

S. LAKE.
BALLAST DEVICE FOR SUBMARINE VESSELS.
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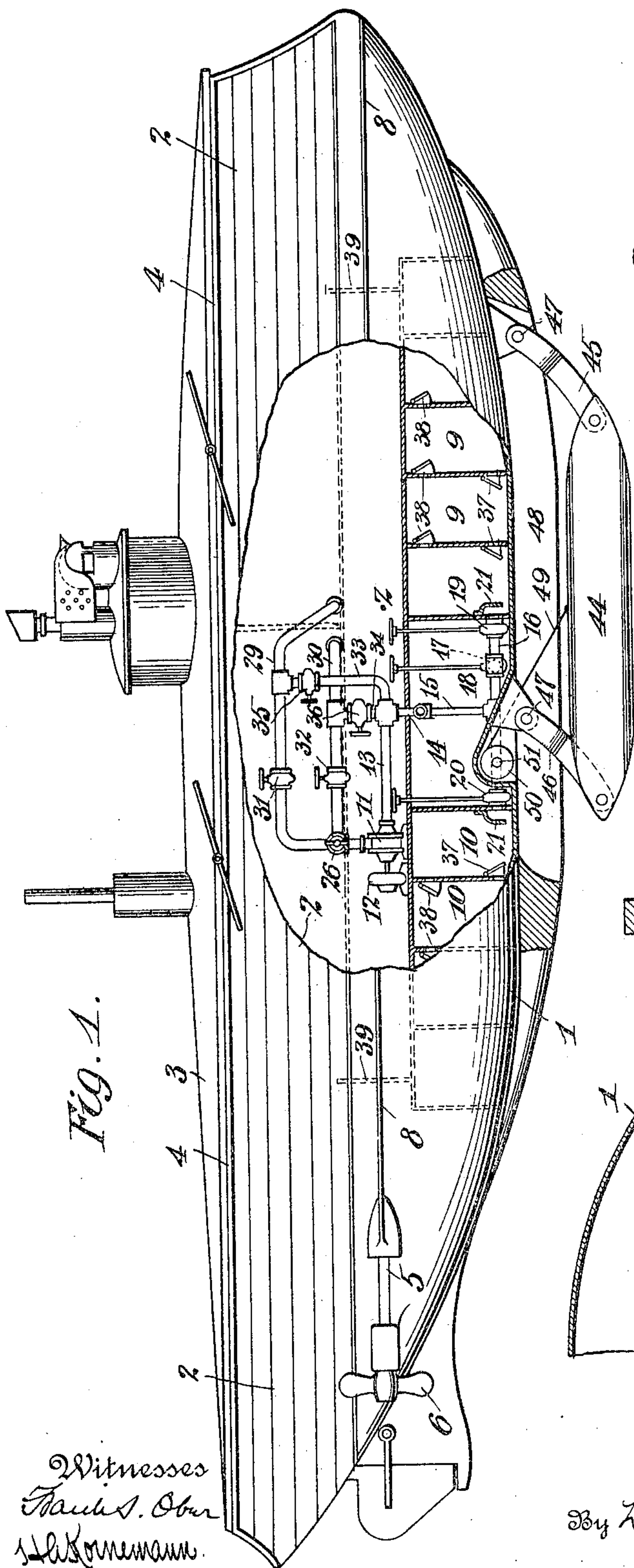


Fig. 1.

Witnesses
Paul S. Ober
H. Komemann.

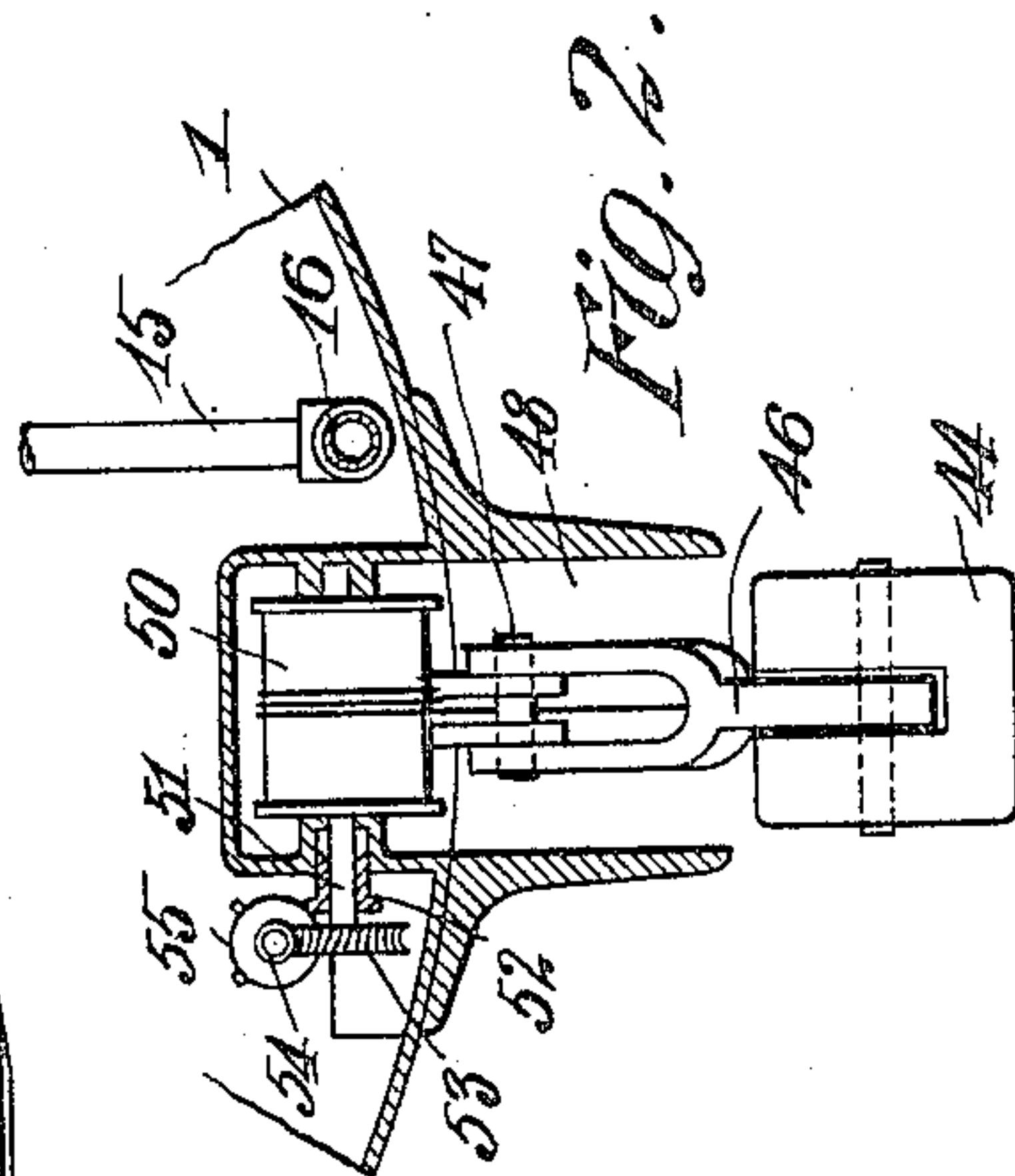


Fig. 2.

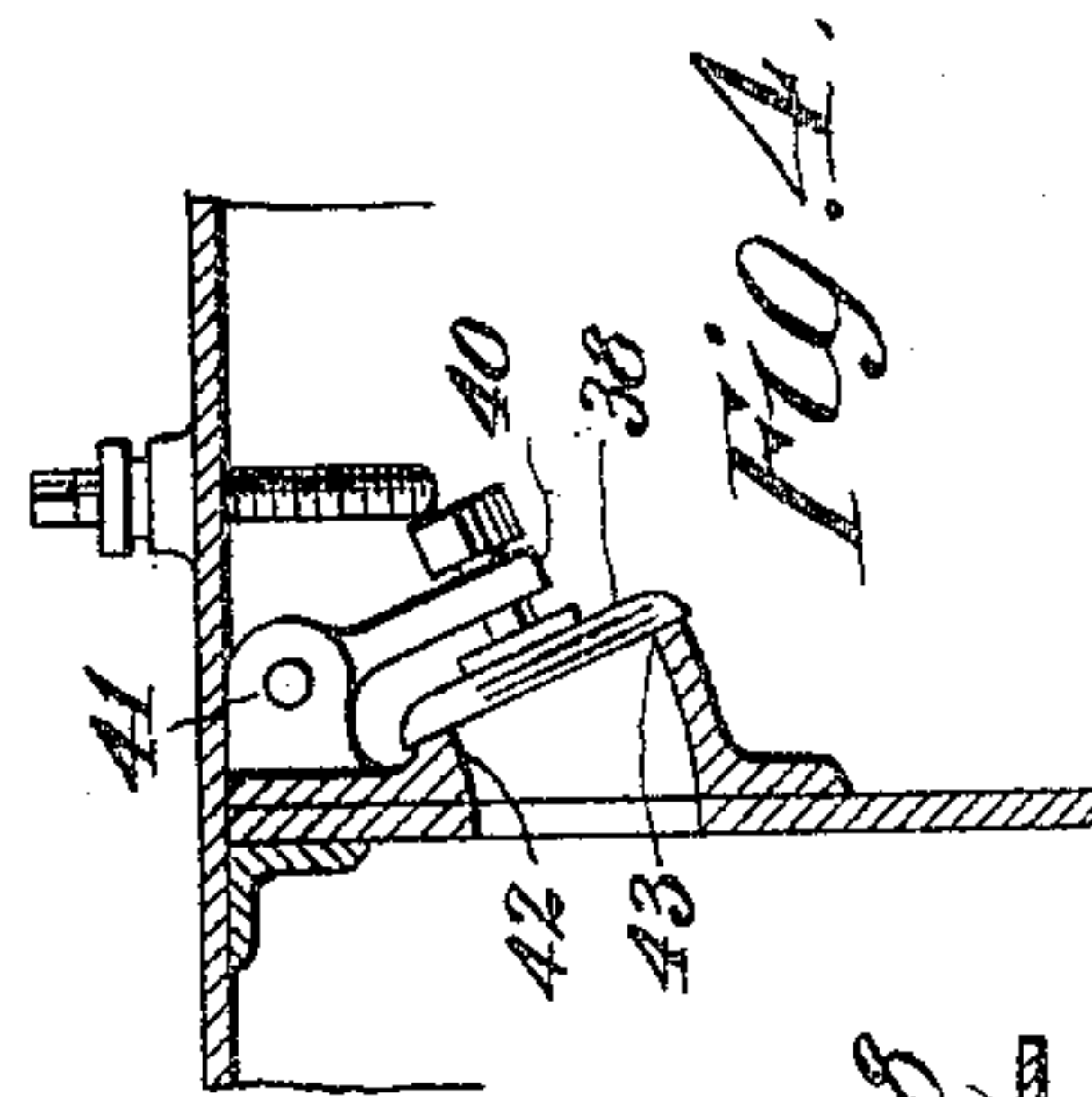


Fig. 4.

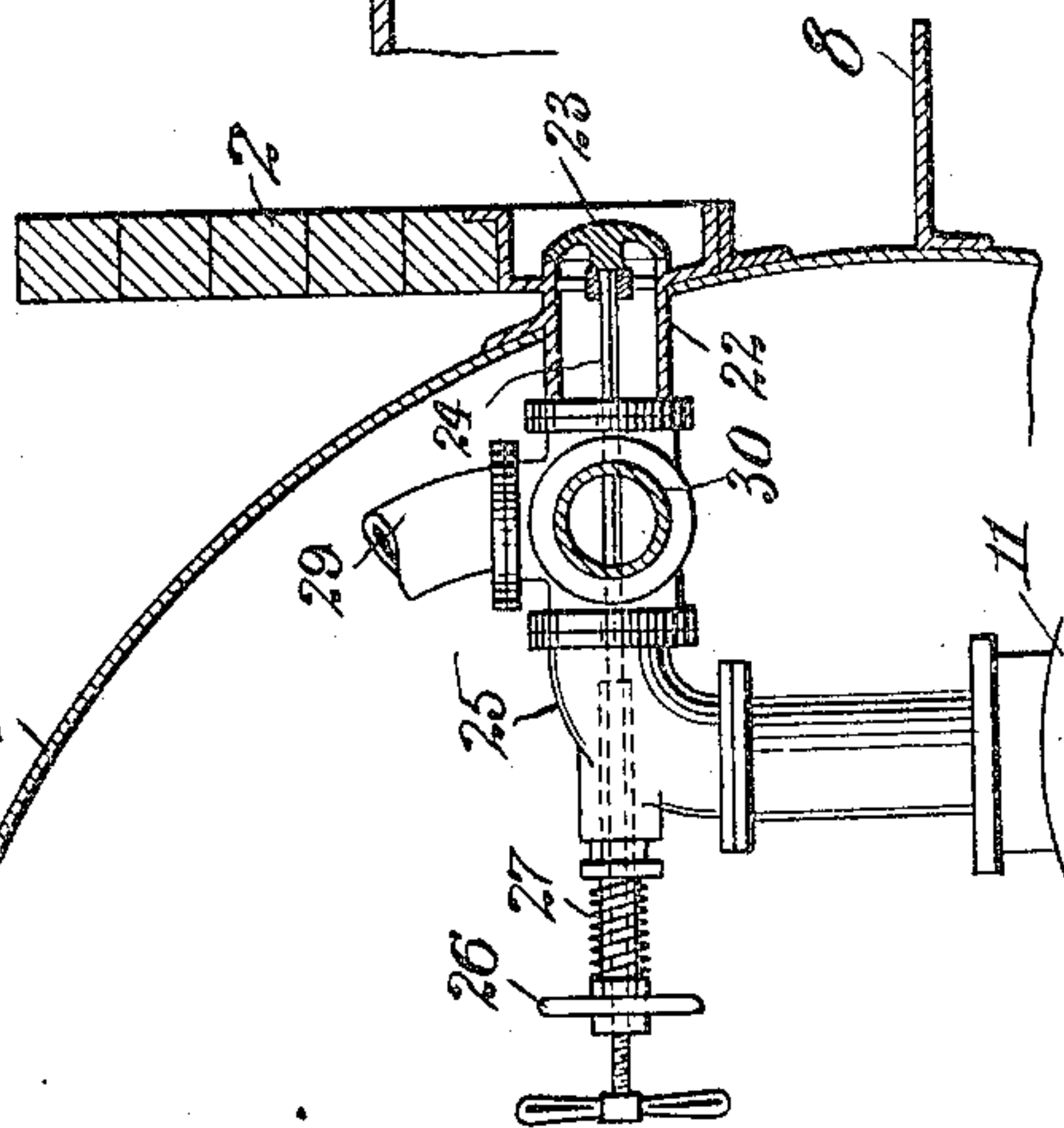


Fig. 3.

Inventor
S. Lake
By His Attorney
Henry J. Miller.

UNITED STATES PATENT OFFICE.

SIMON LAKE, OF BRIDGEPORT, CONNECTICUT.

BALLAST DEVICE FOR SUBMARINE VESSELS.

No. 803,174.

Specification of Letters Patent.

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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 Ballast Devices for Submarine Vessels, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to an improvement particularly in that type of submarine vessels forming the subject of the United States Patent No. 650,758, granted to me May 29, 1900; and it has for its object the more effective control of the structure under conditions of submergence.

According to the present invention the vessel is provided with a flat guide plane or planes substantially parallel with the direction of thrust of its propelling means and comprising a comparatively flat deck or lateral guards or fins along the edges, or both, in combination with a heavy ballast-weight which is movable longitudinally in respect of the center of gravity of the hull, the shifting of which forwardly or backwardly operates to give the vessel a slight upward or downward inclination in opposition to the steadying tendency of the guide plane or planes, and thereby cause the vessel to rise toward or descend from the surface. By suitably suspending the ballast-weight it is also adapted to serve the additional function when lowered materially beneath the hull into its normal position beneath the center of gravity of correspondingly lowering the resultant center of gravity of the component parts of the structure.

40 In my prior patent above mentioned a pair of swinging arms carrying bearing-rollers disposed at opposite ends of the vessel was disclosed; but these were not of such a nature and suitably mounted, nor were they of sufficient weight in proportion to that of the hull to serve the purpose of the present improvement, nor were they designed or operated with such object in view.

50 The present improvement will be more fully understood by reference to the drawings annexed, in which—

Figure 1 is a side elevation, partly in section, of a submarine boat provided with my present improvements. Fig. 2 is a transverse section, on a greatly-enlarged scale, of the lower portion of the same, showing the suspended ballast-weight and the means for op-

erating the same. Fig. 3 is a partial transverse section showing a portion of one of the pumps and discharge-pipe leading therefrom, and Fig. 4 is a detail sectional view representing one of the check-valves intermediate the ballast-tanks.

The hull 1 of the vessel is of usual form adapted for resisting the pressure of the external water during submergence and is shown provided with a superstructure having upright side walls 2 and substantially flat deck 3 overhanging the latter at the edges, and thus affording the lateral guide-planes 4, extending longitudinally of the hull in a plane parallel with that of the shafts 5 of the twin-screw-propeller wheels 6, each of which is in practice driven by an electric motor during submergence and by the usual gasoline-engines when traveling upon the surface. The hull is shown provided also with a pair of side fins 8, disposed beneath and parallel with the guide-planes 4 and serving a like purpose.

The lower portion of the hull is shown provided with systems of forward and after ballast-tanks 9 and 10, respectively, separated by upright partitions or bulkheads, and water may be introduced into and expelled from such tanks by any suitable means. As represented in the accompanying drawings, the water-ballast apparatus comprises a pair of rotary pumps 11, each driven by an electric motor 12 and having suction or inlet pipes 13, communicating through the pipe 14, which is connected, by means of an upright pipe 15 and distributing-pipe 16, with the sea-inlet pipe 17, controlled by a gate-valve 18. The distributing-pipe 16 has gate-valves 19 and 20, controlling its communication with the lower portion of each initial ballast-tank of the forward and after systems, respectively, the mouths of said pipe within each tank being inclosed by a guard 21 open at the bottom only.

The discharge-passage of each pump is connected with a pipe 22, extending outboard and closed by a valve 23, whose stem 24 passes through a stuffing-box in an elbow-fitting 25, between which and an adjustable thrust-collar 26 is interposed the spring 27, acting to yieldingly hold said valve normally closed. The discharge-pipe 22 is provided with two branches 29 and 30, controlled by valves 31 and 32, leading, respectively, to the forward and after compartments of the superstructure. The suction-pipes 13 of both pumps are also connected by pipes having branches 33 and

34, joining the pipes 29 and 30 intermediate their controlling-valves and the superstructure and also provided with controlling-valves 35 and 36, respectively.

5 Each tank of both systems of forward and after ballast-tanks is connected at the bottom to the adjacent tank or tanks by a passage having a check-valve 37, opening toward the primary tank of its respective system connected with
10 the pump 11, as before described, and at the top with the adjacent tank or tanks of its respective system through a passage having a check-valve 38 opening in the opposite direction, and the farthest from the primary tank of each
15 system is provided with an upwardly-extending air-vent pipe 39, communicating with the interior of the hull 1. As shown in Fig. 4, each check-valve is constructed of a disk 38, attached by a loose connection with the free
20 end of a swinging arm 40, hinged to suitable lugs 41 upon the valve-plate 42, provided with a suitably-faced inclined seat 43 to receive the valve-disk.

In practice the check-valve in the discharge-
25 pipe 22 is set to open when the pressure in such pipe slightly exceeds that required to force water-ballast into the superstructure through the pipes 29 and 30, the complete filling of the superstructure or the closing of
30 the valves 31 and 32 in the pipes leading thereto serving to direct the water thereafter discharged by the pump outboard through the pipe 22.

Water may be admitted to the ballast-tanks
35 9 and 10 in succession by overflow from one into the adjoining tank through the upper check-valves 38 and may be drawn from such tanks also successively in reverse order by
40 movement from the last-filled tanks into the adjacent tank through the lower check-valves 37, as will be readily understood.

While the external pressure will be sufficient to force the water into the ballast-tanks through the sea connection 17 and distribut-
45 ing-pipe 16 when their valves are opened, the introduction of water to the superstructure and expulsion of the same from both superstructure and ballast-tanks is effected by setting either or both of the pumps 11 in opera-
50 tion and suitably manipulating the valves in the connecting-pipes, as will be readily understood.

The ballast-weight 44 is shown supported beneath the center of gravity z of the struc-
55 ture by means of a pair of swinging links or arms 45 46, to the lower ends of which the same is pivoted, said links being suspended by pivotal pins 47 from the interior of the ballast-weight housing 48, constituting a hol-
60 low keel portion of the vessel. To control the position of the ballast-weight, the latter is connected intermediate its ends with one extremity of a cable 49, having its other end attached to a winding-drum 50, disposed in a
65 well in the bottom of the hull and mounted

upon a shaft 51, of which one end passes through a stuffing-box 52 into the interior of the hull and carries a worm-wheel 53, meshing with a worm 54 upon the shaft of the actuating electric motor 55. To insure the
70 direct lead of the cable 49 from the ballast-weight 44 to the drum 50, the after supporting-link 46 is forked at its upper end and the cable led between the branches thus formed.

For travel upon the surface the drum 50 is
75 operated to draw the ballast-weight 44 upwardly into its housing in the keel 48; but the ballast-weight is readily adjusted for submergence by lowering it into its operative position beneath the center of gravity z , as
80 before described. When the vessel is in proper trim for submergence, with only a very small margin of buoyancy, a sufficient downward inclination may be given to the
85 bow by a slight forward movement of the ballast-weight 44 forward of the center of gravity, so as to cause the vessel to gradually descend beneath the surface of the water while in motion under the action of its propelling apparatus, and it is evident that a con-
90 trary movement of the ballast-weight will cause the vessel to rise to the surface.

Having thus described the invention, what I claim herein is—

1. In a submarine boat, the combination
95 with the hull, propelling means for the same, and means for effecting its submergence beneath the surface of the water, of a flat guide plane or planes carried by said hull and acting in conjunction with said propelling means
100 to maintain a uniform direction of movement in respect of the surface of the water when under submergence, and an external shifting ballast-weight carried by said hull with means
105 for controlling the same in overcoming the action of said guide plane or planes for changing the direction of movement of said boat in respect of the surface of the water.

2. In a submarine boat, the combination
110 with the hull, propelling means for the same, and means for effecting its submergence beneath the surface of the water, of a flat guide plane or planes carried by said hull and acting in conjunction with the said propelling means to maintain a uniform direction of
115 movement when under submergence, a ballast-weight suspended movably beneath the center of gravity of the hull, and means within the hull for shifting said weight to overcome the tendency of said guide plane or planes in
120 changing the direction of motion in respect of the surface of the water.

3. In a submarine boat, the combination
125 with the hull, propelling means for the same and means for introducing water-ballast for trimming and overcoming the normal buoyancy of said hull, of a flat guide plane or planes carried by said hull and acting in conjunction with said propelling means to maintain a uniform direction of movement when
130

under submergence, a ballast-weight suspended beneath the center of gravity of the hull and movable in respect of the same both vertically and longitudinally, and means within
5 the hull for shifting said weight to correspondingly lower or raise the resultant center of gravity and for holding the same fixed in any given relation.

4. In a submarine boat, the combination
10 with the hull, propelling means for the same, and means for effecting its submergence beneath the surface of the water, of a flat guide plane or planes disposed substantially parallel with the direction of thrust of the propelling
15 means, a ballast-weight suspended from said hull by swinging arms pivoted thereto, a hoisting-drum with means for actuating it, and a cable attached at one end to said ballast-weight and having its other end connect-
20 ed with said hoisting-drum.

5. In a submarine boat, the combination with the hull, propelling means for the same, and means for effecting its submergence beneath the surface of the water, of a flat guide
25 plane or planes disposed substantially parallel with the direction of thrust of the propelling

means, a ballast-weight, a pair of swinging arms by which said weight is suspended beneath said hull, one of said arms being forked at its upper end, a hoisting-drum with means
30 for actuating it, and a cable attached at one end to said ballast-weight intermediate its suspending-arms and having its other end led between the branches of said forked suspending-arm to said hoisting-drum. 35

6. In a submarine boat, the combination with the hull, propelling means for the same, and means for effecting its submergence beneath the surface of the water, of a ballast-weight suspended from said hull by swinging
40 arms pivoted thereto, a hoisting-drum with means for actuating it, and a cable attached at one end to said ballast-weight and having its other end connected with said hoisting-drum. 45

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

SIMON LAKE.

Witnesses:

L. B. MILLER,
HENRY J. MILLER.