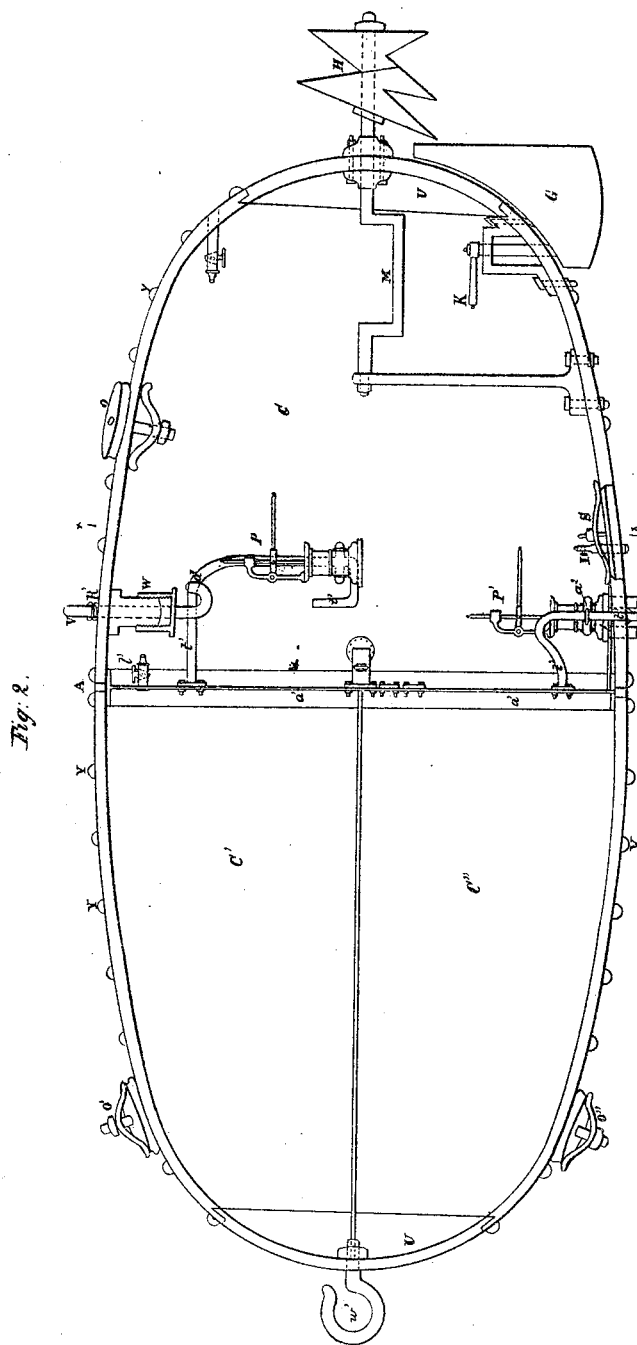


L. ALEXANDER.  
SUBMARINE BOAT.

No. 7,609.

Patented Sept. 3, 1850.



*Witnesses:*

Thomas H. Jones

*Inventor:*

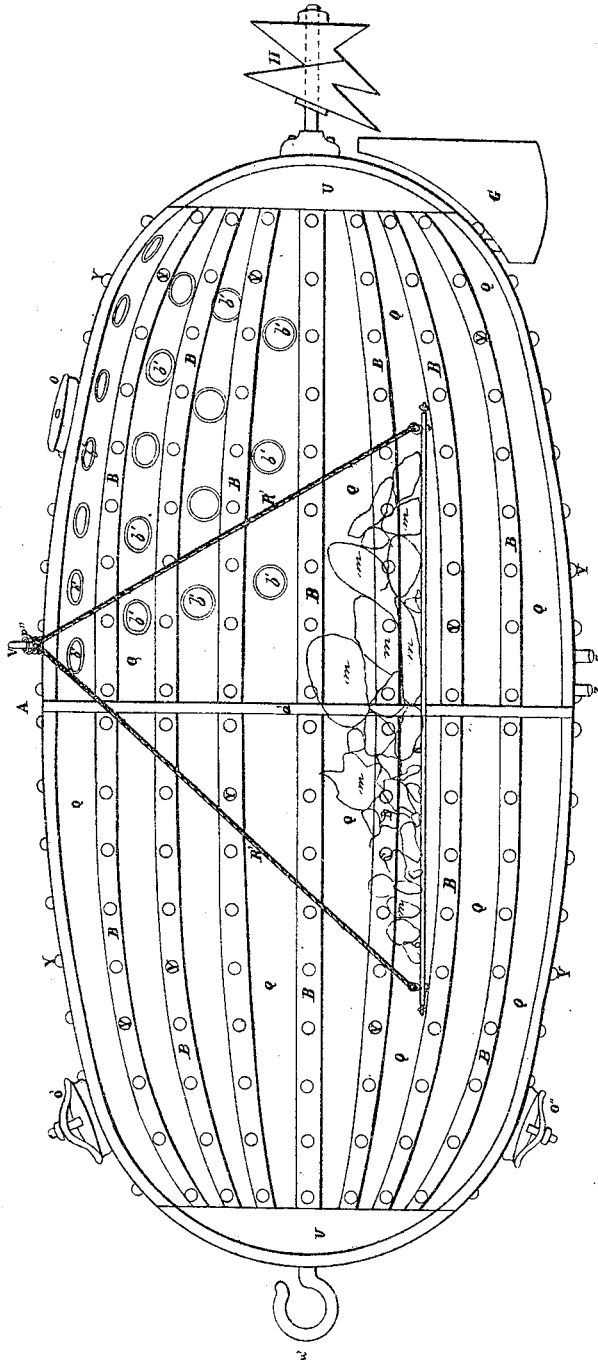
*Pamiers*

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Fig. 4.



Witnesses:

*John W. Alexander*  
*Thomas W. Alexander*

Inventor.

*L. Alexander*

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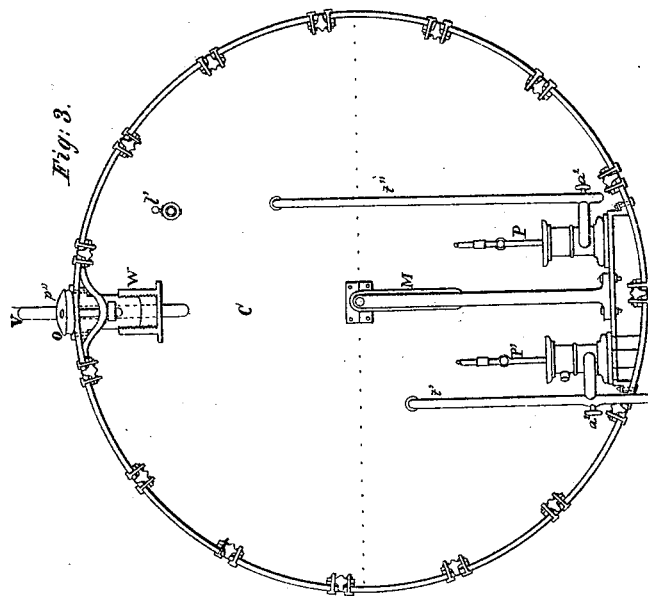
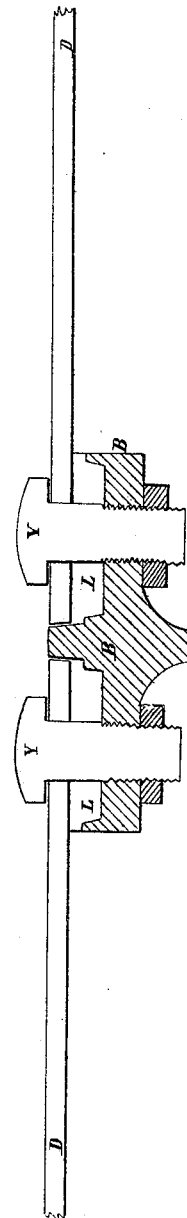


Fig. 4.



Witnesses:

*Wm. H. H. H.*  
*Wm. H. H. H.*

Inventor:

*L. Alexander*

# UNITED STATES PATENT OFFICE.

LAMBERT ALEXANDRE, OF FRANCE.

## SUBMARINE VESSEL.

Specification of Letters Patent No. 7,609, dated September 3, 1850.

*To all whom it may concern:*

Be it known that I, LAMBERT ALEXANDRE, a citizen of France, have invented certain new and useful Improvements in Submarine Vessels for the Exploration of the Bottoms of Rivers, Lakes, and other Bodies of Water; and I do hereby declare that the following is a full, clear, and exact description of my said improvements, reference  
10 being had to the accompanying drawing, which makes part of this specification, and in which—

Figure 1 is a side elevation of my said submarine vessel; Fig. 2 is a vertical longitudinal section of the same; Fig. 3 is a transverse section through the line *xx* of Fig. 2, and Fig. 4 is a section of fragment upon an enlarged scale of the ribs and panels of the sides of the vessel.

The invention or discovery of the means by which persons can descend at will and explore the bottoms of rivers, lakes and other bodies of deep water, and thence at will return again to the surface of the water with facility and safety, has long been considered a great desideratum and many devices have at different times and by different persons been contrived for this purpose; some of these have manifested a high degree  
30 of ingenuity and skill, but none of them have possessed such a degree of adaptation to the general purposes of submarine explorations, as to render them practically useful or capable of superseding the cumbersome and unwieldy, but hitherto indispensable diving-bell. The chief reasons of the failure of these attempts have been in my opinion the difficulty of keeping up a proper circulation of air within the vessel and the difficulty of discharging instantaneously the load or ballast by means of which the vessel is forced to sink, thus allowing her to rise to the surface with a buoyant force proportioned to the load discharged, whenever this operation becomes necessary from some derangement of her machinery. To obviate these defects is the object of my invention which consists, first, in securing within the working-chamber or cabin of the vessel a pump which is connected by pipes with an airtight compartment from which it can draw air and into which it can compress air at will, the connection being such that by moving proper cocks or valves the  
55 pump becomes either a suction or a force

pump with respect to the airtight compartment or to the cabin.

My second improvement consists in attaching to each side of the submarine vessel a ballast platform which is hinged at its inner edge to the vessel and is slung at its outer edge by chains from rings which are hung upon the end of a pin at the top of the vessel; the arrangement of the various parts of this device being such that when the pin  
65 is pulled inward by the occupants of the vessel the rings are let go and the platforms, being no longer supported at their outer edges, turn down upon the hinges at their inner edges and discharge instantaneously  
70 any load placed upon them.

My improved submarine vessel has the general form of an egg, being an ellipsoid, whose long axis is about double the length of its short axis; it is composed of pieces  
75 united together in such a manner that they can be separated at will, put up in convenient packages for transportation, and can, with facility be again put together with water and airtight joints, to reconstruct the vessel, which will then be ready for launching into the water. The interior of this vessel is subdivided into compartments, one of which is called the cabin and will conveniently accommodate several persons, the  
85 other compartments are for the reception of water to ballast the vessel, and to contain a supply of compressed air for the persons in the cabin to respire during the period that the vessel is submerged. The cabin is provided with force pumps by which its occupants can keep the air in circulation, and also maintain it in a sufficiently pure state for respiration, by forcing it through a solution of caustic potash which absorbs the  
95 carbonic acid, with which the air has been charged by breathing. The pumps likewise enable the occupants of the cabin to keep the water from encroaching upon them by its increasing pressure as they descend to the bottom, as by their operation the bulk of the atmosphere in the cabin can be increased by pumping air out of the reservoir, so as to keep the cabin constantly filled with an atmosphere of a density proportioned to the  
105 force with which the water presses on and tends to enter the vessel. The cabin is provided with other force pumps by which a portion of the external water is drawn into a tight receptacle in the lower part of the  
110

vessel to increase the load of the vessel and cause it to descend to the bottom of the water; these pumps are also used to eject again this ballast-water from the receptacle, thereby lightening the vessel, increasing its buoyancy, and causing it to rise from the bottom to the surface of the water.

Before any ballast water is admitted the vessel is generally loaded by stones or other weights until it is within a fraction of the specific gravity of the water in which she is placed, so that a small quantity of water drawn in by the pump will cause her to sink and the ejection of this small quantity will cause her to rise; but, in case a considerable weight is to be raised from the bottom it will generally be most convenient to draw in a weight of ballast-water equal to that of the body it is intended to raise. Ballast-stones may then be loaded on until the vessel is as near the sinking point as is desirable, when the sinking can finally be effected by pumping in the additional quantity of water required.

As the buoyancy of the vessel is increased in proportion to the weight of water expelled from her, and as her tendency to sink is increased in like proportion by pumping water into her, the force pumps and ballast-water receptacle afford the occupants of the vessel a ready and easy means of ascending or descending in the water. To these means of effecting vertical movements of the vessel are added a screw propeller and a rudder for effecting and regulating her horizontal movement. She is thus rendered capable of locomotion in any direction, the rudder-post passes through a stuffing box into the cabin and its inner end is fitted with a tiller by which it can be operated. The shaft of the propeller likewise passes through a stuffing or water-tight box into the cabin, where it terminates in a crank, which is turned by the inmates to operate the screw which propels the vessel. The top and sides of the cabin are provided with bull's-eyes to admit light, and its top and bottom are also provided with one or more man-holes, those on top for the entrance and egress of the men when at the surface of the water, the lower ones for the purpose of gaining access from the interior of the cabin to the earth or other substance at the bottom of the water, or to examine, draw in, or make fast to any object that may there be met with. Other man-holes are likewise provided for gaining access from the outside to the interior of the vessel. The outside of the vessel is fitted with two drop platforms, hinged by their inner edges to the sides of the vessel, their outer edges being suspended by ropes or their equivalent to a pin on the top of the vessel, these platforms when free will drop down into a vertical position, but when suspended by the

ropes to the pin are held in a horizontal position suitable for supporting a load. The drop platforms are for the purpose of carrying the ballast which generally consists of stones or other heavy bodies; the weight of this ballast should be equal to the force with which it is desired the vessel should tend to rise to the surface in case the pumps should become deranged and fail to work while she is at the bottom, or she should refuse to ascend by the discharge of the water-ballast alone, because in the event of anything being wrong while the vessel is at the bottom, which renders it desirable that she should ascend promptly to surface the pin from which the outer edges of the platform hang is withdrawn, thus allowing the platforms to drop and discharge their ballast; by this operation the vessel is relieved of so much of her load, and as her buoyancy is correspondingly increased she starts instantly toward the surface; as the vessel is thus fully under the control of its inmates they are insured from every danger of detention at the bottom any longer than they choose to remain there. These drop-platforms by which the submarine navigator can at will instantly discharge the ballast and thereby control such effective means for raising the vessel to the surface, I deem of the highest importance, because it renders submarine explorations for the first time, nearly, if not quite as safe, as sailing on the surface of the water, by giving more full and perfect control over the vessel than has heretofore been attained.

The accompanying drawings represent one of my improved submarine vessels constructed in this instance of longitudinal cast iron ribs (B) united by screw bolts to two end pieces (U) in the form of segments of the ellipsoid to which the general configuration of the vessel corresponds. The interstices between the ribs are filled by pannels of sheet iron whose edges are screwed down into rabbets on the corners of the ribs; strips of india rubber being interposed between the panels and the ribs to make the joints air and water tight; this mode of fastening the panels to the ribs will be best seen in Fig. 4 which is a section on an enlarged scale taken through a rib and a portion of two adjacent panels; D, D represent the panels, B the rib, L L the strips of india rubber, and Y and E the screw bolts and nuts by which the panels and ribs are bound together. All the joints between the different pieces forming the vessel are secured and rendered air and water tight in this, or some equivalent.

The interior of the vessel is divided into two parts by a bulk head ( $a'$ ) the space (C) behind the bulk-head constitutes the cabin for the reception of the persons who descend in the vessel and is provided with an

sel, by pumping it either out of or into the  
cabin or air reservoir as may be required,  
even when the density of the atmosphere in  
the compartment whence the air is drawn is  
5 less than that of the atmosphere in the com-  
partment into which it is forced, as herein  
set forth.

2. I also claim the device, consisting sub-  
stantially of the drop platforms, chains, and  
10 draw pin, for the purpose of carrying bal-

last on the exterior of a submarine vessel  
and of discharging it at will as herein set  
forth.

In testimony whereof I have hereunto  
subscribed my name.

LAMBERT ALEXANDRE.

Witnesses:

A. S. FARARYER,  
JNO. M. WYSE.

upper man-hole (O) for the men to enter the cabin and a lower man-hole (S) to give access to the ground or other object at the bottom of the water; the cabin is lighted by means of bull's-eyes ( $b'$ ) placed in the panels at its top and side.

At the stern of the vessel a screw (H) is placed, its shaft passing through into the cabin where it terminates in a crank (M) which is turned by the inmates of the cabin to operate the screw and propel the vessel in a horizontal direction. The stern of the vessel is likewise provided with a rudder (G) the head of which passes through into the cabin and is fitted with a tiller (K) by which the vessel is steered.

The space forward of the bulk-head is subdivided by an air tight deck into two compartments, into the upper of which ( $C'$ ) a sufficient quantity of air is compressed by means of one or more pumps (P) to furnish the inmates of the vessel with a supply for respiration during the time they are submerged; this air can be let out of the reservoir into the cabin as it is wanted through a stop cock ( $Z'$ ), when the air in the cabin has become vitiated by breathing it is purified by forcing it by means of the pump through a solution of potash in water kept caustic by an excess of lime.

The bulk of the atmosphere in the cabin is increased or diminished by pumping air out of or returning it into the reservoir ( $C'$ ) as may be required, to keep the cabin always full of air of a density sufficient to counter-balance the pressure of the water from without, for instance, if in the descent of the vessel it should not be kept filled with such an atmosphere the water will begin to enter the cabin through the lower man-hole which is generally kept open, but a few strokes of the pump (P) drawing air from the reservoir ( $C'$ ) and forcing it into the cabin will sufficiently increase the bulk of the atmosphere in the cabin to drive the water out again. To prevent loss of air resulting from its expansion and consequent escape from the lower manhole while the vessel is ascending, the excess is forced back again into the reservoir. The lower subdivision  $C''$ , or compartment forward of the bulkhead ( $a'$ ) is for the reception of water to ballast the vessel so as to keep her from overturning and likewise to aid in sinking her when it is desired to descend to the bottom. When the vessel is to be raised this water is drawn out of this receptacle and expelled from the vessel by means of the pump ( $P'$ ), the buoyancy of the vessel being increased in proportion to the quantity of water expelled; the receptacle can be emptied and refilled by the inmates of the vessel at will by working the pumps and thus the vessel can be made to sink or rise with great facility.

Both the air and water pumps are provided with four way cocks  $a^2$  and induction and eduction pipes  $t'$  which communicate with the air and water reservoirs. These pumps are constructed in the usual manner and the fourway cocks  $a^2$  are so arranged that by turning them to the proper positions the pumps may be made to force or draw through either one of the pipes  $t'$  at will.

The subcompartments  $C'$ ,  $C''$ , are both provided with man-holes  $O'$ ,  $O''$ , by which access may be had from the outside to the interior whenever it is necessary for repairs or for other purposes.

A hook ( $W'$ ) is secured to the bow of the vessel to which a line may be fastened to moor her or for the purpose of towing her.

The sliding pin ( $V$ ) on which the stay ropes ( $R'$ ) of the platform ( $R$ ) are hung, is passed through a stuffing box ( $W$  Fig. 2) secured to the top of the vessel; the lower end of this pin, which is within the vessel, is bent in order that it may be laid hold of more easily to draw it into the vessel when the platforms are to be dropped. The platform stays have rings or loops on the upper ends which fit loosely over the pin, and oppose much less resistance to its withdrawal than if they fit tightly upon it.

In Fig. 1 the ballast ( $m$ ) is shown piled on the top of the platform, which is in a horizontal position. The place at which vessels of this description can be best and most economically constructed is usually very distant from the place at which they have to be used, consequently it is a matter of great importance to have them so constructed that they can be taken to pieces and put up in convenient packages for transportation, and so that any piece that may happen to get damaged may be replaced without disarranging the rest. This easy portability is also important because of the facilities it affords for conveying the vessel over mountainous and bad roads to inland lakes or other bodies of water whose bottoms are to be explored with a view of finding precious metals or for other purposes.

It is obvious that different kinds of material may be used in the construction of the vessel and that the structure and arrangement of its parts may be varied to a great extent without in any manner changing the principle of the invention.

Having thus described my submarine vessel what I claim therein as my invention and desire to secure by Letters Patent is—

1. The method of effecting a circulation of the air, and of maintaining an atmosphere in the cabin of the requisite bulk to prevent the encroachment of water during the descent of the vessel, and of preventing the waste of air by its expansion and escape from the cabin during the ascent of the ves-