

No. 726,705.

PATENTED APR. 28, 1903.

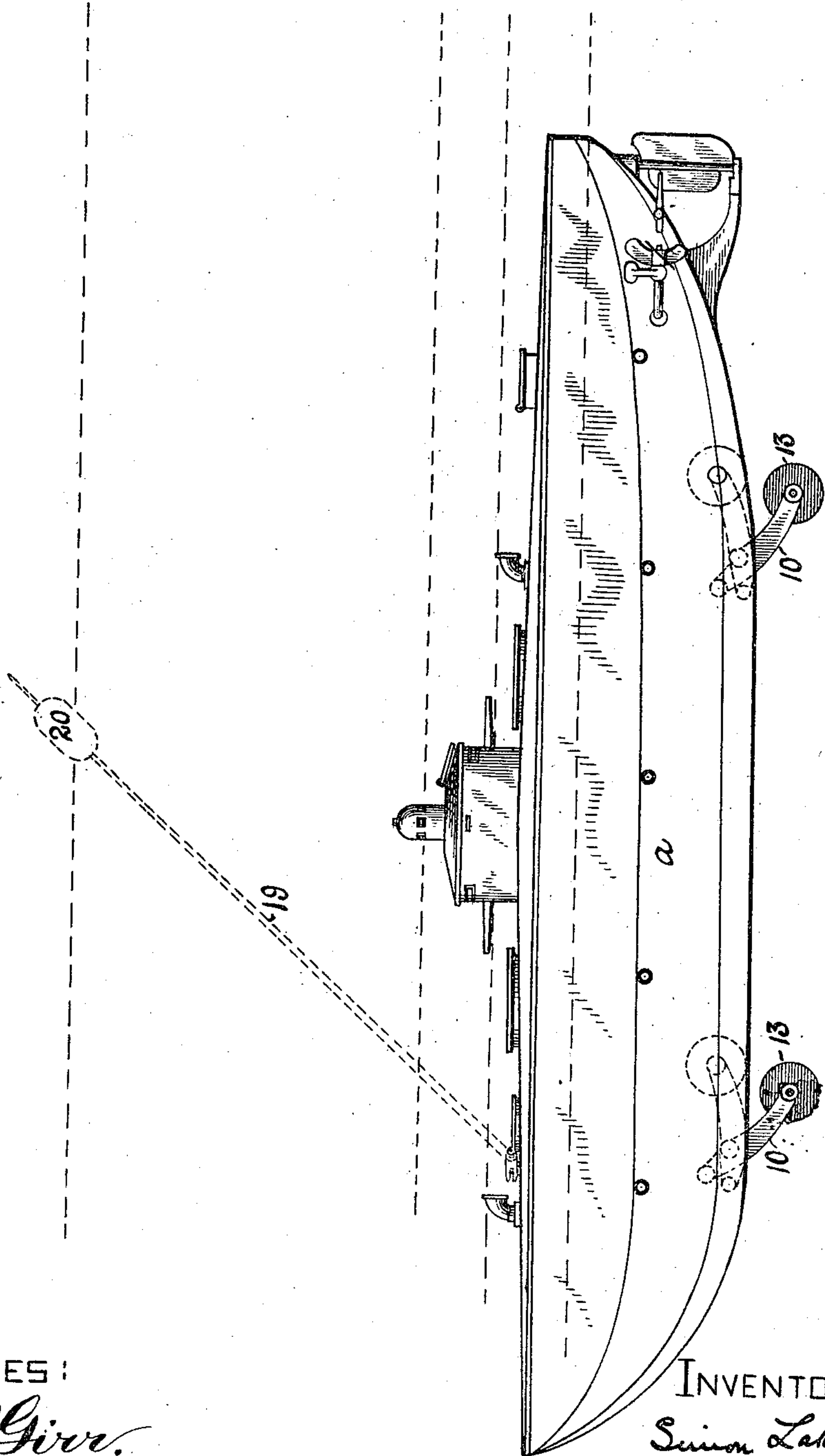
S. LAKE.  
SUBMARINE BOAT.

APPLICATION FILED FEB. 15, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:  
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2 SHEETS—SHEET 2,

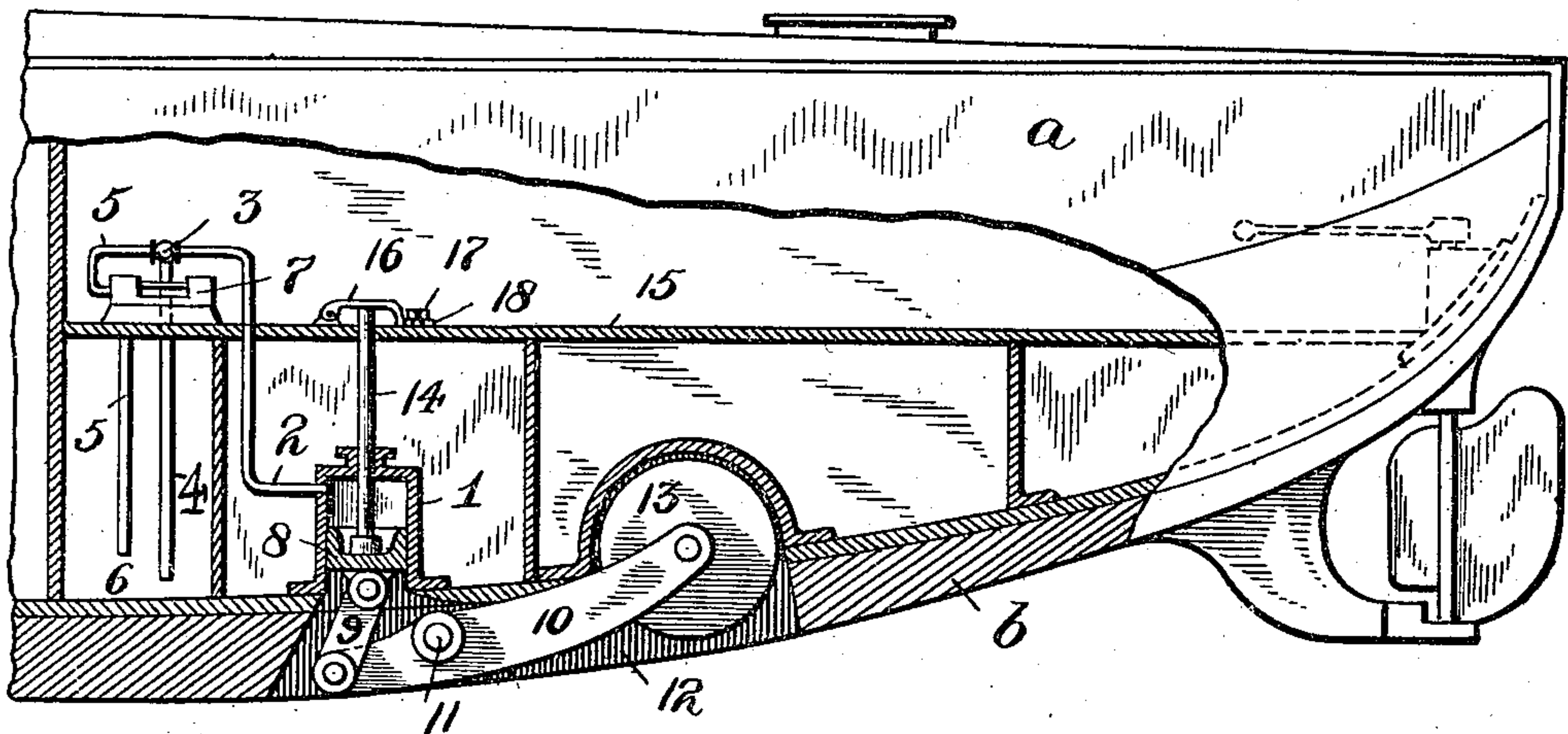


Fig. 2.

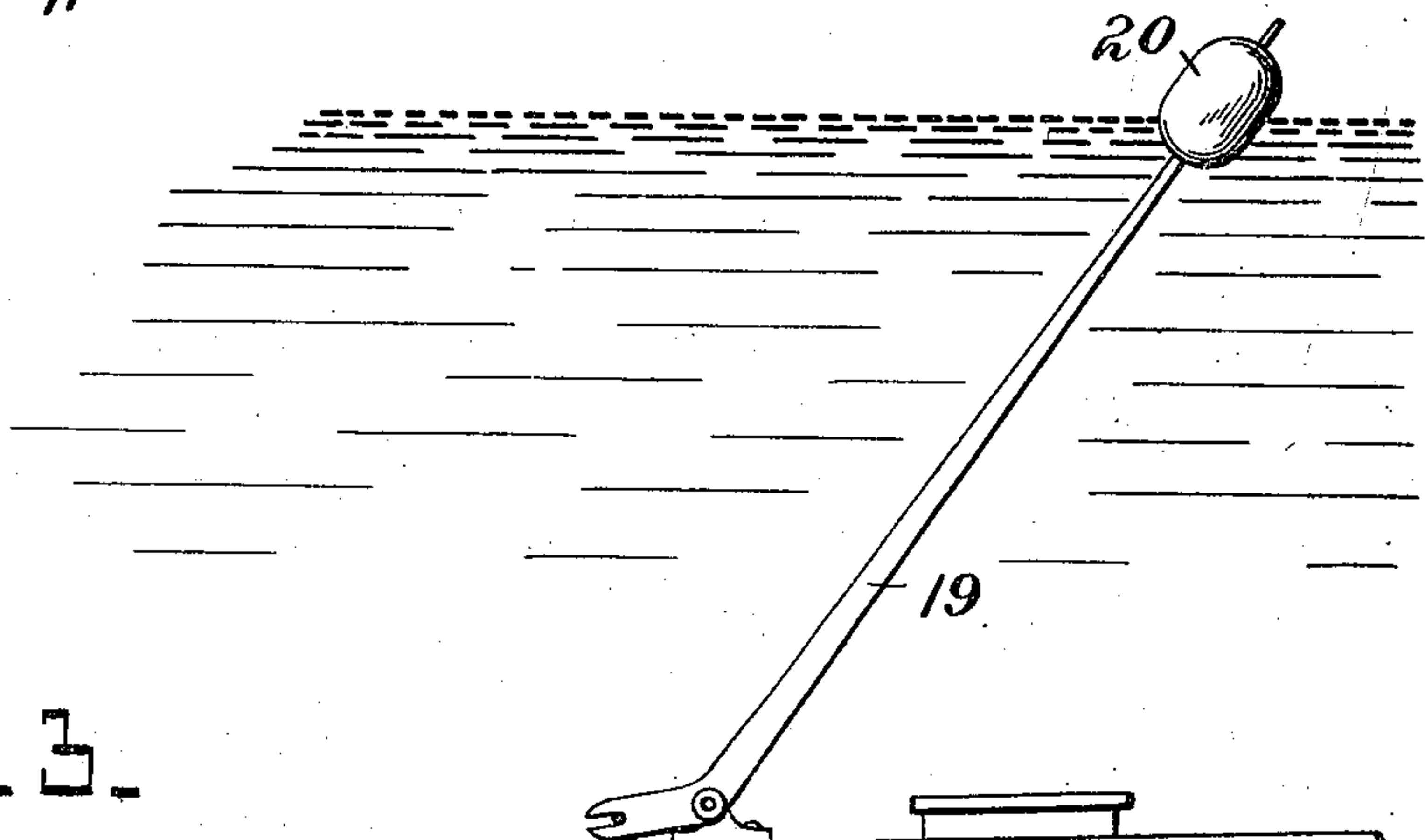
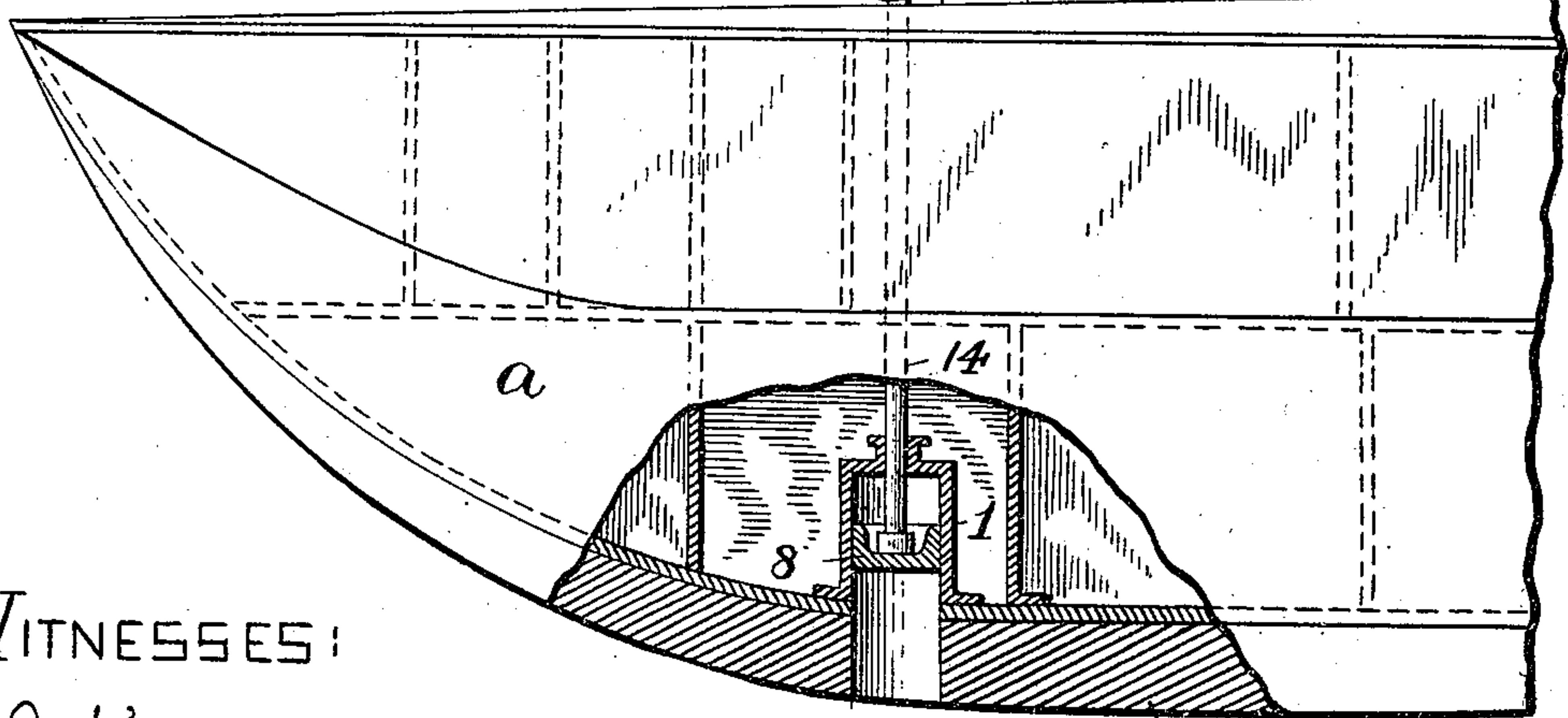


Fig. 3.



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# UNITED STATES PATENT OFFICE.

SIMON LAKE, OF BRIDGEPORT, CONNECTICUT.

## SUBMARINE BOAT.

SPECIFICATION forming part of Letters Patent No. 726,705, dated April 28, 1903.

Original application filed May 28, 1901, Serial No. 62,207. Divided and this application filed February 15, 1902. Serial No. 94,204. (No model.)

*To all whom it may concern:*

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

This application is a division of my copending application, Serial No. 62,207, filed May 28, 1901.

The object of the present improvement is to adapt the normally buoyant hull of a submarine boat to automatically maintain a uniform distance from the water-bed or the surface, as may be desired, for operations connected more particularly with the requirements of naval warfare. When traveling upon or near the water-bed especially, it is important that the contact with the same or with any irregularities therein or obstructions thereupon should not be with the hull, which should be maintained a safe distance above the water-bed, for which reason I have provided means whereby the buoyancy may be automatically, either wholly or partially, restored temporarily to enable the hull to clear such uneven portions of the water-bed. This result is attained, preferably, by the provision of a hydraulic cylinder having one end connected to a water-ballast tank or compartment and the other end exposed to the exterior of the vessel and provided with a piston or plunger connected with one end of a downwardly and rearwardly inclined swinging arm, of which the opposite end is adapted to contact with the water-bed when the boat sinks to the vicinity of the same, the fixed pivot or fulcrum of said swinging arm being disposed intermediate its ends. By this means not only is the contact of the boat with the water-bed cushioned by reason of the yielding resistance of the external water upon the outer face of said piston against the air within the connected water-ballast compartment, but the outward movement of the latter against such pressure, because of the yielding of the free end of the pivoted controlling-arm by its contact with the water-bed, causes the expulsion of the external water in the outer end of the cylinder in front of said piston, whereby the displacement of the boat is increased by

the volume of such vacated space without effecting a corresponding increase of the volume of the water-ballast contained therein, and by reason of the increased buoyancy thus produced the boat is caused to rest with less weight upon said pivoted arm or to actually rise temporarily from the water-bed in case such increased displacement should be sufficient to create buoyancy. In the United States Patent No. 650,758, granted to me May 29, 1900, devices were shown to provide for the yielding contact of such a vessel with the water-bed; but while such apparatus effectively served its purpose as a cushioning device to prevent any injurious effect of groundswells and other conditions causing the rise and fall of the boat when normally resting lightly upon the water-bed its outwardly-open hydraulic cylinder and piston operated incidentally by a connection with its trailing contact-arm to increase the displacement of the boat as the hull approached the water-bed under such external conditions and to decrease the displacement as the hull receded from the water-bed in following the contour of the latter, the variations of buoyancy thus produced causing a still greater tendency of the boat to recede from its initial or normal relation in respect of the water-bed under any variation in its elevation above the latter by reason of inequalities therein, such tendencies being ultimately counteracted by other conditions of the apparatus.

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

Figure 1 is a side elevation of a submarine boat embodying my present improvements. Fig. 2 is a sectional elevation showing the stern water-ballast-controlling apparatus upon a larger scale. Fig. 3 is a view similar to Fig. 2, showing a modification.

The body or hull *a* of the boat may be caused to travel close to the water-bed without actual contact of its keel *b* therewith, and so follow all irregularities within its vertical plane of the surface of the latter at a substantially uniform elevation above the same by an automatic control of the displacement of the boat, as before indicated. For attaining this capability the boat is shown in the drawings provided near each end with similar depth-



controlling devices; but as they are identical in construction and arrangement with relation to the water-ballast tanks with which they are respectively connected only the one in the stern portion is herein specifically described. This comprises a hydraulic cylinder 1, having its inner or upper end connected, by means of the pipe 2, with the three-way valve 3, from which one branch pipe 4 leads directly into the interior of the water-ballast compartment 6, while the other branch pipe 5 leads indirectly into the same compartment through the hydraulic pump 7. The piston 8 of the cylinder 1, the outer end or face of which is exposed to the exterior of the boat through the open lower or outer end of said cylinder, is connected, by means of a link 9, to one end of an arm or lever 10, pivoted intermediate its ends by a pin 11 within a well 12 in the bottom of the boat and carrying at its free opposite end the bearing-roller 13. The inner side of the piston 8 is provided with a guide-rod 14, passing through a stuffing-box in the inner end of the cylinder and upwardly through an aperture in the floor 15, where its upper end serves by its height to indicate the position of the piston in the cylinder, and hence the relation of the degree of buoyancy at a given time to the initial buoyancy established by the water-supply in the ballast-tanks when the piston is in its normal position in the cylinder 1. When the piston is in its lowermost position and the lever 10 is housed in its well 12, the top of the guide-rod 14 is designed to be just flush with the floor 15, and the several parts may be locked mechanically in such positions by applying a cap 16 to the floor over the upper extremity of such guide-rod and securing it in place by means of a suitable bolt or button, as 17, engaging a projecting lug 18 upon said cap. The cap 16 being removed and the arm or lever 10 being thus allowed to drop into the position indicated in full lines in Fig. 1, the piston 8 assumes its innermost position in the cylinder, into the lower end of which external water is allowed to follow said retreating piston, the reduced displacement caused by the receding of the piston and consequent forcing of the contents of the inner end of the cylinder inwardly into the compartment 6 producing a reduction of the space occupied by the boat, which is measured by the capacity of the open end of the cylinder in addition to the displacement of the hull proper, which subjects the boat to a corresponding loss of buoyancy. In this operative position of the forward and after arms or levers 10 the boat may be ballasted to any desired degree of approach to but below actual buoyancy, when it will settle down close to the water-bed, with the bearing wheels or rollers 13 of said arms contacting lightly with the water-bed. Any rise in the surface of the water-bed during the progress of the boat will cause a corresponding movement of the trailing arms 10 with reference to the course temporarily main-

tained by reason of the momentum of the boat, thereby causing the advance of the piston 8 toward the open end of the cylinder 1, from which it forces the water, and thus temporarily increases the displacement of the adjacent portion of the boat by a like volume, which causes the rise of the boat until the arm 10 and its connected piston regain their initial operative relations, when the boat continues in the course thus assumed until similarly affected by the subsequent rise or fall of the said arm, its condition relative to buoyancy being preferably so adjusted as to maintain said piston normally in a position intermediate the ends of the cylinder. It is obvious that the roller 13, journaled in the free end of the arm 10, may be dispensed with, thus causing the end of the downwardly-inclined trailing arm itself to drag upon the water-bed as a skate or runner in performing its normal function. In order to lift the arm 10 from its lowered operative position into its well 12, it is only necessary to properly manipulate the valve 3 in the pipe connections 4 and 5 to connect the pump 7 with the cylinder 1, when by actuating the pump the piston 8 can be forced outwardly, so as to bring the arm into the level position, (indicated in dotted lines in Fig. 1,) when it will be housed in its respective well.

It will be observed that the hydraulic cylinder 1 and the system of piping and interposed pump perform the function of and collectively constitute a part of the ballast-compartment 6, and they are so considered in certain of the claims annexed hereto. It is, however, evident that this portion of the present improvement is not limited to the particular manner of controlling the buoyancy and particularly of securing the variable displacement of the boat, whereby the result above described is attained, and such parts of the automatic apparatus for controlling the displacement are therefore immaterial to the essential feature of the device, which may include any means suitable for performing the described operation.

It is to be observed that the depending arm for controlling the buoyancy of the boat may be of any desired length, so as to determine the elevation of the hull above the water-bed, and that such a trailing arm, as 19 in Fig. 3, if suitably disposed to adapt it to be connected with a float 20 upon the surface will operate similarly to maintain the boat a uniform distance beneath the surface regardless of the condition of the water-bed or depth of water. It will be readily seen that by suitable manipulation of the water-ballast compartments in connection with the automatically-acting device referred to the predetermined submerged position at which the latter normally maintains the boat may be adjusted within certain limits governed by the proportions of said device for controlling the buoyancy at the will of the occupants of the boat.



As I believe myself to be the first to have devised a submarine boat provided with means acting automatically and independently of the external water-pressure for controlling the buoyancy of the normally buoyant hull to maintain it at substantially a predetermined submerged position intermediate the surfaces of the water and the water-bed and in a given relation in respect of one of said surfaces, either of which would constitute a guiding medium for such purpose, the language of the claims appended hereto directed to such feature of the present improvement is to be understood in its broadest sense to embrace all modifications and equivalents of the specific devices herein shown and described for attaining this object, whether by controlling the displacement, and thereby maintaining the same at a uniform distance from either the surface or the water-bed, or by varying the contents of a water-ballast compartment or compartments under a predetermined maximum external water-pressure, as described in my application filed simultaneously herewith.

In practice the pump 7 serves an additional function to that above described in regulating the quantity of water-ballast in the several compartments through suitable connections with the exterior of the boat and the ballast tanks or compartments in a well-known manner.

Having thus set forth the nature of the invention, what I claim herein, and desire to secure by Letters Patent, is—

1. In a submarine boat adapted to travel between the surface and the bed of the water, one of which limits constitutes a guiding medium therefor, the combination with the hull having water-ballast tanks or compartments and means for controlling the volume of water-ballast contained therein, of a trailing arm or lever pivotally connected with and projecting from said hull and vertically movable in respect thereof with its outer end adapted to contact with one of said guiding mediums, auxiliary depth-controlling means for regulating the condition of submergence of said hull, and a connection between said auxiliary depth-controlling means and said trailing arm or lever whereby the descent of the hull below or its ascent above normal relation with said guiding medium will cause the actuation of said auxiliary depth-regulating means to produce a contrary movement of said hull toward normal relation.

2. The combination with a submarine boat having a water-ballast compartment, a hydraulic cylinder open at one end to the exterior

rior of the boat and a connection between the other end of said cylinder and said water-ballast compartment, of a piston fitted to said cylinder, a pivoted trailing arm depending from said boat and having one end adapted to contact with the water-bed and the other end connected with said piston, and provided intermediate thereof with a fixed fulcrum upon which the same is adapted to swing.

3. The combination with a submarine boat, of means for automatically varying its displacement under conditions of submergence, and a device for mechanically locking said means in inoperative position when desired.

4. The combination with a submarine boat having a water-ballast compartment, of a plunger having one face presented to the interior of said compartment and the other face exposed to the exterior of said boat, a yielding pivoted arm depending from said boat and adapted to contact with the water-bed, a connection from said arm to said plunger, and an indicator connected to one of said movable members and extending into the interior of the boat to indicate the position of said member and the degree of variation of displacement of said boat produced by said parts.

5. The combination with a submarine boat having a water-ballast compartment, of a plunger having one face presented to the interior of said compartment and the other face exposed to the exterior of said boat, a yielding pivoted arm depending from said boat and adapted to contact with the water-bed, a connection from said arm to said plunger, and an indicator-rod projected inwardly from the inner face of the plunger into the interior of the boat, for the purpose described.

6. The combination with a submarine boat having a water-ballast compartment, of a plunger having one face presented to the interior of said compartment and the other face exposed to the exterior of said boat, a yielding pivoted arm depending from said boat and adapted to contact with the water-bed, a connection from said arm to said plunger, an indicator-rod projected inwardly from the inner face of the plunger into the interior of the boat, and a cap or stop device for retaining said indicator-rod and attached plunger in fixed position.

Signed at Elizabeth, in the county of Union and State of New Jersey, this 6th day of February, A. D. 1902.

SIMON LAKE.

Witnesses:

L. B. MILLER,  
HENRY J. MILLER.