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S. LAKE.

AIR SUPPLY APPARATUS FOR SUBMARINE VESSELS.

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Fig. 1.

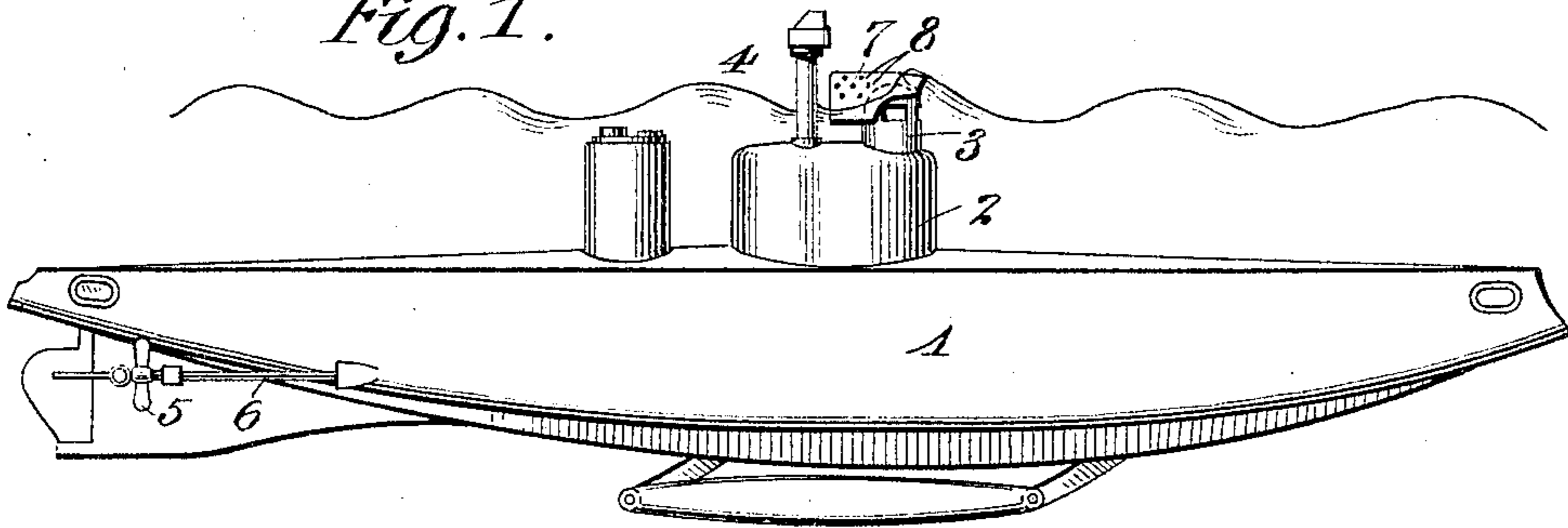


Fig. 2.

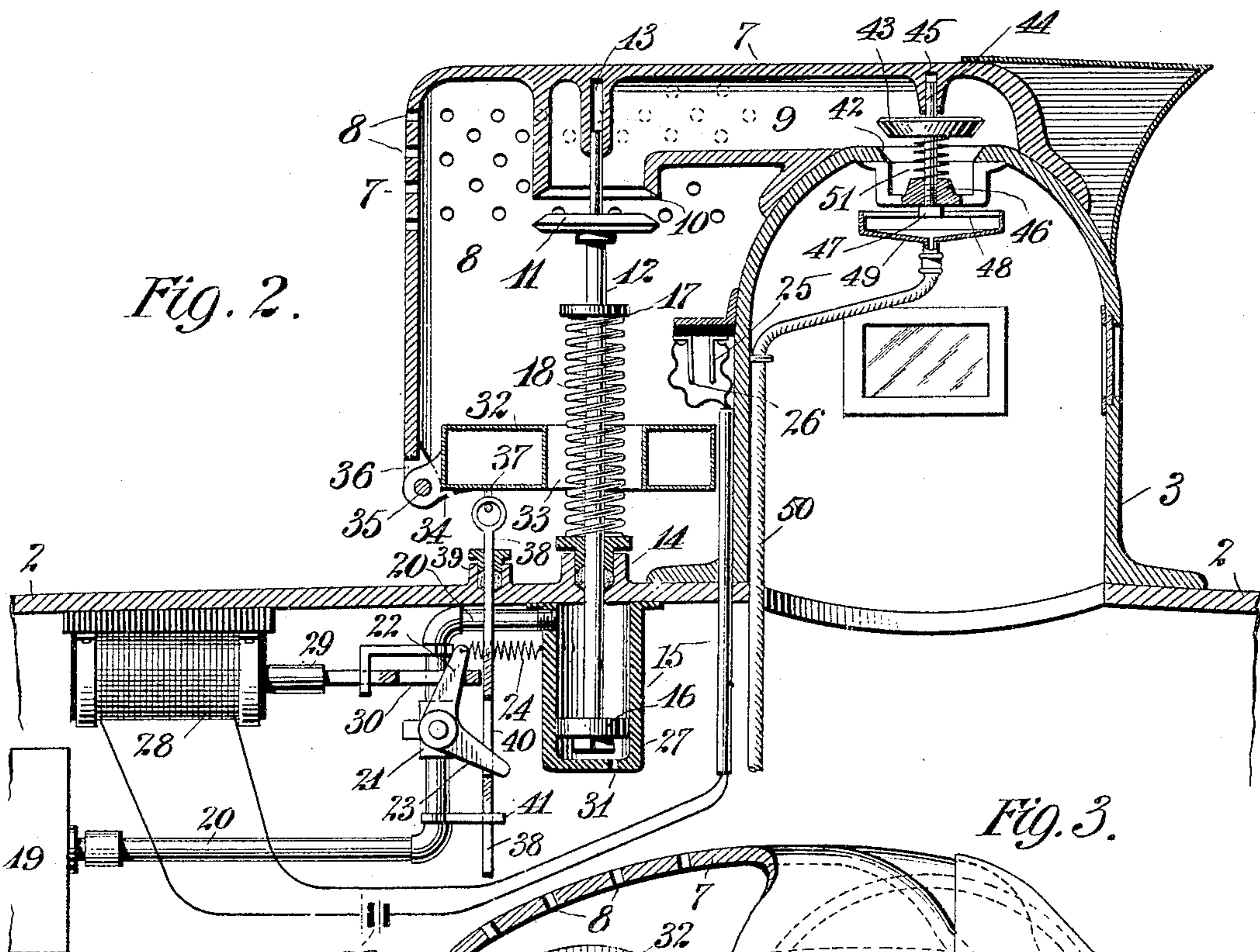
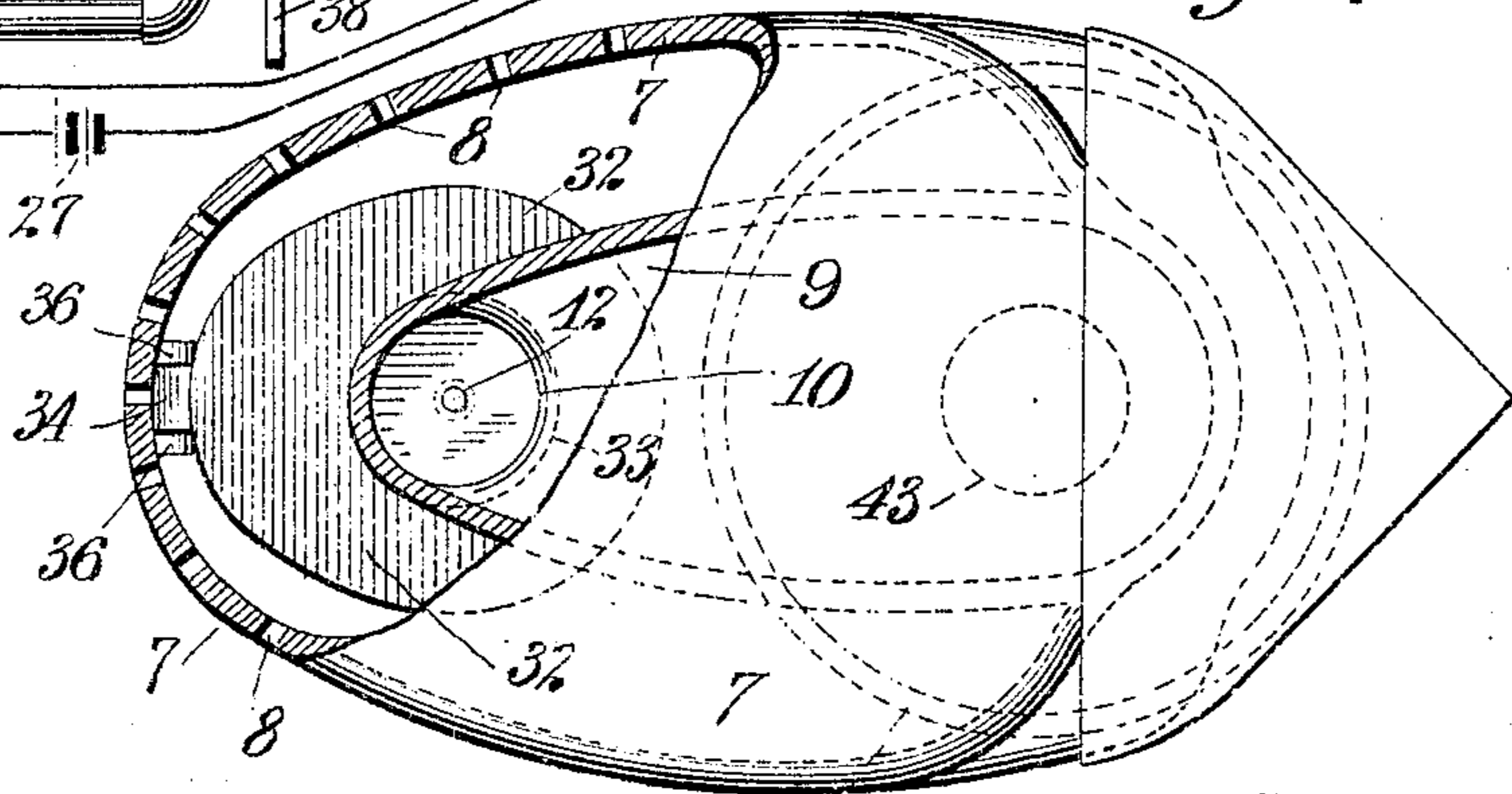


Fig. 3.



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AIR-SUPPLY APPARATUS FOR SUBMARINE VESSELS.

No. 803,176.

Specification of Letters Patent.

Patented Oct. 31, 1905.

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To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Air-Supply Apparatus for Submarine Vessels, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates more particularly to an improvement in that class of submersible or submarine boats designed for navigation by power other than electricity with the hull entirely submerged beneath the surface of the 15 water; and it has for its object to provide means whereby when the boat is under way in such condition an air-supply to support combustion in the generation of heat may be available from a device projecting from the 20 vessel but slightly above the surface even when the sea is otherwise than entirely calm, the temporary submergence of the receiving device being insufficient to permanently cut off the air-supply or permit water to enter the 25 boat.

The invention consists, primarily, in a casing projecting upwardly or outwardly from some high portion of the boat, as the conning-tower or sighting-hood, and provided in the upper 30 rearward portion with a lateral air-inlet opening or openings and a water-escape opening in the lower portion beneath the same, the forward portion of such casing serving, in the travel of the vessel, to create adjacent its rear- 35 ward portion a trough-like depression in the surface of the water above which air may freely enter through the lateral opening or openings and any water introduced with the same from time to time falling to the bottom 40 and passing outward through the lower escape-opening therefor.

The invention further includes an air-duct leading inwardly into the interior of the boat from the upper portion of the casing provided at its mouth with a valve which is connected with automatic operating means, whereby the rise of the water in the casing from any cause above a certain predetermined level causes the closing of the valve as well 45 as its opening upon the lowering of such abnormal water-level within the casing.

The invention further includes an inner valve disposed at the inner end of the air-in-

let duct, such valve being yieldingly held in normally open position with means for locking it closed and for automatically closing it temporarily in case the outer valve should fail to act with sufficient quickness to prevent the entrance of water into the duct.

The invention will be more fully understood 60 by reference to the annexed drawings, in which—

Figure 1 is an elevation of a vessel provided with the present improvement represented as submerged to the point at which the device is 65 designed to operate. Fig. 2 is a sectional elevation upon a much larger scale; and Fig. 3 a sectional plan view with the section plane taken through the air-inlet duct, representing the device with its valves in open or operative 70 position.

The hull 1 is shown with the conning-tower 2, surmounted by the sighting-hood 3 and observing-tube 4, and is represented as propelled by twin screws 5, carried by shafts 6, which 75 may be driven by the usual heat-engines (as gasoline-engines) and electric motors.

Secured to the upper portion of the sighting-hood 3 is the air-inlet casing 7, with depending rear portion open at the bottom behind the sighting-hood and provided with lateral apertures 8 above the same at the sides and back. The downturned mouth of the air-duct 9, leading from the rearward upper portion of the casing 7 to an aperture in the top 85 of the sighting-hood 3, is provided with a valve-seat 10, to which is fitted the conical valve 11, mounted upon the stem 12, of which the upper end is fitted to the guide-socket 13 in the top of the duct, and the lower portion 90 extends downwardly through a stuffing-box 14 into the interior of the conning-tower within an air-cylinder 15, having its piston 16 secured to the lower end of such valve-stem.

The valve-stem 12 is provided below the 95 valve 11 with a thrust-collar 17, between which and the gland of the stuffing-box is interposed a spring 18, acting to maintain the valve normally closed. The valve 11 is held open when the device is in practical operation by means 100 of compressed air admitted to the upper end of the cylinder 15 from an air-reservoir 19 through a supply-pipe 20, having a three-way valve 21, having a plug with two operating-arms 22 and 23, of which the former is yield- 105 ingly drawn by means of the spring 24 toward

the cylinder into position to operate the valve for opening the connection between the air-supply and the cylinder. The automatic closing of the air-inlet valve 11 is effected by the rise of the water within the casing 7, and thus connecting the relatively insulated terminals 25 and 26 of an electrical circuit from the battery 27, passing through the coils of a solenoid-magnet 28, whose longitudinally-movable core 29 is provided in its outer end with a transverse slot 30, embracing the upper arm 22 of the valve 21, whereby the magnet is energized and operated to move its core in opposition to the spring 24, and thereby operate the valve 21 to cut off the air-supply and release the air previously admitted to the cylinder 15, which is provided with an air-vent hole 31 to admit external air beneath the piston, and thus allow the latter to act under the stress of the spring 18, which closes the valve 11. As a safeguard to insure the closing of the air-inlet valve in case the electrical controlling device should fail to act from any cause I provide also in the lower part of the casing 7 a float 32, having an aperture 33, embracing the valve-stem 12 and provided at the rear side with a lug 34, pivoted by means of a pin 35 to the lugs 36 upon the rear of the casing 7. The bottom of the float is provided with an eye 37, to which is loosely connected the upper end of a rod 38, passing through a stuffing-box 39 into the top of the conning-tower, where it is provided with a transverse slot 40, embracing the lower arm 23 of the air-supply valve 21, and beneath the same enters the guide 41, carried by the pipe 20. As will be evident, the rise of the float 32 with the water within the casing will cause the rod 38 to be lifted, and thereby raise the arm 23 of the valve 21 to actuate the air-cylinder, as before described. It will be seen that as the outer end of the magnet-core and the lower end of the rod 38 are both slotted, so that only the farther end thereof engages its respective arm of the air-supply valve, either of these air-inlet-valve-controlling devices may act entirely independently of the other. As a still further safeguard to exclude water from the interior of the boat by temporary total submergence from any cause the inlet-aperture in the top of the sighting-hood and at the inner end of the air-duct 9 is provided with a valve-seat 42, to which is fitted the valve 43, the top of whose stem 44 is fitted to the guide-socket 45 in the top of the duct and whose lower portion passes through a bearing 46 in a suitable fixed bracket and is screw-threaded upon the lower end, to which is applied a similarly-threaded socket 47, carried by a cross-bar 48 of a drip-pan 49, having an apertured boss in its bottom connected by a swivel-joint with the flexible waste-pipe 50, leading downwardly through the interior of the boat and in practice into one of the ballast-tanks. Intermediate the valve 43 and the bearing 46 is a

spring 51, surrounding the valve-stem and of just sufficient strength to support the weight of the valve and its connections. When, however, through any cause water passes the valve 43 and is caught by the drip-pan 49, the additional weight upon the valve overcomes the stress of the spring 51, and the valve is caused to seat itself automatically, and thereby cut off the further inflow of water. As the waste-aperture in the bottom of the pan 49 is very small, the weight thus added is permitted only gradually to be removed by the escape of the water through the waste-pipe 50.

When it is desired to maintain the inner valve 43 closed by positive means, the rotation of the drip-pan upon the threaded lower end of the valve-stem 44 causes the latter to be drawn downward by the engagement of the socket 47 with the bearing 46.

From the foregoing description it will be observed that the present improvement is not limited to the precise constructive details herein shown and described, but may be varied to a considerable extent without departure from the scope of the invention.

Having thus set forth the invention, what I claim herein is--

1. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the upper portion with lateral apertures, and an opening beneath the same in the rearward portion, and an air-inlet duct leading into said boat from the upper portion of said casing.

2. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the upper portion with an aperture or apertures and an opening beneath the same in the rearward portion, and an air-inlet duct having its mouth directed downwardly within the upper portion of said casing and leading into the interior of said boat.

3. The combination with a submarine boat, of a casing projecting outwardly therefrom and having its rearward portion at the bottom provided with a water-escape opening and with an air-inlet aperture or apertures above the same, an air-inlet duct leading inwardly from the upper portion of said casing, a valve within said duct, and automatically-actuated means for effecting the closing of said valve when said casing is flooded with water up to a predetermined maximum level.

4. The combination with a submarine boat, of a casing projecting outwardly therefrom and having its rearward portion at the bottom provided with a water-escape opening and with an air-inlet aperture or apertures above the same, an air-inlet duct leading inwardly from the upper portion of said casing, a valve within said duct, and means actuated by the rise of water within said casing for effecting the closing of said valve.

5. The combination with a submarine boat,

of a casing projecting outwardly from the hull of the same and having its rearward portion provided with lateral air-holes and a water-escape opening beneath the same, an air-inlet duct leading from the upper portion of said casing into the interior of the hull, a valve within said duct, means for operating said valve including an electrical device connected by a normally open circuit with the source of electric current, and spaced relatively insulated contacts in said circuit disposed within said casing and adapted to be electrically connected by rise of water therein and by such closure of the circuit causing the actuation of said electrical device to effect the closing of said valve.

6. The combination with a submarine boat, of a casing projecting outwardly therefrom and having an opening in the lower portion at the rear, an air-inlet duct leading from the upper portion of said casing into the interior of the boat, a valve in said duct, yieldingly-acting means for maintaining said valve normally closed, means acting in opposition to said yieldingly-acting means for holding said valve open, and a device controlled by the rise of water in said casing for causing said yieldingly-acting means to become effective in closing said valve.

7. The combination with a submarine boat, of a casing projecting outwardly therefrom and open in the lower portion at the rear, an air-inlet duct leading from the upper portion of said casing into the interior of said hull, a valve in said duct, a pneumatic cylinder having a piston operatively connected with said valve, an air-reservoir, a connection from said reservoir to said cylinder, a valve in said connection, and means controlled in its action by rise of the water in said casing for actuating the last-named valve to control the pneumatic piston in operating the air-inlet valve.

8. The combination with a submarine boat, of a casing projecting outwardly therefrom and open in the lower portion at the rear, an air-inlet duct leading from the upper portion of said casing into the interior of said boat, a valve in said duct, a pneumatic cylinder having a piston operatively connected with said valve, an air-reservoir, a connection from said reservoir to said cylinder, a valve in said connection, provided with a lateral arm, a solenoid-magnet, a core for the same connected with the lateral arm of said valve, and an open electric circuit connected with said magnet and having two spaced insulated contacts within said casing and adapted to be electrically connected to close said circuit and thereby cause said magnet to be energized to effect the actuation of said connected valve when the water rises in said casing.

9. The combination with a submarine boat, of a casing projecting outwardly therefrom and open in the lower portion at the rear, an air-inlet duct leading from the upper portion

of said casing into the interior of said boat, an air-inlet valve in said duct, a pneumatic cylinder having a piston operatively connected with said valve, an air-reservoir, a connection from said reservoir to said cylinder, a controlling-valve in said connection, provided with lateral arms, a solenoid-magnet, a core for the same connected with one of the lateral arms of said controlling-valve, a float in said casing, a connection between the same and the other lateral arm of said valve, and an open electrical circuit connected with said magnet and having two spaced relatively insulated contacts also within said casing whereby the rise of water within the latter will act both to raise said float and to close the circuit through said contacts to insure the operation of the said controlling-valve in causing the actuation of said air-inlet valve.

10. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the lower portion with a water-escape opening and above the same with lateral air-inlet aperture, a duct leading from the upper portion of said casing into the interior of the boat, a valve in the outer end of said duct and an automatically-closing valve at the inner end of said duct.

11. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the lower portion with a water-escape opening and above the same with lateral air-inlet aperture, a duct leading from the upper portion of said casing into the interior of the boat, a valve in the outer end of said duct, a valve at the inner end of said duct, a spring for holding the same normally open, and means actuated by a volume of water admitted through said valve for closing the same.

12. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the lower portion with a water-escape opening and above the same with lateral air-inlet aperture, a duct leading from the upper portion of said casing into the interior of the boat, a valve in the outer end of said duct, an upwardly-opening valve at the inner end of said duct provided with a vertical stem, a spring for holding said valve normally open, and a drip-pan carried by the stem of said valve for receiving water admitted through the latter and thereby causing the closure of said valve in opposition to its spring.

13. The combination with a submarine boat, of a casing projecting outwardly from the hull of the same and provided in the lower portion with a water-escape opening and above the same with lateral air-inlet aperture, a duct leading from the upper portion of said casing into the interior of the boat, a valve in the outer end of said duct, an upwardly-opening valve at the inner end of said duct provided with a vertical stem, a spring for holding said

valve normally open, a drip-pan carried by
the stem of said valve for receiving water ad-
mitted through the latter and thereby causing
the closure of said valve in opposition to its
5 spring, and a waste-pipe having a flexible con-
nection with said drip-pan for leading away
the water received in the same.

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

SIMON LAKE.

Witnesses:

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HENRY J. MILLER.