No. 638,342.

Patented Dec. 5, 1899.

S. LAKE.

SUBMARINE VESSEL.

(Application filed Apr. 4, 1898.)

(No Model.)

2 Sheets—Sheet 1.

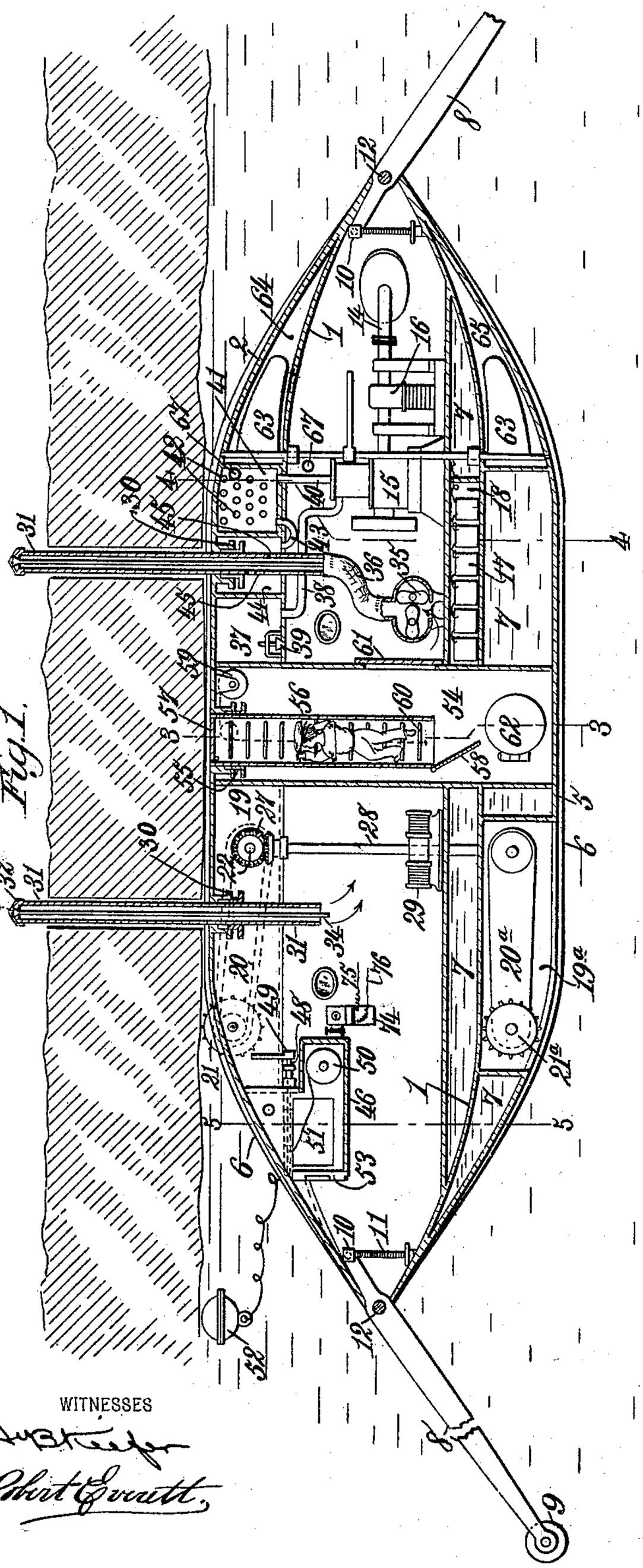

Fig. 1.

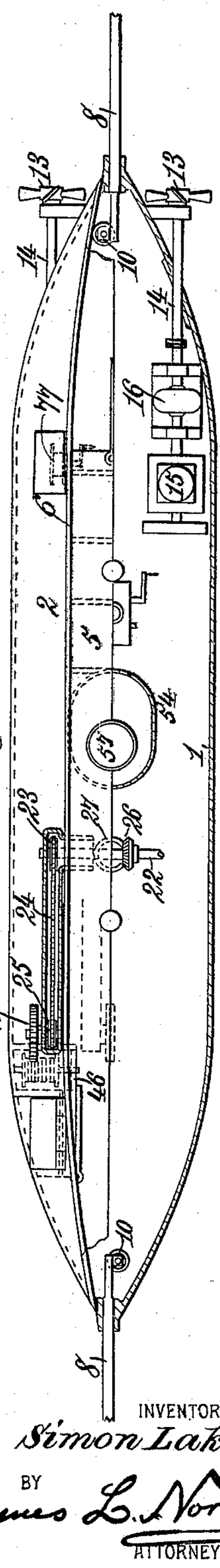

Fig. 2.

WITNESSES

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Fig. 3.

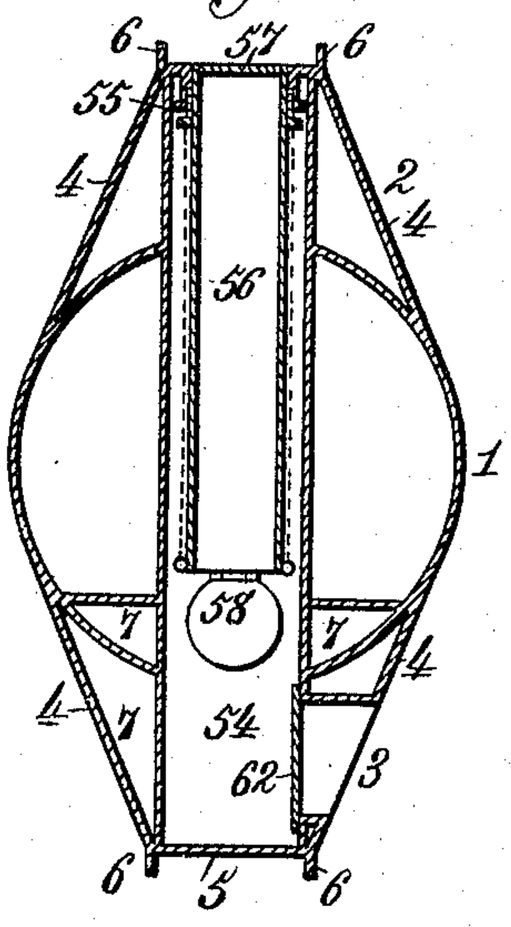


Fig. 4.

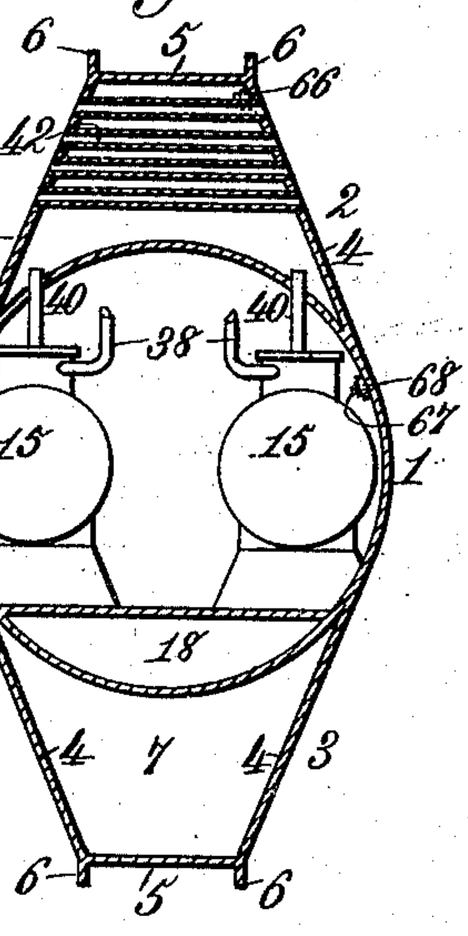


Fig. 5.

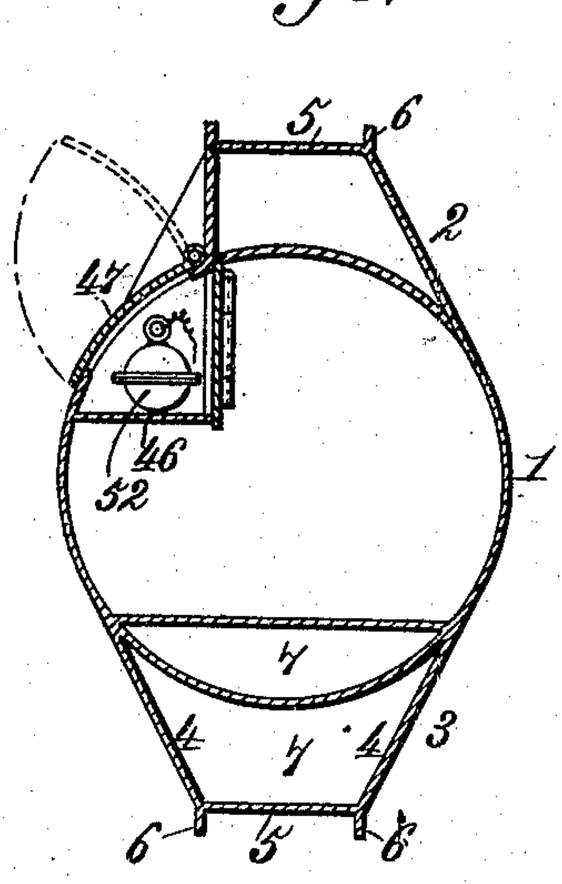
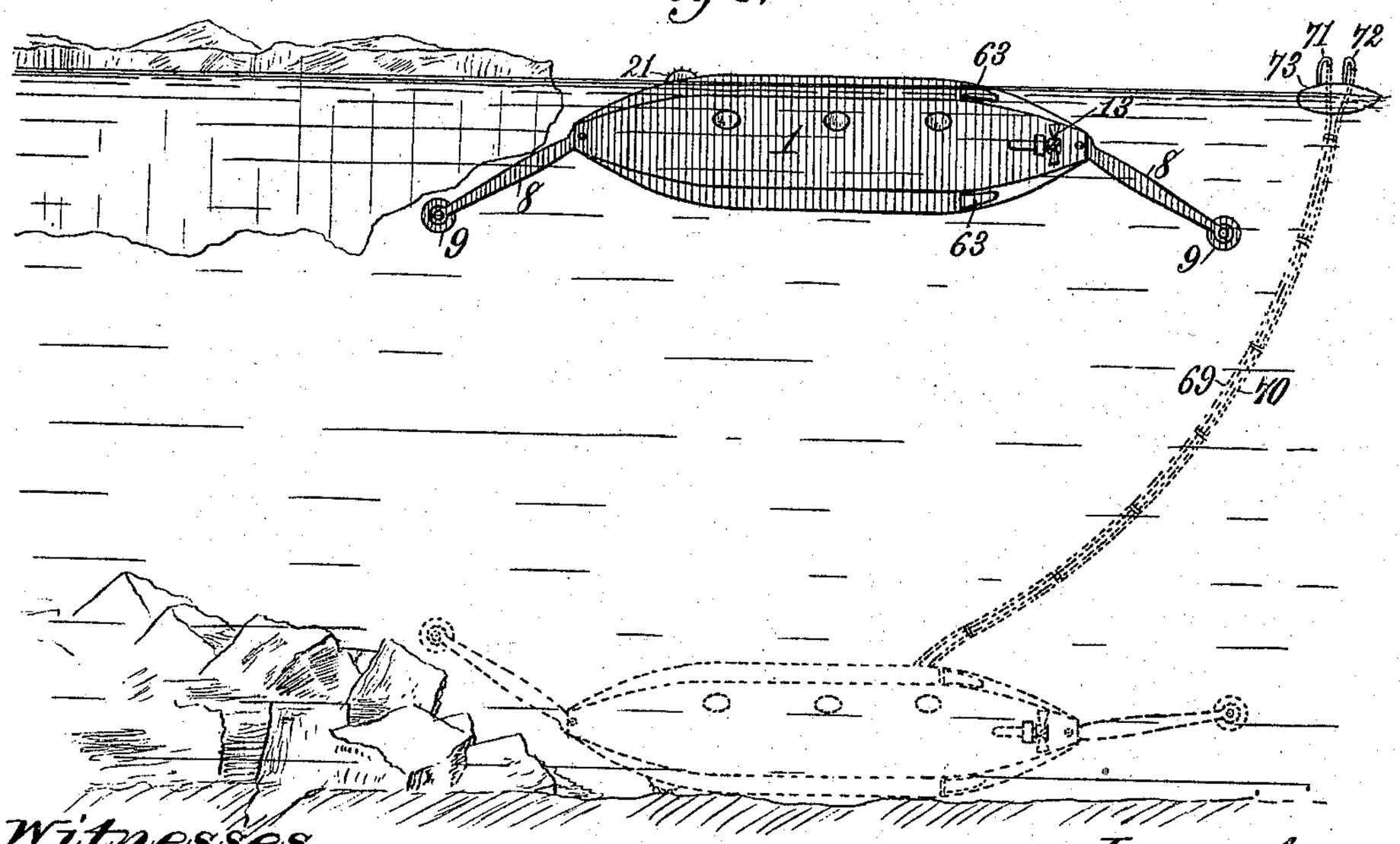


Fig. 6.



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UNITED STATES PATENT OFFICE.

SIMON LAKE, OF BALTIMORE, MARYLAND.

SUBMARINE VESSEL.

SPECIFICATION forming part of Letters Patent No. 638,342, dated December 5, 1899.

Application filed April 4, 1898. Serial No. 676,390. (No model.)

To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented new and useful Improvements in Submarine Vessels, of which the following is a specification.

This invention relates to submarine vessels, and is particularly designed for navigating in water covered by surface ice, and has for its object, first, to provide a submarine boat with means for engaging the under side of the ice to furnish a sliding contact therewith and to combine with such means means for ballasting the boat in such manner that the contact between the boat and the bottom of the ice will be reduced to a minimum; second, to provide the boat with a vertically-adjustable guide or guides projecting from the boat and adapted to engage the surface ice or the water-bed and guide the vessel over the uneven surface thereof; third, to provide a traction-wheel arranged to engage the under surface of the ice and means for rotating the said wheel to propel the vessel; fourth, to provide improved means for supplying air to and exhausting it from the interior of the boat and the engine; fifth, to provide improved means for rendering harmless back explosions of the engine; sixth, to provide novel torpedo mechanism for blasting the ice, blowing up ships, and the like; seventh, to provide means for affording an exit from the boat through the ice; eighth, to provide novel means for establishing telephonic communication between the submarine vessel and another vessel or a fixed station, and, lastly, to provide certain other features of invention, hereinafter fully described.

To these ends my invention consists in the features and in the novel construction, combination, and arrangement of parts hereinafter described, and particularly pointed out in the claims following the description, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is a vertical central longitudinal sectional view of my improved submarine boat, illustrating the same in contact with the under surface of the ice. Fig. 2 is a top plan view of the boat, partially in horizontal section. Fig. 3 is a transverse vertical section taken on the line 3 3 of Fig. 1. Fig. 4 is a similar view on the line 4 4 of Fig. 1. Fig. 5 is a similar view on the line 5 5 of Fig. 1. Fig. 6 is a view illustrating the operation of the guide-arms.

Referring to the drawings, the numeral 1 indicates the hull of the vessel, which is preferably of usual double conoidal form and possessing sufficient strength to resist the pressure of the water at ordinary depths. The vessel is shown as being provided with a superstructure 2 and a substructure 3, each consisting of an outer shell or casing extending from the bow to the stern and having converging sides 4, united at their outer edges by transverse horizontal decks or partitions 5. The upper and lower decks or partitions 5 intermediate their forward and after ends are parallel for the major portion of their length with the upper and lower portions of the hull proper, 1, and at their ends are tapered to a point and curved toward and united to the conical bow and stern of the hull 1. The superstructure and substructure are united with the cylindrical hull water-tight, and each is provided at its outer edges with longitudinal rails or ribs 6, which project beyond the decks or partitions 5, as most clearly shown in Figs. 3, 4, and 5, and which extend from the bow to the stern and follow the outlines of the said decks or partitions. Arranged within the substructure 3 is a series of tanks 7, which are adapted to contain water to serve as ballast, and means well known and usual in submarine vessels are provided for filling and emptying the tanks to adjust the trim of the boat and to adjust or destroy its buoyancy.

Pivoted in the bow and stern of the vessel are guide-arms 8, which project in front and rear of the boat and at their outer ends are provided with guide-wheels 9. The inner end of each of said arms projects inboard and is loosely connected to a nut 10, that is threaded onto a vertical shaft 11, fitted to turn in fixed bearings. By turning the screw-shaft 11 the guide-arm will be swung about its fulcrum 12 above or below the longitudinal axis of the boat, as shown in Fig. 1, and when the arm is swung to the extreme limit of its movement in either direction it will preferably lie

in the same inclined plane as the adjacent end of the upper or lower runners, for the purpose hereinafter explained.

The boat is preferably provided with twin propellers 13, fixed on shafts 14, which are driven by engines 15 when the vessel is afloat upon the surface or when the vessel is in communication with the atmosphere and by convertible electric motors 16 when the vessel is running submerged. For furnishing the power to drive the motors I provide storage batteries 17, arranged in a compartment 18 in the substructure. The motors 16 are convertible into dynamos, and when the vessel is in communication with the atmosphere the engines may be employed to drive the dynamos to generate currents by means of which the batteries are charged. For this purpose suitable and ordinary clutch mechanism (not shown) is provided for throwing the propellers out of operation.

Arranged in the superstructure and substructure, respectively, are wells 19 and 19ª, in which are pivoted arms 20 and 20ª, and in the free ends of the latter are journaled traction-wheels 21 and 21ª, having toothed peripheries. Each pivoted end of each of the arms is fixed on a shaft 22, the outer end of which is provided with a sprocket-wheel 23, that is geared by a chain 24 to a corresponding sprocket-wheel 25, fixed on the axis of the traction-wheel carried by the arm. On the shaft 22 is a bevel-gear 26, which is engaged by a similar beveled gear 27, arranged on the end of a vertical shaft 28. The shaft 28 is adapted to be driven by an electric motor 29 and may be thrown into and out of gear, by ordinary shifting mechanism, (not shown,) with either of the shafts 22 and through the medium of the gearing described rotate the traction-wheels.

Let it be assumed that the boat is submerged with its upper runners 6 resting lightly in contact with the under side of the ice. Then by throwing the upper shaft 22 into gear with the driving-shaft 28 and starting up the motor the arm 20 will be thrown upward by the initial movement of the gears and cause the traction-wheel 21 to engage the under side of the ice, and as said wheel is rotated by the means described it will operate to draw or propel the vessel forward. The runners 6 present a very small surface to contact with the ice, and hence offer but little resistance to the boat's progress, and by admitting water to the ballast-tanks in such quantity as to barely render the boat buoyant the friction between the runners and the ice will be reduced to a minimum. When traveling in this manner, (either forward or backward,) the arms 8 will be swung down into the position shown in Fig. 1 and will act as fenders or feelers, so that should the ice suddenly increase in thickness or unevenness, or if when the boat in running awash it should approach the edge of an ice field or pack, or in the event of the boat encountering a partially-submerged obstruction of any nature, the guide will engage the obstruction and roll along the under side thereof, causing the boat to dip under the same. In a similar manner the boat may be caused to travel over the bottom or water-bed on the runners attached to the substructure and be propelled forward by means of the traction-wheel 21ª, and in such case the arm 8 will be swung upward, as shown by dotted lines in Fig. 6, and will operate to guide the boat over obstructions on the bottom. When the vessel is traveling upon the surface of the water, the arms 20 and 20ª are drawn into their wells by any suitable means, (not shown,) or for this purpose the arm 20 may be made heavy enough to drop by gravity into its well, while the arm 20ª may be made sufficiently bouyant to float up into its well when thrown out of gear with the driving mechanism.

In practice the vessel will be provided with compressed-air reservoirs and a pump for charging them, from which the air in the vessel may be renewed from time to time, whereby the vessel may run for a comparatively long period of time without the necessity of communicating with the atmosphere.

To enable the vessel to take in a fresh supply of atmospheric air to recharge the compressed-air tanks or to permit of running the oil-engines to drive the dynamos to recharge the storage batteries, I provide the following means: Arranged to be thrust in and out through stuffing-boxes 30 in the top of the vessel are two metallic tubes 31, that are open at their lower inner ends and have fitted on their upper outer ends drill points or cutters 32, in which are formed apertures or air-openings arranged to be closed by valves 33. The valves are provided with pendent stems or rods 34, which extend down through the tubes into the interior of the vessel. The tubes 31 constitute both air-tubes and drill-rods, and any suitable drill mechanism may be provided for rotating the same. When it is desired to recharge the compressed-air tanks, the vessel is stopped and the drill mechanism is set into operation. The drills bore or cut through the ice, and when their points project beyond the top of the ice the valve-rods 34 are raised and held up, thus opening the apertures in the drill points or cutters and placing the interior of the vessel in communication with the atmosphere, when the air-compressor may be put in operation to charge the tanks with a fresh supply of compressed air. For the purpose of maintaining a circulation of the atmospheric air through the vessel I provide an air-pump 35, the intake of which communicates with the interior of the vessel and its outlet is detachably connected by a flexible tubing 36 with the lower end of the tube 31. The pump 35 being put in operation, the air is drawn into the vessel through the forward tube 31 and

is forcibly ejected through the after tube 31, a constant supply of fresh pure air being thus provided.

When the vessel is in the position above described, the storage batteries may be recharged by setting the oil-engines in operation to drive the dynamos. I have found in practice that most injurious results follow the occasional back explosions of the engines, the gases being blown back into the vessel, vitiating the air and rendering the crew liable to asphyxiation. To guard against and prevent such a result, I provide an air-chamber 37, with which the air-supply pipe 38 of the engines communicates. The chamber takes its supply of air from the interior of the vessel through an inwardly-opening valve 39, the arrangement being such that should a back explosion occur in the engines the valve 39 will automatically and immediately be closed by the pressure of the explosion and will prevent the gases from being blown into the interior, and the tank or chamber is of such size that a series of such explosions may occur in succession without injury. As the engines draw in the air from the chamber 37 to mix with the oil-gas the valve 37 rises and admits air to the chamber to supply the place of the air withdrawn, so that the air-chamber will always be filled. From the engines leads an exhaust-pipe 40, which discharges into a condenser consisting of a tank 41, arranged on top of the hull 1 in the superstructure and provided with a plurality of water-tubes 42, which pass transversely through the tank 41 water-tight and at their ends communicate with the water surrounding the vessel. From the tank 41 leads a pipe 43, which enters a chamber 44, surrounding the air-tube 31, and the latter, near its lower end, is perforated, as at 45. Assuming the combined air-tubes and drill-rods 31, 32, and 34 to be in the position shown in Fig. 1 and the engines to be in operation, the burned gases from the latter will be exhausted by the pipe 40 into the condenser, where the gases will be cooled and condensed by the water passing through the water-tubes. The volume of the burned gases is thus reduced, rendering their passage to the atmosphere easy and avoiding the loud explosive sounds usually caused by the exhaust of engines of the type referred to. From the condenser the gases pass by the pipe 43 into chamber 44 and through the perforations 45 into the tube 31, from the upper end of which latter they escape into the atmosphere. The drills may be accommodated to drill through ice of any thickness that may be encountered by providing a number of tube-sections, which may be screwed or otherwise suitably coupled to the drill-tubes and to each other.

To afford egress from the vessel through the ice, I provide means for blasting through the ice and a companion-way that may be thrust up through the opening blasted in the ice, constructed and operating as follows: Arranged in the upper part of the hull 1 is a chamber 46, which communicates with the exterior of the vessel by an opening in the hull, normally closed by a door or cover 47. The door is hinged on a pintle 48, which extends into the interior of the vessel, and is provided with a handle 49, by means of which the door may be opened and closed from the boat's interior. Journaled in the chamber 46 is a drum 50, on which is wound a cable 51, the end of the cable being attached to a torpedo 52, which rests within the chamber. A door 53 is provided for affording access to the chamber 46 from the interior of the vessel to enable the torpedo being placed in the chamber, and a crank or its equivalent may be provided for operating the drum 50 from the interior of the boat in a manner well understood by those skilled in the art to which this invention relates. By opening the door 47 the torpedo is released and floats out of the chamber and up against the bottom of the ice or vessel, as the case may be. Then by backing the boat the cable is paid off by the drum and the vessel removed to a safe distance, when the torpedo may be exploded by any well-known or preferred means. After an opening has been formed in the ice by the explosion of the torpedo the boat is prepelled forward again until it lies beneath said opening, when a passage from the interior of the boat to the surface of the ice may be had by the following means: Formed in the vessel is an air-tight compartment 54, that extends vertically through the top and bottom of the hull 1 and to the decks 5 of the super and sub structures 2 and 3. Telescoped in a stuffing-box 55 in the upper deck of the superstructure is a tubular hatchway 56, that is adapted to be closed air and water tight at top and bottom by doors 57 and 58. Means for raising and lowering the telescoping hatchway, of any suitable construction, are provided, a rope and pulley 59 being shown for the purpose in the drawings. When an opening has been blasted in the ice, as described, the vessel may be brought thereunder and the tubular hatchway raised and thrust up through the opening in the ice and the doors 57 and 58 opened. The tubular hatchway is provided with a companion-ladder 60, by means of which the members of the crew may ascend to the surface of the ice. The compartment 54 forms an air-lock and is provided with a door 61, opening into the interior of the vessel, and a door 62, communicating with the exterior thereof. A diver by entering the chamber 54 and closing the door 61 can then pass to the exterior of the vessel through the door 62 and may return to the vessel in the same manner, compressed air from the reservoirs being admitted to the chamber until the pressure is equal to the pressure of the water surrounding the vessel, and thus prevents the entrance of water into the chamber.

Any suitable or preferred means for steering and guiding the vessel may be provided,

and for this purpose I have shown twin rudders 63, arranged in open compartments 64 and 65, formed in the after portions of the super and sub structures.

At times it may be desirable to run submerged and employ the engines for the purpose of driving the propellers, or it may be desirable to operate the engines to recharge the storage batteries without rising to the surface to supply to and exhaust the air from the engines, and to meet such conditions I have provided the following means: Tapped in the side of the condenser-tank is a hose-nipple 66, which when not in use is adapted to be closed by a plug or stopper 67, and a similar hose-nipple 68 is tapped into the side of the vessel, as shown most clearly in Fig. 4. Adapted to be coupled to said nipples are two sections of hose 69 and 70, which at their other ends are respectively coupled to nozzles 71 and 72, carried by a float 73. The nozzles are bent downward at their outer ends, as shown in Fig. 6, to prevent spray and water from washing down through the hose, and said nozzles, as well as the hose-nipples, are provided with check-valves of ordinary construction, the check-valves in the nozzles preventing the entrance of water in the event of the float being drawn beneath the surface of the water and the check-valves in the nipples serving the same purpose should the hose-sections be cut or carried away by an obstruction. The air enters the vessel through the air-hose 70 and is discharged from the condenser-tank through the hose 69.

It will be manifest that the super and sub structures may be omitted and the runners attached directly to the hull, and it will also be obvious that but a single propeller and engine may be employed.

I have described the buoyant torpedo as being for the purpose of blasting the ice; but it will be evident that it could also be employed as a weapon of offense, and in such cases the torpedo would be deposited under or permitted to float against a vessel of the enemy and after the submarine boat had receded to a safe distance would be exploded. It could also be employed for destroying derelicts and other obstructions.

Having described my invention, what I claim is—

1. The combination with a submarine boat constructed to travel beneath surface ice, of a runner attached to the upper side of the boat and arranged to contact with the under side of the ice, substantially as described.

2. The combination with a submarine boat constructed to travel beneath surface ice, of runners attached to the upper and under sides of the boat, and means for ballasting said boat to cause the upper runner to contact with the ice or the lower runner to contact with the water-bed, substantially as described.

3. In a submarine boat constructed to travel beneath surface ice, runners attached to the upper side of the boat and arranged to contact with the under side of the ice, a traction-wheel arranged to engage the under surface of the ice, and means for driving said wheel to propel the vessel, substantially as described.

4. In a submarine boat constructed to travel beneath and in contact with surface ice, an arm pivoted at one end in a well in the upper side of the boat, a traction-wheel journaled in the other end of said arm, means for raising said arm to throw said wheel into contact with the ice, and mechanism for driving said wheel to propel the boat, substantially as described.

5. In a submarine boat provided with a well in its under side, of a buoyant arm pivoted at one end in said well and operating to automatically rise and house itself in the well, a traction-wheel journaled in the free end of said arm, means for submerging the boat, means for swinging downward the arm to hold the traction-wheel in contact with the bottom, and mechanism for driving the traction-wheel to propel the boat, substantially as described.

6. The combination with a submarine boat and means, such as water-ballast tanks, for maintaining the vessel on substantially an even keel as it is moved bodily to different levels, of an arm projecting beyond the end of the boat and arranged to engage obstructions in the path of the boat, and means for holding said arm rigid to deflect the boat from a horizontal plane, substantially as described.

7. The combination with a submarine boat and means, such as water-ballast tanks, for maintaining the vessel on substantially an even keel as it is moved bodily to different levels, of an arm projecting beyond the end of the boat, a guide-wheel journaled in the free end of the arm, and means for holding said arm rigid, substantially as described and for the purpose specified.

8. The combination with a submarine boat, of a hollow drill telescoped through the top of the vessel and constructed to drill a hole through surface ice, said drill being arranged to communicate at its opposite ends with the interior of the boat and the atmosphere above the ice, substantially as described.

9. The combination with a submarine boat, of a hollow drill-rod telescoped through the top of the boat and opening at its lower end into the interior of the vessel, a valved point or cutter arranged on the upper end of the drill-rod, and means for opening the valve to place the hollow drill-rod in communication with the atmosphere above the ice, substantially as described.

10. The combination with a submarine boat, of two hollow telescopic tubes in the top of the boat, and communicating at their opposite ends respectively with the interior of the boat and the atmosphere, one of said tubes forming an air-inlet and the other an air-outlet, and valves arranged for opening and closing said tubes, substantially as described.

11. In a submarine boat having a compart-

ment for the reception of a buoyant torpedo, of a door for normally closing said compartment water-tight, means for opening said door from the interior of the vessel to permit the escape of the torpedo, a drum arranged in the compartment, a cable wound upon the drum and connected to the torpedo, and means for operating the drum from the interior of the vessel to control the torpedo, substantially as described.

12. The combination with a submarine boat, of a tubular hatchway telescopically arranged in the upper side of the boat, and a hatch for normally closing the upper end of said hatchway water-tight, substantially as described.

13. In a submarine boat, the combination with an air-inlet adapted to communicate with the atmosphere, of an explosive-engine, an exhaust for discharging the burned gases from the engine to the exterior of the boat, an air-tank arranged in the boat and having an air-inlet communicating with the interior of the vessel, an air-pipe leading from the air-tank to the cylinder of the engine, and a valve controlling the air-inlet in the tank and arranged to be closed by the back explosion of the engine, substantially as described.

14. In a submarine boat, the combination with an explosive-engine and means for supplying air thereto, of a condenser, a pipe for exhausting the burned gases from the engine into said condenser, and means for discharging the condensed gases into the atmosphere, substantially as described.

15. In a submarine boat, the combination with the hull and an engine arranged therein, of a tank arranged upon the exterior of the hull and communicating with the exhaust of the engine, and a flexible tube leading upward from the said tank and provided with a float for supporting its upper end on the surface of the water, substantially as described.

16. In a submarine boat, the combination with the hull and an engine arranged therein, of a tank arranged upon the exterior of the hull and communicating with the exhaust of the engine, a flexible tube leading upward from said tank, a flexible tube leading upward from the interior of the vessel, and a float for supporting the upper ends of said tubes, substantially as described.

17. In a submarine boat, the combination with the hull and an engine arranged therein, of a closed chamber arranged in the upper part of the boat and communicating with the exhaust of the engine, and a discharge-tube telescopically arranged in said chamber and the hull and having an opening formed near its lower end arranged to establish communication between said chamber and the interior of the tube when the latter is raised, substantially as described.

18. In a submarine boat, the combination with the hull and an engine arranged therein, of a flexible tube leading upward from the exhaust of the engine and provided with a float for supporting its upper end on the surface of the water, substantially as described.

19. In a submarine boat, the combination with the hull and an engine arranged therein, of a flexible tube leading upward from the exhaust of the engine, a flexible tube leading upward from the interior of the vessel, and a float for supporting the upper ends of said tubes in communication with the atmosphere, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

SIMON LAKE.

Witnesses:
JAS. W. GAULT,
EDWARD A. OSSE.