

No. 725,839.

PATENTED APR. 21, 1903.

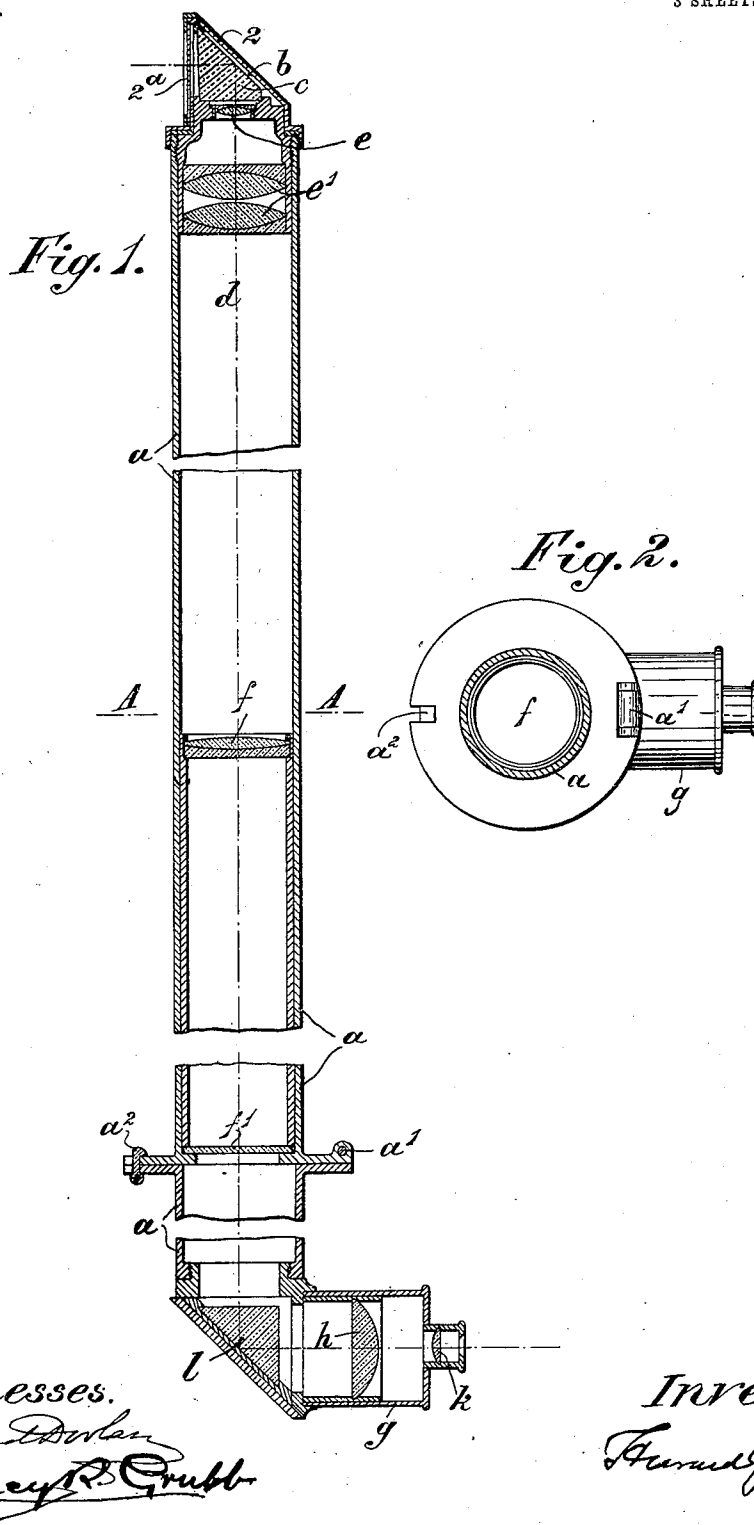
H. GRUBB.

APPARATUS FOR FACILITATING THE SIGHTING OF DISTANT OBJECTS  
FROM SUBMARINE BOATS, BARBETTES, &c.

APPLICATION FILED DEC. 13, 1901.

NO MODEL.

3 SHEETS—SHEET 1.



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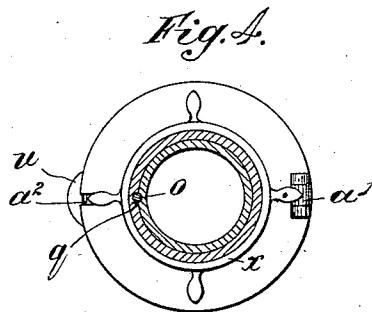
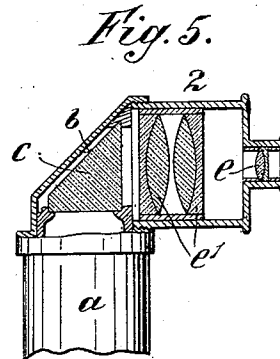
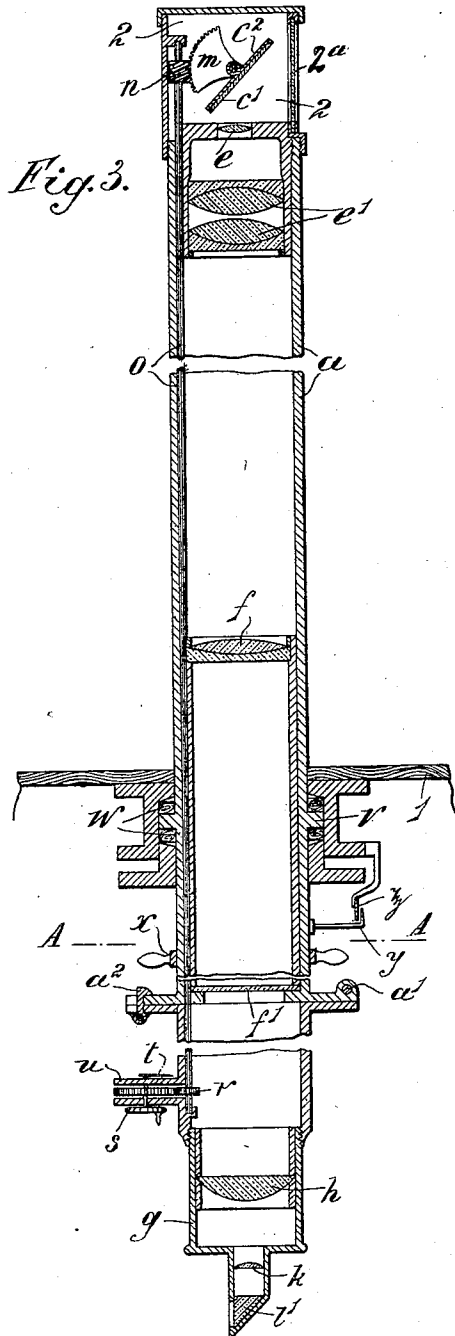
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3 SHEETS—SHEET 2.

NO MODEL.



Witnesses.  
*Edmund D. Doolan*  
*Rowley R. Grubb*

Inventor.  
*Arnold Grubb*

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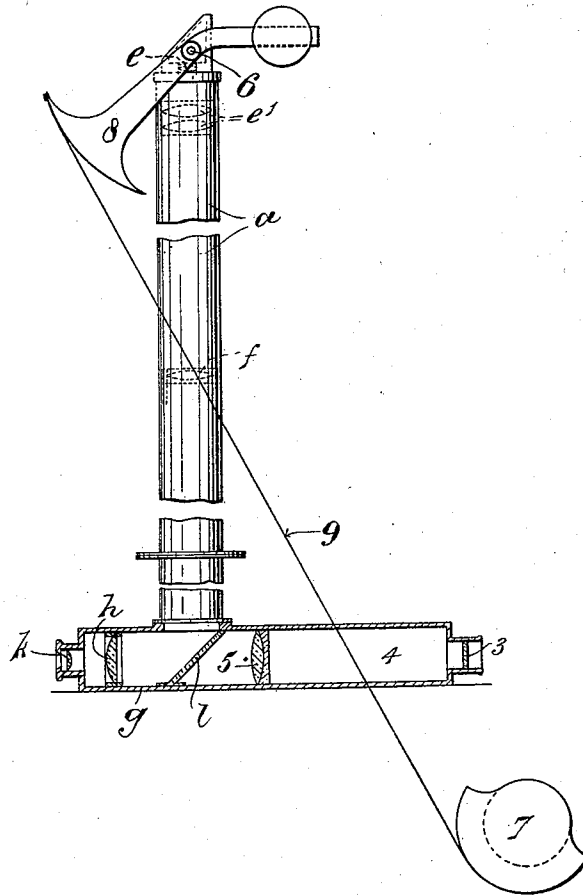
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NO MODEL.

3 SHEETS—SHEET 3.

*Fig. 6.*



*Witnesses.*

*Edmund D. Clark*  
*Rosemary R. Grubb*

*Inventor.*

*Howard Grubb*

# UNITED STATES PATENT OFFICE.

HOWARD GRUBB, OF DUBLIN, IRELAND.

APPARATUS FOR FACILITATING THE SIGHTING OF DISTANT OBJECTS FROM SUBMARINE BOATS, BARBETTES, &c.

SPECIFICATION forming part of Letters Patent No. 725,839, dated April 21, 1903.

Application filed December 13, 1901. Serial No. 85,813. (No model.)

*To all whom it may concern:*

Be it known that I, HOWARD GRUBB, a subject of the King of Great Britain and Ireland, residing at Dublin, Ireland, have invented  
5 Improvements in Apparatus for Facilitating the Sighting of Distant Objects from Submarine Boats, Barbettes, and other Protected Positions, of which the following is a specification.

10 This invention has reference to means or apparatus whereby distant objects can be readily viewed or sighted by persons in submarine boats, barbettes, turrets, and other like protected positions from which the distant  
15 object either cannot be directly seen at all or only by exposing the observer to danger; and it has for its object to provide a large field of view in cases where it is necessary to observe distant objects through a long passage of small cross-section.

20 The invention consists in a novel construction of sighting device for the purpose mentioned and in various combinations and arrangements of parts, all as hereinafter described, and set forth in the claims.

25 In the accompanying illustrative drawings, Figure 1 shows in central vertical section, and Fig. 2 in cross-section on the line A A of Fig. 1, one construction of apparatus of the  
30 kind referred to constructed according to this invention. Figs. 3 and 4 are similar views to Figs. 1 and 2, respectively, showing a modified construction. Fig. 5 is a vertical section showing a modified construction of the upper  
35 end of such apparatus. Fig. 6 shows in vertical section how the said sighting apparatus can be used in connection with barrette and like protected guns.

40 The new sighting apparatus comprises an upwardly - extending tube *a*, which in the case of a submarine boat would be arranged to project upward through the top therefrom to a point above the surface of the water and in the case of a barrette, turret, or like protecting device to a point above the same or  
45 to a point opposite an opening in the upper part thereof. The tube, which may be vertical or more or less inclined to the vertical, is provided at its upper end with an inclined  
50 reflecting-surface *b*, such as that of a reflecting-prism *c*, Fig. 1, or that of a mirror *c'*, Fig.

3, such reflecting-surface being so arranged that it will reflect luminous rays coming from a distant object and impinging upon it downward through the tube, as indicated by the  
55 dotted lines *d*, Fig. 1. Fitted within the upper end of the tube and below the reflecting-surface *b* is a lens or objective *e*, shown as an achromatic objective, that is capable of forming an image of the distant object  
60 at a distance below it corresponding to its focal length, and at the plane within the tube *a* where an image produced by the said lens or objective could be formed on a piece of ground glass or a photographic plate is arranged a lens or condenser *e'*, that is preferably  
65 achromatic and as large as the tube will allow and from which the luminous rays will proceed downward through the tube, so that if the image be viewed from below by the  
70 unaided eye a picture of the distant object, but diminished in apparent size, would be seen. By the use, as set forth, of a condenser *e'*, which acts *inter alia* to alter the direction of the axis of the lateral pencils of luminous  
75 rays proceeding down the tube *a* and which would otherwise spread out after passing the focal plane referred to and be lost upon the sides of the said tube, a large field of view  
80 can be seen when looking through a tube *a* of small diameter. By the use of a condenser, as set forth, there is no difficulty in obtaining a field of view of ninety degrees, if desired. To increase the apparent size of the distant  
85 object, the lower portion of the tube is provided with a telescopic objective *f* and with an eyepiece *g*, preferably of the positive form, composed of two lenses *h* and *k*, so that by modifying the magnifying power of the telescope the distant object can be viewed either  
90 under the same angle, as if seen directly without any optical means by an observer on the deck of the boat or at the upper part of the barrette or like device, or magnified two, three, or more times.

95 The eyepiece *g*, carrying the lenses *h* and *k*, may advantageously be arranged at an angle—say a right angle—to the upper portion of the tube *a*, carrying the reflecting device *c* or *c'* with condenser *e'* and objective lens *f*, as  
100 shown in Fig. 1, in which case an inclined reflecting device, such as a reflecting-prism *l*,

Fig. 1, or a mirror, is arranged in the angle between the upper and lower portions of the tube, so as to reflect the luminous rays coming from the objective  $f$  through the eyepiece  $g$  and the lenses  $h$  and  $k$  therein. The eyepiece  $g$  may, however, be arranged in a straight line with the tube  $a$ , as shown in Fig. 3; but in this case it will be desirable to provide at the lower end of the eyepiece an inclined reflecting-surface, such as that of a mirror or a reflecting-prism  $l'$ , so as to allow of observations being conveniently made by an observer standing or sitting in a vertical position. In each case by the use of the lower inclined reflector  $l$  or  $l'$  the image of the distant object will always appear in the right position, erect and correct for starboard and port sides.

The upper reflecting-surface  $b$ , Fig. 1, may in some cases, as shown in Fig. 3, be mounted to turn on or in the tube  $a$  about a horizontal axis and be provided with means comprising, for example, a rod extending down inside and along the tube  $a$ , whereby its inclined position relatively to the tube can be adjusted from below to suit the position of the object to be observed. In Fig. 3 the upper reflecting-surface (shown as a mirror  $c'$ ) is fixed to a carrier  $c^2$ , mounted in bearings in the upper end of the tube  $a$  and provided with a segment  $m$  of a worm-wheel, with which gears a worm  $n$ , fixed to a rod  $o$ , that extends down through a vertical recess  $q$  in the tube  $a$ , (see Fig. 4,) the lower end of the rod being connected to gearing  $r$ , carried by the tube, and adapted to be operated, as by a hand-wheel  $s$ , the extent of adjustment of the mirror being determined by the aid of a pointer  $t$  working over a suitable scale on a dial-plate  $u$ . When the tube  $a$  is vertical and the distant object is not elevated, the mirror  $c'$  would be inclined at an angle of forty-five degrees to the axis of the tube. When it is desired to direct the line of sight a little above or below the horizontal, the mirror can be correspondingly adjusted about its horizontal axis by the adjusting means  $r$ . The said tube  $a$  may also be mounted to turn about its longitudinal or vertical axis, so that all parts of a landscape or seascape may be readily viewed. For this purpose the tube  $a$  may be suitably supported—as, for example, by a flange  $v$  in a stuffing-box  $w$ —and be provided with suitable means—for example, a hand-wheel  $x$ —by which it can be turned about its axis to any desired extent. A suitably-arranged pointer  $y$  and a scale  $z$  may be provided to indicate the extent of turning movement of the tube in either direction. The tube  $a$  may be made of any convenient diameter and length and the objective and condensing lenses  $e$  and  $e'$  adapted to suit the particular length of the tube employed. When the tube  $a$  is made of considerable length, it may be made in parts hinged together, as indicated at  $a'$  in Fig. 1, and the two parts secured together by suitable fastening means  $a^2$ . In this case the lower end of the hinged upper

portion of tube may be closed and protected by a sheet of glass  $f'$ , Fig. 1.

For use with a submarine boat 1 the tube  $a$  extends upward through the top thereof, and its upper end is closed in a water-tight manner. For this purpose the upper end of the tube may be provided with a water-tight closed end or head 2, wherein the upper prism  $c$  or mirror  $c'$  is mounted and which is provided on the side opposite the prism or mirror with a water-tight window  $2^a$ , through which the luminous rays from a distant object can pass and impinge on the reflecting-surface of the prism or mirror. The window may be formed by a plain sheet of glass, as in Fig. 1, or by a lens or objective  $e$  and condenser  $e'$ , as shown in Fig. 5. In the latter case the lens  $e$  and condenser  $e'$ , arranged directly below the upper reflecting-surface  $b$ , as shown in Fig. 1, are omitted.

The present invention may be applied in connection with sighting apparatus of the kind described in the specification of former Letters Patent granted to me, dated September 24, 1901, No. 683,204, for sighting bar-bette and other protected guns, so as to obtain as large a field of view as possible combined, if desired, with some magnifying power. In this case the inclined reflecting-surface  $b$ , arranged at the angle between the lower end of the upper vertical portion of the tube  $a$ , carrying the upper mirror  $c'$ , objective  $e$ , condensing-lens  $e'$ , and telescopic objective  $f$  and the lower horizontal portion  $g$  of the tube carrying the eyepiece-lenses  $h$  and  $k$ , is arranged, as shown in Fig. 6, to serve also as the surface through which an image of the sight proper on a diaphragm 3, produced by parallel luminous rays, can be seen simultaneously with the image of the distant object reflected from such surface, which, as in the apparatus described in my said former specification, is made both transparent and reflecting, for which purpose it may be provided with a very thin film of semi-transparent reflecting material, such as sulfid of lead or metallic silver. 4 is a tube that carries the diaphragm 3 with sight proper and also the object-glass 5 for rendering the luminous rays proceeding from the sight parallel to one another. This tube 4 is secured to or, as shown, formed in one piece with the lower tube  $g$ , which, together with the upper portion of the tube  $a$ , is arranged to turn horizontally with the gun to which the apparatus is applied. In this arrangement the upper mirror  $C'$  is fixed upon a spindle 6, suitably mounted to turn about a horizontal axis, and is connected to the gun—as, for example, with one of its trunnions 7—through an arm 8 on the spindle 6 and a flexible connector 9 in such a way as to turn through half the angle through which the gun is elevated, like the upper mirror in the sighting apparatus described in my said former specification.

It will be evident that various other changes

can be made in the details of construction and mode of mounting the apparatus without departing from the spirit and scope of the invention so long as the relative arrangement of parts shown in the drawings or the mode of operation described in the specification is preserved.

What I claim is—

1. A sighting apparatus, comprising a tube the upper portion of which is provided with an inclined reflecting-surface upon which luminous rays from a distant object can impinge, with an object-glass, and with a condenser, said reflecting-surface, object-glass and condenser being arranged to direct luminous rays from a distant object down said tube and form a picture of the object, and said condenser being placed at the plane where an image produced by the object-glass would be formed.

2. A sighting apparatus comprising a tube provided at its upper end with a reflecting-surface inclined to the axis of the tube and upon which luminous rays from a distant object can impinge, with a lens capable of forming an image of the distant object, and at a lower part at the plane where an image produced by the first lens would be formed with a second lens from which the luminous rays will proceed downward through the tube.

3. A sighting apparatus, comprising a tube provided at its upper end with an inclined reflecting-surface, with an objective, and with a condenser, placed at the plane where an image produced by the objective would be formed, and at its lower end with optical means whereby the image of a distant object produced by the objective and condenser will appear in the correct position.

4. A sighting apparatus, comprising a tube provided at its upper end with an inclined reflecting-surface, and with an objective, at a lower part, at the plane where an image produced by the objective would be formed, with a condenser, and at its lower end with a telescopic objective and an eyepiece.

5. A sighting apparatus, comprising a tube provided at its upper end with an inclined reflecting-surface and with an objective, at an intermediate part of its length with a condenser, and at its lower end with a telescopic objective and an eyepiece, and a reflecting-surface inclined to the axis of the portion of said tube containing the first-mentioned objective and condenser, said condenser being placed at the plane where an image produced by the first-mentioned objective would be formed.

6. A sighting apparatus comprising a tube the upper portion of which is provided with an inclined reflecting-surface and with an objective and below these at the plane where an image produced by the objective would be formed with a condenser, and the lower portion of which is provided with a telescopic objective, and with an eyepiece arranged at an angle to said tube, and a reflecting-surface

arranged in the angle between said tube and eyepiece and capable of reflecting luminous rays from one portion to the other.

7. A sighting apparatus comprising a tube provided at its upper end with an inclined reflecting-surface upon which luminous rays from a distant object can impinge and be directed down said tube, and with an objective adapted to form an image of said distant object, at an intermediate part at the plane where the image produced by the objective would be formed with a condenser, and at the lower part with a telescopic objective and a magnifying eyepiece.

8. A sighting apparatus comprising a tube, an inclined reflecting-surface mounted at the top of the upwardly-extending portion of said tube and adapted to reflect luminous rays impinging thereon down said tube, an objective arranged below said reflecting-surface, a condenser arranged below said objective at the plane where an image produced by the objective would be formed, a telescopic objective arranged below said condenser, an eyepiece carried by the lower portion of said tube and arranged at an angle thereto, and an inclined reflecting-surface arranged in the angle between said tube and eyepiece.

9. A sighting apparatus, comprising a tube, an inclined reflecting-surface mounted at the upper end of said tube so as to reflect luminous rays falling upon it down said tube, means for adjusting the angular position of said reflecting-surface relatively to the axis of said tube, an objective adapted to form an image of said distant object, and a condenser arranged within said tube behind said objective at the plane where an image produced by the objective would be formed.

10. A sighting apparatus, comprising a tube having a closed upper end or head provided with a window at one side, an inclined reflecting-surface arranged within said end or head opposite said window, an objective adapted to form an image of a distant object, and a condenser arranged within said tube below said reflecting-surface at the plane where an image produced by the objective would be formed.

11. A sighting apparatus comprising a tube having a closed upper end or head provided with a window at one side, an inclined reflecting-surface arranged within said end or head opposite said window, an objective adapted to form an image of a distant object, a condenser arranged within said tube below said reflecting-surface at the plane where an image produced by the objective would be formed, and optical means attached to the lower end of said tube and whereby the image of the distant object will appear in the right position.

12. A sighting apparatus comprising a tube having a closed upper end or head provided with a window at one side, an inclined reflecting-surface arranged within said end or head opposite said window, an objective arranged below said reflecting-surface and adapted to

form an image of a distant object reflected downward from said reflecting-surface, a condenser arranged below said objective at the plane where an image produced by the objective would be formed, and a telescopic objective and eyepiece carried by the lower end of said tube.

13. A sighting apparatus comprising a tube the upper portion of which is provided with a closed upper end or head having a window at one side, and the lower portion of which is arranged at an angle to the upper portion and provided with an eyepiece, an inclined reflecting-surface arranged within said closed end or head, an objective arranged in the upper part of said tube below said reflecting-surface and adapted to form an image of the distant object reflected downward from said reflecting-surface, a condenser arranged below said objective at the plane where an image produced by the objective would be formed, a telescopic objective arranged between the condenser and eyepiece, and an inclined reflecting-surface arranged in the angle between the upper and lower portions of tube.

14. A sighting apparatus comprising a tube having a closed upper end or head provided with a window at one side, a reflecting-prism arranged opposite said window, an objective arranged within said tube below said prism, a condenser arranged within said tube below said objective at the plane where an image produced by the objective would be formed, a telescopic objective arranged within said tube below said condenser, an eyepiece arranged at right angles to and carried by the lower end of said tube, and a reflecting-prism having an inclined reflecting-surface arranged between said tube and eyepiece.

15. The combination with a structure containing objects to be protected, of a sighting apparatus comprising an upwardly-extending tube provided at its upper end with an inclined reflecting-surface upon which rays of light from a distant object outside said structure can impinge and with an objective whereby an image of said object can be produced, at a lower part, at the plane where an image produced by the objective would be formed, with a condenser from which luminous rays will proceed downward through said tube and produce an image of said distant object, and with means whereby it can be rotated about its upwardly-extending axis.

16. The combination with a structure containing objects to be protected, of a sighting apparatus comprising an upwardly-extending

ing tube provided at its upper end with an inclined reflecting-surface upon which rays of light from a distant object outside said structure can impinge and with an objective whereby an image of said object can be produced, and at the plane where an image produced by the objective would be formed with a condenser from which luminous rays will proceed downward through said tube and produce an image of said distant object, and with a telescopic objective, an eyepiece arranged at the lower end of said tube and at right angles thereto, an inclined transparent reflecting-surface arranged between the upwardly-extending portion of tube and the eyepiece, a sight, and means for rendering luminous rays proceeding from said sight parallel to one another and producing an image of the sight that can be viewed through said eyepiece simultaneously with an image of the distant object.

17. The combination with a submarine boat, of a sighting apparatus comprising a tube extending upwardly through and above the deck of said boat and provided with a closed upper end or head having a window at one side, an inclined reflecting-surface carried by the closed upper end or head and upon which luminous rays from a distant object can fall, an objective arranged to form an image of the distant object the luminous rays from which are reflected down said tube, and a condenser arranged at the plane where an image produced by the objective would be formed.

18. The combination with a submarine boat, of a sighting apparatus comprising a tube extending upwardly through and above the deck of said boat and provided with a closed upper end or head having a window at one side, an inclined reflecting-surface carried by the closed upper end or head and upon which luminous rays from a distant object can fall, an objective arranged to form an image of the distant object the luminous rays from which are reflected down said tube, a condenser arranged below said reflecting-surface at the plane where an image produced by the objective would be formed, and means for rotating said tube about its axis.

Signed at Rathmines, Dublin, this 2d day of December, 1901.

HOWARD GRUBB.

Witnesses:

EDMUND DOOLAN,  
ROMNEY R. GRUBB.