSES.

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SUBMARINE BOAT.

APPLICATION FILED DEC. 5, 1914.

1,135,537.

Patented Apr. 13, 1915.

6 SHEETS—SHEET 6.

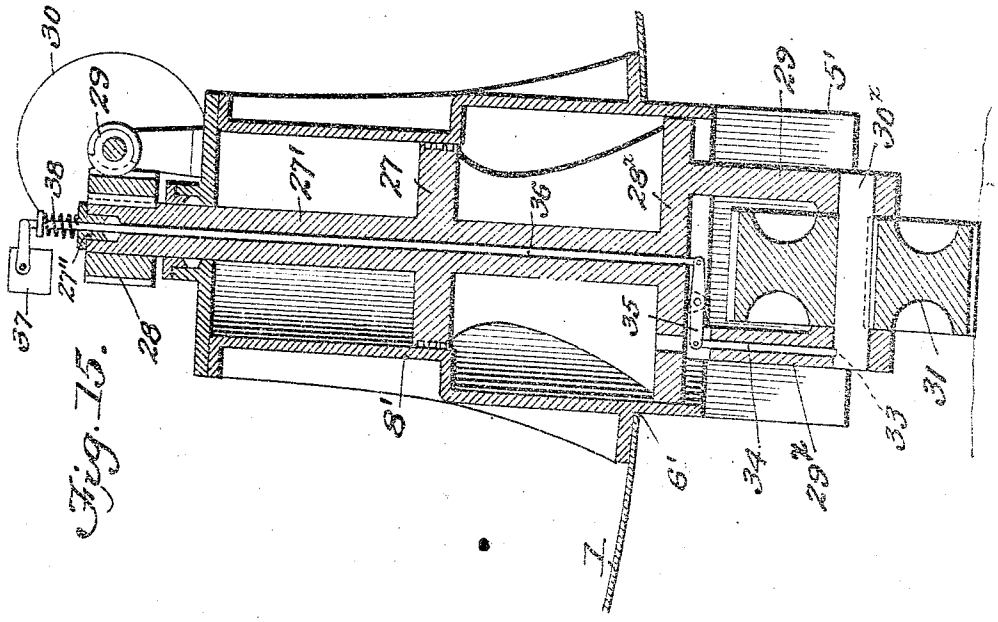



Fig. 15.

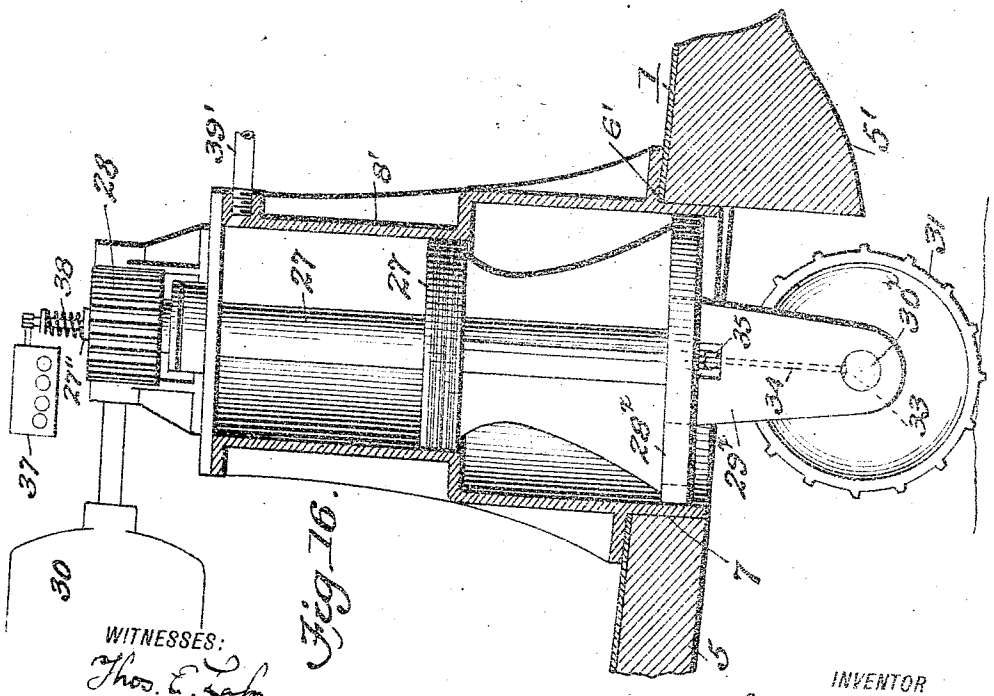



Fig. 16.

WITNESSES:

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# UNITED STATES PATENT OFFICE.

SIMON LAKE, OF MILFORD, CONNECTICUT, ASSIGNOR TO THE LAKE TORPEDO BOAT COMPANY OF MAINE, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF MAINE.

## SUBMARINE BOAT.

1,135,537. Specification of Letters Patent. Patented Apr. 13, 1915.

Application filed December 5, 1914. Serial No. 875,636.

*To all whom it may concern:*

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Submarine Boats, of which the following is a specification.

The object of the invention is to provide a submarine or submersible torpedo or mine-planting boat which is capable of operating in contact with the water bed and through devious channels and mine sowed waters without danger of contacting with or exploding the mines, and which is also capable of navigating past obstructions placed in channels, and under torpedo nets thrown out from ships when operating in the presence of submarine or surface torpedo boats.

The invention consists in providing the forward end of a submarine or submersible boat with a vertically adjustable fender arranged in front of the bow of the boat, the forward end of the fender being connected with the boat by guard rails which extend rearwardly along the sides of the boat and over the deck and under the keel thereof to enable the boat to contact with the anchor cables of the mines and easily ride past the mines, and also to work its way under torpedo nets or other obstructions, said fender being constructed to serve as an aquascope which will enable those in the submarine to see through the water a sufficient distance to permit steering clear of mines or other obstructions.

The invention also consists in providing a submarine or submersible boat with traction wheels by which the boat may be propelled over the water-bed and steered in any given direction, the said traction wheels being an improvement upon those shown in Letters Patent Nos. 581,213 and 726,705 granted to me April 20, 1897 and April 28, 1903, respectively.

The invention further consists in certain novel features of construction and in certain parts, improvements and combinations which will be hereinafter fully described and then claimed.

In the drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a diagrammatic side elevation of a submarine or submersible boat equipped with my invention. Fig. 2 is a plan view of same. Fig. 3 is a detail section drawn through the casting at the after end of the guard rails of the boat illustrating the operating of what I prefer to call a sweep-line guard arm. Fig. 4 is a side elevation of the forward end of the boat showing the fender adjusted downwardly in dotted lines, the piston cylinder for controlling the movement of the fender being shown in section. Fig. 5 is a detail transverse section drawn on the line 5—5 of Fig. 4. Fig. 6 is a horizontal section drawn on the line 6—6 of Fig. 4, the intermediate section of the fender being broken and the forward end moved rearwardly. Fig. 6ª is a detail view of a slightly different arrangement of the objectives carried by the head of the fender. Fig. 7 is a transverse section drawn on a larger scale on the line 7—7 of Fig. 6. Fig. 8 is a sectional elevation of the forward end of the fender. Fig. 9 is a diagrammatic sectional view drawn through the boat. Fig. 10 is a front view illustrating the operation of the invention. Fig. 11 is a sectional elevation drawn through one side of the boat and one of the side guard rails illustrating the operation of what I prefer to call side sweep-line guard arms. Fig. 12 is a detail front view of the same. Fig. 13 is a transverse section drawn through the forward propelling and steering wheel and its cylinder. Fig. 14 is a longitudinal section of the same. Figs. 15 and 16 are similar views drawn through the aft steering wheel.

1 designates the hull of a submarine or submersible boat of any approved design and provided with the usual propellers 2 and vertical and horizontal rudders 3 and 3′ for navigating on the surface of the water and between the water-bed and the surface.

4 designates the superstructure, 4′ the conning-tower and 5 the keel of the boat. Forward and aft of the longitudinal center of the boat the hull 1 is provided with openings 6 and 6′ Figs. 13, 14, 15 and 16, which aline with openings 7 arranged in the keel 5, and surrounding the said openings and connected air-and-water-tight to the hull plating are pneumatic trunk-cylinders 8 and 8′. In the forward cylinder 8 is a piston 9 having a hollow rod 9′ which extends

through a stuffing box 10 in the head 10′ of the cylinder, and has its lower end extended below the said piston and terminating in a casing or box 11 which, with a removable lower cap section 11′, provides a bearing for a shaft 12 upon the outer ends of which are mounted bearing rollers or traction wheels 13. Within the casing or box 11 is a worm wheel 14 which is keyed to the shaft 12 and meshed by a worm 15 arranged upon the lower end of a shaft 16 journaled in the hollow rod 9′ of the piston. The shaft 16 extends through the upper end of the rod 9′ and has a worm wheel 18 mounted thereon which is meshed by a drive worm 19 carried by the shaft 20 of a suitable motor 20′ a portion of which is indicated in Figs. 13 and 14. The upper end of the piston rod 9′ is provided with a worm wheel 21 which is meshed by a worm 22 arranged upon the shaft of a motor 23 indicated in Figs. 13 and 14 and which is designed for rotating the rod to thus steer the boat over its course. The rod 9′ below the piston 9 is formed with arms 24 having a rim 25 connecting their outer ends which snugly fits the lower enlarged end of the cylinder 8. The arms are connected to the rod 9′ by webs 26 and also with webs 26′ which latter connect said arms with the upper section of the casing or box 11 thereby providing a thoroughly rigid construction.

In the aft cylinder 8′ is arranged a piston 27, the rod 27′ of which extends through the head of the cylinder 8′ and has its upper end provided with a worm wheel 28 which is meshed by a worm 29 carried upon the shaft of a motor 30 indicated in Figs. 15 and 16. The lower end of the said rod extends below the piston 27 and is formed with a cross-head 28× snugly fitting the lower end of the cylinder and having downwardly extending arms 29× in the lower ends of which is journaled a shaft 30× having a bearing roller or traction wheel 31 keyed thereto.

As indicated in Fig. 13, the shaft 20 of the motor 20′ is operatively connected with a speedometer 32 of any suitable design by which the revolutions of the traction wheel 13 may be determined so that the distance traversed by the boat may be readily calculated. The aft traction wheel 31 has its shaft 30× provided with a small cam groove 33 (Fig. 15), which is engaged by a rod 34, operatively held in a bore formed in one of the arms 29× and has its upper end operatively connected to the outer end of a lever 35 pivoted intermediate its ends to the lower side of the cross head 28× and which has its inner end operatively connected to a rod 36 which is extended up through the piston rod 27′ and has its upper end operatively connected with a speedometer 37 indicated in Figs. 15 and 16. The rod 34 is normally held in engagement with the shaft 30× by an expansion spring 38 surrounding the upper end of the rod 36 and bearing against a collar applied to said rod 36 and against the gland of a stuffing box 27″ in the upper end of the piston rod 27′.

Air under pressure is supplied to the upper ends of the cylinders 8 and 8′ through pipes 39 and 39′ respectively, extending from suitable sources of compressed air supply (not shown). It will be evident that when air is admitted or pumped into the cylinders the pistons, and likewise the traction wheels will be forced below the keel of the boat, and in order to elevate the wheels I connect the pipes 39 and 39′ with a suitable vacuum pump (not shown), by which a partial vacuum may be created in the upper ends of the cylinders which, with the water pressure against the lower sides of the pistons, will elevate the latter and their connected wheels. It may be stated that the pipes 39 and 39′ will be provided with suitable valves (not shown), by which the connections with the compressed air supply may be cut off and the cylinders connected up with a suitable vacuum pump.

The sides of the boat adjacent to the bow are provided with openings in which are arranged castings 40 forming bearings for a hollow sectional shaft 41 to the outer ends of which are connected elbow castings 42 to which are connected tubular fender arms 43 which converge toward their outer ends. These ends are connected to a conical casting 44 having openings in its sides in which are held plano-concave lenses 45 constituting object-glasses behind each of which is a prism 46 suitably held in pockets 47 formed in the casting 44 and which are disposed so as to bend the light rays entering through the object-glasses rearwardly through the tubular fender arms. In the elbow castings 42 are mounted prisms 47′ disposed to receive the light rays reflected through the tubular arms and bend the same through the hollow sectional shaft 41 upon prisms 48 held in a casting 49 connected to the inner ends of the sections of said shaft 41, the said casting 49 having openings in which are arranged eye-pieces 50 through which the observer may secure a view of the object reflected through an object-glass of the casting 44. In practice the tubular fender arms will be provided with suitable focusing lenses 51 Fig. 6.

Normally the fender arms are held in a substantially horizontal position as shown in Fig. 4, and in order to control the position of the arms the casting 44 is applied to the forward end of a connecting rod 52, the rear end of which is connected to a cross head 53 slidingly mounted in a bracket 54 arranged upon the forward end of the deck of the boat, as shown most clearly in Figs. 4 and 5. To the cross head 53 is connected

a piston rod 55 carried by a piston 56 arranged in a hydraulic cylinder 57 mounted upon the deck in longitudinal alinement with the cross head 53. The opposite ends of the cylinder are connected by pipes 58 with a suitable hydraulic pump (not shown) mounted within the boat. As water is pumped into either end of the cylinder 57 through pipes 58 the piston will be caused to travel therein to thus raise or lower the fender.

To the rear end of the cylinder 57 is connected a fender rail 59 which is extended over the deck of the boat and has its after end terminating a suitable distance from the stern of the boat and connected to a hollow conical casting 60 Figs. 1, 2 and 3. To the lower side of the forward casting 44 is pivotally connected a hollow fender bar or rail 61 in which is telescopically fitted the forward end of a fender bar or rail 62 having its rear end pivotally connected to a bracket 63 projecting from the lower side of the forward end of the hull of the boat, and from the bracket 63 extends a fender rail 64, the rear end of which is forked to straddle the forward traction wheel 13 and engage the sides of the keel of the boat in rear of said traction wheel. Immediately forward of the opening 6′ the keel is formed with a skeg 5′ to the sides of which are connected the forked ends of a fender rail 65 having its rear end connected to the casting 60 as shown in Figs. 1 and 3.

To the elbow castings 42 are pivotally connected fender or guard rails 66 which extend rearwardly along the sides of the boat at a suitable distance therefrom and have their rear ends connected to the casting 60 as shown in Figs. 1 and 2. The several fender or guard rails are braced to the boat by stanchions or bars 67. The connecting rod 52 also serves as a fender or guard rail. By arrangement of the fender rails as described, it will be evident that as the boat is navigated over or upon the water-bed should the anchor cable of a mine be engaged, the said cable and mine will be pushed to one side as shown in Fig. 10 without drawing the mine into contact with the hull of the boat.

As is well-known, observations may be made through clear water a distance of thirty feet even at a depth of one hundred feet. When a boat is being maneuvered through a mined-channel or other body of water upon the water bed, it is driven at a very slow speed and when so operating an observer stationed at the eye-pieces 50 is enabled to ascertain the approach of the boat toward a mine, net or other obstruction, so that he may advise the navigator in time to avoid the danger. When operating at night, however, such observations cannot be made, and in order to meet this contingency automatically the moment the fender engages a mine anchor-cable, for instance, laterally movable arms or antennæ 68 are pivoted to the rear end of the casting 44 and have rods 69 applied to them near their pivots, the inner ends of said rods being connected, as by universal joints, with slide rods 70 which operate through stuffing boxes 71 secured to and extending through the sides of the hull, said rods 70 having their inner ends arranged to coöperate with electric switch levers 72, one of which is shown diagrammatically in Fig. 6, the said switch lever 72 being connected to a solenoid 73 from which extends a conductor wire 74 which is connected to a battery 75 from the opposite terminal of which extends a conductor wire 76 which is connected to a contact fixed upon the extreme inner end of the sliding rod 70. The plunger of the solenoid has a lever 77 connected to its outer end from which extends a terminal 78 leading from a suitable switch (not shown), which is operatively connected to the motors for operating the traction wheels and coacting with said lever is a contact 79 carried by the opposite terminal connecting the switch. By this arrangement should either antenna engage an obstruction and be forced rearwardly in the direction indicated by the arrow in Fig. 6 the inner end of the sliding rod will engage the lever 72 thus completing a circuit through the battery and energizing the solenoid, thus drawing the plunger inwardly to cause the lever 77 to engage the contact 79 and thus complete a circuit to throw the switch and stop the motor. The occupants of the boat then reverse the motors in the ordinary manner to thus back the boat away from the obstruction encountered, and when the boat has been moved rearwardly sufficiently to avoid the obstruction the motors are again started to drive the boat ahead when the course of the latter may be changed as will be readily understood. Any suitable means may be employed for holding the antennæ in their outer position and for the purpose of illustration I show them provided with expansion springs 80, Fig. 6, interposed between a collar on the rod 70 and a stuffing box surrounding the opening in a partition or bulkhead 1′ arranged in the forward end of the boat, the said bulkhead having an opening or door-way controlled by a suitable cover by which the compartment in the forward end of the boat may be cut off from the main section of the latter.

So far as described it will be observed that my improved attachment is designed to enable a submarine boat to work its way past or above or under obstructions without being observed or detected. Now, should the boat make an attack upon a hostile ship and it should be desirable to further submerge

and lie upon the water-bed for a reasonable length of time, and to avoid detection by means of "sweep-lines" carried by surface vessels, I provide the casting 60 with a sweep-line guard-arm 81 which is designed to be lowered so that its free end will rest against the water bed as shown in dotted lines in Fig. 1, and in this event the fender at the forward end of the boat is also lowered as shown in dotted lines in Fig. 4 so that in the event of a sweep-line being drawn across the water-bed in the vicinity of the submarine boat, the sweep-line will readily pass over the boat without being caught in any of the projections thereof. In order to prevent the sweep-line catching hold of the boat should it be drawn against the sides thereof I provide the side guard rails 66 with sweep-line guard arms 82 as shown in Figs. 1, 2, 9, 11 and 12 which are also designed to have their free ends lowered to engage the water-bed as shown particularly in Fig. 9. In practice the inner ends of the side sweep-line arms and the inner end of the stern sweep-line arm are connected to sprocket wheels 83 rotatably mounted respectively on the side guard rails 66 and in the casting 60 and around the sprockets operate chains 84 which have their inner ends connected to slide rods 85 operating through stuffing boxes 86 secured to the hull plating of the boat, the inner ends of said rods being connected by sprocket chains 87 which operate over sprockets 88 mounted within the boat as shown diagrammatically in Fig. 9. The sprockets 88 may be operated in any suitable manner and for the purpose of illustration I show them provided with crank handles 89. In the drawings I show only 2 side sweep-line guard arms but it will be apparent that a greater number may be employed if necessary. It will be evident that by rotating the sprockets 88 in one direction or the other the sweep-line guard arms may be adjusted up or down as the case may be. It will also be evident that by rotating the forward traction wheel 13 to a position at right angles to the longitudinal axis of the boat, and then operating the wheel as a propelling medium, the boat may be swung around with the aft wheel 31 acting as a pivot to thus enable the occupants of the boat to maneuver it without deviating greatly from its course; in other words, it enables the occupants of the boat to swing it away from an obstruction without maneuvering it over a large territory.

I desire it further understood that I do not wish to be limited to the location of the objectives 45 in the sides of the conical head 44 as it will be apparent that the openings in the said casting may be arranged in longitudinal alinement with the tubular fender arms 43 to enable the observer stationed at the eye-pieces 50 to see directly ahead of the course in which the vessel is being steered. In this arrangement it will be further understood that the prisms 46 may be dispensed with and the lenses 45 arranged directly in longitudinal alinement with the tubular arms 43 to thus enable the observer to perceive an object lying directly in the path of the boat.

What I claim is:

1. The combination with a submarine boat provided with bottom wheels for navigating over the water-bed and movable for steering purposes and for short radius turning, of fenders connected to the vessel and extending out beyond the line and appendages thereof overhead, under the keel and at the sides, and adapted for the purpose specified.

2. The combination with a submarine boat provided with bottom wheels for navigating over the water-bed, of fenders connected to the vessel and extending out beyond the line and appendages thereof and also extending from a point forward of the bow of the boat to a point aft of the stern thereof.

3. The combination with a submarine boat, of a fender journaled to the forward end of the boat, and fender-rails extending from said fender over the deck, along the sides, under the keel and terminating aft of the stern of the boat.

4. The combination with a submarine boat, of a fender journaled at the bow of the boat and having a conical forward end, fender-rails extending from said fender over the deck, along the sides and under the keel of the boat, and means for controlling the position of said fender.

5. The combination with a submarine boat, provided with wheels for propelling the boat over the water-bed, of a fender journaled in the sides of the bow of the boat, said fender having a conical outer end, fender guard rails extending from said fender over the deck, along the sides, under the keel of the boat, and terminating aft of the stern of the boat, means for controlling the position of the fender, substantially for the purpose specified, and sweep-line guard arms connected to said fender guard rails.

6. The combination with a submarine boat, of a fender journaled in the sides of and at the bow of the boat, said fender constructed with converging side arms and a conical end to which said arms are connected, means mounted upon the deck of the boat and connected to said conical end for controlling the position of said fender, said means being operable from within the boat, and fender rails connected to said fender and extending over the deck, along the sides, under the keel of the boat and terminating aft of the stern of the boat, and a casting connected to the after ends of said fender-rails.

7. The combination with a submarine

boat, of a combined steering and traction wheel mounted in the boat forward of the longitudinal center thereof, and adapted to be projected below the keel of the boat, and a steering wheel also mounted in the boat aft of the center thereof and adapted to be projected below the keel, means for operating said wheels, as for the purposes specified, a fender journaled in the bow of the boat and having its forward end terminating in a conical casting or head, means for controlling the position of said fender, fender rails arranged over the deck, along the sides and under the keel of the boat and terminating aft of the stern of the boat, and a conical casting connecting the after ends of said rails.

8. The combination with a submarine boat, of combined steering and propelling wheels mounted in the boat and adapted to be projected below the keel thereof, a fender journaled in the sides of the bow of the boat, and comprising converging hollow arms having their outer ends connected by a conical casting, means for controlling the position of said fender, fender rails extending from said fender over the deck, along the sides and under the keel of the boat, said rails having their after ends terminating aft of the stern of the boat, and antennæ connected to the casting of said fender, substantially as and for the purpose specified.

9. The combination with a submarine boat, of a hollow shaft journaled horizontally in the bow of the boat and having castings at its outer ends, forwardly converging arms connected to said castings, a conical casting connected to the forward ends of said arms, a cross-head slidably mounted in a guide mounted upon the deck of the boat and having a connecting rod connected thereto and to said conical casting, said rod serving as a fender rail, a cylinder having a piston operating therein, the rod of said piston being connected to said cross-head, means for supplying fluid under pressure to the opposite ends of the cylinder, for the purpose specified, a fender rail extending rearwardly from said cylinder over the deck of the boat, a fender rail extending rearwardly from said conical casting under the keel of the boat, a conical casting connecting the rear ends of said fender rails, antennæ carried by said fender and a signal apparatus arranged within the boat and connected to the said antennæ substantially as and for the purpose specified.

10. The combination with a submarine boat, of a sighting instrument, constituting a fender, journaled at the forward end of the boat and adapted to swing vertically, means operable from within the boat for controlling the position of the fender, and fender-rails extending from said fender along the sides of the boat and terminating aft of the stern of the boat.

11. The combination with a submarine boat, of a sighting instrument, constituting a fender, mounted at the forward end of the boat and adapted for a vertically swinging movement, and means for controlling the position of said sighting instrument.

12. The combination with a submarine boat provided with wheels for navigating over a water-bed, of a sighting instrument constituting a fender journaled at the forward end of the boat and adapted for a vertically swinging movement, and means for controlling the position of said sighting instrument or fender and serving as a fender rail as specified.

13. The combination with a submarine boat, of a sighting instrument constituting a fender journaled in the forward end of the boat, said instrument comprising a rotatable hollow shaft and outwardly converging hollow arms, a conical casting connected to the forward ends of said arms and having pockets or recesses formed therein and openings in its sides, object-glasses arranged in said openings, and reflectors arranged in said pockets and in said shaft, and eye-pieces carried by said shaft.

14. The combination with a submarine boat, of a sighting instrument constituting a fender journaled in the forward end of the boat and adapted for a vertically swinging movement, means for controlling the position of said sighting instrument or fender, and antennæ carried by said sighting instrument or fender for the purpose specified.

15. The combination with a submarine boat, of a fender connected thereto, a cylinder mounted in and opening at its lower end through the hull of the boat, a piston operating in said cylinder having its lower face exposed to the water of flotation and having a piston rod, a combined steering and traction wheel journaled in the lower end of said piston rod, and means for operating said wheel, for the purpose specified.

16. The combination with a submarine boat, of a fender connected to the hull thereof, cylinders mounted in and opening through the hull of the boat, pistons operating in said cylinders having their lower faces exposed to the water of flotation, a combined steering and traction wheel carried by one of said pistons, a steering wheel carried by the other piston, independent means for operating said wheels, for the purposes specified, and means to supply pressure to the upper faces of said pistons to project said wheels beyond the hull.

17. The combination with a submarine boat, of cylinders mounted therein, pistons operating in said cylinders having piston rods extended through both ends of said

cylinders, a combined steering and traction wheel carried by one of said pistons, a steering wheel carried by the other piston, and independent means for operating said wheels for the purposes specified.

18. The combination with a submarine boat, of a fender adjustably mounted at the forward end of the boat, means for controlling the position of said fender, and fender rails extending from said adjustable fender and terminating at a point aft of the stern of the boat.

In testimony whereof I have hereunto set my hand this 1st day of December, A. D. 1914.

SIMON LAKE.

Witnesses:
PHILIP B. BRILL,
ARTHUR ROBINSON.