

No. 622,529.

Patented Apr. 4, 1899.

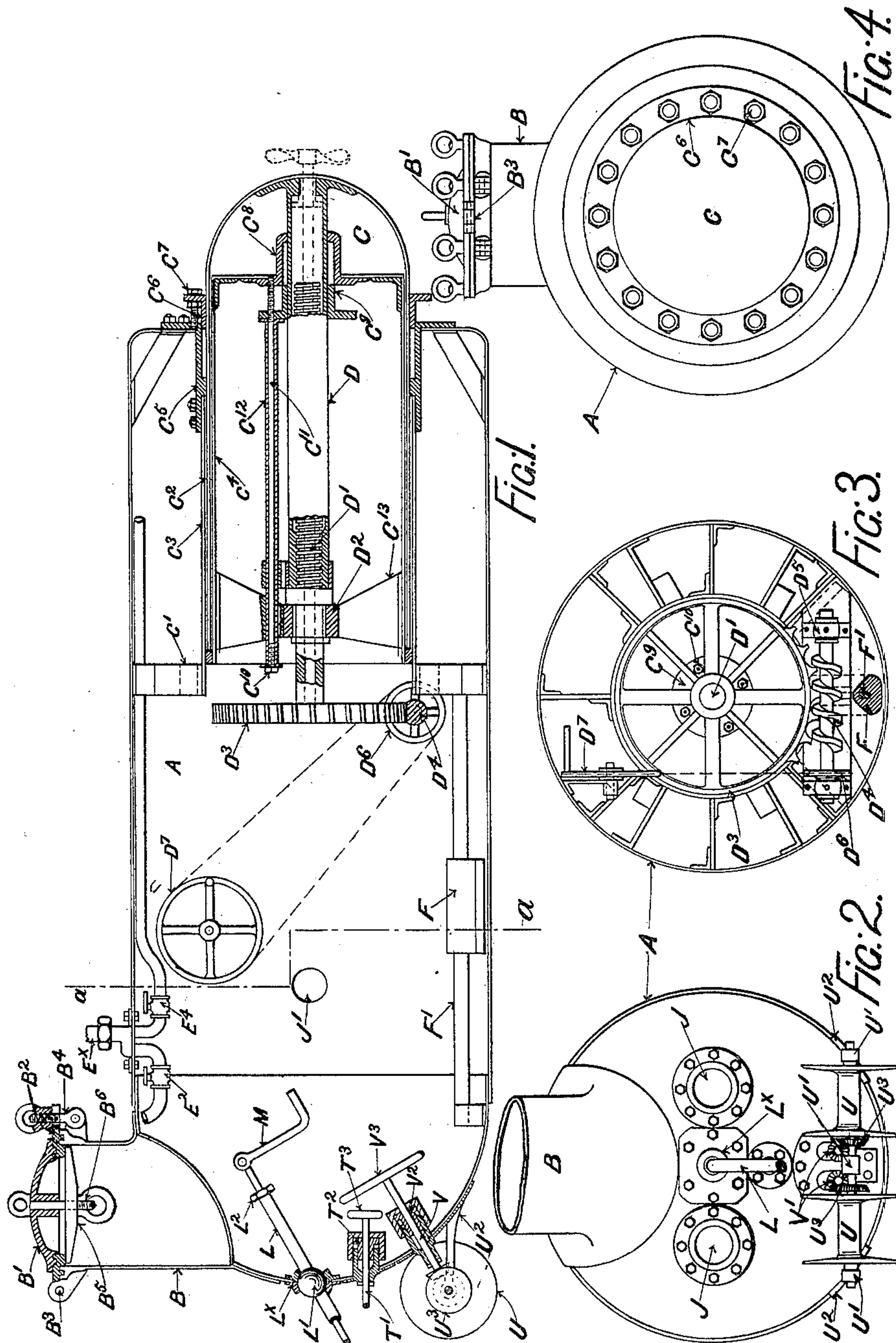
C. PAUL.

SUBMARINE VESSEL OR DIVING APPARATUS.

(Application filed May 2, 1898.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses

J. B. Keefe  
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By James L. Norris

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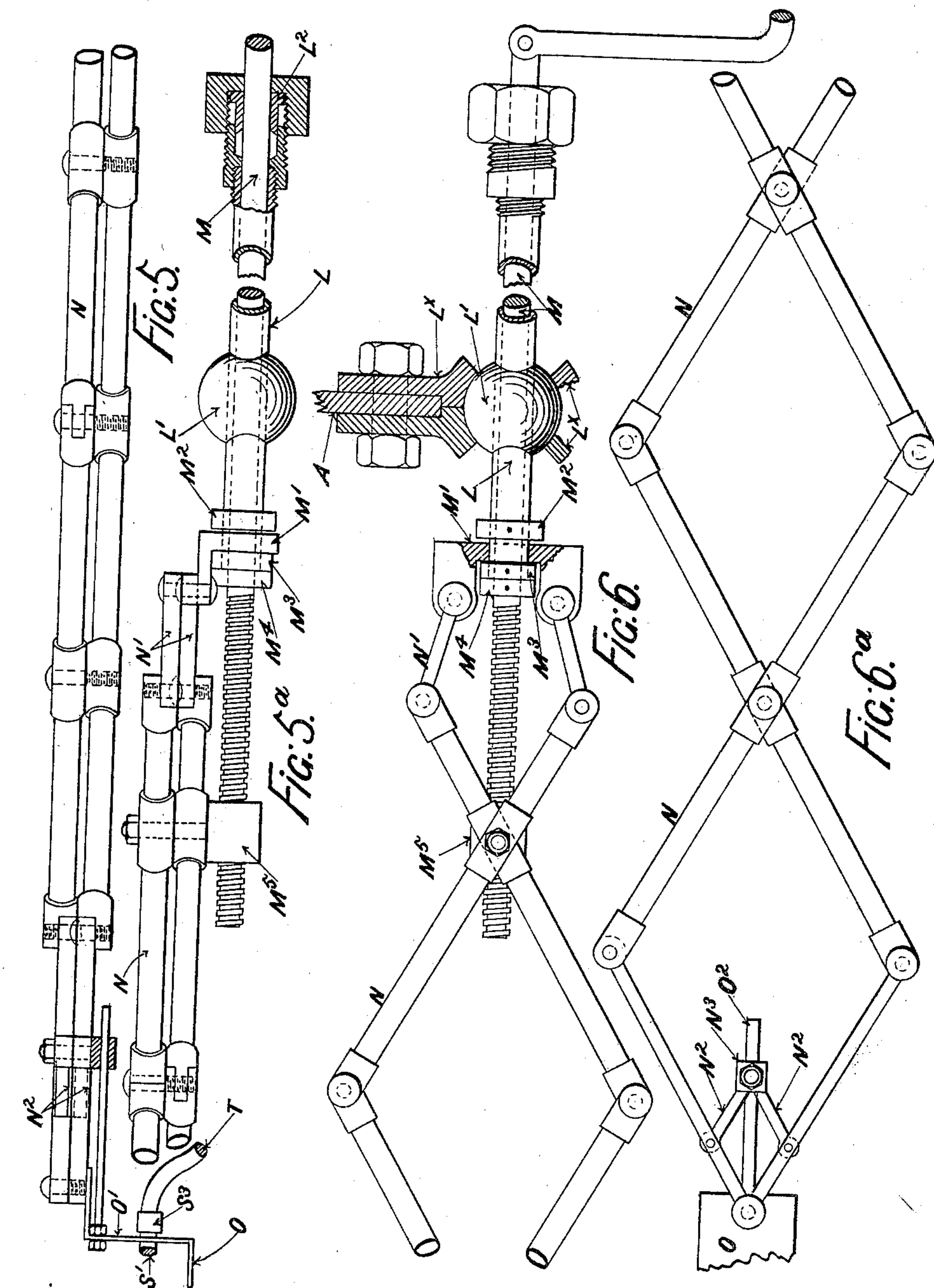
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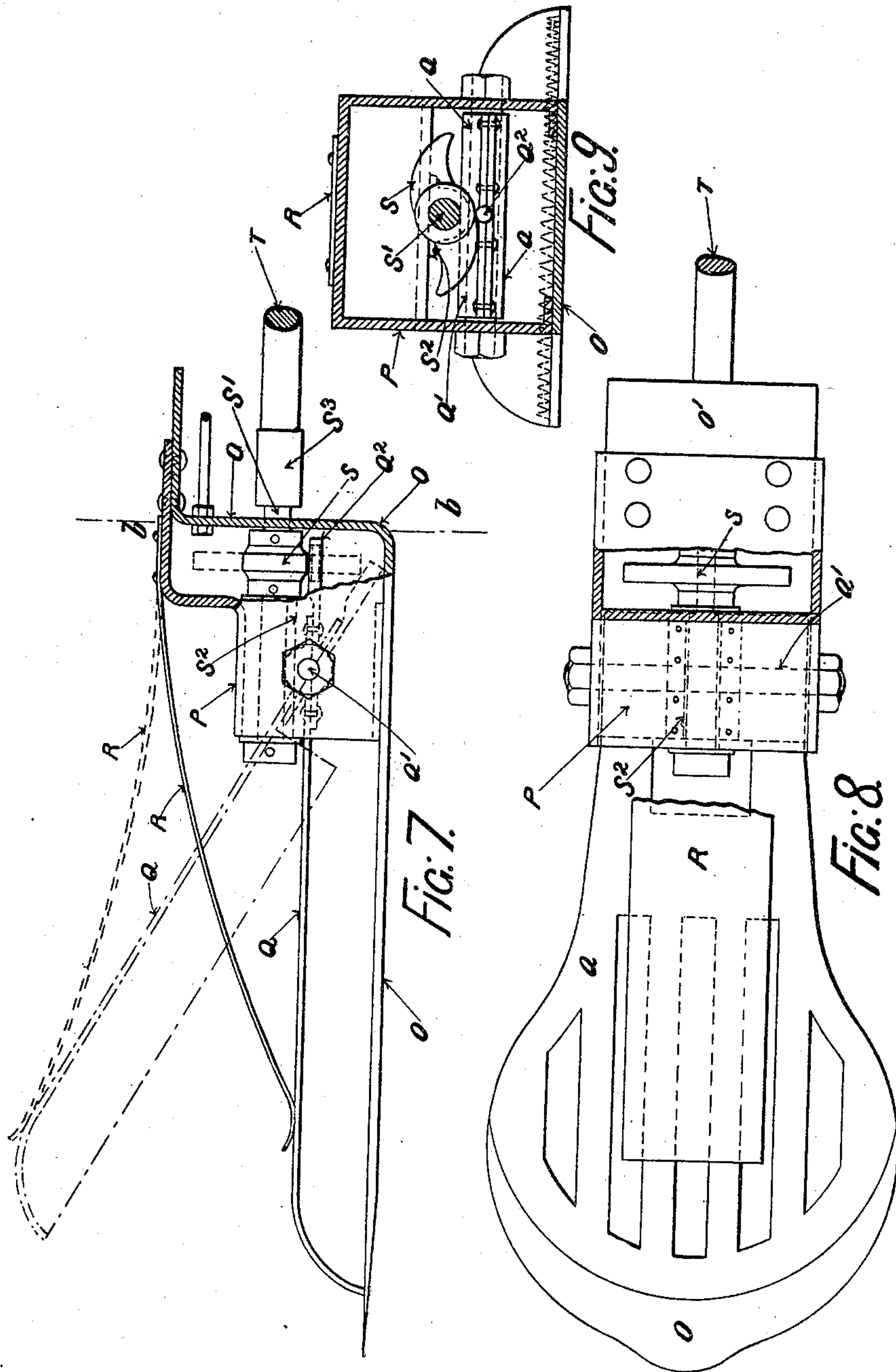
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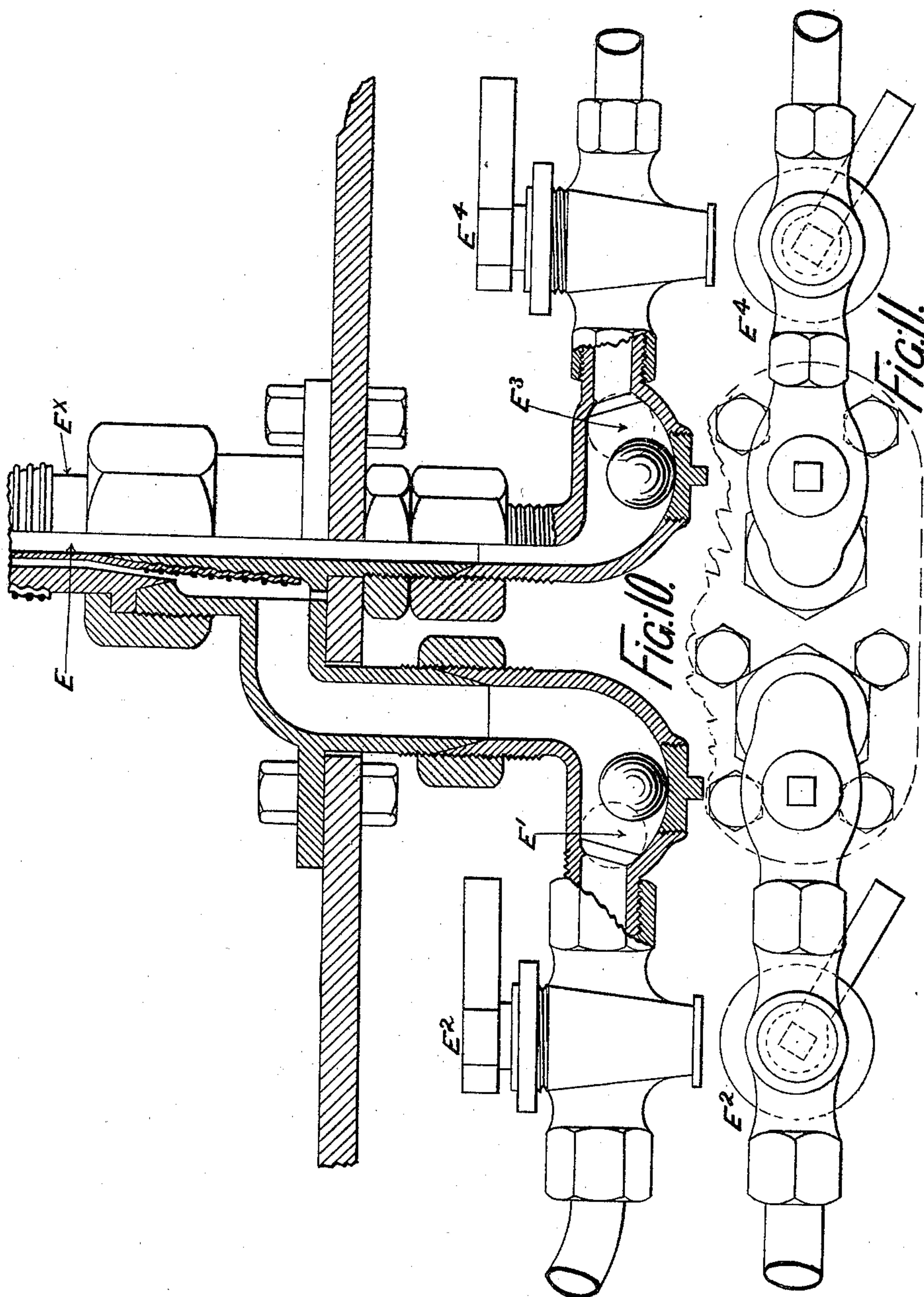
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Witnesses

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# UNITED STATES PATENT OFFICE.

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## SUBMARINE VESSEL OR DIVING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 622,529, dated April 4, 1899.

Application filed May 2, 1898. Serial No. 679,531. (No model.)

*To all whom it may concern:*

Be it known that I, CARRICK PAUL, civil engineer, a subject of the Queen of Great Britain, residing at Carrington avenue, Hurstville, near Sydney, in the British Colony of New South Wales, have invented new and useful Improvements in Submarine Vessels or Diving Apparatus, of which the following is a specification.

This invention relates to submarine vessels or diving apparatus specially devised for working under water in comparatively great depths, and so as to be practically safe and easy in operation.

The submarine vessel or diving apparatus to which the present improvements refer is of the kind in which the operators are "housed" in a shell or inclosure which is in communication with the atmosphere above the level of the water; and the present improvements have been specially contrived to enable the operators to have better control than heretofore over the lowering and raising of the vessel and its movement generally and to provide the operators with more effective and more easily manageable tools or grips than heretofore.

According to this invention, besides the main vessel or shell or inclosure for the operators, there is a second but smaller vessel, hereinafter referred to as the "auxiliary" vessel, which can be extended outwardly of the main vessel and withdrawn inwardly into the main vessel in order to increase the displacement of the whole, so that the vessel will rise, or to lessen the displacement, so that the vessel will sink. The joints between the auxiliary and main vessels are practically air-tight and waterproof, while the inner end of said auxiliary vessel is open to the main vessel and draws its supply of air therefrom. In combination with the main vessel there is arranged a sliding dead-weight, so that the center of gravity of the apparatus may be altered at will to suit its level or its inclination to the operation performed. At the opposite end of that from which the auxiliary vessel protrudes, hereinafter referred to as the "front" or "forward" end, is the gear for lifting and gripping, such being of peculiar construction,

as hereinafter particularly described, and at this forward end also are windlasses outside of the vessel capable of being revolved from within, so that the vessel may be easily maneuvered by means of warps from moorings or the like. In combination with the main vessel there is a dome or entrance extension on which is tightly fixed a door or cover adapted to be released from the inside and from the outside, and in combination with the vessel is a safety connection for the air supply and escape pipes, which is self-closing under stress of outside pressure.

In order that this invention may be clearly understood, reference is now made to the drawings herewith, in which—

Figure 1 is a longitudinal sectional elevation of a submarine vessel or diving apparatus constructed according to these present improvements. Fig. 2 is an elevation of the front end. Fig. 3 is a cross-section on the line *a a* of Fig. 1, and Fig. 4 is a view of the end hereinafter referred to as the "back" end. Figs. 5 and 5<sup>a</sup> are enlarged side views of the gripper-arms, and Figs. 6 and 6<sup>a</sup> are plans of the same. Fig. 7 is a part-sectional elevation of the gripper-jaws. Fig. 8 is a part-sectional plan of the same. Fig. 9 is a transverse section of the same on the line *b b* of Fig. 7. Figs. 10 and 11 are respectively an elevation, partly in section, and an inverted plan of safety-valve connections between the vessel and the air supply and escape pipes.

A is the main vessel, preferably cylindrical in form, having at the front end thereof dome or entrance-way B. On top of this dome B is a water-tight door or cover B', sitting upon ring B<sup>2</sup>, hinged at B<sup>3</sup> and pressed air-tightly upon top flange of dome B by screw B<sup>4</sup>. Internally of it and taking under the ring B<sup>2</sup> is a dog B<sup>5</sup>, by means of which and ring-screw B<sup>6</sup> the cover B' is caused to make an air-tight joint on ring B<sup>2</sup>. If at any time it is necessary for the operators to make an exit from the vessel A without assistance from outside, by unscrewing screw-bolt B<sup>6</sup> the dog B<sup>5</sup> is loosened and the cover B' pushed outwardly and away from the ring B<sup>2</sup> to provide a way for such exit.

Extending from the back end of the vessel



A inwardly to a ring-support C' is an annular channel or chamber C<sup>2</sup>, blocked at the inner end and formed of shell C<sup>3</sup> and inner shell C<sup>4</sup>, said inner shell C<sup>4</sup> being blocked at its outer  
 5 end. In this annular channel, between shells C<sup>3</sup> and C<sup>4</sup>, takes the inner end of a dome-shaped cylinder or casing forming the auxiliary vessel C, which is adapted to travel longitudinally in said channel, so that it may be  
 10 extended outwardly of the main vessel A and be withdrawn from any extended position. Joining the shell C<sup>3</sup> with the back end of the vessel A is an annular bracket (or rather stuffing-box) C<sup>5</sup> for the reception of a gland C<sup>6</sup>  
 15 around the vessel C, so as to make a water-tight joint between the back end of vessel A and said secondary vessel C. The gland C<sup>6</sup> is tightened in the stuffing-box C<sup>5</sup> by means of a series of studs and nuts, one of which is  
 20 shown and marked C<sup>7</sup>. The auxiliary vessel C is extended and drawn in by means of an internally-threaded ram or pole D, extending from the dome end through the back or blocked end of shell C<sup>4</sup> to close up to the end  
 25 inner end of said shell C<sup>4</sup>. On this end of the shell C<sup>4</sup> is a central bearing D<sup>2</sup>, supporting the inner end of the screw-ram D', which for the purpose of passing therethrough a shaft or spindle to carry a screw-propeller is made  
 30 hollow. On the back or blocked end of auxiliary vessel C<sup>4</sup> is a stuffing-box C<sup>8</sup>, in which takes gland C<sup>9</sup> for making a tight joint around the ram or pole D. This gland C<sup>9</sup> is tightened from the inner end of the shell C<sup>4</sup> by means  
 35 of nuts C<sup>10</sup> on long studs C<sup>11</sup>, on which are the sleeves or tubes C<sup>12</sup>, so that when the nuts C<sup>10</sup> are tightened such sleeves or tubes will force said gland C<sup>9</sup> into said stuffing-box C<sup>8</sup>. The sleeves and studs are supported by and  
 40 form guides for the inner end of the ram or pole D by reason of passing through star bracket or flange C<sup>13</sup>. It will be seen from the above that no matter how the auxiliary vessel C may be moved longitudinally out-  
 45 wardly or inwardly by means of the ram or pole D and screw-ram D' impassable joints are maintained between the outer water and the interior of the vessel. The screw-ram D' carries on its inner end a worm-wheel D<sup>3</sup>, in  
 50 which gears the worm or endless screw D<sup>4</sup> in bearings on brackets D<sup>5</sup>. On the end of the spindle of said worm or endless screw D<sup>4</sup> is a pulley D<sup>6</sup>, around which and around a hand-wheel D<sup>7</sup> in a convenient situation in the vessel  
 55 A is an endless chain or belt, so that by revolving said hand-wheel D<sup>7</sup> the screw-ram D' is revolved within the female thread of the ram or pole D to longitudinally move the vessel C as may be desired.  
 60 At a convenient part on the top of vessel A is fixed the safety connection of the air-supply pipe E, (from the surface,) which pipe E is inside of the air-escape pipe E<sup>x</sup>, which branches to self-closing ball-valve E' at back  
 65 of cock or valve E<sup>2</sup>. The supply-pipe bends to self-closing ball-valve E<sup>3</sup> and in front of cock or valve E<sup>4</sup>. Upon any inrush of water,

&c., owing to accident, the balls close their respective valves E' and E<sup>3</sup>, and thus give the operators in the vessel opportunity to  
 close the cocks or valves E<sup>2</sup> and E<sup>4</sup> and prevent flooding, &c., of the vessel.

In the vessel A is a weight F, sliding on a rod F', which is held at each end by brackets or pillars, as shown. This weight F can be easily  
 shifted longitudinally by hand, as may be desired, to balance any extension or withdrawal  
 of the auxiliary vessel C to balance the vessel A and its extension C and to alter the  
 level or inclination of the whole vessel, as  
 may be desired or required.

Where necessary, the vessel A, particularly at the front end and in any convenient situation, has ports or light-holes, (marked J,) and such ports or light-holes can be placed where  
 convenient in the sides—say as shown at J'. If necessary or desirable, a screw-propeller  
 may be placed at the back end of the vessel—that is, at the back end of the auxiliary vessel  
 C—in which case a shaft, as shown by  
 dotted lines, is passed through the hollow screw-ram D' and through a stuffing-box at  
 the outer end of the ram or pole D, as shown by dotted lines. This shaft of the screw-propeller  
 may be revolved or operated in a similar  
 manner to that which has been described in  
 reference to the screw-ram D'.

The lifting and operating appliances comprise a special arrangement of lazy-tongs extension-pieces, on the outer end of which, operated by a handle inside the vessel, are jaws or grippers also operated internally of the vessel, though by independent devices. On the front end of the vessel A is the socket  
 part L<sup>x</sup> of a ball-and-socket joint, the ball  
 part L' being upon a pipe L, on the end of which is a stuffing-box and gland L<sup>2</sup>, and through which passes rod M. On the outer  
 end of this pipe L is carried a bracket or L-piece M', fitted thereto by means of the collars  
 M<sup>2</sup> and M<sup>3</sup>. The rod M is screwed at the end after passing through the bracket M' and  
 collar M<sup>4</sup>, and it passes through a nut M<sup>5</sup>, pivoted to the first joint of the lazy-tongs extension.  
 From the bracket M' short links N' are connected to the inner end of the lazy-tongs  
 extension N. This lazy-tongs extension N is constructed generally as shown in the drawings,  
 and it terminates after as many cross-joints as may be convenient at a point at  
 which is attached the back end O' of the bottom grip O, which is bent downwardly, as  
 shown. Just inwardly of this connection are pivoted short links N<sup>2</sup>, carrying a pivoted  
 guide N<sup>3</sup> over the tail O<sup>2</sup> of the back end O' of the gripper O. To the bent back end O'  
 of the bottom gripper O is affixed the box-piece P, carrying the pivot-bolt Q' of the upper  
 jaw or gripper Q, and also covering the devices by which this upper jaw Q is opened  
 from or closed upon the lower gripper O. To this box-piece P is also affixed the inner end  
 of spring R, adapted to press the upper jaw Q toward or onto lower gripper O. Attached



to the inside of box-piece P is a bearing S<sup>2</sup> for the spindle S', on which is cam S. The inner end of said spindle S' after passing through the back end O' of the bottom gripper O has a union S<sup>3</sup>, to which is attached the outer end of a flexible shaft T. The upper gripper Q extends backwardly of its pivot Q' and terminates in a tailpiece Q<sup>2</sup>. Upon revolution of flexible shaft T the cam S presses upon and revolves upon the tail Q<sup>2</sup> and so elevates the front or outer end of the gripper Q, opening the pair of grippers, which being placed on the article or other thing to be lifted or operated upon and the flexible shaft T being further operated the spring R will press the gripper Q toward the gripper O and cause said grippers to grip said article between them. The edge of the upper gripper Q is preferably serrated, as shown, and both the grip Q and the grip O are perforated or have orifices of various forms, as shown. The flexible shaft T extends backwardly from the front end of the lazy-tongs extension to a union on the spindle T', which passes through stuffing-box and gland T<sup>2</sup> and terminates in handle T<sup>3</sup>. The operating of said handle T<sup>3</sup> by the persons in the vessel A will open and close the grippers or grips as said persons may desire. The windlass-barrels U are carried in bearings U' on brackets U<sup>2</sup>, and have upon their ends beveled tooth-wheels U<sup>3</sup>, in each of which gears the respective beveled pinion V' on the end of spindle V, passing through gland and stuffing-box V<sup>2</sup> and terminating in hand-wheel V<sup>3</sup>. The revolution of said hand-wheel V<sup>3</sup> by the operators will revolve its particular windlass-barrel and so wind or unwind the warp from mooring-anchors or the like to shift the position of the submarine vessel.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a submarine vessel or diving apparatus, the combination with a main vessel A provided with inner concentric shells C<sup>3</sup>, C<sup>4</sup>, stuffing-box C<sup>5</sup> and gland C<sup>6</sup>, of an auxiliary vessel C adapted to slide between said shells, and mechanism for protruding and retracting said auxiliary vessel to vary the displacement of the whole apparatus, substantially as described.

2. In a submarine vessel or diving apparatus, the combination with a main vessel A, inner concentric shells C<sup>3</sup>, C<sup>4</sup>, stuffing-box C<sup>5</sup>, gland C<sup>6</sup>, and auxiliary vessel C adapted to slide between said shells, of a tubular ram or pole D attached to the closed end of said auxiliary vessel, stuffing-box C<sup>8</sup>, gland C<sup>9</sup>, screw-

ram D' geared with the interior of the tubular ram D, and means for revolving said screw-ram D', substantially as described.

3. In a submarine vessel or diving apparatus, the combination with a main vessel A, and an auxiliary vessel C adjustably supported in said main vessel and having fluid-tight connection therewith, of a tubular ram or pole attached to the closed end of the said auxiliary vessel, a screw-ram D' geared with the interior of said tubular ram, and gearing for revolving said screw-ram, to protrude or retract the auxiliary vessel, substantially as described.

4. In a submarine vessel or diving apparatus, the combination with the entrance-dome B, of a ring B<sup>2</sup> hinged to the top of said dome at one side, a cover B' seated upon said ring, a dog B<sup>5</sup> adapted to engage the under side of said ring within the dome, a screw-bolt B<sup>6</sup> accessible from the inside of the dome and connecting said cover and dog, whereby the cover and the ring and the dog are movable together on the hinge B<sup>3</sup> of said ring, a screw B<sup>4</sup> located on the outside of the dome opposite said hinge, and a nut to clamp the said cover and ring onto said bolt and accessible from the outside of the dome, substantially as described.

5. In a submarine vessel or diving apparatus, the combination with a ball-jointed tube L, and lazy-tongs N carrying grippers at one end, of a screw-rod M, extended through said tube and connected with the lazy-tongs to actuate the same, substantially as described.

6. In a submarine vessel or diving apparatus, the combination with the lazy-tongs N, of a bottom-gripper O and spring-gripper Q, and mechanism adapted to be actuated from within the said vessel to open the spring-gripper away from the bottom-gripper, substantially as described.

7. In a submarine vessel or diving apparatus, the combination with the gripper O and spring-gripper Q having tailpiece Q<sup>2</sup>, of the cam S having connection to a flexible shaft connected to operating mechanism in the interior of the vessel, substantially as described.

8. In a submarine vessel or diving apparatus, the combination with the windlass-barrel U carried in bearings outside the vessel, of spindles V connected with the shaft of said windlass by bevel-gearing, and stuffing-boxes for said spindles, substantially as described.

Dated this 22d day of March, 1898.

CARRICK PAUL.

Witnesses:

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