No. 725,570. PATENTED APR. 14, 1903.

S. LAKE.

OBSERVING TUBE FOR SUBMARINE BOATS.

APPLICATION FILED DEC. 13, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

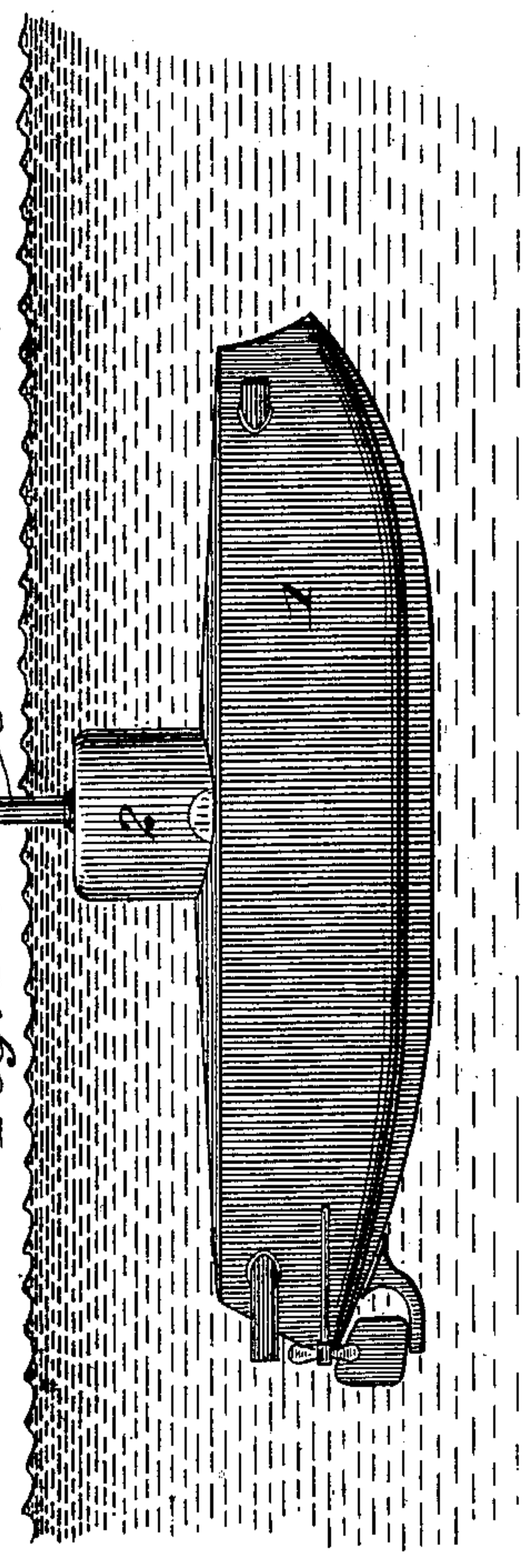
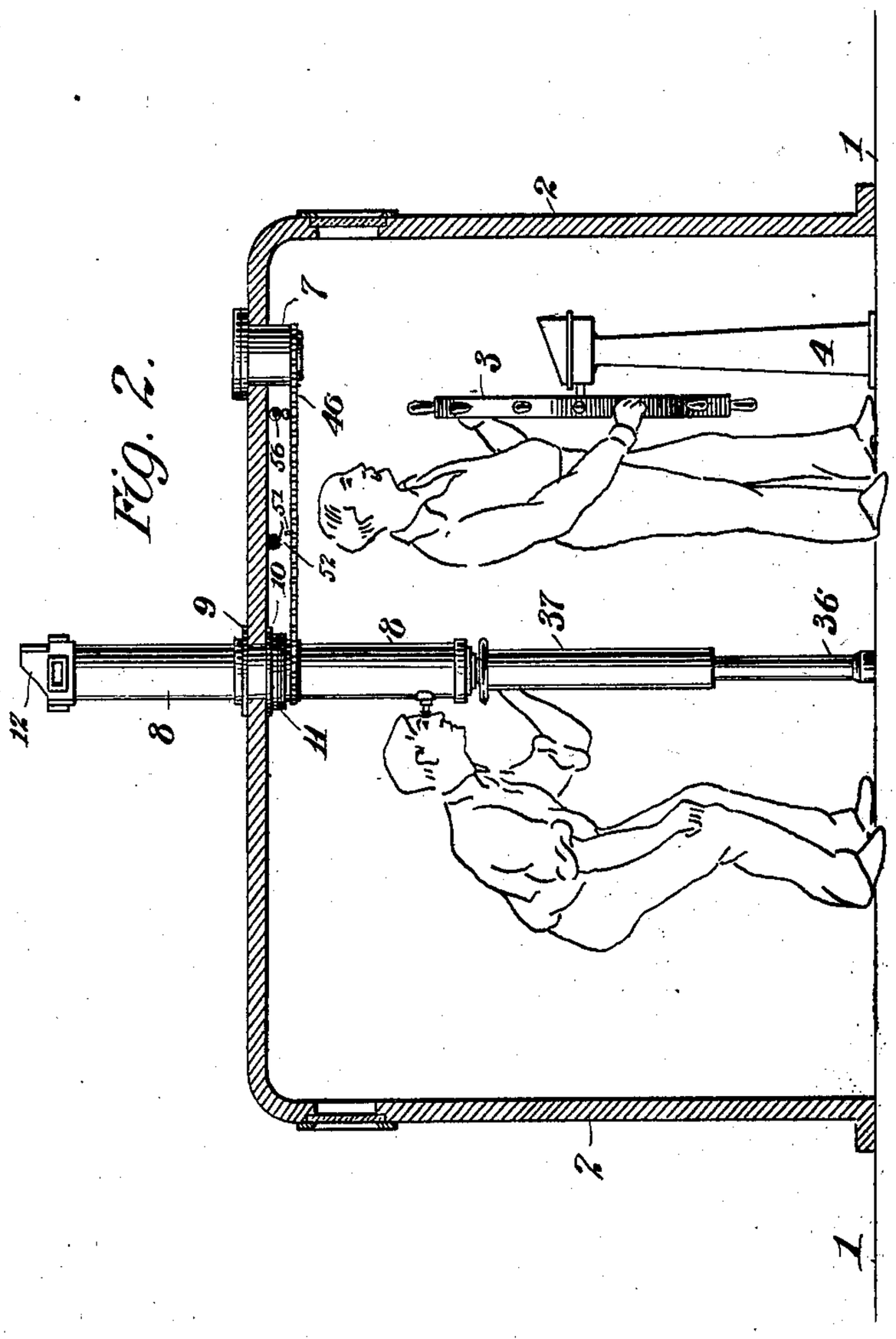


Fig. 2.



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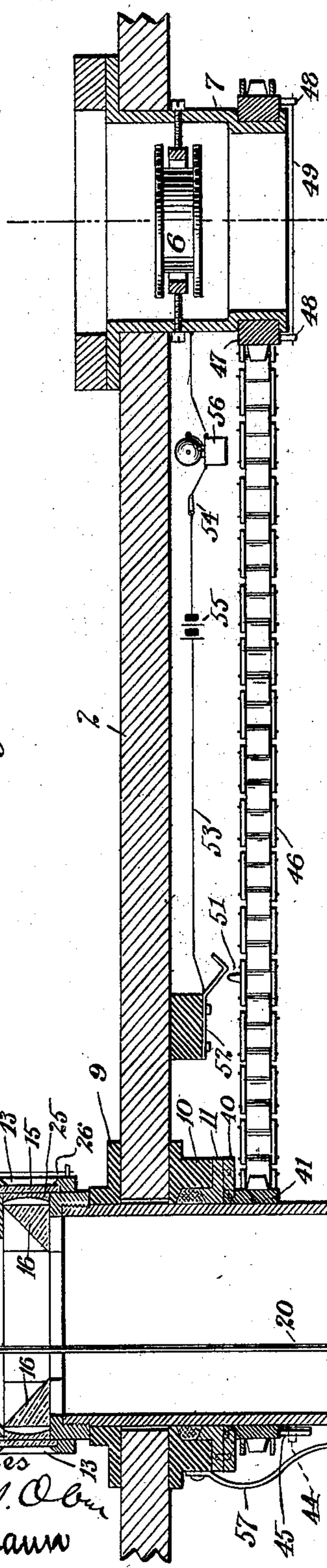
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.



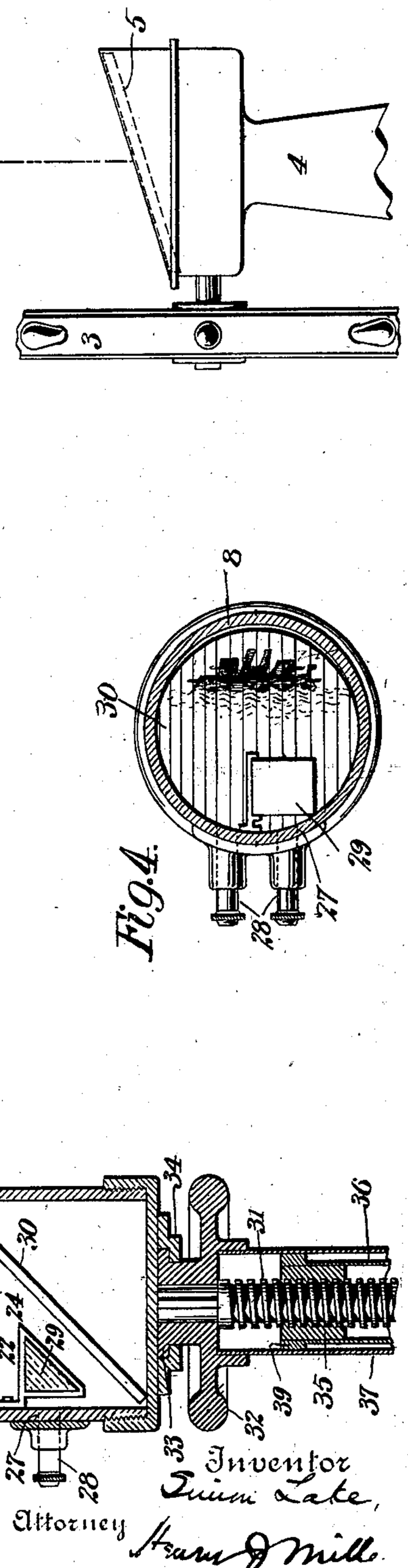


Fig. 4.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 7.

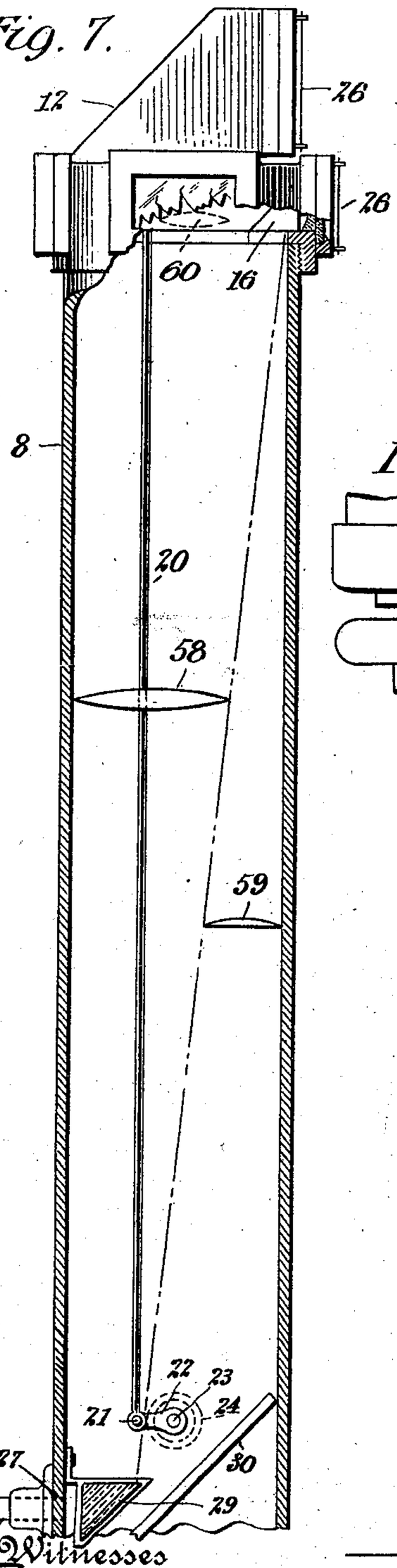


Fig. 6.

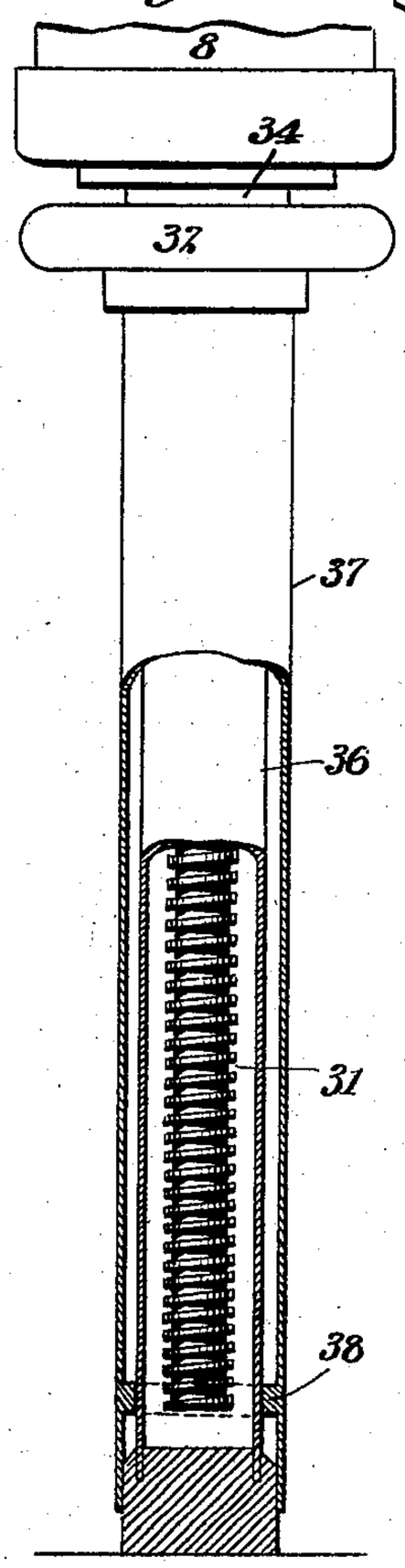
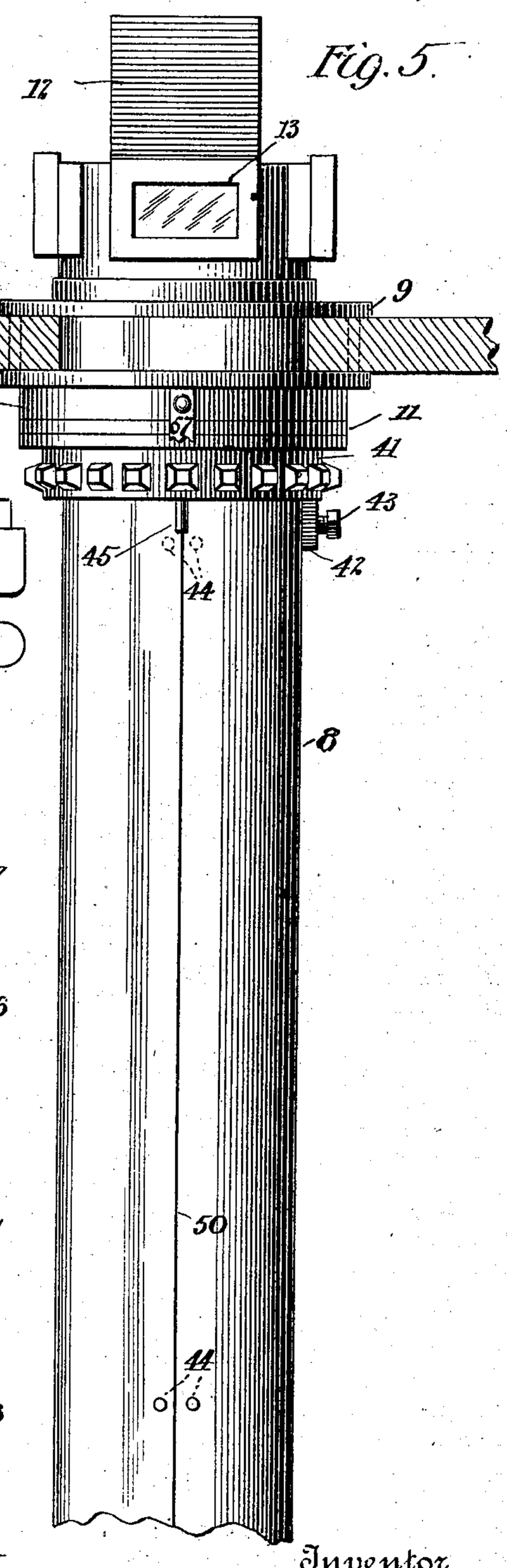


Fig. 5.



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UNITED STATES PATENT OFFICE.

SIMON LAKE, OF BRIDGEPORT, CONNECTICUT.

OBSERVING-TUBE FOR SUBMARINE BOATS.

SPECIFICATION forming part of Letters Patent No. 725,570, dated April 14, 1903.

Application filed December 13, 1902. Serial No. 135,055. (No model.)

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 Observing-Tubes for Submarine Boats, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention has for its object to provide a submarine torpedo-boat with means whereby the occupants may take observations throughout the horizon above the surface of water while the boat remains wholly submerged beneath the surface, and of insuring precision of aim of its torpedoes at a hostile vessel without disclosing its whereabouts to the occupants of the latter.

To this end the invention consists partly in an observing-tube having in its upper or outer end means for receiving an image of an external object from any direction and reflecting it downwardly into the interior of the boat, either or both by the rotation of the tube and by a special arrangement of mirrors or reflectors covering partially or wholly the entire horizon, partly in devices for measuring the distance of such object from said boat, partly in a special telescopic arrangement of lenses in said device for affording a closer inspection of the object toward which the same is directed, partly in means for indicating to the steersman and gunner the direction of the hostile vessel in respect of said boat, and partly in particular constructive features and arrangements of the operative parts of such devices.

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

Figure 1 is an elevational view of a submerged submarine boat, showing the present improvement in operation. Fig. 2 is a longitudinal vertical section of the conning-tower or turret and apparatus contained therein, upon an enlarged scale. Fig. 3 is a longitudinal sectional elevation, upon a still larger scale, showing the upper and lower portions of the observing-tube, (of which the middle portion is removed,) also the compass-case having a rotary filament-holding ring, with which said tube has a chain-and-sprocket connection, and the steering-wheel. Fig. 4 is a sectional plan view taken on line $x\,x$ of Fig. 3. Fig. 5 is a view of the upper portion of the apparatus in external elevation, as seen from the left of Fig. 3; and Fig 6 is a similar view, partly in section, at the lower end to expose the internal construction of the supporting-stand for the observing-tube, showing also the base of said tube resting thereon. Fig. 7 is an elevation, partly in section, of the observing-tube, showing magnifying-lenses interposed between the reflecting-surfaces intermediate the upper and lower ends of said tube.

The boat 1 is shown provided with a conning-tower or turret 2, containing the steering-wheel 3, upon the supporting-column 4 of which is an inclined mirror 5, by means of which the steersman is enabled to see and read the compass 6, which is pivotally mounted, as usual, by means of gimbals in the compass-case 7, depending from the roof of the conning-tower.

The observing-tube 8 is inserted in a hole in the top of the conning-tower and is closely embraced by but adapted to be revolved within a stuffing-box of which the stationary member comprises the two clamping-rings 9 and 10, the latter of which has an annular cavity containing the usual packing, which is confined by the gland or follower 11.

The upper or outer end of the observing-tube is provided with a headpiece or hood 12, in which is shown a series of four lateral openings 13, arranged at the same level, and an additional lateral opening 14, facing in the same direction as one of those of the series but disposed above the same, each of such lateral openings being closed by a glass plate 15 to exclude water when the hood is submerged. At each of the lateral openings 13 of the series is arranged a glass prism 16, having its reflecting-face inclined at such an angle with the axis of the observing-tube that an image of an external object received through its respective opening will be reflected downwardly through the tube into the interior of the conning-tower for the inspection of the observer or lookout, as will hereinafter appear. At the lateral aperture 15 in the hood 12 is a similarly-disposed reflecting-prism 17, which is not stationary, like the prisms 16, but is mounted adjustably by means of the metallic frames 18, embracing its ends, and supported in the hood by means of pivots 19 and an adjusting-rod 20, having its upper end connected with one of said frames 18 eccentric to its pivot and its lower end con-

nected with the pin 21 of a crank-arm 22 upon the end of a rotary spindle 23, passing through the wall of the tube 8 and provided upon its outer end with a hand-wheel 24. By turning the hand-wheel 24 the prism 17 may be tilted upon its bearing-centers 19 to compensate for any possible defect in the trim of the vessel, the friction of the spindle 23 in the wall of the tube insuring the maintenance of the prism in any of its adjustments, although positive holding means may be employed when desired.

Intermediate each glass 15 and prism 16 of the series is shown interposed a plano-concave lens 25, which gives to the prism behind it a range of vision of the required extent so that the series will together cover the entire horizon and reflect downwardly through the observing-tube an image of any object within seeing distance in any direction from the boat. While it is considered preferable to construct each prism with a flat reflecting-face and to employ in conjunction therewith a condensing-lens of the required power in order that the prisms of the series may together form a compound member of the required character, such parts may, if desired, be formed of a single piece of glass in prismatic form.

The single prism 17 is shown formed with flat faces, and therefore adapted to reflect an image downwardly through the tube upon the same scale as the object would be viewed by the naked eye of the observer, and it is designed to have a much smaller visual angle, even if similarly provided with a condensing-lens, than the combination reflecting member 16 25 of the series, which latter obviously reduces the scale of the image which it reflects downwardly through the tube 8, and hence the former may be termed a "narrow-angle" reflector or reflecting-prism and the latter a "wide-angle" reflector or reflecting-prism.

In order that the field of vision of the narrow-angle prism may be readily brought into register with the center of that of the primary wide-angle prism 16 beneath it, which is similarly directed, the wide-angle prism or both of said prisms are or may be provided directly in advance of their central points with vertical filaments 26, as indicated in Fig. 3, by which means the revolution of the tube 8 to bring the lower filament directly in line with the center of the external object sighted will enable the lookout to center the field of the smaller-angle prism thereon for a closer inspection than may be secured by the wider-angle reflector.

The observing-tube 8 is shown provided in its lower or inner end portion with two lateral apertures 27 upon the side opposite the upper lateral opening 14, to each of which apertures may be applied a telescopic eyepiece 28 for magnifying the images reflected downwardly through the tube from the upper lateral openings to the prism 29, located opposite the right eyepiece and the graduated speculum or mirror 30 behind it, the effective surfaces of both of such reflectors being inclined upwardly and backwardly in respect of said eyepieces through which their respective images are visible.

In the form of the improvement illustrated in Figs. 1 to 6, inclusive, the primary wide-angle prism 16 is so arranged in relation to the graduated speculum or mirror 30 that the image reflected by it will be directed thereupon, as illustrated in Fig. 4, while the relative dispositions of the narrow-angle prism 17 and the other prisms 16 of the series with reference to the lower prism 29 is such that all the images therefrom are received by the latter in their relative positions and reflected through the lateral aperture 27 into its respective eyepiece 28. Thus with the present improvement the lookout or observer, who would preferably be the captain of the vessel, having full power to direct the entire operation of the craft, may scan with one eye simultaneously every portion of the entire horizon and also more closely inspect the vessel toward which the instrument may be directed, while with the other eye he may measure its distance away, being thus able to identify the vessel, and therefore to determine its known actual length, which by comparison with the length of the image measured upon the speculum 30 renders it a simple matter to calculate its distance from the boat or to determine the same by reference to a suitable table which may be prepared for use under such conditions. Although the parallel lines of the scale upon the speculum are represented in Fig. 4 as disposed equidistant and lying in vertical planes parallel with the axial lines of the eyepieces 28 merely for the purposes of illustration, it is evident that the graduations would be in practice properly calibrated by actual trial, so as to insure accuracy in the measurement of distances.

The rigid cylindrical casings of the eyepieces 28 may serve as handles for use in turning the tube 8 to enable it to maintain its primary reflector or reflecting-face trained upon the external object being observed; but it is evident that special handles may be provided at the lower end of the tube for the purpose.

The observing-tube is adapted to be raised and lowered to place it, respectively, in operative and inoperative position by means of a jack-screw 31, to the upper end of which is keyed the hub of a hand-wheel 32, attached to the lower end of the tube 8 by a swivel-joint formed by a flange 33 on said hub and a flanged ring 34 of the said tube, the said screw having fitted thereto a nut 35, mounted in the upper end of a tubular stand 36, attached to and resting upon the floor of the conning-tower, which receives the thrust of the screw when manipulating the hand-wheel to operate the observing-tube.

Surrounding the stand 36 is a tubular guard

or sheath 37, closely embracing said stand, either directly or by means of distance pieces or rings 38 and 39, the former being attached to or formed upon the interior of the lower end of the guard 37 and the latter to the exterior of the upper end of the stand 36, said guard being rigidly secured within a socket in the hub of the hand-wheel 32. By turning the hand-wheel for operating the screw the latter, with the attached observing-tube, is raised or lowered, the guard 37 protecting the occupants of the conning-tower from contact with the screw and also serving materially to steady the observing-tube by reason of its greater surface of contact with the stand 36 than the screw 31.

In order that the lookout may indicate with certainty to the steersman the exact direction of a hostile vessel or other external object from the submarine boat, the device now to be described is employed.

Secured to the follower 11 is shown a fastening-ring 40, having an annular rabbet in which is fitted a flange upon the hub of a sprocket-wheel 41, which latter is fitted also to the exterior of the tube 8, which is movable vertically through the same. The hub of this sprocket-wheel is provided with a depending lug 42, carrying a set-screw 43, by which the sprocket-wheel may be fixed to rotate with the tube 8 in any of the latter's positions of vertical adjustment, while in its extreme raised position two lateral pins or studs 44 upon its lower portion are caused to straddle a pin 45, depending from the hub of the sprocket-wheel 41 to establish a positive driving connection therewith. The sprocket-wheel 41 is connected, by means of a metallic chain 46, with a sprocket-wheel 47, of equal size, fitted to and revoluble in respect of the compass-case 7, by which it is sustained. The sprocket-wheel 47 carries two depending pins 48, between which is stretched a filament 49, extending across the center of the field of the compass and intermediate the compass 6 and the steersman's mirror 5. The driving-sprocket 41 is coupled to the tube 8 for operation by first turning the tube, so that its fore-and-aft line 50 corresponds in relation to the vessel's center-line with that of the compass when the set-screw 43 is tightened or the clutch-pins 44 and 45 brought into engagement, as the case may be, and the turning of the observing-tube thereafter to direct its principal narrow-angle prism having the vertical filament 26 upon the exterior object, with both filaments crossing the center of the latter, will cause a corresponding movement of the sprocket-wheel and filament-holding ring 47, which clearly indicates to the steersman, by means of his mirror 5, the exact direction of the object, as well as the relation of the course in which he is steering to it.

In order to insure the firing of the torpedo directly at the mark at which the observing-tube is pointed, the chain 46 is provided with a contact-stud 51, which when the tube is directed precisely in the fore-and-aft line of the vessel makes contact with an insulated contact-spring 52, connected by an electric conductor or conducting-wire 53, through a suitable switch or push-button 54, with an electric battery 55, an electric bell or other indicator 56 being also interposed in the circuit, of which one terminal is grounded upon the wall of the vessel with which the other, consisting of the stud 51, is also metallically connected through the sprocket-wheels 41 and 47 and the observing-tube and compass-case. It is evident that as the observer continues to follow the hostile vessel or other target with the observing-tube and the steersman turns the course of the vessel to the direction indicated by the filament 49 the electrical alarm-circuit will be closed by the contact of the stud 51 with the contact-spring 52, the switch 54 having previously been closed. The ringing of the alarm-bell thus indicates positively that the course of the vessel is directly toward the object to be attacked and apprises the gunner with certainty of such times at which he may properly operate the torpedo-ejecting apparatus.

In order to provide a gage for setting the observing-tube in initial axial position, a stationary pointer or indicating-finger 57 is attached to the ring 10, the rotation of the tube to bring its fore-and-aft line 50 into register with which pointer insures the finding of the correct position for the connection thereto of the sprocket-wheel 41.

By reference to Fig. 7 it will be observed that in order to magnify all the images reflected downwardly from the upper prisms upon the lower prism 29 a magnifying-lens 58 may be interposed between the same, in which case an image reflected from the primary wide-angled lens may also be separately magnified and directed upon the speculum 30 by means of the lens 59, or, as indicated in dotted lines in said figure, a lens 60 may be interposed only between the narrow-angled lens 17 and the reflector receiving its image in the lower portion of the observing-tube, as circumstances may demand.

As the boat is required to be propelled rapidly through the water when submerged, as when traveling under surface conditions, it is important that the observing-tube be sustained rigidly in upright position in order that its resistance in the water may not cause it to be disarranged from its normal or operative position, and thus not only reduce its effective elevation above the top of the hull, but throw out of operative relation the reflector or reflectors in its upper or outer end.

Although I prefer to construct the tube with lateral apertures through which the reflecting-prisms may receive laterally and reflect downwardly or inwardly through the tube images of external objects, it is evident that by providing the outer end of the observing-tube with a transparent cap having

the general character of the inspection-dome forming the subject of the United States Patent No. 717,101, granted to me December 30, 1902, such individual apertures for the several reflectors or reflecting-surfaces would not be required.

It will be readily seen that inasmuch as the most important part of the horizon which should be visible to the occupants of the boat when submerged is that part in advance of the boat the prisms or reflectors at the upper or outer end of the observing-tube may each be directed so that collectively they cover only such half of the entire horizon, the apparatus in such case being revoluble or held in fixed axial relation to the boat, as the requirements may determine; but a series of reflectors, having visual angles collectively covering the entire horizon mounted in a revoluble vertically-movable observing tube, as shown and described herein, is considered preferable.

It is to be understood from the foregoing description that the present invention is not limited to any of the details of construction and arrangement of parts above described, nor to the employment of lenses in combination with the inclined reflectors, (each of which may obviously be of any desired or suitable character,) nor to the number and arrangement of such reflectors in either the upper or lower portion of the observing-tube, such matters being in a large degree governed by the requirements of individual cases, the essential feature of the present invention being the provision of the observing tube with a reflector or reflectors in its upper or outer end, so arranged or operated as to adapt it to give an extended view of the horizon.

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

1. The combination with a submarine boat, of an observing-tube passing through the wall of the same and surrounded by a stuffing-box by which it is held rigidly in upright position but is permitted to slide outwardly and inwardly and to be revolved in respect of said boat, a mirror or reflector in the upper or outer end of said tube adapted to receive laterally an image of an external object and to reflect it downwardly through said tube, and means for raising and lowering said tube through its surrounding stuffing-box.

2. In a submarine boat, the combination with an observing-tube passing through the wall of the same surrounded by a stuffing-box and having in its outer end an inclined mirror or reflector for receiving laterally and reflecting inwardly through said tube an image of an external object, of means connected with the inner portion of said tube for moving it outward and inward through said stuffing-box comprising a jack-screw and a stand having a nut fitted thereto, and means for turning one of said parts.

3. In a submarine boat, the combination with an observing-tube passing through the wall of the same surrounded by a stuffing-box and having in its outer end an inclined mirror or reflector for receiving laterally and reflecting inwardly through said tube an image of an external object, of a jack-screw having one end swiveled to the inner end of said tube and provided with means for turning it, and a stand provided at the end adjacent said tube with a nut fitted to said jack-screw for receiving the thrust of the latter.

4. In a submarine boat, the combination with an observing-tube passing through the wall of the same surrounded by a stuffing-box and having in its outer end an inclined mirror or reflector for receiving laterally and reflecting inwardly through said tube an image of an external object, of a jack-screw having one end swiveled to the inner end of said tube and provided with means for turning it, a stand provided at the end adjacent said tube with a nut fitted to said jack-screw for receiving the thrust of the latter, and a guard or sheath rigidly connected with said tube and closely embracing said stand.

5. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with means for simultaneously receiving laterally and reflecting downwardly or inwardly through said tube images of all objects throughout the horizon.

6. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with a plurality of mirrors or reflectors for simultaneously receiving laterally and reflecting downwardly or inwardly through said tube images of all objects throughout that half of the horizon upon one side of said tube.

7. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with a plurality of reflectors or mirrors for receiving laterally and reflecting downwardly or inwardly through said tube images of all objects throughout the horizon.

8. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with an annular series of prisms directed each toward a different portion of the horizon and adapted to receive laterally an image of an external object and to reflect it downwardly or inwardly through said tube.

9. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with a series of prisms directed each toward a different portion of the horizon and adapted to receive laterally an image of an external object and to reflect it downwardly or inwardly through said tube, said observing-tube being revoluble in respect of said boat.

10. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer

end with a series of prisms directed each toward a different portion of the horizon and adapted to receive laterally an image of an external object and to reflect it downwardly or inwardly through said tube, and a series of condensing-lenses of which each lens is disposed in the field of vision of one of said prisms.

11. The combination with a submarine boat, of an observing-tube projecting from the same and provided at its upper or outer end with two inclined mirrors or reflectors each having a different visual angle from the other but directed in the same vertical plane and adapted to receive and to reflect inwardly through said tube an image of an external object.

12. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with two inclined mirrors or reflectors each having a different visual angle from the other but directed in the same vertical plane and adapted to receive and to reflect inwardly through said tube an image of an external object, said observing-tube being revoluble in respect of said boat.

13. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with two inclined mirrors or reflectors each having a different visual angle from the other but being directed in the same vertical plane and adapted to receive and to reflect inwardly through said tube an image of an external object, and a vertical filament arranged in the field of vision of said mirror or reflector having the greater visual angle, said observing-tube being revoluble in respect of said boat.

14. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with a series of prisms of uniform visual angles each directed toward a different portion of the horizon, and a prism having a smaller visual angle directed toward the same portion of the horizon as one of the prisms of said series, each of said prisms being adapted to receive an image of an external object and to reflect it downwardly or inwardly through said tube.

15. The combination with a submarine boat, of an observing-tube revoluble in respect of said boat and provided at its upper or outer end with a series of prisms of uniform visual angles each directed toward a different portion of the horizon, and a prism having a smaller visual angle directed toward the same portion of the horizon as one of the prisms of said series, each of said prisms being adapted to receive an image of an external object and to reflect it downwardly or inwardly through said tube, and a vertical filament disposed in the field of vision of that prism of the series directed toward the same portion of the horizon as said prism having the smaller visual angle.

16. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with a series of prisms of uniform visual angles each directed toward a different portion of the horizon, and a prism having a smaller visual angle directed toward the same portion of the horizon as one of the prisms of said series, each of said prisms being adapted to receive an image of an external object and to reflect it downwardly or inwardly through said tube, and one or more inclined mirrors or reflectors at the inner end portion of said tube for receiving and reflecting said images laterally from said tube.

17. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with a series of prisms of uniform visual angles each directed toward a different portion of the horizon, and a prism having a smaller visual angle directed toward the same portion of the horizon as one of the prisms of said series, each of said prisms being adapted to receive an image of an external object and to reflect it downwardly or inwardly through said tube, and an inclined mirror and a prism with inclined reflecting-face in the inner or lower end of said observing-tube, all but one of the prisms of said series and the narrow-angle prism at the outer end of said tube being arranged to reflect their images upon one of said lower reflecting members and the remaining wide-angle prism adjacent the narrow-angle prism to reflect its image upon the other of said lower members.

18. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with a series of divergently-directed prisms and a single prism directed correspondingly with one of the prisms of said series but having a smaller visual angle, a graduated mirror or reflector in the inner or lower end portion of said tube adapted to receive an image of an external object reflected from the prism of the series directed similarly to the narrow-angle prism and a prism adjacent to the graduated mirror or reflector for receiving and reflecting laterally images reflected from all the other prisms in the other end of said tube.

19. The combination with a submarine boat, of an observing-tube provided at its upper or outer end with a series of divergently-directed prisms and a single prism directed correspondingly with one of the prisms of said series but having a smaller visual angle, an inclined graduated mirror or reflector within the boat beneath said prisms adapted to receive an image of an external object reflected from that prism of the series directed similarly to the narrow-angle prism, a prism adjacent to said graduated mirror or reflector for receiving and reflecting laterally images reflected from all the other prisms at the upper end of said tube, and a magnifying-lens interposed between said narrow-angle prism at the upper end of the observing-tube and the reflecting-face of said lower prism.

20. The combination with a submarine boat, of an observing-tube provided at its up-

per or outer end with a series of divergently-directed prisms and a single prism directed correspondingly with one of the prisms of said series but having a smaller visual angle, an inclined graduated mirror or reflector in the inner or lower end portion of said tube adapted to receive an image of an external object reflected from that prism of the series directed similarly to the narrow-angle prism, a prism adjacent to said graduated mirror or reflector for receiving and reflecting laterally images reflected from all the other prisms at the other end of said tube, and telescopic eyepieces applied to said tube and directed, respectively, toward said graduated mirror and the adjacent prism.

21. The combination with a submarine boat, of an observing-tube having in its upper or outer end two similarly-directed mirrors or reflectors of different visual angles adapted to receive images of external objects and to reflect the same downwardly or inwardly through said tube, a graduated speculum within the boat beneath the said mirrors or reflectors in the upper or outer end of said tube, and a lower mirror or reflector adjacent said graduated speculum and adapted to receive and reflect laterally the image reflected from one of said upper mirrors or reflectors while the image from the other of said upper mirrors or reflectors is received by said speculum.

22. The combination with a submarine boat provided with a steering-wheel, of a revoluble observing-tube rising above the same and provided with an inclined mirror or reflector for receiving an image of an external object and reflecting it downwardly or inwardly through said tube, a revoluble holder carrying a filament or other direction indicator disposed near said steering-wheel, and a connection between said observing-tube and said revoluble holder whereby the rotary movement of said tube communicates a corresponding movement to said revoluble holder.

23. The combination with a submarine boat, of a revoluble observing-tube provided with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, a compass, a revoluble holder carrying a filament or other direction indicator disposed near said compass, and a connection between said observing-tube and said revoluble holder whereby the rotary movement of said tube communicates a corresponding movement to said revoluble holder.

24. The combination with a submarine boat, of a revoluble observing-tube provided with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, and means for indicating the coincidence of the center of the field of vision of said mirror or reflector with the direction of the fore-and-aft line of said boat.

25. The combination with a submarine boat, of a revoluble observing-tube provided with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, a compass, a revoluble holding-ring mounted upon the compass-case and carrying a filament crossing the field of the compass, and a connection between said observing-tube and filament-holding ring for effecting a rotary movement of said members in unison.

26. The combination with a submarine boat, of a revoluble observing-tube provided with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, a vertical filament stretched across the center of the field of vision of said mirror or reflector, and means for indicating the coincidence of the axial relation of said filament to said tube with the fore-and-aft line of said boat.

27. The combination with a submarine boat, of a revoluble observing-tube provided in its upper end with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, a compass, a revoluble holding-ring mounted upon the inclosing case of said compass and carrying a filament diametrically crossing the field of the compass, a connection between said observing-tube and filament-holding ring whereby they effect a rotary movement in unison, an electrical indicator, an electrical circuit comprising a contact device having normally insulated contact members one of which is carried by the connection between the holding-ring and the observing-tube and the other of which is stationary and adapted to engage the first said member only at a single point in the revolution of said connected parts.

28. The combination with a submarine boat, of a revoluble observing-tube provided in its outer end with an inclined mirror or reflector for receiving and reflecting downwardly or inwardly through said tube an image of an external object, a compass, a revoluble holding-ring mounted upon the inclosing case of said compass, a metallic chain and sprocket-wheels connecting said holding-ring and observing-tube, an electric bell, and an electrical circuit comprising a contact device of which one of the insulated members is stationary and adapted for engagement with the movable member which is carried by said chain, whereby the circuit is closed to cause said bell to ring when the initial line of the compass coincides in direction with that of the said filament.

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

SIMON LAKE.

Witnesses:
H. A. KORNEMANN,
H. J. MILLER.