A. M. FULLER.

SUBMARINE TORPEDO BOAT.

APPLICATION FILED APR. 14, 1908.

970,210.

Patented Sept. 13, 1910.

11 SHEETS—SHEET 1.

Fig. 1.

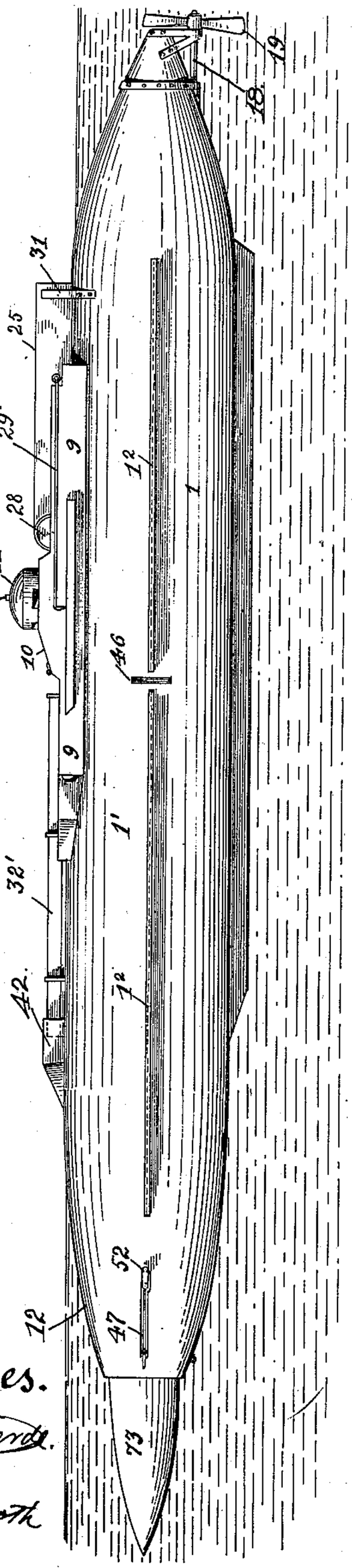
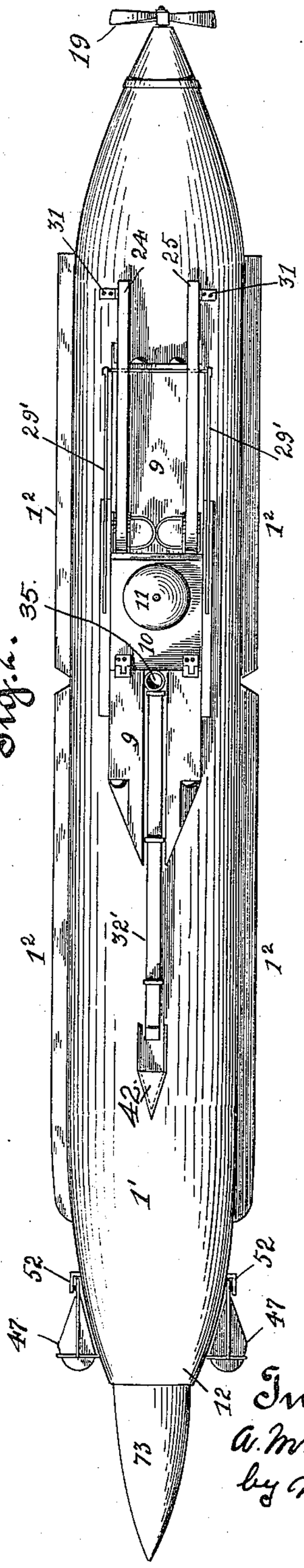


Fig. 2.



Witnesses.

H. Montevert.

Wm. F. Booth

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A. M. Fuller

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11 SHEETS—SHEET 2.

Fig. 3.

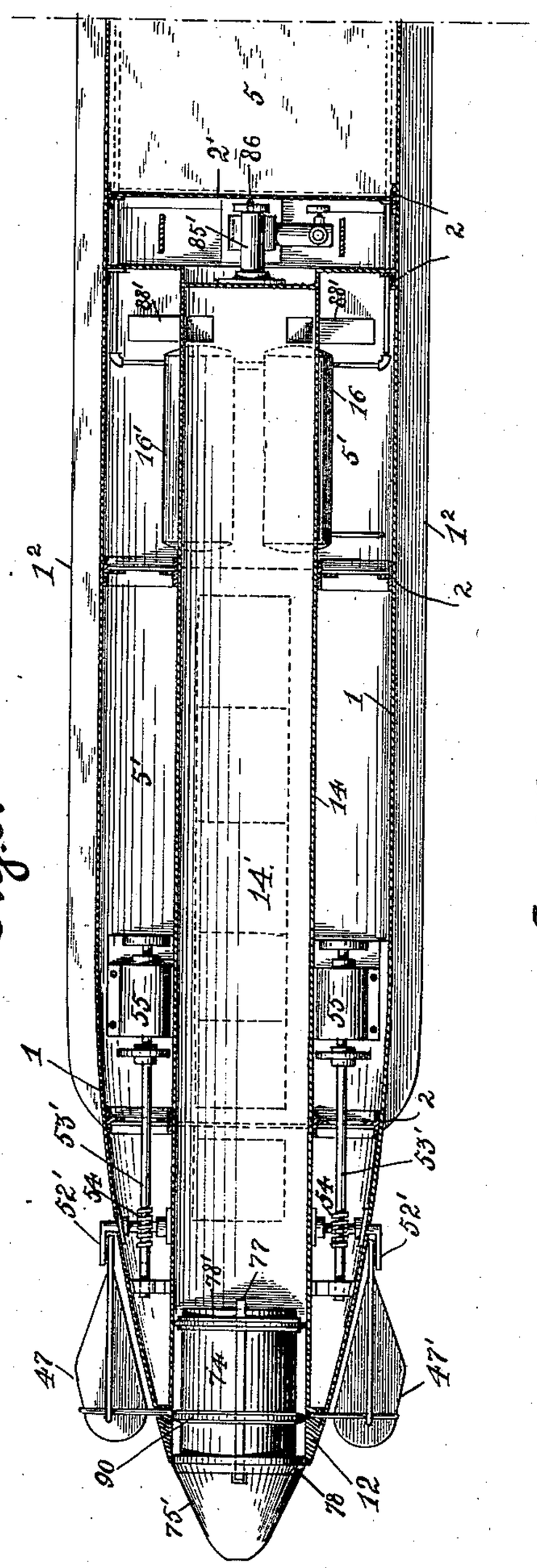
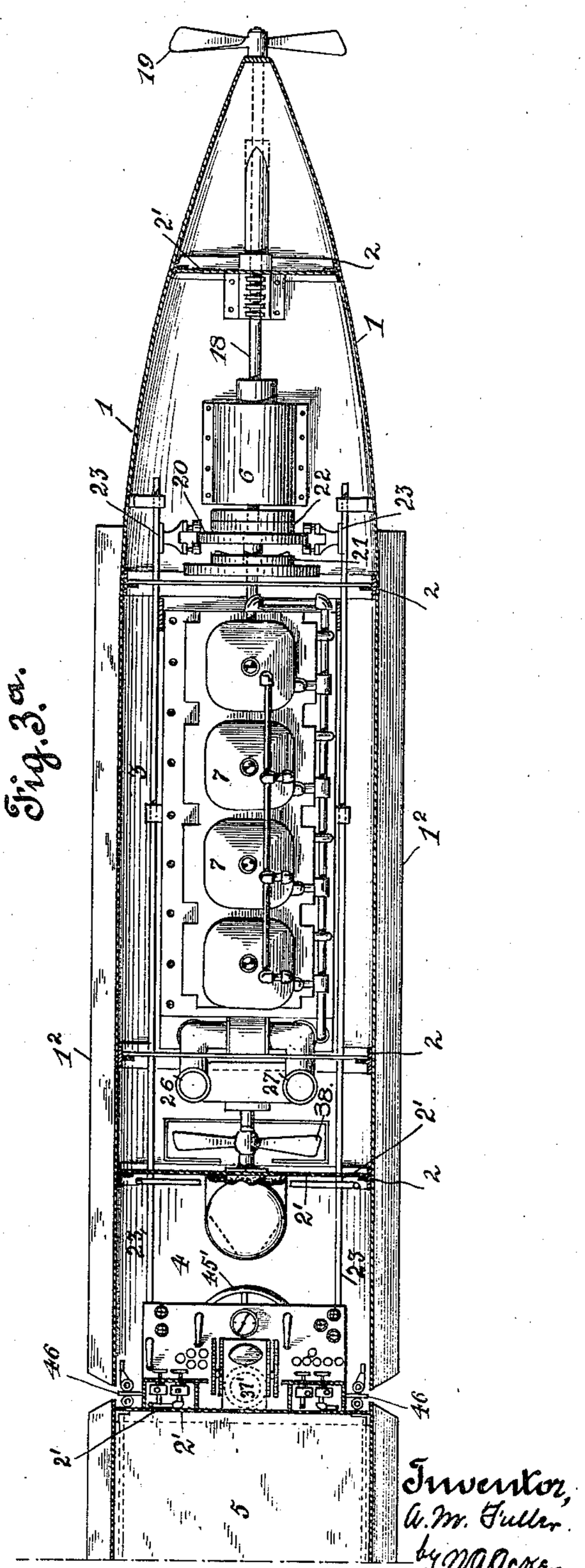


Fig. 3ª.



Witnesses.

F. Hotteverdt.

Wm. F. Booth

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11 SHEETS—SHEET 3.

Fig. 4.

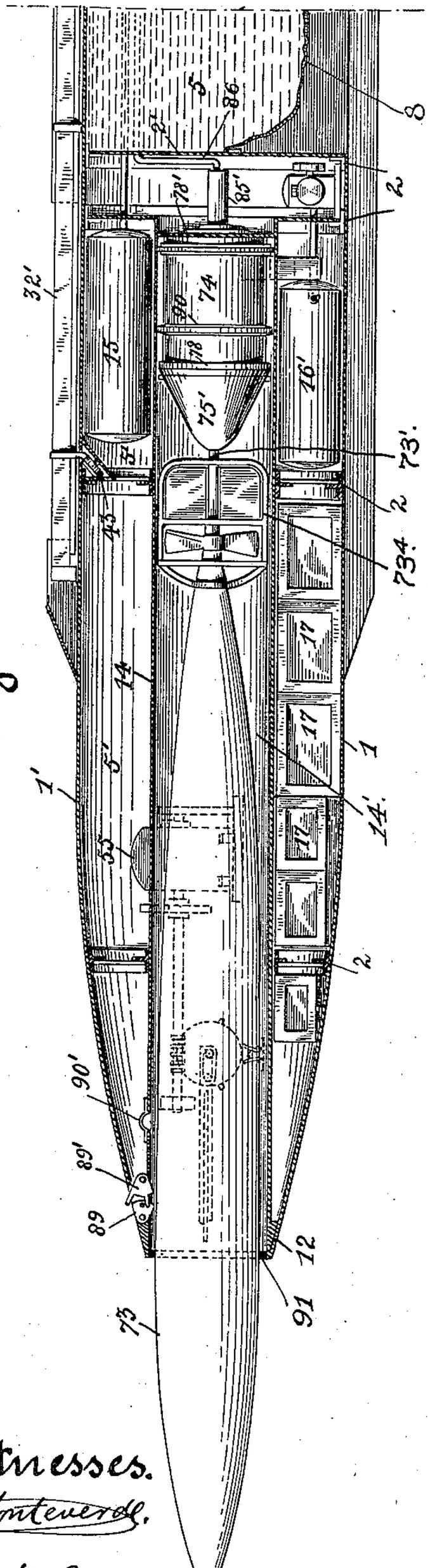
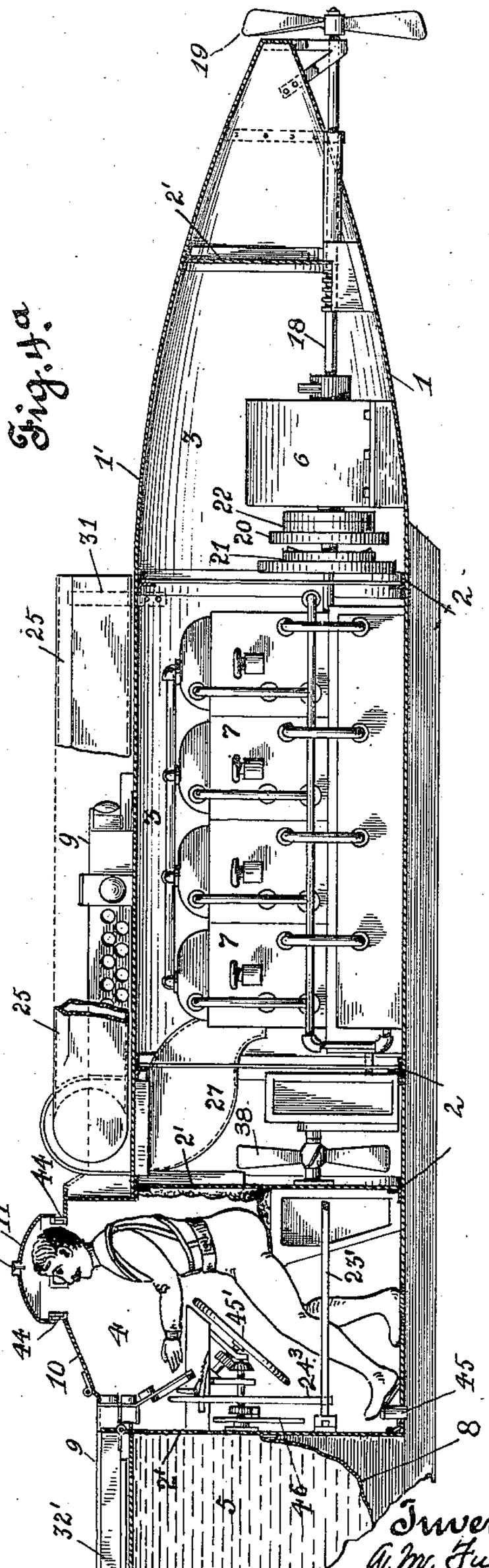


Fig. 4a.



Witnesses.

F. Montenerdi.

Wm. F. Booth

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A. M. FULLER.

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11 SHEETS—SHEET 4.

Fig. 5.

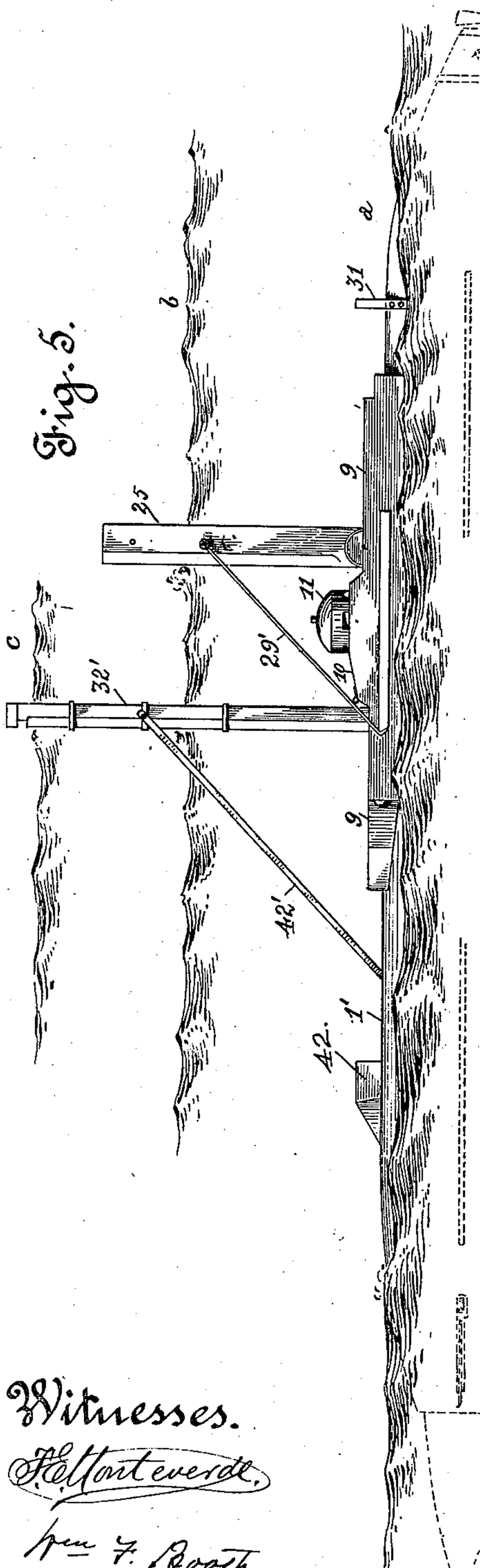


Fig. 3.

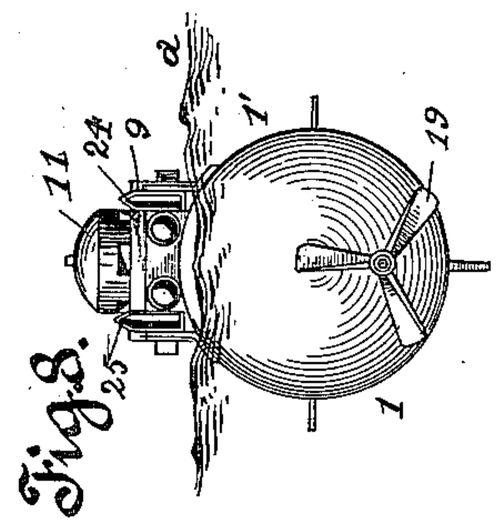


Fig. 2.

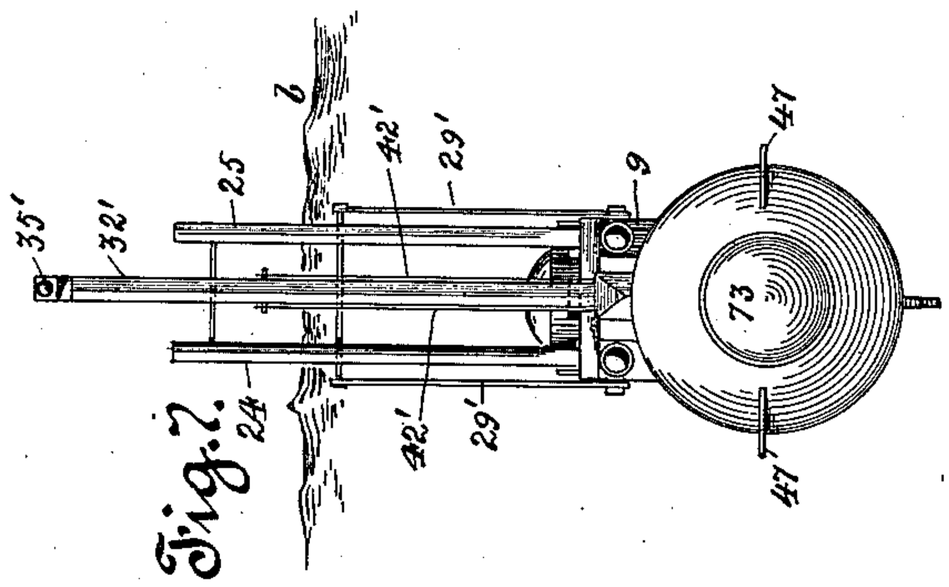
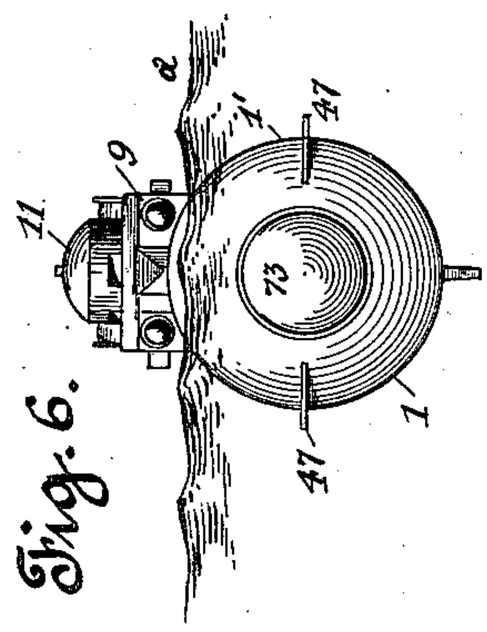


Fig. 6.



Witnesses.

F. E. Monteverde.

Wm. F. Booth

Inventor.

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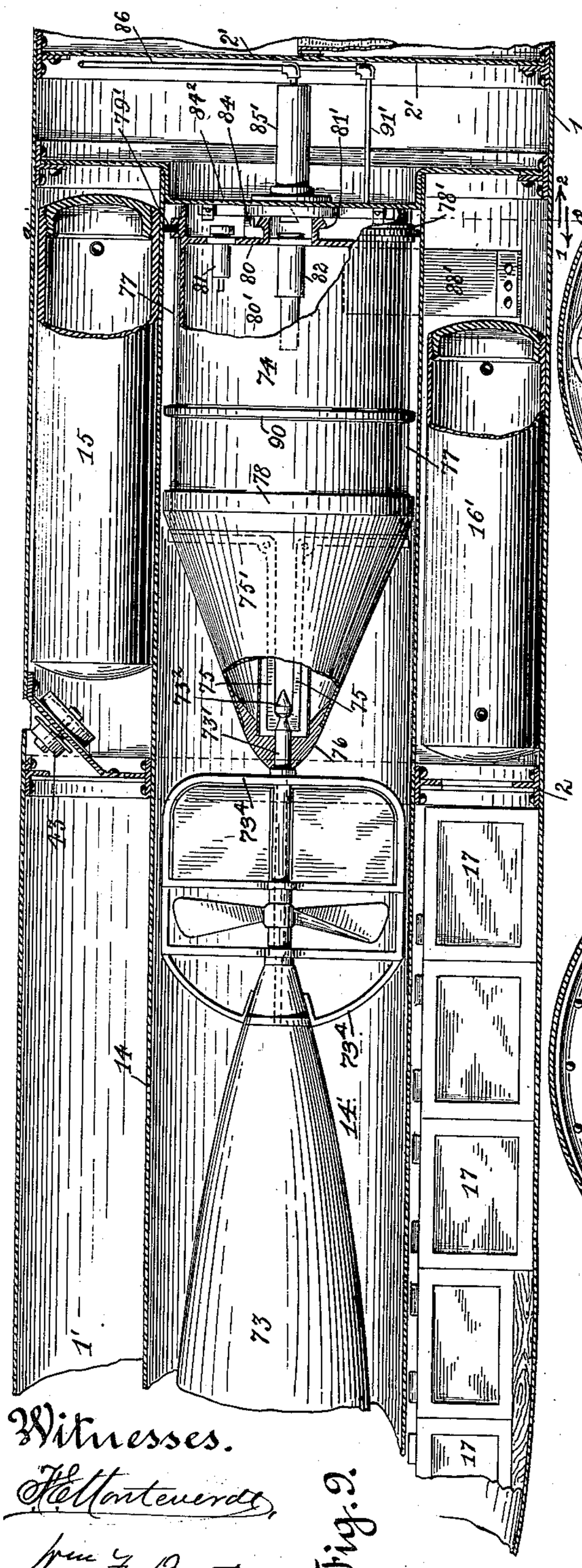

Fig. 2.

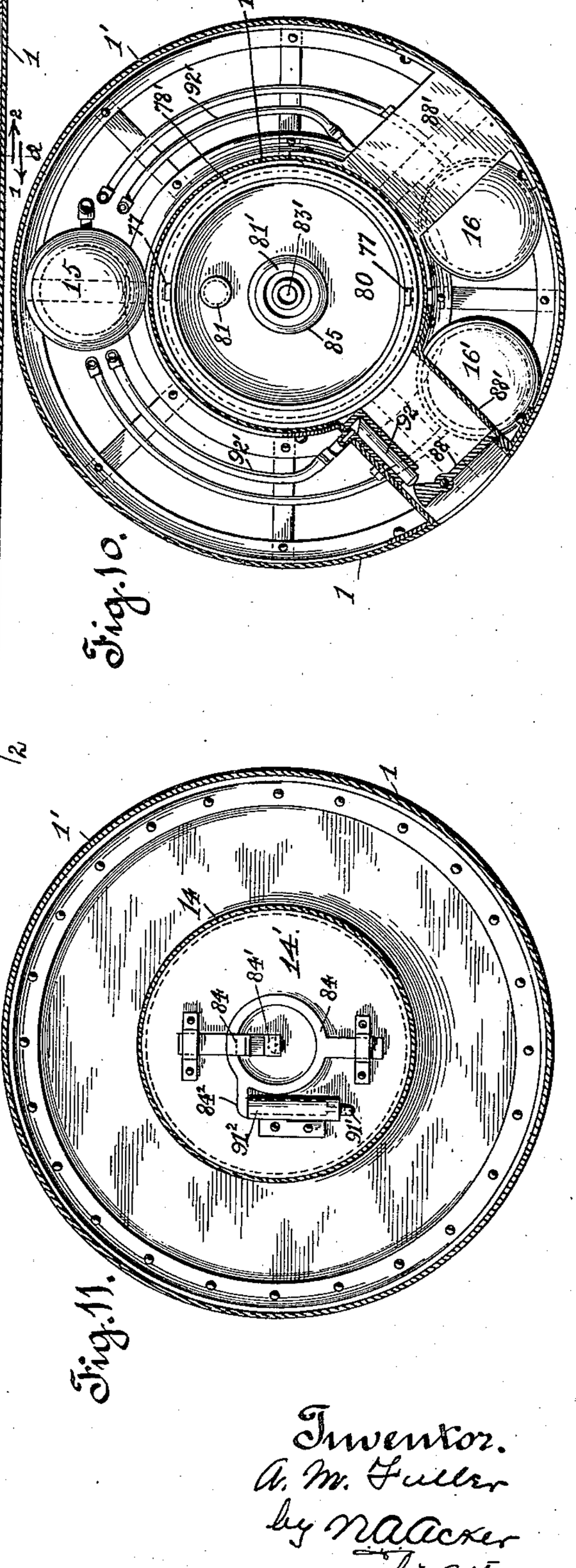

Fig. 10.

Fig. 11.

Witnesses.

H. Hartenerdt,

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11 SHEETS—SHEET 6.

Fig. 14.

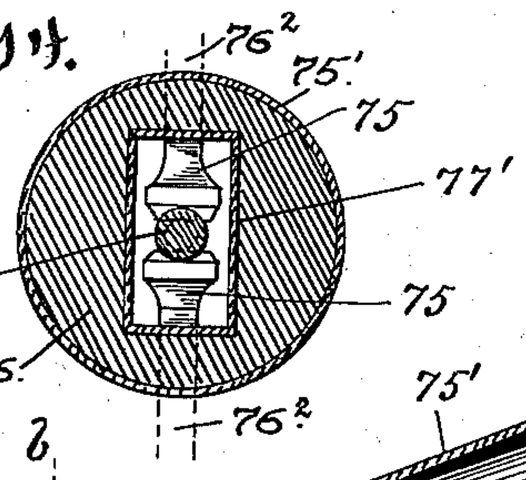
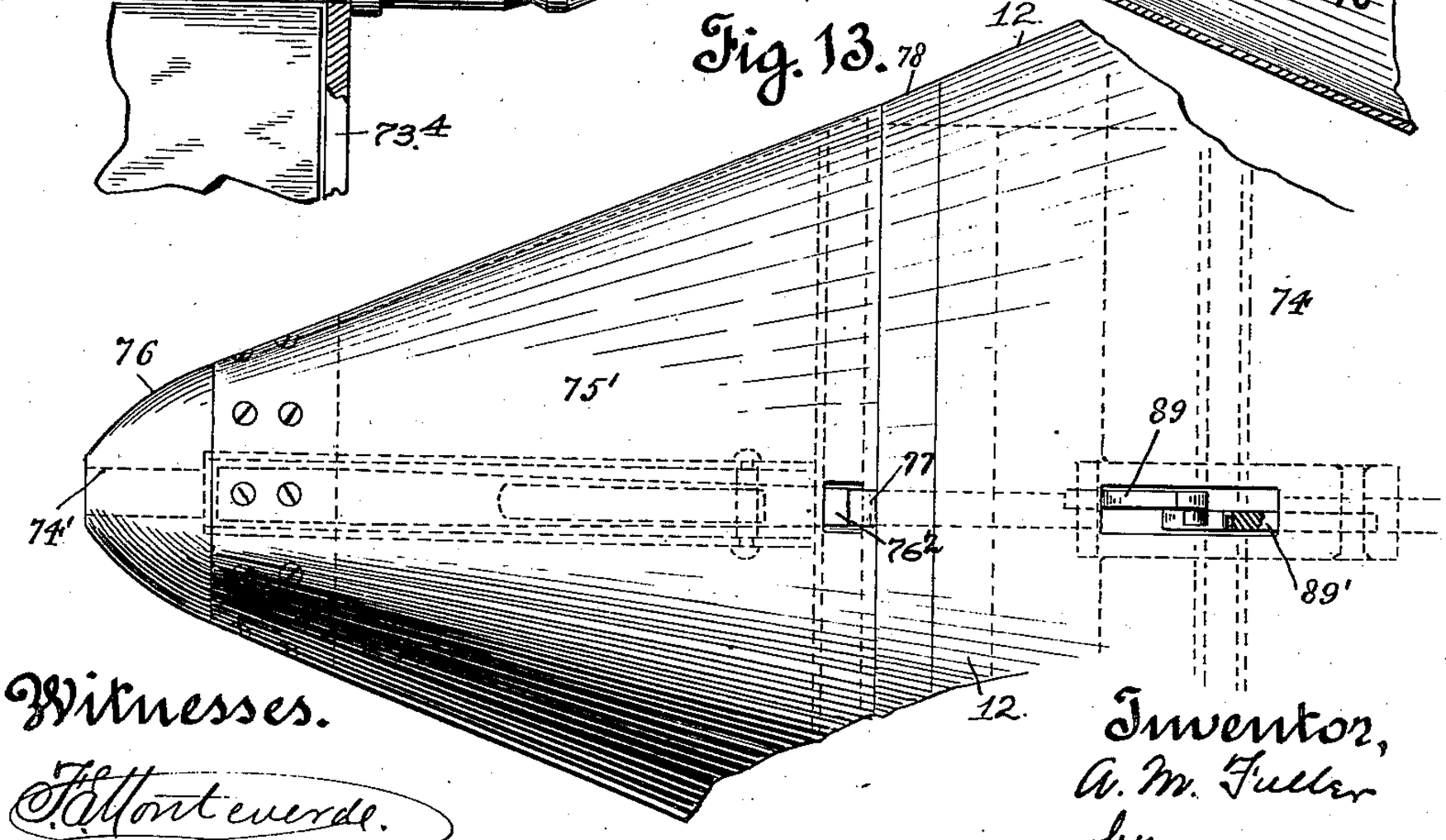


Fig. 12.

Fig. 15.

Fig. 13.



Witnesses.

F. Montgomerie.

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970,210.

A. M. FULLER.

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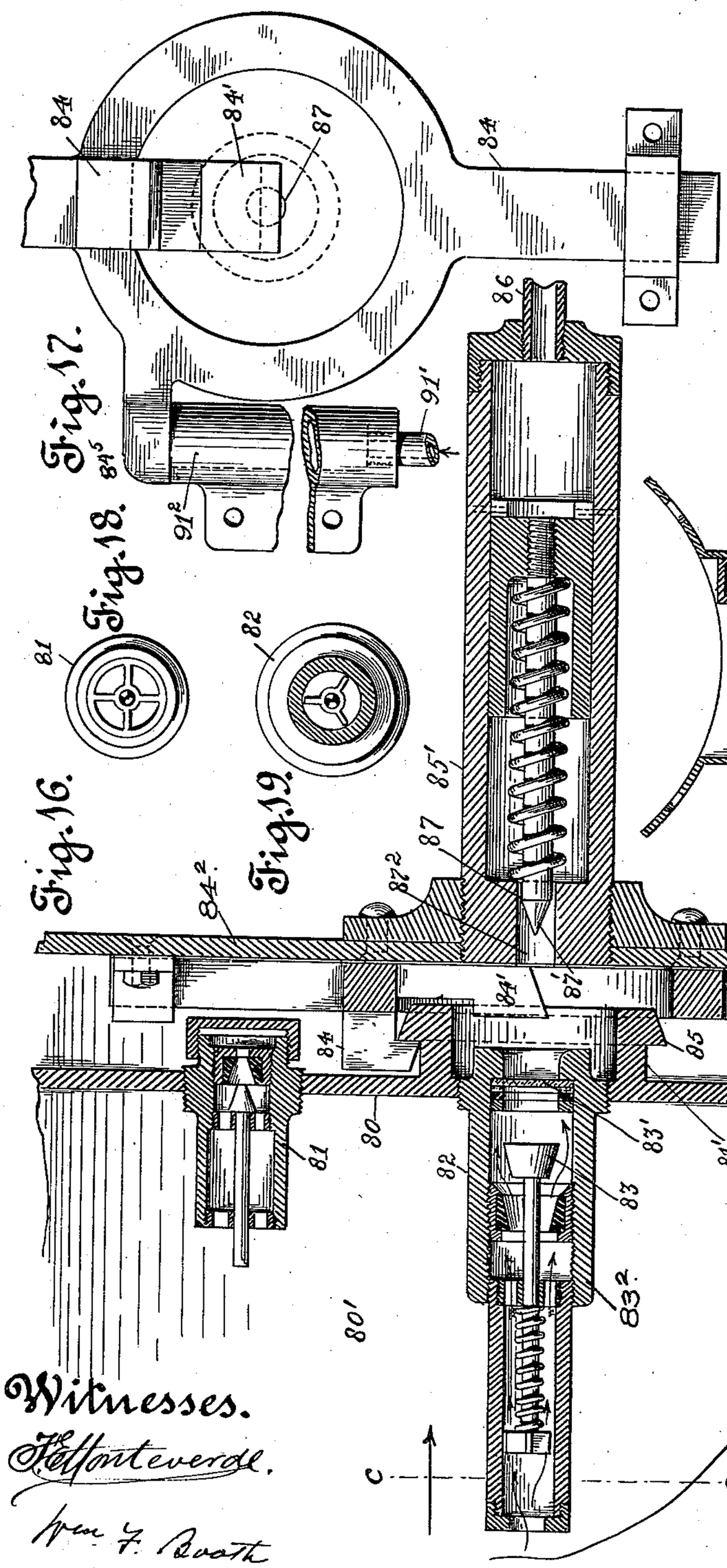

Fig. 17.

Fig. 18.

Fig. 16.

Fig. 19.

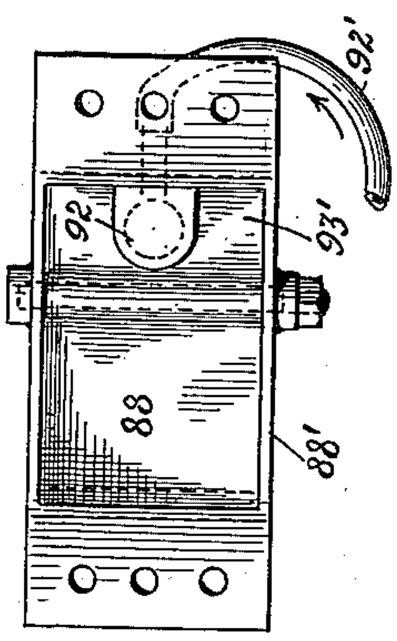

Fig. 21.

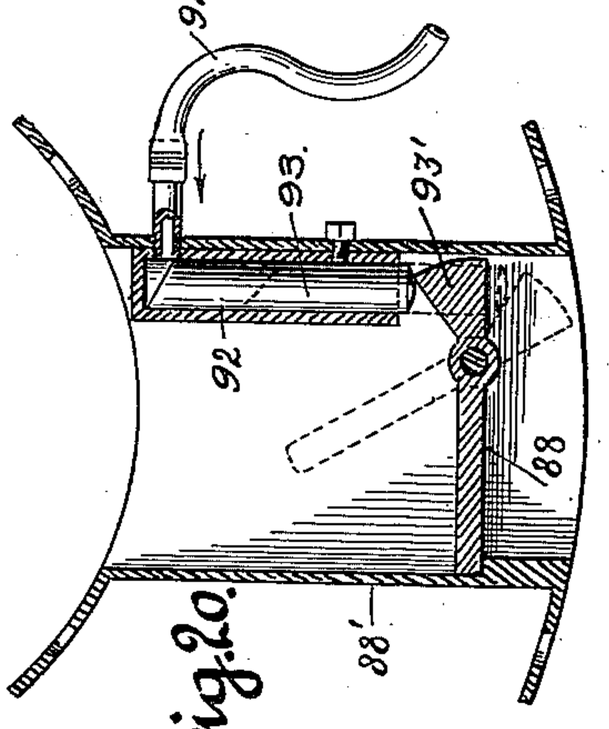

Fig. 20.

Witnesses.

F. Fellonteverde.

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SUBMARINE TORPEDO BOAT.

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11 SHEETS—SHEET 8.

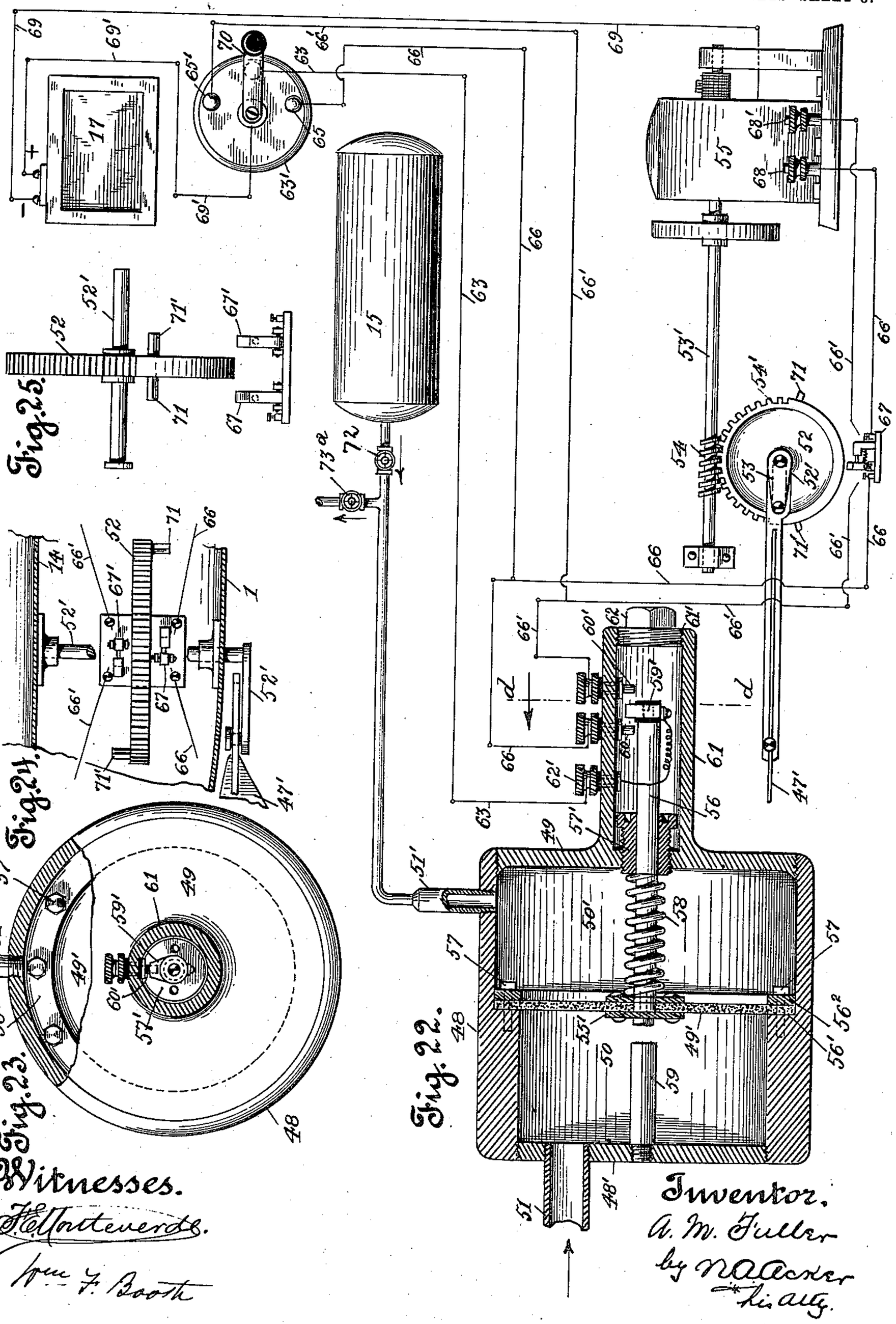

Fig. 25.

Fig. 24.

Fig. 23.

Witnesses.

F. E. Montenverde.

Wm. F. Booth

Inventor.

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by N. A. Acker

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11 SHEETS—SHEET 9.

Fig. 26.

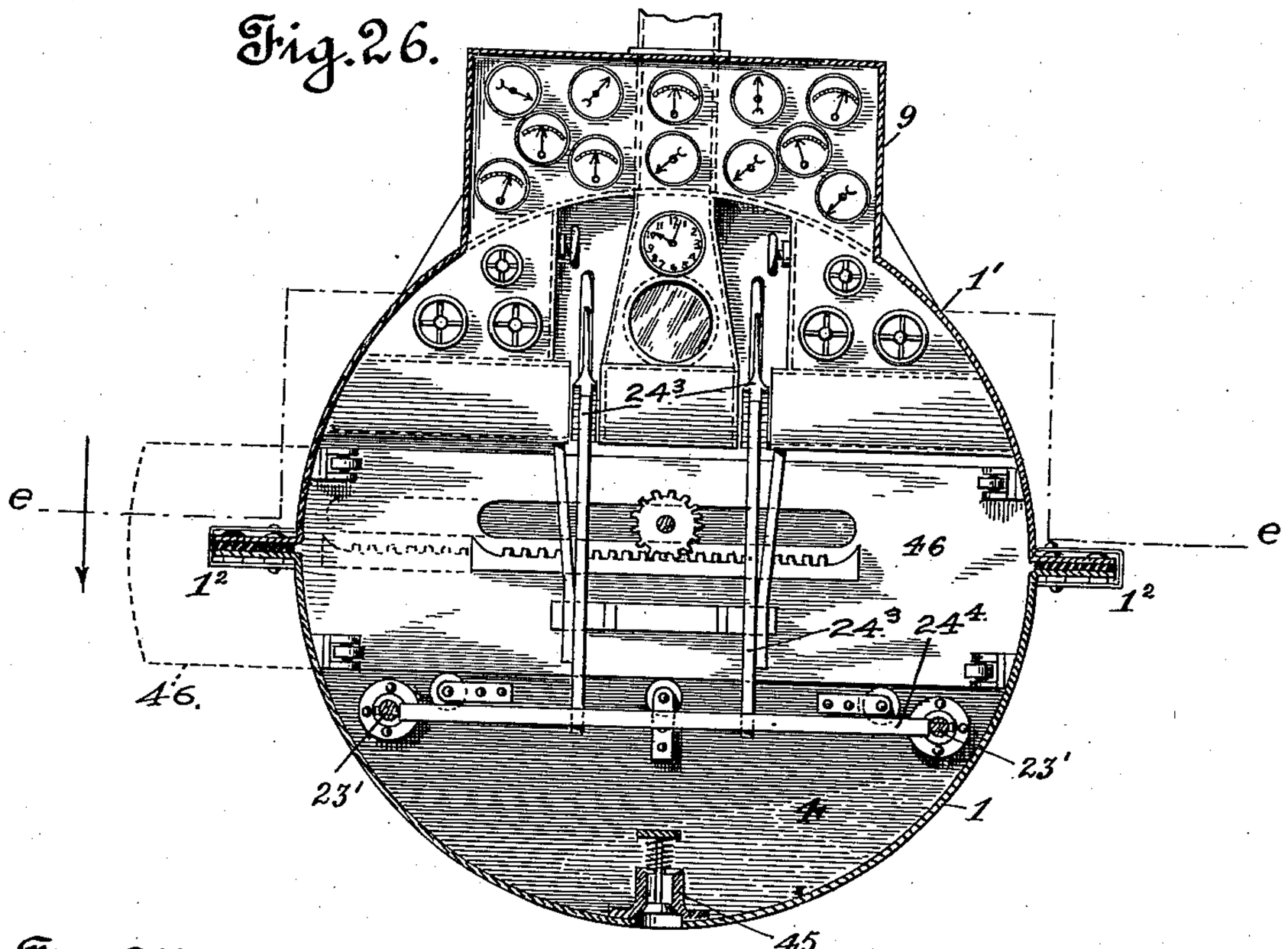
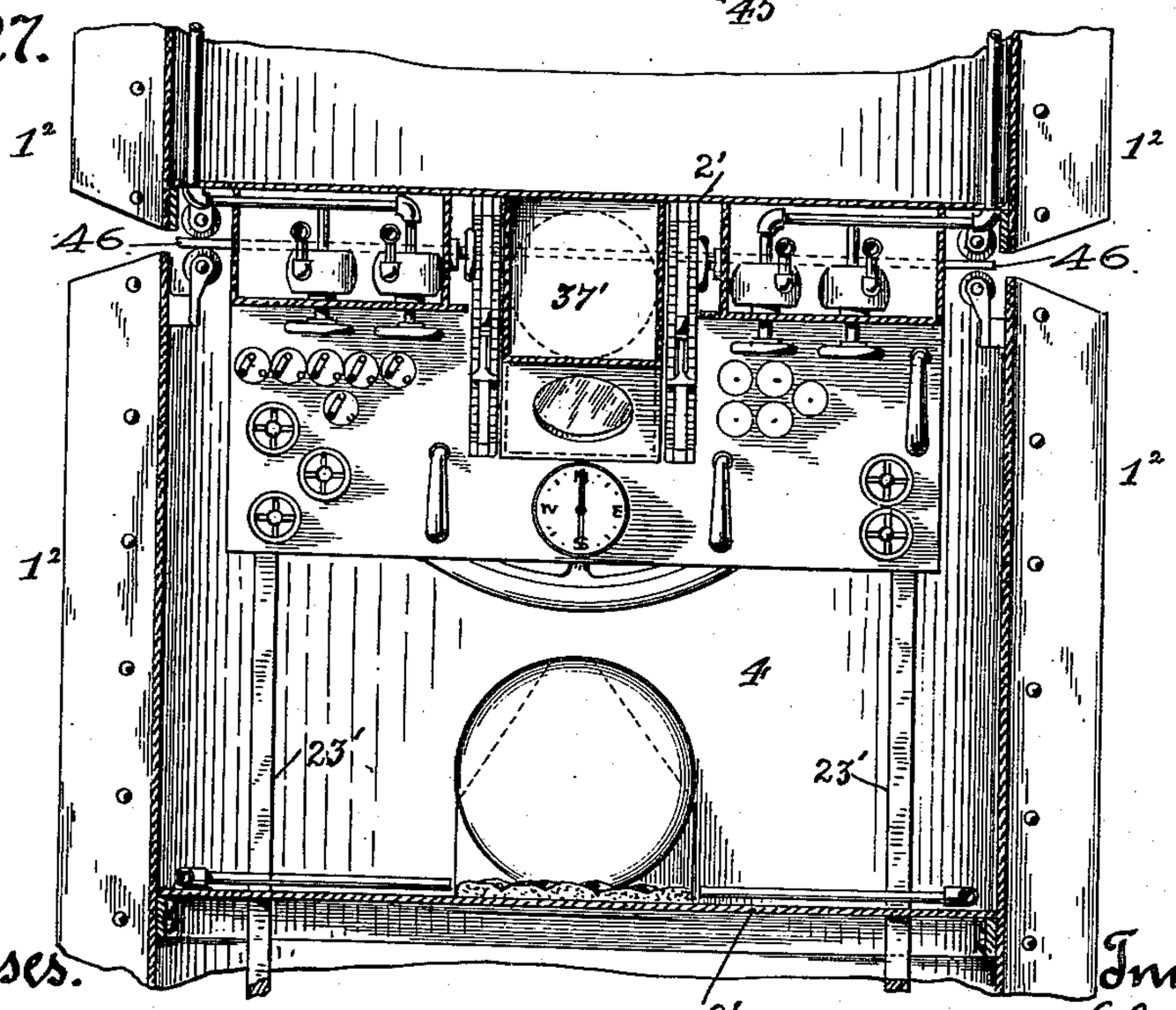


Fig. 27.



Witnesses.

F. A. Tontevero.

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A. M. FULLER.

SUBMARINE TORPEDO BOAT.

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Patented Sept. 13, 1910.

11 SHEETS—SHEET 10.

Fig. 28.

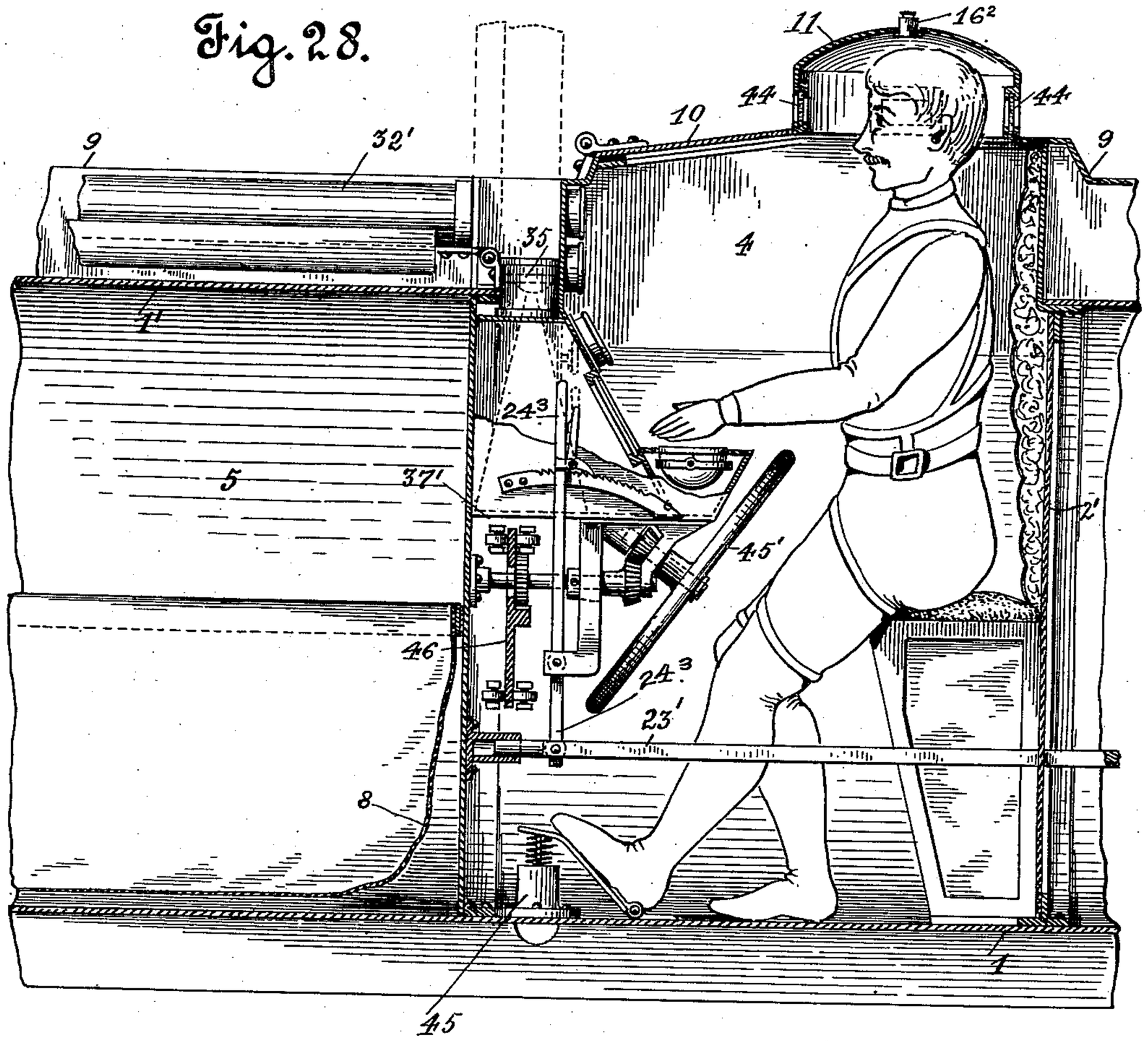


Fig. 29.

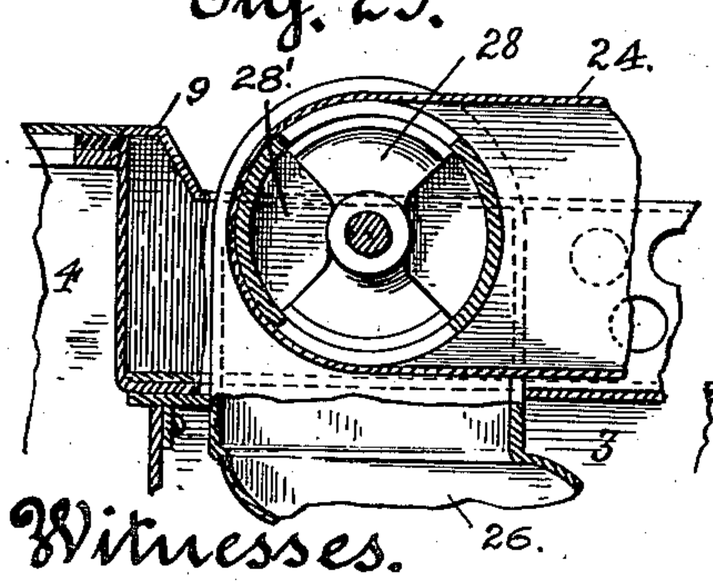


Fig. 31.

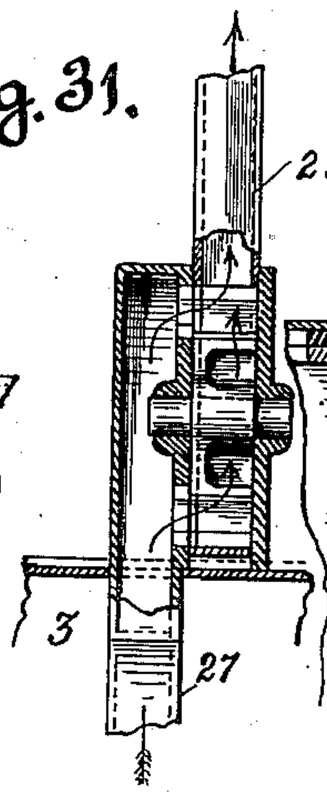
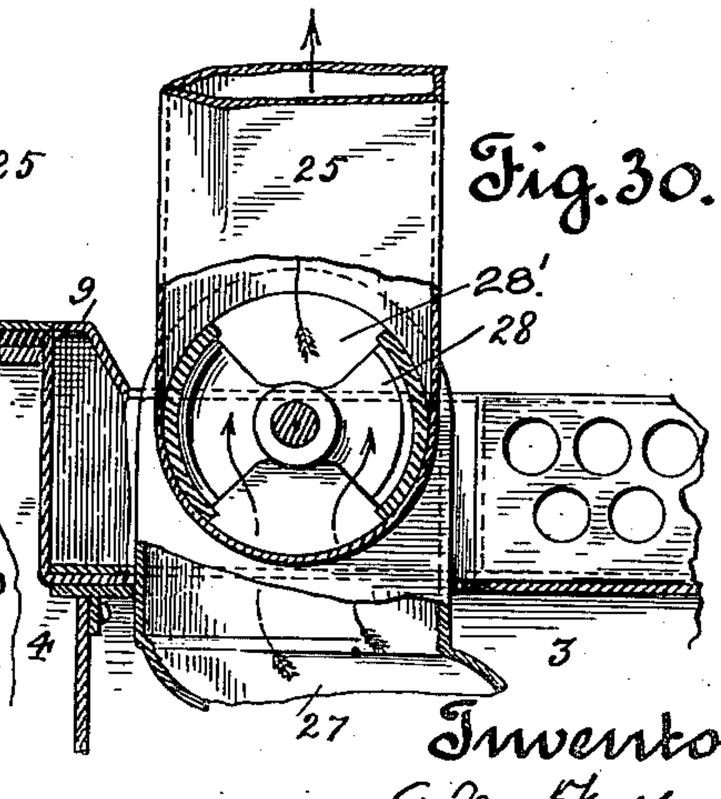


Fig. 30.



Witnesses.

F. Montevercle.

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A. M. FULLER.

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APPLICATION FILED APR. 14, 1908.

Patented Sept. 13, 1910.

11 SHEETS—SHEET 11.

Fig. 32.

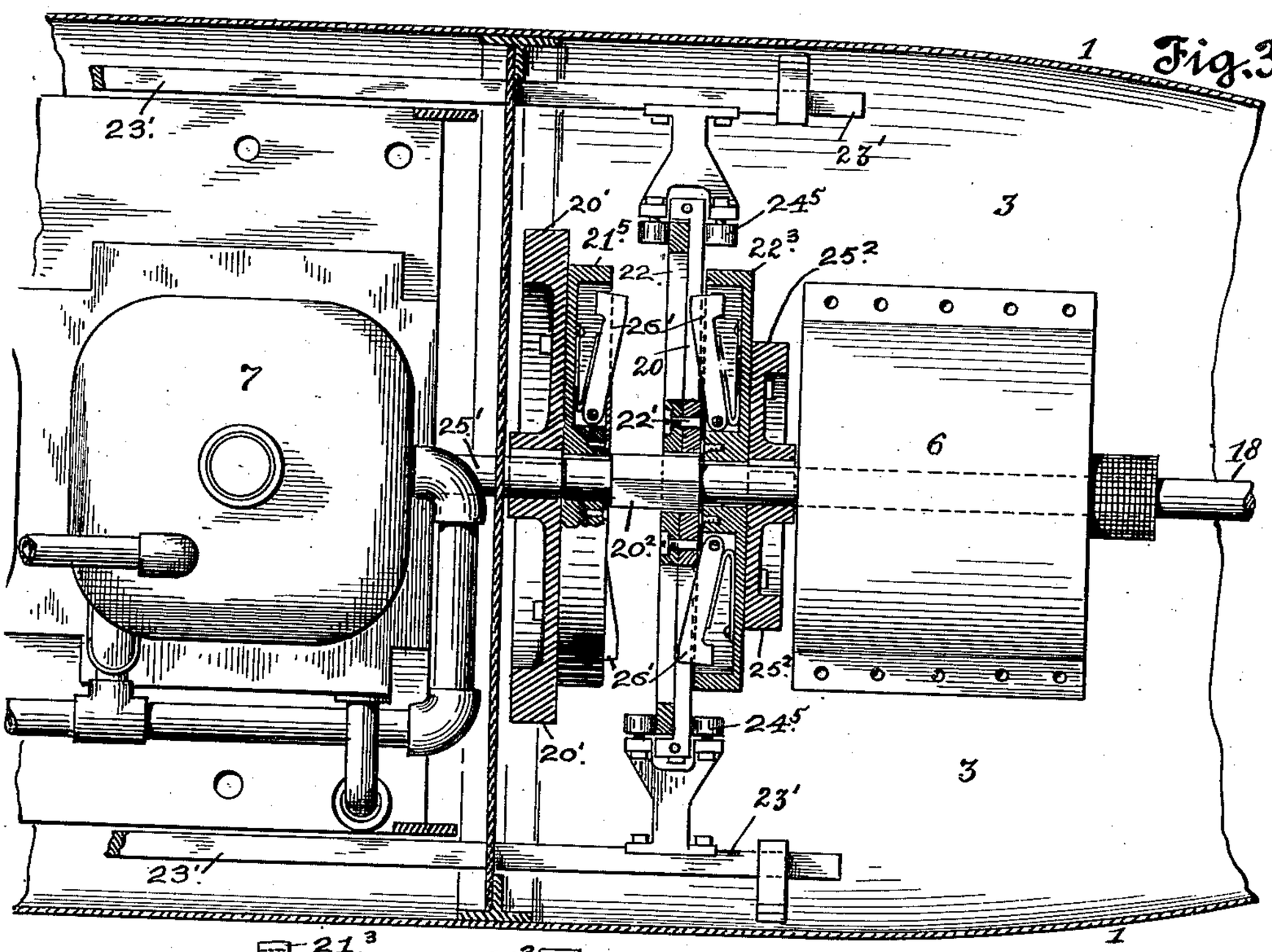


Fig. 34.

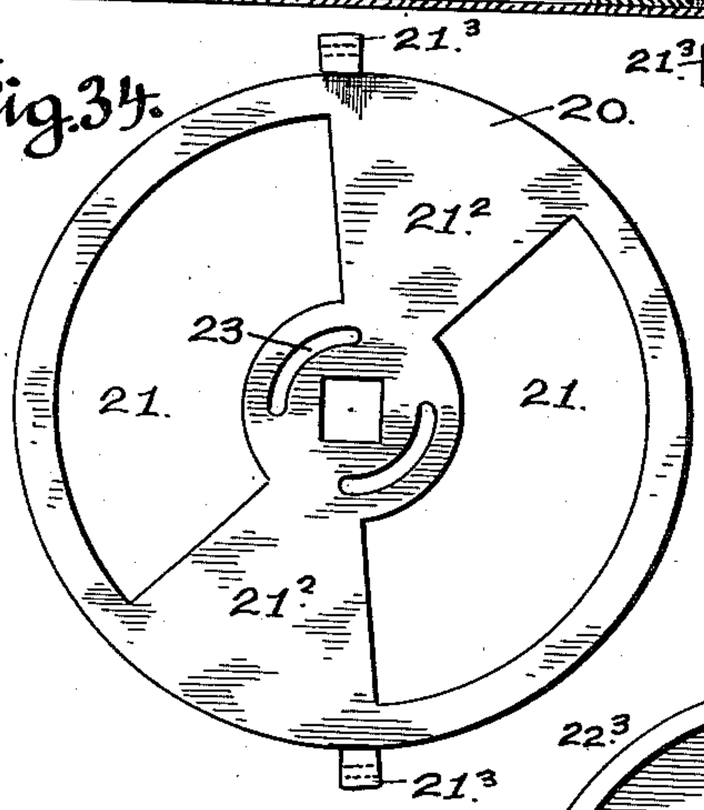


Fig. 35.

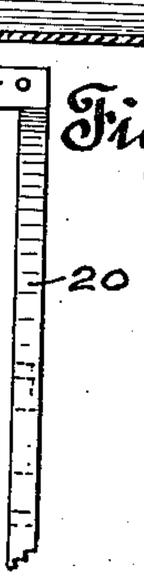


Fig. 33.

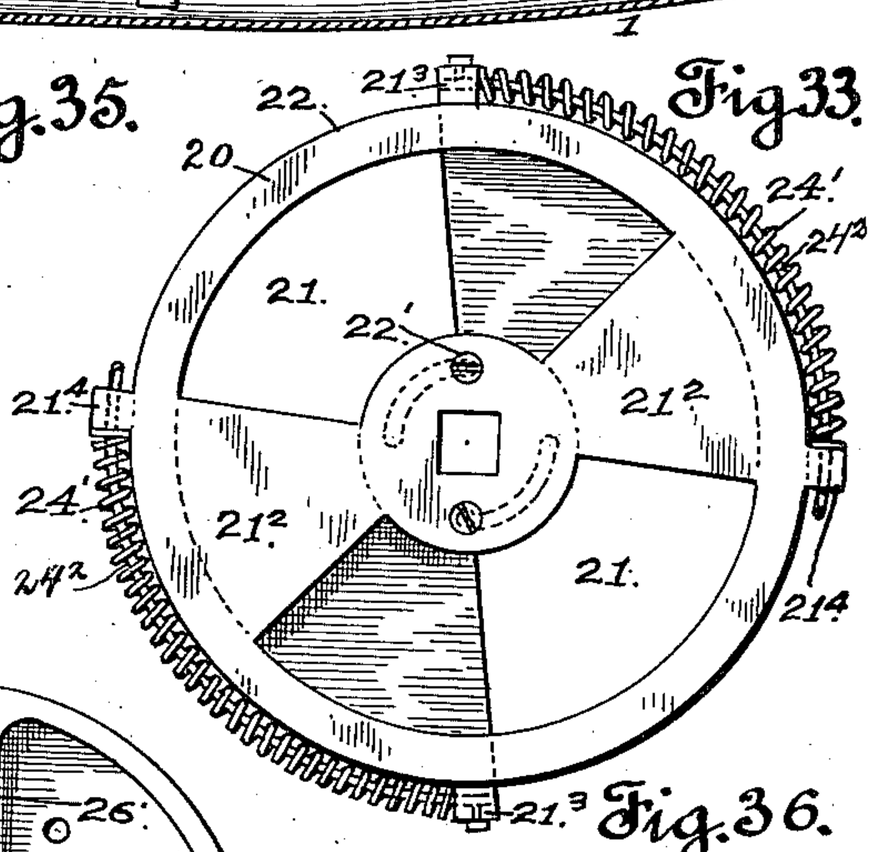


Fig. 36.

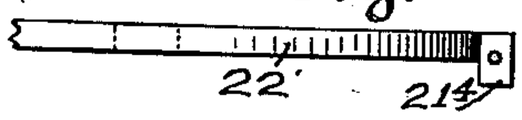
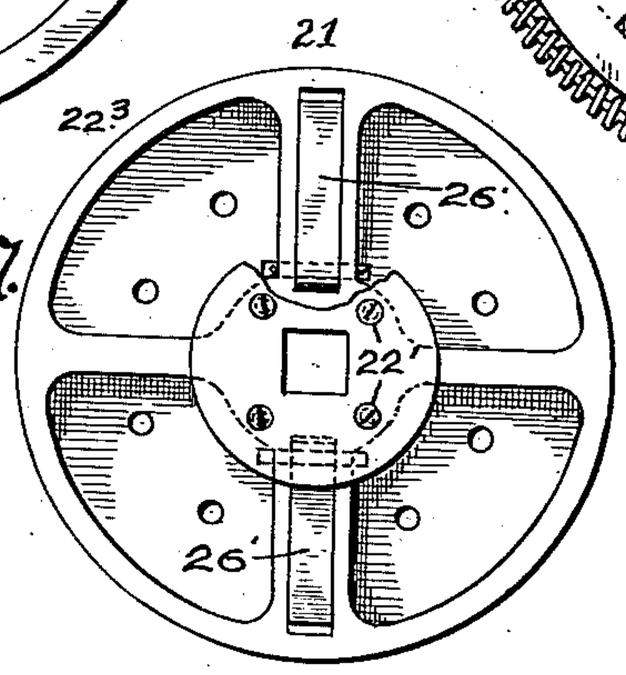


Fig. 37.



Witnesses.

F. Wanteverde.

Wm. F. Booth

Inventor,

A. M. Fuller

by Macker

his atty.

UNITED STATES PATENT OFFICE.

ALVARADO M. FULLER, OF TOPEKA, KANSAS.

SUBMARINE TORPEDO-BOAT.

970,210. Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed April 14, 1908. Serial No. 427,070.

To all whom it may concern:

Be it known that I, ALVARADO M. FULLER, a citizen of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Submarine Torpedo-Boats, of which the following is a specification.

Submarine torpedoes of the present and accepted type are large and of heavy tonnage, comparatively, and generally too large to be carried upon superior vessels and must, consequently, operate in water from their original base. They require a crew of several men to operate them and are, in general terms, coast defense torpedo submarines. Their sphere of action and usefulness in naval warfare is, therefore, very limited. Their submergence depends mainly upon taking in water, and expelling the same when coming to the surface; factors which take more or less time. Again, their draft is too great for the very shallow water of many roadsteads.

The hereinafter described torpedo-boat may be characterized in general terms as a boat capable of operating on the surface of the water or submerged, it being mainly designed to be carried upon cruisers and other war vessels, or upon specially constructed vessels for the carrying of a flotilla of from four to twenty of the torpedo-boats, which boats are to be employed as an auxiliary equipment to the war vessels, generally; the torpedo-boat being thus adapted for attack in harbors or other waterways, for cruising out to sea, and for general defense purposes. In fact, the torpedo-boat is to be launched from its vessel in a manner similar to the launching of a torpedo, the said boat after launching being directed by the operator situated therein toward the vessel of an enemy, and the torpedo carried thereby being discharged at any desired time by the operator, the torpedo-boat being thus transported by the war vessel or the vessel constructed for such purpose (constituting the base of supply for the torpedo-boat) to the field of action. The idea involved is: that, with war vessels and cruisers thus equipped these submarines shall be launched in the sphere of action and, through their speed, smallness and sub-surface action discharge their torpedoes with absolute certainty and at short range; accomplishing this, they retreat to their superior vessel. If flotilla cruisers constitute a part of the fleet or constitute a fleet, alone, their superior speed shall permit of seizing the proper time and distance, (keeping out of range of the enemy's heavy guns) to discharge two or three lines of submarines and hurl against the enemy fifty to eighty of these submarines. Thus it is seen, that the auto-submarine torpedo boat is carried upon vessels, may be launched from superior vessels as a torpedo is now launched through tubes; is able to fight in any place or in any sea; is fully competent for all coast defense, reconnoitering, and has a cruising radius of large area in any water. The torpedo-boat thus becomes a buoyant gun tube or shell for carrying a standard torpedo into positive action. Inside of this tube or shell is a single operator as, also, all of the engines, batteries, machinery, stores, &c., necessary for a full and complete operation of the same. Inasmuch as each launched torpedo-boat constitutes a fighting unit, it is obvious that, as a number of such units approach the enemy's vessel, from different directions, it will be impossible for the enemy to concentrate a full and efficient defensive fire on any one of such units without leaving the other units free to attack unmolested. This submarine is adapted for every purpose for which the present type is applicaple, together with the greater purpose of being carried, as an auxiliary equipment to war vessels and cruisers, and as a full fighting machine in flotilla cruisers; its size, arrangement and working being such as to enable it to be operated and entirely controlled in its movements by a single operator, situated within the boat; thus making it essentially a one man operated torpedo-boat, in contra-distinction to that class of submarine torpedo-boats operated by a general crew, while the weight of the boat is such as to enable a number thereof being carried by a war vessel as a portion of its permanent armament.

The construction of the torpedo-boat is such that a single torpedo which it carries shall constitute a bow therefor, the torpedo being held within an interior tube, which forms the torpedo chamber of the boat, until released for discharge, by means of a sabot, the said sabot automatically assuming the position of the torpedo, after having been discharged, and in its turn forming a temporary bow for the boat. The boat itself may be said to constitute a buoyant sad-

dle, or inclosing tube or shell, for the torpedo, it being of such an arrangement as to act as a buoyant support for the operator, and as a means for returning to its base of supply (the war vessel) after having performed its duty of directing and discharging the torpedo, while at the same time serving as a support for the mechanism for enabling the operator to guide the torpedo toward the objective point of attack.

The torpedo-boat is designed to run on the surface of the water or to run at fixed depths below the surface; the single torpedo carried within its inner tube or torpedo chamber being of a standard type lying in the axis of the boat, the said boat having a false deck or super-structure containing the conning tower, and a gate for entry and exit of the operator to the conning chamber containing the controlling means for the propelling mechanism, and the mechanism for discharging the torpedo, and for regulating the submergence of the boat.

Briefly stated, the object of the invention is the production of a torpedo-boat which may be absolutely controlled in its movement by a single operator, the boat being of such construction that it may be conveniently carried in numbers by war vessels generally as a portion of their fighting armament; which boat is to be launched from the war vessels, and, after being launched, guided and directed by its operator, situated within the conning room, toward the vessel of an enemy, until within the proper distance for positive action in the discharge of its torpedo; the torpedo then being discharged and the boat (which serves as a buoyant support for the operator) returned to its base of supply (the war vessel), where it receives a fresh torpedo to be in readiness for further offensive action. The torpedo-boat thus serves as an auxiliary equipment to be carried by the war vessels, and acts as a buoyant support for the conveying of the operator to direct the torpedo, and as a means for enabling the operator after having discharged the torpedo, to return to the base of supply. In other words, the proposed torpedo-boat constitutes a buoyant gun tube or shell for the torpedo, by means of which the operator is enabled to intelligently guide and direct the movement of the torpedo, to control the discharge thereof, and to return to the vessel to which it belongs, or other point of safety.

To comprehend the invention reference should be had to the accompanying sheets of drawings, wherein—

Figure 1 is a side view of the torpedo-boat with its torpedo protruding therefrom and forming a temporary bow therefor, the boat being illustrated in normal position on the surface of the water, the air and exhaust vents for the engine, and the fresh air vent and the periscope being in lowered position. Fig. 2 is a plan view of the boat with the torpedo secured thereto and protruding from the forward end thereof to form the bow, the various vents and the periscope being in lowered position. Figs. 3 and 3ª constitute longitudinal sectional plan views of the boat, illustrating the interior mechanism of the same and the position of the working parts therein, said view being of the boat with its torpedo discharged, the sabot being shown in locked position at the outer end of the torpedo chamber and as forming a temporary bow for the boat. Figs. 4 and 4ª represent a longitudinal sectional view of the boat, illustrating the position of the torpedo within the torpedo chamber and the sabot to which the torpedo is held as locked within said chamber or tube, also illustrating the position of the batteries, the compressed air cylinder, the gasolene tank, the engines for operating the boat, the conning-room with the operator situated therein, and the false deck or superstructure carrying the conning-tower and the gate for permitting the operator to pass in and out of the conning-room, within said room being situated the steering-wheel, the gage plate, the keyboard, and the levers and valves required to be operated to control the various actions of the boat and its working mechanism. Fig. 5 is a side view of the boat as launched from a vessel, and illustrated as running under different depths of water, the vents and periscope being shown in raised position, the normal or surface position of the boat being illustrated, also position in respect to the water when submerged five feet, and the final position of the boat when running ten feet under water or ten foot submergence, which is the position assumed by the boat when approaching close to the enemy. Fig. 6 is a front end view of the boat with the vents and periscope in lowered position. Fig. 7 is a similar view with the vents and periscope elevated. Fig. 8 is a rear end view of the boat. Fig. 9 is an enlarged broken longitudinal sectional side view of that part of the boat containing and illustrating the torpedo therein interlocked, the sabot being locked within the said tube, the lock clutch at the rear end of the tube with which the sabot interlocks, one of the water inlet valves for admitting water into the torpedo tube to replace the weight of the torpedo when discharged, likewise the position of the air cylinders and battery boxes, and one of the circular braces for the boat. Fig. 10 is a cross sectional view taken on line *a*—*a* of Fig. 9—looking toward the bow of the boat, as per arrow 1; showing rear end of sabot, air cylinders, water inlet valves, one of the inlet valves being shown

in section, and a circular brace for the boat. Fig. 11 is a similar view taken on same line *a*—*a*—looking toward the stern of the boat, as per arrow 2—showing a front view of the rear end of the torpedo tube, with the lock clutch mechanism for locking the sabot. Fig. 12 is an enlarged partly broken longitudinal sectional view of the bow end of the boat with the sabot locked within the torpedo tube and projecting therefrom to form the bow of the boat, after the discharge of torpedo, the locking device for holding the sabot in such position being illustrated, also the grip levers with the torpedo tail held thereto, just prior to the torpedo's separation therefrom. Fig. 13 is an enlarged broken detail top view of Fig. 12, the torpedo tail being released. Fig. 14 is a cross sectional detail elevation of the sabot nose piece, taken on line *b*—*b* of Fig. 12 of the drawings, showing the chamber within which works the grip levers and torpedo tail. Fig. 15 is a broken detail elevation of the torpedo tail frame, and its tail piece. Fig. 16 is an enlarged detail sectional view of the sabot lock clutch for locking the sabot within the torpedo tube, said view illustrating the firing chamber and the bolt therein for releasing the lock clutch and puncturing the cap of the sabot to release the air contained in the chamber thereof, to permit of the same escaping into the torpedo chamber to expel the sabot and torpedo therefrom, also showing the air filling valve to the sabot chamber. Fig. 17 is an enlarged detail front view of the lock clutch for locking the sabot, also the air cylinder connected to the same and by means of which the lock clutch is opened to allow the extraction of the torpedo and sabot without necessitating the puncture of the sabot cap. Fig. 18 is a detail rear view of the air inlet valve casing of the sabot. Fig. 19 is a cross sectional rear view of the air expelling valve of the sabot, taken on line *c*—*c* of Fig. 16 of the drawings. Fig. 20 is a detail sectional view of one of the water inlet valves for flooding the torpedo tube after the discharge of the torpedo, to replace the weight thereof in order that the buoyancy of the boat may not be disarranged by having an empty tube. Fig. 21 is a top plan view of the water inlet valve disclosed by Fig. 20 of the drawings. Fig. 22 is a part diagrammatic elevation of the diving controlling mechanism; the controlling chamber proper being shown in enlarged vertical section and disclosing in full detail its various parts; the parts shown outside of the controlling chamber, being the operating electric key in the conning room, the motor shaft and its connections to the actuating electric battery. Fig. 23 is a front sectional elevation of the controlling chamber partly broken, taken on line *d*—*d* of Fig. 22 of the drawings. Fig. 24 is a top plan broken detail view showing the circuit breakers, one of the fin wheels, and the connection thereof with its fin. Fig. 25 is an end view in elevation of one of the fin wheels, and the circuit breakers operated thereby. Fig. 26 is a front sectional elevation of the forward end of conning room, showing the rudder plate, its operating mechanism, levers, valves and gages by means of which the operator controls the movements and operations of the boat. Fig. 27 is an irregular sectional view of the conning room, taken on line *e*—*e* of Fig. 26 of the drawings. Fig. 28 is a broken detail side sectional elevation, the features disclosed by Figs. 26 and 27 of the drawings, the operator being illustrated in the conning room. Fig. 29 is an enlarged broken sectional detail view of the air vent pipes, showing the circular valve connecting same with the interior of the engine room, (to the exhaust on one side and to the fresh air on the other,) the vent being shown lying down on the superstructure of the boat, the valve being closed. Fig. 30 is a similar view with the exhaust vent raised, the valve being shown in open condition. Fig. 31 is a side view of the mechanism disclosed by Fig. 30 of the drawings, partly broken, showing connection of valve chamber to flue from engine room. Fig. 32 is an enlarged broken top plan of that portion of the boat between the motor engines and electric motor, showing the disk clutch connection between these two, by means of which either is thrown into operation without necessitating the interruption of the boat's movement. Fig. 33 is a front view of the coupling disk. Fig. 34 is a detail front view of one of the half plates forming the coupling disk. Fig. 35 is a broken edge view of same. Fig. 36 is a broken edge view of the opposite half plate forming the coupling disk. Fig. 37 is a front view partly broken of one of the clutch disks, showing the projecting clutch arms carried thereby for engaging with the coupling disk to lock the same thereto.

It may be stated that the boat is propelled by means of a gasolene engine, and by means of an electric motor, the gasolene or gas engine being utilized for the driving of the boat when the same is running on the surface of the water or at a depth of submergence not exceeding approximately seven feet, or at such a depth as will permit of the air inlet and the exhaust vents for the engine being exposed above the surface of the water; while when working at a depth of submergence to place the said vents beneath the surface of the water, the gas engine is thrown out of commission and the electric motor is thrown into action.

The boat is preferably of the cigar-shape, and constructed of sheet steel plates of

proper thickness for the work required. The lower half or section 1 of the boat is constructed as a whole, while the upper section 1′ is composed of curved plates in sections; some of said sections being riveted to the circular braces and to the lower half of the shell, at the bended lips or side keelsons. The other sections, over engines, &c., being removable for inspection of the interior, and being screwed to the lower half, and to the side sections and hermetically sealed by soft solder for action. The upper and lower sections form lips 1^2 on either side of the boat, 4″ wide, as keelsons, to diminish rolling. Within the tube or shell thus formed, which is strengthened interiorly by means of the circular braces 2, are located the various working features of the boat, the said interior of the tube or shell being divided by a series of transverse bulkheads 2′, to form the engine room 3, the conning-room 4, the gasolene chamber 5, and the storage chamber 5′, for the air cylinders and the batteries, Fig. 4 of the drawings. Within the room 3, the electric motor 6 and the gas engines 7 are located, the compartment 4 serving as the conning-room for the operator of the boat, while the chamber 5 is subdivided by the diaphragm 8 into an upper and lower compartment, the lower one of which is open to the outside water, while in the upper compartment is contained and stored the necessary gasolene for the running of the gasolene engine 7. The formed tube or shell is approximately the size of a life boat, being about forty-two (42) feet long, with a cylindrical body portion of about forty-four (44) inches in diameter, more or less. A superstructure or false deck 9 is provided for the boat, which superstructure covers the main body of the tube or shell fore and aft, the same being provided with an outwardly or upwardly swinging door or gate plate 10, which carries the conning-tower 11. It is by means of the said swinging door or gate plate 10, that the operator is permitted to enter and leave the conning-room 4. The cylindrical body portion of the boat is formed with a truncated cone bow 12, and within the said bow portion, and the forward portion of the main shell is arranged a torpedo-tube 14, forming a torpedo chamber 14′, and above and below this tube and within the compartment or storage room 5′, the air cylinders 15, 16, and 16′, and the storage batteries 17 are arranged. The upper cylinder 15 contains air at approximately two thousand pounds pressure, cylinder 16 contains air at approximately one hundred and sixty-five pounds pressure, while the cylinder 16′ contains air at fifteen pounds pressure per square inch for breathing purposes. The cylinders 15 and 16 are suitably connected, and are used for supplying air under pressure for actuating the hereinafter described mechanism, likewise for supplying fresh air to the operator situated within the conning-room, when the boat is submerged. This air is taken from the cylinder 16′, which takes air from the cylinder 16, a suitable reducer, not shown, being introduced within the connection between the said two cylinders. The storage batteries 17, by means of the usual electric connections, supply the energy for actuating the electric motor 6, for the driving of the boat when submerged.

Gasolene is supplied to the feed chamber of the gas engine 7, from the upper compartment of the gasolene chamber 5. As the gasolene is taken from the upper compartment of the chamber 5, water enters the lower compartment thereof for gradually restoring the weight lost by the consumption of the gasolene, the water being separated from the body of gasolene by means of the flexible diaphragm 8, which diaphragm is gradually forced upwardly by the pressure of the water admitted into the lower compartment of the gasolene chamber 5.

The propeller shaft 18 has secured thereto the propeller 19, which shaft, by means of the hereinafter described coupler mechanism, is driven from either the engine 7, or the electric motor 6. The coupler mechanism will be fully understood by reference to Figs. 32, 33, 34 and 37 of the drawings. It will be observed that the propeller shaft plays through the center of the electric motor 6, and its inner end is loosely socketed in the fly-wheel 20′, secured to the engine shaft 25′. The said propeller shaft 18 is formed with a square shouldered portion 20^2, on which is slidably mounted the coupler. This coupler consists of the disk 20, and the slide plate 22. The coupler disk 20 and the slide plate 22 are formed with the open fields 21, and the solid fields 21^2, the slide plate 22 being movably held relatively to the disk 20 by means of the pins 22′, which pins work through the curved slots 23, in the said disk 20. The slide plate 22 is loose on the shouldered portion 20^2, so that the same is free to rotate relatively to the coupler disk 20, until the pins 22′ reach the limit of the slots 23, when the motion of the said plate is transmitted to the coupler disk 20, to impart rotation to the propeller shaft 18. A resistance is offered to the rotation of the slide plates 22, by means of the tension springs 24′, which springs surround the rods 24^2 secured to the projections 21^3 of the coupler disk 20, and which work through the projections 21^4 of the slide plate 22. The coupler rotates between the grip rollers 24^5, carried by the reach bars 23′, which reach bars are thrown forward and backward to move or slide the coupler on the shouldered portion of the

propeller shaft, by means of the levers 24^3, situated within the conning-room 4 of the boat, Figs. 4^a, 26 and 28 of the drawings. The cam disk 21^5, Fig. 32 of the drawings, is rigidly secured to the fly-wheel 20′ of the engine shaft 25′, while the cam disk 22^3 is rigidly secured to the fly-wheel 25^2 of the electric motor 6. Each of the said cam disks is provided with two outwardly spring held clutch arms 26′, which arms, as the coupler is moved into engagement with either of the said cam disks, enter the open fields 21 of the coupler disk 20 and slide plate 22, and, during rotation of the cam disk by which they are carried, engage with or bear against the edge portion of the solid fields of the slide plate 22, which plate is so arranged relatively to the coupler disk 20, as to partially cover a portion of its open fields, and carry the slide plate therewith, until the pins 22′ reach the limit of the curved slots 23, when motion will be imparted to the coupler disk 20, and through said disk transmitted to the propeller shaft 18. The slide plate 22 thus acts as a shock consumer, taking up the initial strain of the cam disk with which the coupler is moved into engagement.

By the described form of coupling mechanism, it is not required to stop the working of the boat in order to change from one form of motor power to the other, and, as the take up by the coupler is a gradual one, jarring or shock to the boat as either form of motor power is thrown into action, is avoided.

During the operation of the boat under the influence of the gas engine 7, air is supplied thereto through the vent 24, the exhaust from the engine being conveyed to the companion vent 25, Figs. 4^a, 7, 29, 30, 31 of the drawings. These vents are trunnioned immediately back of the conning-tower 11, and they communicate respectively with the fresh air and the exhaust pipes 26, 27, Fig. 3^a, of the drawings, the openings of which are controlled by the circular valve 28. The openings 28′ of these valves are uncovered or opened as the said vents 24 and 25 are thrown into vertical position, the same being raised or elevated by any suitable mechanism. The mentioned vents are rectangular with a knife edge toward the front, and are supported in raised or vertical position by means of the vent tongs 29′, which tongs hold the vents against the pressure of the water exerted thereon, as the boat is forced through the water. These said vents supply air to the gas engines and take the exhaust therefrom while the boat is running on the surface of the water, or when running submerged at a depth of approximately five feet, but when running submerged at a greater depth, the boat is propelled under the influence of the electric motor 6; in which case the vents 24, 25, communicating with the pipes 26, 27, are submerged or beneath the surface of the water. As the boat is submerged to place the upper end of the vents 24, 25 beneath the surface of the water, the said vents are lowered into a longitudinal position onto the vent rests 31, Fig. 1 of the drawings. When the torpedo boat is running under the electric motors (submerged more than five feet) air is furnished to the operator from the breathing tanks and vitiated air escapes through a spring vent 16^2 in the top of the conning tower. Under these circumstances, the usual pressure in the conning chamber will be about 15 pounds.

The periscope-tube 32′ is located forward of the conning-tower 11, Figs. 2, 5 and 7 of the drawings. The periscope-tube 32′, when in a raised position rests against the front of the gate 10, the bottom of the tube resting immediately over a glass bull's-eye 35, in the top of the shell. The said periscope-tube carries at its upper end the periscope 35′, and has fitted therein a wide angle lens, which converges the rays onto a prism and thence through lenses to the bottom of the tube 32′, where they diverge through the bull's-eye 35 onto a table 37′ in the conning-room or pilot house, affording a view of all surrounding objects, when the boat is submerged to a depth of about seven feet. When thus submerged, fresh air is taken into the boat through the air vent 24, being drawn therein by the fan 38, while the vitiated air is expelled therefrom by the said fan through the exhaust vent 25. When the periscope-tube 32′ is in a lowered position, it will lie on the top of the super-structure or false deck 9, the periscope 35 being protected by means of the guard 42. The described periscope-tube 32′ when elevated, is held against water-pressure, during the movement of the boat through the water, by means of the steel ribbons 42′, Figs. 5 and 7 of the drawings, which ribbons are self winding on the reels 43, as the periscope-tube is lowered, one of said reels being shown in Fig. 4 of the drawings. The said reels 43 are located inside the main shell of the boat, and the edge of the ribbons, when the periscope-tube is raised, are presented to the water during the forward movement of the boat.

The conning-tower 11 of the boat is provided with the glass protected eye-slots 44, four in number, by means of which the operator within the conning-room may take observations while the boat is running on the surface of the water.

In the bottom of the conning-room 4 is located an outwardly movable foot-actuated valve 45, by means of which the operator may flood the said room with water, if desirable, Fig. 4^a, of the drawings. Whenever the

outer water pressure on the gate 10, by reason of accident, shall be too great to permit the same to be opened, then water may be admitted through the valve 45 in the conning chamber to equalize internal and external pressures, when the gate may be easily opened. In the said conning-room 4, is located the tiller-wheel 45′, which is connected to operate the slide tiller plate 46, which is thrust outward, on either side of the boat, that is, to port or starboard, for the guidance of the boat laterally.

The submergence of the boat is regulated by the fins 47, 47′, located at or near the bow of the boat and on each side thereof, the said fins being controlled as to movement by the operator situated within the conning-room of the boat. The fins 47, 47′, are maintained in any desired adjusted position, by means of a diving-controller; which controller, briefly stated, may be said to consist of a steel cylindrical casing 48, having screw end plates 48′, 49, the interior of the casing being divided by a flexible diaphragm 49′, into end chambers or compartments 50, 50′. The compartment 50 receives water through the water inlet 51, which communicates with the outside water; while the compartment 50′ receives air under pressure from the high pressure cylinder 15, which air enters through the valved air inlet 51′, which connects with the said air cylinder. It should be stated, at this time, that the fins 47, 47′ are hinged at their forward ends to each side of the bow of the boat, the said fins at their rear ends being connected to the fin-wheels 52, by means of the connecting crank arms 52′, which arms extend from the fin-wheels located inside of the boat, and work through and within the longitudinally slotted portion 53 of each fin, Figs. 3, 22 and 24 of the drawings. The said fin-wheels are driven by the shafts 53′, which shafts have a worm portion 54, that engages with a worm section 54′ of each fin-wheel 52, the rotation of the shafts 53′ being thus transmitted to actuate the fin-wheels to raise and lower the fins 47, 47′, in accordance as to whether the boat is desired to dive for submergence, or to move upwardly. The shafts 53′ are driven from the electric motors 55, which motors may be operated to raise and lower the fins 47, 47′ by the operator within the conning-room for the proper submergence of the boat, or to cause the boat to move upwardly for surface running, or the said motors may be automatically thrown into action by the diving controller, in order to operate the fins to maintain the boat in proper or adjusted position of submergence, such action of the fins by the diving controller being independent of the operator within the conning-room of the boat. The flexible diaphragm 49′ of the diving controller, is preferably in the form of a rubber disk, which is clamped to the head 55′ of the piston 56, the said diaphragm or disk 49′, being also clamped air and water tight to a circular shoulder 56′, on the interior of the casing 48, and held thereto by the securing ring 56^2, secured in place by the screws 57. The said piston 56 works through the adjusting screw-head 57′, which head acts as a guide for the piston 56, Fig. 22 of the drawings. Within the air chamber or compartment 50′ of the diving controller casing, is located the spiral spring 58, which spring surrounds that portion of the piston 56 projecting within the said chamber or compartment 50′, the mentioned spring 58 bearing against the piston head 55′. The said spring acts against the flexible diaphragm or disk 49′, and the pressure thereof is regulated by the adjusting head 57′. Inasmuch as the inlet 51, of the diving controller is open to the outside water, it is obvious that the chamber or compartment 50 will at all times be filled with water, and, as the flexible diaphragm or disk 49′ is approximately twelve square inches, the normal pressure of the water on the disk or diaphragm 49′ will be approximately 1.66 pounds per square inch. To counteract this normal water pressure, before the boat is launched, the screw-head 57′ is turned to compress the spring 58, until the disk or diaphragm 49′ is forced against the shock-post 59, inwardly extended from the end screw-plate 48′ into the chamber or compartment 50 of the diving controller. The pressure thus brought to bear onto the mentioned disk or diaphragm 49′, will cause the same to become concaved, but, once the boat is in the water and the chamber or compartment 50 filled with water, the pressure of the water admitted into the chamber or compartment 50 balances the compression of the disk or diaphragm 49′, and the same will become flat.

The inner end of the piston 56 carries an insulated contact-point 59′, which point, when the disk or diaphragm 49′ is in its flattened condition, remains normally midway between the contacts 60, 60′, which contacts extend through the tubular extension 61 of the end screw-plate 49, of the diving controller casing 48, so as to be in the path of the contact-point 59′, as the same is moved inwardly and outwardly by the stroke of the piston 56. The outer or open end 61′ of the tubular extension 61, is closed by means of a screw-plug 62, which plug prevents the escape of air from within the chamber or compartment 50′. The contact-point 59′ is connected to the binding post 62′, from which extends the wire 63, which wire leads to the key 63′, located in the conning-room of the boat, said wire entering beneath the key 63′. From buttons 65, 65′ of the said key 63′, extend the wires 66, 66′,

which wires connect respectively with the contacts 60, 60′, and with the circuit breakers 67, 67′, from which said circuit breakers the mentioned wires 66, 66′ extend to the electric motors 55, entering respectively at the binding posts 68, 68′. The said motors are connected to one pole of the battery 17 by the connections 69, while the key 63′ in the conning-room is connected with the opposite pole of the battery by the connection 69′. The circuits are controlled by the operator within the conning-room, by means of the switch 70, which is connected to and immediately above the key or key-plate 63′. If the said switch be thrown to contact with button 65, a circuit will be established from the battery 17, to the motors 55, through the connections 66, 69 and 69′, operating the said motors to rotate the motor-shafts 53′, for actuating the fin-wheels 52, by imparting thereto a part rotation, the rotation of which in turn is transmitted through the described connections, that is the fin-arms 52′, to raise the rear end of the fins 47, 47′, thus positioning the same to cause the boat to dive or submerge itself, and this positioning of the said fins being independent of the action of the diving controller; while the throwing of the switch 70 to make contact with the button 65′, establishes a circuit between the battery and the motors 55, through the connections 66′, 69, and 60′, which actuates the motors 55 reversely, to impart a reverse rotation to the motor-shafts 53′, to that previously described, and a reverse part rotation to the fin-wheels 52, which, through the action of the said fin-arms, lowers the rear end of the fins 47, 47′, positioning the same to cause the boat to rise toward the surface of the water. For guidance of the boat in either direction, that is up or down, the fin-wheel 52 should not be permitted to turn in either direction more than seventy degrees. It is for such reason that the circuit breakers 67, 67′, are provided, which breakers destroy the established circuit after the fin-wheels have turned their allotted distance. The breaking of the circuit cuts out the working of the motors 55, and by stopping the working thereof the fins 47, 47′ are maintained at their incline of greatest elevation, or depression. The described circuit breakers are opened after the fin-wheels have rotated or revolved their full allotted distance, the opening thereof being caused by means of the studs 71, 71′, which studs project from the fin-wheels 52, and engage respectively with the circuit breakers 67, 67′, to open the same, and thus destroy the circuit.

As previously stated, the pressure of the water admitted within the chamber or compartment 50, when the boat is launched, offsets or balances the compression of the spring 58, and, flattens or straightens out the disk or diaphragm 49′, forcing outwardly the piston 56, until its contact-point 59′ stands midway between the contacts 60, 60′, or what may be termed a neutral position. Should it be the wish of the operator within the conning-room to submerge the boat, he opens the valve 72, to admit air under pressure from the cylinder 15 to enter the chamber or compartment 50′, through the inlet 51′. The pressure of the admitted air bears against the flexible diaphragm or disk 49′, and forces the same toward the post 59, expelling a portion of the water from within the chamber or compartment 50, at the same time forcing the piston 56 inwardly, until its contact-point 59′ is brought against the contact 60, which establishes a circuit between the battery and the motor through the described connections. When an electrical circuit has been thus established, the motor 55 is operated to actuate the motor-shaft 53′, for part rotating the fin-wheel 52, to raise the inner end of the fins 47, 47′, for positioning the same to cause the boat to dive. The quantity of air permitted to enter the chamber or compartment 50′, is regulated by the operator, or rather is known to the operator within the conning-room by means of any suitable gage, the operator admitting the requisite quantity of air under pressure to enter the chamber or compartment 50′ to insure the desired submergence of the boat. For instance, if the air under pressure admitted into the said chamber or compartment 50′ is sufficient for a submergence of the boat to a depth of five feet (the air inlet valve 72 being then closed), the external pressure of the water during the downward movement of the boat gradually increases the pressure of the body of water within the chamber or compartment 50, of the diving controller, and, this gradually increasing pressure acting against the disk or diaphragm 49′, will move the same until the water pressure equalizes or balances the air pressure within the chamber or compartment 50′, at which time the disk or diaphragm 49′ will have been restored to its normal position, the piston 56 moving with the disk or diaphragm 49′ to take its contact-point 59′ away from the contact 60, until the said contact-point stands midway between the contacts 60, 60′. The circuit being thus broken, the working of the motors ceases. The moment the boat has reached the desired depth of submergence, the downward pressure of the water at such depth onto the fins 47, 47′, will be such as to cause the said fins to assume a horizontal position, by reason of which assumed position of the fins the boat is maintained horizontally at its depth of submergence. However, more or less of a tendency will exist, due to circumstances beyond the control of the operator, for the boat to rise, which it is also the function of the diving controller to overcome or provide

against. Supposing the boat starts to move upwardly or rise toward the surface of the water, the pressure of the air within the chamber or compartment 50′, overcomes or predominates the pressure of the water within the chamber or compartment 50, which excess pressure of the air within the chamber or compartment 50′, bearing against the disk or diaphragm 49′, moves the same toward the post 59, carrying the piston 56 inwardly, until its contact-point 59′ is brought against the contact 60, which establishes a circuit for operating the motors 55, to actuate the shafts 53′, which in turn actuates the fin-wheels 52 for raising the rear ends of the fins 47, 47′, which causes the boat to dive until the proper depth of submergence is reached, the pressure of water within the chamber or compartment 50 gradually increasing, until the pressure thereof equals that of the air pressure in the chamber or compartment 50, at which time the disk or diaphragm 49′ will have become flat, the piston 56 being gradually forced inwardly to move its contact-point 59′ away from the contact 60, to destroy the electrical circuit, as previously described. In case the boat should continue its downward course or diving below the desired depth of submergence, then the pressure of the water within the chamber or compartment 50, as previously explained, is gradually increased to exceed or overbalance the pressure of the air within the chamber or compartment 50′, and forces the disk or diaphragm 49′ inwardly or away from the post 59, moving therewith the piston 56, until the contact-point 59′, carried thereby engages with the contact 60′, establishing a circuit between the battery and the motors, as hereinbefore described, which reverses the operation of the motors 55, and likewise that of the motor-shafts 53′, imparting an opposite throw or part rotation to the fin-wheels 52, to that given when the circuit is established by the contact-point 59′ engaging with the contact 60, which presses the inner end of the fins or blades 47, 47′, and causes the boat to rise, until the pressure of the air within the chamber or compartment 50′ gradually equalizes the pressure of the water within the chamber or compartment 50, causing the disk or diaphragm 49′ to gradually move toward the post 59, carrying therewith the piston 56, until its contact-point 59′ moves from engagement with the contact 60′, when the circuit is destroyed. The moment the pressure of the air within the chamber or compartment 50′ equalizes the pressure of the water within the chamber or compartment 50, the boat will be at the desired depth of submergence, when the disk or diaphragm 49′ will stand flattened, and the contact-point 59′ midway between the contacts 60, 60′.

It will be observed that the diving controlling mechanism serves as a balancing device for maintaining the boat in substantially a condition of equilibrium, preventing the upward or downward movement thereof beyond the sphere of the desired depth of submergence; the tendency for such fluctuation of the boat, being due to numerous causes during the handling thereof. To increase the depth of submergence, it is only required that the operator increase the pressure of air within the chamber or compartment 50′, sufficient to cause the diving movement or action of the boat until the required depth has been reached, when, as previously described, the current which controls the electric motors is automatically broken by the contact-point 59′ moving away from the contact 60. To cause the boat to rise or come to the surface of the water, the exhaust valve 73ª is opened to release the air pressure within the chamber or compartment 50′, when the pressure of water within the chamber or compartment 50 predominates, and the piston 56 is gradually forced outwardly until its contact-point 59′ engages with the contact 60′, thus automatically closing the circuit to the motors 55, which established circuit, as previously described, reverses the operation of the motors and shafts 53′, and the fin-wheels 52, to that given when the boat is diving, the part rotation thus given to the said fin-wheels, through the described connections, lowering the inner end of the fins, or blades 47, 47′ to position the same to direct the boat upwardly.

Referring to Figs. 4, 9, 10 and 11 of the drawings, it will be noted that within the chamber 14′ of the torpedo-tube 14 of the boat, is fitted the torpedo 73, the length of the said torpedo being somewhat greater than the depth of the torpedo-chamber 14′. The said torpedo 73 is provided with tail-frame 73^4, from which projects a spike-tail 73′, which spike-tail enters a hollow conical head 75′ of the sabot 74, through an opening 74′; the head 73^2 of the spike-tail 73′ of the torpedo, being engaged by the hook-ends of the grip-levers 75, Figs. 9 and 12 of the drawings. The said grip-levers are preferably in the form of bell-cranks, and the same are fulcrumed within the hollow conical head 75′ of the sabot 74, said grip-levers 75 being normally held in an open position by means of the spring 76, except at such times as the crank-extension 76^2 of each grip-lever is forced inwardly by the slide plates 77, which plates are forced against the projecting end of the laterally extending crank extension 76^2, of the grip-levers 75, to throw the same together when the slide plates 77 are thrown outwardly, as hereinafter explained; the ends of the crank extensions 76^2, extending through the hol-

low-housing 77′ within the conical head 75′, of the sabot 74.

The sabot 74 consists of a cast steel shell, to which the hollow conical head 75′ is suitably attached. The said conical head 75′ is formed with or has secured thereto a solid steel nose ring 76, and, inside of the conical head is arranged an air tight case or canister 76′, which is filled with air for the purpose of reducing the weight of the bow or head of the sabot. The head 75′ is separated from the cylindrical body of the sabot by means of a solid bulkhead or partition 75^2, so that in case the conical head should be damaged or punctured, water cannot gain entrance to the interior of the sabot. The body of the sabot has secured thereto the rings 78, 78′, through openings in which work the slide plates 77. The ring 78′ is a double or circumferentially channeled ring, its diameter being slightly less than the interior diameter of the torpedo-tube 14, and within the circumferential channel of the said ring, is fitted a rubber packing ring 79′, which ring fits snugly within the torpedo-tube chamber 14′, and bears on the interior wall thereof, as the sabot 74 is forced therein, thereby making the chamber of the torpedo-tube back of the sabot air tight, to prevent the escape of the compressed air which enters the said chamber behind the sabot at the time of firing, to discharge the torpedo 73. The heads 75^2 and 80 of the sabot are formed preferably integral with the cylindrical body thereof, to form an inner air chamber 80′, into which air is admitted under pressure of approximately one hundred and sixty-five pounds per square inch, which air is admitted through the filling valve 81, in the sabot head 80, Figs. 9, 10 and 16 of the drawings. To this head is secured the projecting clutch-ring 81′, which ring surrounds the opening into which is fitted the firing cap 82, located in the center of the said head 80. The firing-cap comprises an outwardly opening spring held valve 83, working within a cap or tube 82, protected by a glass cap 83′, the said cap being of sufficient strength to withstand the pressure of the air within the air chamber 80′ of the sabot. The firing cap is ruptured by the hereinafter described firing-bolt, the rupture of which cap permits of the air under pressure to escape from within the air chamber of the sabot.

The sabot 74 is locked within the chamber 14′ of the torpedo-tube 14, by means of the sabot-clutch, located at the rear or inner end of the said chamber, which clutch consists of a slide lock-bolt 84, situated and working within a chamber or socket 84′. Into this lock-bolt socket 84′, enters the clutch-ring 81′, when the sabot is forced home within the torpedo-chamber 14′. As the clutch-ring moves inwardly, it lifts the slide-bolt 84 to clear the flanged collar 85 thereof. The moment the flanged collar 85 has been carried past the slide-bolt 84, the said bolt drops by gravity in front of the circular flange or collar 85, of the clutch-ring, thus holding the sabot locked within the said torpedo-tube.

Immediately back of the rear wall 84^2 of the torpedo chamber 14′, and upon which is mounted the bolt 84, is located the firing chamber 85′, which chamber communicates with the air pressure cylinder 15, by means of the connection 86, within which connection is located an actuating valve, not shown, under the control of the operator within the conning-room of the boat, Fig. 16 of the drawings. In the chamber 85′, which constitutes the firing-chamber, is located the firing-bolt 87, the pencil point 87′ of which moves through the opening 87^2, of the chamber 85′, when the said bolt is forced outwardly, which movement of the firing-bolt is accomplished by the opening of a valve within the conning-room, to admit air under pressure into the firing-chamber 85′. This air is admitted back of the firing-bolt, and the pressure thereof moves the same forwardly and outwardly with great force, causing its pencil point 87′ to rupture the glass-cap 83′ of the firing-cap, secured in the head of the torpedo-sabot. As the firing-bolt is forced outwardly, it impinges against the lower edge of the slide lock-bolt 84′, this latter being integral with and part of bolt 84, and lifts the same clear of the circular flange or collar 85, of the clutch-ring of the sabot, thus releasing the sabot from locked engagement with the sabot-clutch. The moment the firing cap of the sabot has been ruptured, which follows the unlocking of the sabot-clutch, the compressed air confined within its chamber 80′ is released, and the same escapes into the torpedo-chamber 14′, back of the sabot 74, the pressure thereof bearing onto the upwardly movable water valves 88, located within the valve casings 88′, and forces the same downwardly to close or seat the valves against the admission of water into the torpedo-tube 14, the pressure of the released or liberated air forcing the unlocked sabot with its locked torpedo outwardly.

The slide-plates or bars 77, before referred to for actuating the grip-levers of the sabot, extend a slight distance beyond the head 80 of the sabot, the projecting ends thereof bearing against the rear wall 84^2 of the torpedo-chamber 14′, as the sabot is forced home, and the same are moved outwardly to actuate the grip-levers 75, to lock the spike-tail 73′ of the torpedo 73 to the sabot 74, as the said sabot is locked within the sabot-clutch previously described. The grip-levers 75 release the spike-tail 73′ of the torpedo 73, as the sabot is released from the sabot-

clutch; hence the torpedo is free to disconnect itself from the sabot, when the said sabot has reached its full outward position. It is not intended that the sabot shall be entirely expelled or discharged from the torpedo-chamber 14′; on the contrary, it remains locked thereto so as to form a temporary bow of the boat, after the torpedo has been discharged, the nose of which torpedo prior to its discharge having formed the bow of the boat. Thus, when the chamber 14′ contains a torpedo, the said torpedo forms a bow for the boat—due to the fact that the torpedo is somewhat greater in length than the length of the said torpedo-chamber 14′, so that its end or nose protrudes beyond the truncated conical forward end of the boat, Figs. 1, 2 and 4 of the drawings; while after the torpedo has been discharged, the nose of the sabot protrudes to form a temporary bow for the boat, Figs. 3, 12 and 13 of the drawings.

The sabot 74 is automatically locked near the outer end of the torpedo-chamber 14′ during its outward movement, by means of the lock-jaws 89, 89′, situated and pivoted within the mouth of the truncated cone-bow of the boat, Figs. 4 and 12 of the drawings. During the outward movement of the sabot, the shock-ring 90, secured to the cylindrical body thereof, strikes against the hinged lock-jaw 89′, and raises the same so as to clear the said shock-ring 90, falling or dropping by gravity back of the said ring the moment the same has been carried past the face or outer edge of the said lock-jaw, the shock-ring at the same time striking or abutting against the inner face of the co-acting lock-jaw 89, and the sabot is brought to a halt and held by the said lock-jaw against further outward movement. The sabot is thus held in locked position with the conical hollow head 75′ thereof protruding beyond the boat, and forming a temporary bow therefor, which position was formerly occupied by the nose of the torpedo. As the sabot 74 moves outwardly, its shock-ring 90 is carried past the air outlet 90′, so that the air confined within the torpedo-chamber 14′ escapes therefrom. The pressure on the water inlet valves 88 being thus released, the same are raised or lifted by the outside pressure of the water, to which the valve casings 88′ are opened, and the water is permitted to rush in and fill the torpedo-chamber 14′, back of the outwardly moved sabot. The purpose of admitting an inrush of water to fill the empty torpedo-chamber, is that the weight of the boat at its bow may be substantially the same as when loaded with a torpedo, the buoyancy of the boat thus not being disarranged by having an empty tube. Inasmuch as the sabot 74 is held locked at the outer end of the torpedo-chamber, after the torpedo has been discharged, it forms a bow to complete the boat, and reduces the resistance to its forward movement, and overcomes the obstruction which would ensue by the water entering therein were the torpedo-chamber left open.

In loading the boat for fighting purposes, the spiked-tail of the torpedo is inserted within the opening of the sabot, and the torpedo with the sabot ahead is forced within the torpedo-chamber 14′, to the head thereof, where the sabot-ring moves into locked engagement with the sabot-clutch, at the same time the projecting end of the slide-plates or bars 77 strike the head or end wall of the torpedo-chamber 14′, and are forced outwardly to operate the grip-levers 75, to lock the spike-tail of the torpedo to the sabot, the torpedo being thus automatically locked to the sabot, and the sabot automatically locked within the torpedo-chamber. The sabot may be said to constitute an adjunct to the torpedo, its function primarily being to automatically form a bow for the boat after the torpedo has been discharged, it serving at the same time as the means for holding the torpedo locked within the torpedo-chamber, also acting as a medium for the holding of air under pressure for pushing the torpedo from within the said torpedo-chamber in its initial flight. When the torpedo is fitted within the torpedo-chamber 14′, a two sectional heavy rubber band 91, Fig. 4 of the drawings, is placed between the outer end portion of the torpedo and the mouth of the torpedo-chamber, the purpose of which sectionized ring is to prevent the shocking action of the torpedo in its tube, during movement of the boat. As the torpedo leaves the torpedo-chamber, the said rubber ring falls off.

At times it is desired to remove or unload the torpedo from the torpedo-chamber, that is, to take the torpedo from the said chamber without firing. For this purpose air under pressure is admitted through the valve connection 91′,—Figs. 9, 16 and 17 of the drawings,—into the sabot-lock cylinder or chamber 91^2, the pressure of which acting against the tongue 84^5 of the slide-bolt 84, raises or lifts the same to release the sabot from locked engagement therewith, the outrushing air at the same time acting against the sabot to gently force it to the front of the torpedo-chamber, the sabot as released from the sabot-lock, unlocking the spiked-tail of the torpedo, in order that the same may be removed or withdrawn.

As has been described, the torpedo is discharged by admitting air under pressure into the firing-chamber 85′, which causes the firing-bolt 87 to be driven against the firing-cap of the sabot, with sufficient force to rupture the same, allowing the air compressed within the interior chamber of the sabot to escape therefrom into the torpedo-

chamber 14′, back of the sabot 74, and force the same outwardly. At the same time the released air acts against the inwardly movable water-valves 88, to hold the same closed until the sabot 74 has passed beyond the air outlet 90′. As the sabot is carried past the said outlet 90′, the air within the torpedo-chamber escapes, and the pressure on the water-inlet valves 88 is released, when they are raised or unseated by the pressure of the outside water, the water rushing in to quickly fill the torpedo-chamber back of the sabot. Now, as the said chamber becomes filled with water, the weight thereof will hold the water-valves down; hence to reload the torpedo chamber with a fresh torpedo, it becomes necessary that the water inlet valves be held open, in order that the water may be expelled as the sabot is forced therein, for obviously it would be impossible to force the sabot home within a chamber filled with water. To overcome this difficulty, it becomes necessary that the water be pushed or expelled from within the torpedo-chamber, as the sabot is forced within the same. This is accomplished by admitting a small quantity of air under pressure into the cylinders 92, by means of the valved connection 92′, Figs. 20 and 21 of the drawings. The cylinders 92 communicate with the valve casings of the water-inlet valves, and within said cylinders are located the pistons 93, which pistons bear onto a projecting member 93′ of the water-inlet valves 88. As air is admitted into the cylinders 92, the pressure thereof acts against the pistons 93, and force the same downwardly onto the projecting member 93′ of the hinged upwardly movable valves 88, unseating or lifting the same to open the ports of the valve casings 88′, to permit of the water escaping therethrough from within the torpedo-chamber 14′, as the tightly fitting sabot is forced into said chamber. When the sabot is home to its clutch, the air admitted into the cylinder 92 under pressure is cut off, when the valve 88 closes by gravity.

In Fig. 5 of the drawings the boat is illustrated as running under different depths of water, the position designated by the letters *a* being the normal surface or reconnoitering position of the boat, while the position indicated by the letter *b* is the normal fighting position of the boat, or what may be termed the second position of action, it being a submergence of the boat of five feet below the surface of the water. The third position of the boat or that assumed when approaching close to the vessel of an enemy, is designated by the letter *c*. In this position the boat is presumed to be submerged approximately ten feet beneath the surface of the water. The first position, designated by *a*, is the normal position of the boat as launched from the war vessel, and is what is known as surface running of the boat. The second position, designated by the letter *b*, is the first position of submergence, and the normal fighting position of the boat. The third position and the one to be assumed when approaching a cautious enemy, is designated by the letter *c*. This constitutes the final position of the boat in connection with the approach toward the vessel of an enemy, it being the second position of submergence. In its second position the boat is under five feet of water submergence, and is absolutely safe against all shots excepting dropping shells. However, a porpoising position should be assumed in a general attack, or when the enemy is prepared to shoot the periscope away, which is the only feature visible and open to attack when the boat is in its third position, or under a submergence of ten feet. To accomplish this movement of the boat, the operator permits the boat to approach within a distance of two miles of the vessel of the enemy under the second described position, when the periscope and vent tubes are dropped and the boat placed in the first position, or of surface running, when the electric engine or motor is thrown into action for the propulsion of the boat, and the boat submerged for a depth of five feet, and run direct for the enemy, the boat coming to the surface for obtaining bearings and, immediately diving again,—which method of movement is continued until the boat reaches within striking distance, when its torpedo is discharged, and the boat turns and retreats under water toward its base of supplies.

The importance of the described torpedo-boat as an auxiliary armament for war vessels will be readily apparent to those conversant with war conditions generally, serving, as it does, as a means to be carried by the war vessels into the field of action for successfully conveying a torpedo within striking distance of the vessel of an enemy, and by which the torpedo is discharged toward such vessel, and in the fact that a number of such boats may be used to form a permanent armament of the war vessels of a country, to be launched as a fleet of attack, or for reconnoitering purposes, and which may be operated at a distance from shore.

Having thus described the invention, what is claimed as new and desired to be protected by Letters Patent is—

1. The combination with a buoyant tube or shell, of a torpedo carried thereby and forming a bow therefor, and means thrown into action on the expulsion of the torpedo to form a temporary bow for the said tube or shell.

2. A buoyant tube or shell having a cham-

ber therein for the reception of a single torpedo, devices within the chamber for holding a torpedo locked therein with its front end projecting to form the bow of the tube or shell, mechanism for releasing the torpedo and expelling the same from within its chamber, and a movable device within the chamber thrown into action on the expulsion of the torpedo to form a temporary bow for the said tube or shell.

3. An enveloping tube or shell for a torpedo, the same comprising a buoyant body, having a chamber therein for the reception of a single torpedo, of means arranged within the tube or shell for controlling the movement thereof through the water, devices within the torpedo chamber connected to the rear end of the torpedo for locking the torpedo therein with its front end projecting beyond the tube or shell to form a bow therefor, and of mechanism for releasing the torpedo and expelling the same from within its chamber.

4. The combination with a torpedo, of a buoyant tube or shell within which the torpedo is held, to form the bow portion thereof, of devices connected to the rear end of the torpedo for locking the torpedo therein, means within the shell for releasing the torpedo and expelling the same from within a bow for the tube or shell, mechanism for propelling the tube or shell on the surface of the water and when submerged, and devices controlling the submergence of the buoyant tube or shell.

5. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a sabot with which the torpedo interlocks working within the said chamber, devices for locking the sabot within the chamber and holding the torpedo therein to cause its front to project therefrom and form a bow for the tube or shell, mechanism for releasing the sabot and forcing it outwardly to expel the torpedo, devices for locking the sabot at the outer end portion of the torpedo chamber to cause the same to form a temporary bow for the tube or shell on the torpedo being released therefrom, and means within the said tube or shell for propelling the same.

6. A buoyant tube or shell for a torpedo, a compartment therein for the reception of an operator, means under the control of the operator for imparting motion to the said tube or shell, said tube or shell having a chamber therein for the holding of a single torpedo, means for locking the torpedo within the torpedo chamber so that its forward end projects to form a bow for the tube or shell, mechanism under the control of the operator for releasing the torpedo and expelling the same, and a movable device within the torpedo chamber which is thrown into action on the expulsion of the torpedo to form a temporary bow for the tube or shell.

7. A buoyant tube or shell for a torpedo, a compartment therein for the reception of an operator, means under the control of the operator for imparting motion to the said tube or shell, said tube or shell having a chamber therein for the holding of a single torpedo, means for regulating the submergence of the tube or shell, means for locking the torpedo within the torpedo chamber so that its forward end projects to form a bow for the tube or shell, mechanism under the control of the operator for releasing the torpedo and expelling the same, and a movable device within the torpedo chamber which is thrown into action on the expulsion of the torpedo to form a temporary bow for the tube or shell.

8. A buoyant tube or shell for a torpedo, a compartment therein for the reception of an operator, means under the control of the operator for imparting motion to the said tube or shell, said tube or shell having a chamber therein for the holding of a single torpedo, means for regulating the submergence of the tube or shell, means for locking the torpedo within the torpedo chamber so that its forward end projects to form a bow for the tube or shell, mechanism under the control of the operator for releasing the torpedo and expelling the same, automatically actuated mechanism for maintaining the tube or shell at its position of submergence, said mechanism being independent of the operator, and a movable device within the torpedo chamber which is thrown into action on the expulsion of the torpedo to form a temporary bow for the tube or shell.

9. A buoyant tube or shell having a torpedo chamber therein for the reception of a single torpedo, a sabot with which said torpedo interlocks, means for locking the sabot within the torpedo chamber as the torpedo is forced therein and holding the torpedo with its front end projecting to form a bow for the tube or shell, mechanism for releasing the sabot to force the same outwardly to expel the torpedo, devices for locking the sabot at the outer end portion of the torpedo tube to cause the same to form a temporary bow for the tube or shell on the expulsion of the torpedo, a compartment within the tube or shell for the reception of an operator, and means therein under the control of the operator for propelling, guiding and regulating the submergence of the tube or shell.

10. A buoyant tube or shell having a chamber therein for the reception of a single torpedo and a chamber for the reception of an operator, a torpedo fitted therein to form a bow for the tube or shell, devices connected to the rear end of the tor-

pedo for locking the torpedo within its chamber, and means within the chamber for the operator and under the control of the operator of the tube or shell for releasing the torpedo and forcing the same from within the said chamber.

11. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a sabot with which the torpedo interlocks, means for locking the sabot within the torpedo chamber on the torpedo being forced therein and holding the torpedo to cause its front end to form a bow for the tube or shell, an air chamber within the sabot for holding air under pressure, a cap communicating with said air chamber, a firing pin within the tube or shell, of means under the control of the operator of the tube or shell for releasing the lock mechanism for the sabot and actuating the firing pin to rupture the cap of the sabot to release the air under pressure contained therein to force the sabot outwardly to expel the torpedo from within the torpedo chamber, and devices at the outer portion of the torpedo chamber for locking the sabot on the expulsion of the torpedo to cause the said sabot to form a temporary bow for the tube or shell.

12. In a buoyant tube or shell of the described character, the combination with a torpedo chamber therein for the reception of a single torpedo which forms the bow portion of the said tube or shell, a sabot working within the chamber for the torpedo, a torpedo, and means carried by the sabot for locking the torpedo thereto as the sabot is forced within the torpedo tube and releasing the torpedo therefrom as the sabot is forced outwardly under pressure to expel the torpedo.

13. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, of devices within said chamber for locking a torpedo therein with its front end protruding to form a bow for the said tube or shell, means for releasing the torpedo and expelling the same from within its chamber, a movable device within the chamber for forming a temporary bow for the tube or shell on the expulsion of the torpedo, mechanism for propelling the tube or shell, fins movably secured to the exterior thereof for controlling its vertical movement or submergence, and electrically controlled mechanism for actuating the said fins.

14. A buoyant tube or shell having a chamber therein for supporting a torpedo with its front end protruding to form a bow for the said tube or shell, means for releasing the torpedo and expelling the same from within its chamber, fins movably secured to the exterior of the tube or shell adjacent the forward end portion thereof and upon opposite sides of the torpedo, and mechanism for actuating said fins to control the submergence of the tube or shell.

15. A buoyant tube or shell for supporting and carrying a single torpedo which forms the bow thereof, means for releasing and expelling the torpedo, fins hinged to the exterior of the tube or shell adjacent the forward end of the torpedo and upon opposite sides thereof for controlling the submergence shell, devices for actuating said fins, and independently controlled power mechanism for propelling the tube or shell when running on the surface of the water and when submerged.

16. A buoyant tube or shell for partially enveloping a torpedo, mechanism for propelling the same when running on the surface of the water and when submerged, a torpedo fitted within an inner chamber of the tube or shell with its front end protruding to form a bow therefor, devices for locking the torpedo within said chamber, means for releasing the torpedo and expelling the same from within its chamber, means for closing the open end of the chamber when the torpedo is expelled, fins hinged to the exterior of the tube or shell adjacent its forward end to guide the same in its downward and upward movements, mechanism under the control of the operator for actuating said fins, and means independent of the operator for automatically shifting the position of said fins to hold the tube or shell at its proper position of submergence.

17. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, mechanism for releasing the torpedo and expelling the same from within its chamber, a movable device for forming a temporary bow for the tube or shell on the expulsion of the torpedo, motor controlled means for propelling the tube or shell when running on the surface of the water, independently controlled motor means for propelling the same when submerged, and mechanism under the control of the operator for throwing either of said propelling means into action without stopping the movement of the tube or shell.

18. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices within said chamber for locking a torpedo therein with its front end protruding to form a bow therefor, means for releasing the torpedo and expelling the same from within its chamber, a device for forming a temporary bow for the tube or shell on the expulsion of the torpedo, mechanism within the tube or shell for propelling the same, fins for directing the upward and downward movement of the tube or shell, motor means under the control of the oper-

ator for actuating said fins, devices for steering the tube or shell, and means under the control of the operator for operating said steering devices.

19. In a buoyant tube or shell of the described character having a chamber therein for the reception of a single torpedo which constitutes a bow for the said tube or shell, a sabot movable within the torpedo chamber and which forms a temporary bow therefor when the torpedo is freed therefrom, and means for flooding the torpedo chamber on the expulsion of the torpedo to replace the weight of the same.

20. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, of devices for locking a torpedo with its front end protruding to form a bow for the tube or shell, mechanism for releasing the torpedo and expelling the same, a device for forming a temporary bow for the tube or shell on the separation of the torpedo therefrom, means for automatically flooding the torpedo chamber to approximately replace the weight of the expelled torpedo, and mechanism for opening said flooding means to permit of the water escaping from the torpedo chamber as a torpedo is forced therein.

21. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, of devices for locking a torpedo therein with its front end protruding to form a bow, and mechanism independent of the firing means for releasing the lock devices to permit of the torpedo being withdrawn from within its chamber.

22. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, a sabot containing air under pressure movable within said chamber, a firing cap carried by the sabot, means for locking the torpedo to the sabot, devices for locking the sabot with its engaged torpedo within the torpedo chamber so that the front end of the torpedo protrudes to form a bow for the tube or shell, firing means within the tube or shell for puncturing the firing cap of the sabot to release the compressed air contained therein, mechanism under the control of the operator for releasing the locking devices for the sabot and actuating the firing mechanism, devices for locking the sabot at the outer end portion of the torpedo chamber to form a temporary bow for the tube or shell on the expulsion of the torpedo, and means independent of the firing actuating mechanism for releasing the locking devices and gently forcing the sabot outwardly to permit of the withdrawal of the torpedo.

23. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, of devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, means for releasing said locking devices and forcibly ejecting the torpedo from within its chamber, and independently actuated mechanism for releasing the locking devices for the torpedo and gently forcing the same outwardly to permit of its withdrawal from within the torpedo chamber.

24. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo within said chamber with its front end protruding to form a bow for the tube or shell, means for closing the open end of the torpedo chamber on the expulsion of a torpedo therefrom, devices for flooding the said chamber when freed of a torpedo to replace the weight thereof substantially, and mechanism for propelling the tube or shell and controlling the submergence thereof.

25. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo therein with its forward end protruding to form a bow for the tube or shell, means for closing the open end of the torpedo chamber on the expulsion of a torpedo therefrom, devices for flooding the torpedo chamber when freed of a torpedo to replace the weight thereof substantially, means for opening said flooding devices to permit of the water being expelled from the torpedo chamber on the insertion of a torpedo therein, and mechanism for propelling the tube or shell and controlling the submergence thereof.

26. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, mechanism carried by the tube or shell for actuating said locking devices to release the torpedo, and means for closing the open end of the torpedo chamber on the expulsion of a torpedo therefrom.

27. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, of means for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, mechanism for actuating said locking means to release the torpedo and expel the same from within its chamber, a device for closing the open end of the torpedo chamber when the torpedo is discharged therefrom, an inwardly opening valve for admitting water into the chamber to flood the same and replace substantially the weight of the expelled torpedo, and air controlled means for opening said valve to permit the escape of water from within the torpedo chamber on the insertion of a torpedo therein.

28. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo, means for locking a torpedo therein

with its front end protruding to form a bow for the tube or shell, an inwardly opening valve for admitting water into said chamber to replace substantially the weight of an expelled torpedo, air controlled means for holding open said valve to permit the escape of water from within the said chamber on the insertion of a torpedo therein, of mechanism for propelling the tube or shell, and controlled means for regulating the submergence of the said tube or shell.

29. A buoyant tube or shell designed to be carried on a superior vessel, the same having a chamber therein for the reception of a single torpedo which forms a bow for the tube or shell, means within said chamber for forming a temporary bow for the tube or shell when the chamber is freed of a torpedo, mechanism for propelling the tube or shell, and independent mechanism for controlling the submergence thereof.

30. A buoyant tube or shell designed to be carried on a superior vessel, the same having a torpedo chamber therein, a sabot within said chamber to form a temporary bow for the tube or shell when freed of a torpedo, a torpedo provided with an extending tail piece, devices within the sabot with which said tail piece engages to hold the torpedo locked thereto, means for controlling the movement of the tube or shell through the water; and mechanism for regulating the submergence of the said tube or shell.

31. In a buoyant tube or shell having a chamber therein for the reception of a single torpedo which constitutes the bow of the tube or shell, devices for locking a torpedo therein, mechanism for releasing the torpedo and expelling the same from within its chamber, an auxiliary bow to take the place of the torpedo and means for flooding the torpedo chamber behind said torpedo to substantially replace the weight of an expelled torpedo.

32. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a torpedo carried therein and forming a bow for the tube or shell, devices having detachable interlocking connection with the rear end of the torpedo for locking the torpedo within the said chamber, and means mounted on the tube or shell and carried thereby for releasing the torpedo locking devices and expelling the torpedo from within its chamber.

33. A buoyant tube or shell having a chamber therein at its bow end portion for the reception of a single torpedo, and a chamber at its stern end portion which forms an engine room, means within the torpedo chamber for locking a torpedo therein with its end protruding to form a bow for the tube or shell, means for releasing the torpedo and expelling the same from within its chamber, a device for closing the open end of the torpedo chamber on the expulsion of a torpedo, a motor within the engine room for propelling the tube or shell for surface running, an independent motor for propelling the same when submerged, and means under the control of the operator for placing either of said motors into commission.

34. A buoyant tube or shell having a chamber therein at its bow end portion for the reception of a single torpedo, and a chamber at its stern end portion which forms an engine room, means within the torpedo chamber for locking a torpedo therein with its end protruding to form a bow for the tube or shell, means for releasing the torpedo and expelling the same from within its chamber, a device for closing the open end of the torpedo chamber on the expulsion of a torpedo, a motor within the engine room for propelling the tube or shell for surface running, an independent motor for propelling the same when submerged, means under the control of the operator for placing either of said motors into commission, valve controlled vents for supplying air to the engine room and removing the exhaust therefrom, and means for raising and lowering said vents.

35. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a conning-room for the operator, and an engine-room for the motor engines, devices within the torpedo chamber for the locking of a torpedo therein with its front end protruding to form a bow for the tube or shell, means under the control of the operator for releasing the torpedo and expelling the same, a device for closing the open end of the torpedo chamber when emptied of a torpedo, a gate closing the conning-room, a motor within the engine-room for propelling the tube or shell for surface running, an independent motor therein for propelling the same when submerged, devices under the control of the operator for throwing either of said motors into commission, and mechanism for controlling the submergence of the tube or shell.

36. A buoyant tube or shell having a chamber therein for the reception of a torpedo, a sabot containing air under pressure movable within the said chamber, devices for locking the sabot therein, lock means carried by the sabot for connecting a torpedo thereto, a torpedo provided with a tail extension which engages the lock means of the sabot, devices within the sabot for actuating said lock means to engage and release the torpedo, mechanism under the control of the operator for disconnecting the sabot and releasing the air contained therein to force the same outwardly and expel the torpedo, and means for locking the sabot

at the outer end portion of the torpedo chamber on the separation of the torpedo therefrom.

37. A buoyant tube or shell having a chamber therein for the reception of a torpedo, a sabot containing air under pressure movable within the said chamber, devices for locking the sabot therein, lock means carried by the sabot for connecting a torpedo thereto, a torpedo provided with a tail extension which engages the lock means of the sabot, devices within the sabot for actuating said lock means to engage and release the torpedo, mechanism under the control of the operator for disconnecting the sabot and releasing the air contained therein to force the same outwardly and expel the torpedo, means for locking the sabot at the outer end portion of the torpedo chamber on the separation of the torpedo therefrom, a periscope movably held to the exterior of the tube or shell, and means for raising and lowering the same.

38. A buoyant tube or shell having a chamber therein for the reception of a torpedo, devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, means under the control of the operator for releasing said lock devices, motor mechanism within the tube or shell for controlling the propulsion thereof, fins movably secured to the exterior of the tube or shell for directing the submergence thereof, a controller within the said tube or shell for actuating the fins, said controller having its interior divided by a flexible diaphragm into an air receiving compartment and a water receiving compartment, a piston working within the air compartment of the controller, communication between the water compartment thereof and the outside water, means under the control of the operator for supplying air under pressure to the air chamber of the controller, electrically controlled means thrown into action on the movement of the controller piston, and connection between said means and the fins.

39. In a buoyant tube or shell of the described character, fins movably connected to the exterior thereof for directing its submergence, a controller within the tube or shell having its interior divided by a flexible diaphragm into an air receiving compartment and a water receiving compartment, communication between said last mentioned compartment and the outside water, of means under the control of the operator for admitting air under pressure into the air compartment of the controller, and mechanism actuated by the movement of the flexible diaphragm, due to variation of pressure on either side of the said diaphragm, for regulating the position of the diving fins.

40. In a buoyant tube or shell of the described character, fins movably connected to the exterior thereof for directing its submergence, a controller within the tube or shell having its interior divided by a flexible diaphragm into an air receiving compartment and a water receiving compartment, communication between said last mentioned compartment and the outside water, of means under the control of the operator for admitting air under pressure into the air compartment of the controller, a piston extended into the air compartment actuated by the movement of the diaphragm, an electric motor, connections thrown into action by the movement of the piston for operating the electric motor, and mechanism actuated by said motor for shifting the position of the fins.

41. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a torpedo within said chamber and lying in the axis of the tube or shell, devices for locking the torpedo within the said chamber with its front end protruding to form a bow for the tube or shell, air actuated mechanism carried by the tube or shell for releasing the locking means and expelling the torpedo from within its chamber, and a supplemental bow.

42. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, means for releasing the said locking means and expelling the torpedo from within its chamber, an engine room formed within the tube or shell, a motor therein for propelling the tube or shell, a liquid fuel holding chamber, a flexible diaphragm for said chamber acted on by the outside water, and connection between the fuel holding chamber and the engine for supplying liquid fuel thereto.

43. In an apparatus of the character described, a tube or shell having therewithin a centrally arranged tubular chamber adapted for the reception of a torpedo which projects beyond the tube or shell and constitutes the bow therefor, fins adjacent the forward end of the tube or shell, shafts within the space between the walls of the tubular chamber and the tube or shell for operating said fins, and a controller for the shafts.

44. In a buoyant tube or shell for the described purpose, the same having an engine-room therein, a motor within said room for propelling the tube or shell when running on the surface of the water, an independent motor therein for propelling the tube or shell when submerged, a propeller shaft extended within the engine-room and common to each motor, a single clutch member interposed between and common to each motor slidably mounted on the shaft for rotation therewith, and devices under the control of

the operator for placing the clutch member into operative engagement with either of the motors to transmit the rotation thereof to the propeller shaft.

45. The combination with a buoyant tube or shell, of a torpedo carried thereby and constituting a continuation of the outer wall of the tube or shell, means for expelling the torpedo the said means adapted to take the place of the torpedo after the expulsion of the latter.

46. The combination with a buoyant tube or shell, of a torpedo carried and forming a bow for the tube or shell and means thrown into action on the expulsion of the torpedo to form a temporary bow for the said tube or shell, the said means constituting the releasing means for the torpedo.

47. The combination with a buoyant tube or shell, of a torpedo carried thereby and forming a bow therefor, and means movable with the torpedo upon its expulsion to form a temporary bow for the said tube or shell.

48. The combination with a buoyant tube or shell, of a torpedo carried thereby and forming a bow therefor a longitudinally movable device arranged to the rear of the torpedo and arranged to move with the torpedo upon its expulsion to form a temporary bow for said tube or shell, and means for locking said device in extended position.

49. A buoyant tube or shell having a chamber therein for the reception of a torpedo, devices in said chamber for locking said torpedo therein, a compressed air actuated device for expelling the torpedo from the shell, the said device being constructed and arranged to form a temporary bow for the tube or shell.

50. The combination with a buoyant tube or shell, of a torpedo carried thereby and forming a bow therefor, means for holding the torpedo locked, the said means being movable with the torpedo to constitute a temporary bow for the tube or shell when the torpedo is expelled.

51. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a sabot within the said chamber, devices for locking the sabot within the chamber and holding the torpedo therein to cause its front to project therefrom and form a bow for the tube or shell, and mechanism for releasing the sabot and forcing the same outwardly to expel the torpedo.

52. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, a sabot having an interlocking connection with the torpedo and working within the said chamber, devices for locking the sabot within the chamber and holding the torpedo therein to cause its front to project therefrom and form a bow for the tube or shell and mechanism for releasing the sabot and forcing the same outwardly to expel the torpedo.

53. A buoyant tube or shell having a chamber therein for the reception of a single torpedo which latter when in position constitutes a bow for the tube or shell, a sabot for expelling the torpedo, the sabot having an interlocking connection with the torpedo and arranged to take the place of the latter when expelled to constitute a temporary bow for the tube or shell.

54. In an apparatus of the character described, the combination of a buoyant tube having a recess at its forward end, a torpedo mounted within the recess and having a part projecting beyond the end of the tube to constitute a bow therefor, the wall of the torpedo being separated from the wall of the recess whereby when released it is free from contact with said wall, and a supporting gasket for the torpedo positioned adjacent the end of the recess in the tube, which said supporting gasket also constitutes a closure for the forward end of said tube and means to prevent shocking action of the torpedo in said tube prior to its release from the latter.

55. A buoyant tube or shell having a chamber therein for the reception of a single torpedo, devices for locking a torpedo therein with its front end protruding to form a bow for the tube or shell, mechanism for releasing the torpedo and expelling the same from within its chamber, a movable device for forming a temporary bow for the tube or shell on the expulsion of the torpedo, motor controlled means for propelling the tube or shell when running on the surface of the water, independently controlled motor means for propelling the same when submerged, mechanism under the control of the operator for throwing either of said propelling means into action without stopping the movement of the tube or shell, fins hinged to the exterior of the tube or shell to guide the same in its downward and upward movements, and automatically operable means for shifting the position of said fins to hold the tube or shell at its proper position of submergence.

56. In combination with a torpedo, of a buoyant tube or shell constituting an envelop for the torpedo which is positioned centrally of the forward end of the envelop and projects therebeyond to constitute a bow, an auxiliary bow, means within the shell for releasing the torpedo, and means for flooding the torpedo chamber to substantially replace the weight of the expelled torpedo.

57. In an apparatus of the character described, the combination of a buoyant tube having a recess at its forward end, a torpedo mounted within the recess and having

a part projecting beyond the end of the tube to constitute a bow therefor, the diameter of that portion of the torpedo within the tube being less than the width of the recess, and a relatively heavy yieldable support for the torpedo in the space between the torpedo and the wall of the recess for spacing the torpedo from the wall of the recess and to properly position the torpedo for discharge.

58. A buoyant tube or shell body, a bow portion comprising a projecting torpedo fitted within the forward end of the shell, and a gasket fitted between the torpedo and body.

59. A bowless buoyant tube or shell and a torpedo fitted to an opening in the bowless end thereof, to constitute a temporary bow, means for discharging said temporary bow, an auxiliary bow adapted to close the opening, and means for weighting the space behind said auxiliary bow.

60. A bowless buoyant tube or shell and a torpedo fitted to an opening in the bowless end thereof, to constitute a temporary bow, means for discharging said temporary bow, an auxiliary bow adapted to close the opening and means for flooding the space to the rear of said closing means.

61. A buoyant tube or shell having an opening at its forward end, and a temporary bow for the tube comprising a torpedo, means for closing the opening at the connection of said bow to prevent ingress of water to said tube and to constitute an air chamber, and means for flooding said air chamber.

62. A buoyant tube or shell having an opening for a temporary bow, said bow constituting a torpedo projecting beyond the forward end of said shell, means for discharging the torpedo, and means for simultaneously replenishing the weight of the bow.

63. A buoyant tube or shell having an opening for a temporary bow, said bow constituting a torpedo projecting beyond the forward end of said shell, means for discharging the torpedo, and means whereby as the torpedo is discharged from said opening, water is admitted from the rear of said opening.

64. In an apparatus of the character described, the combination of a buoyant tube having a recess at its forward end, a torpedo mounted within the recess and having a part projecting beyond the end of the tube to constitute a bow therefor, the diameter of that portion of the torpedo within the tube being less than the width of the recess, and a sectional yieldable gasket interposed in the space between the torpedo and the wall of the recess, which said gasket constitutes a support for the torpedo and holds the same properly positioned for discharge, the said gasket being adapted to be released by the discharging movement of the torpedo.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALVARADO M. FULLER.

Witnesses:

C. B. JORDAN,

R. A. BIRCHFIELD.