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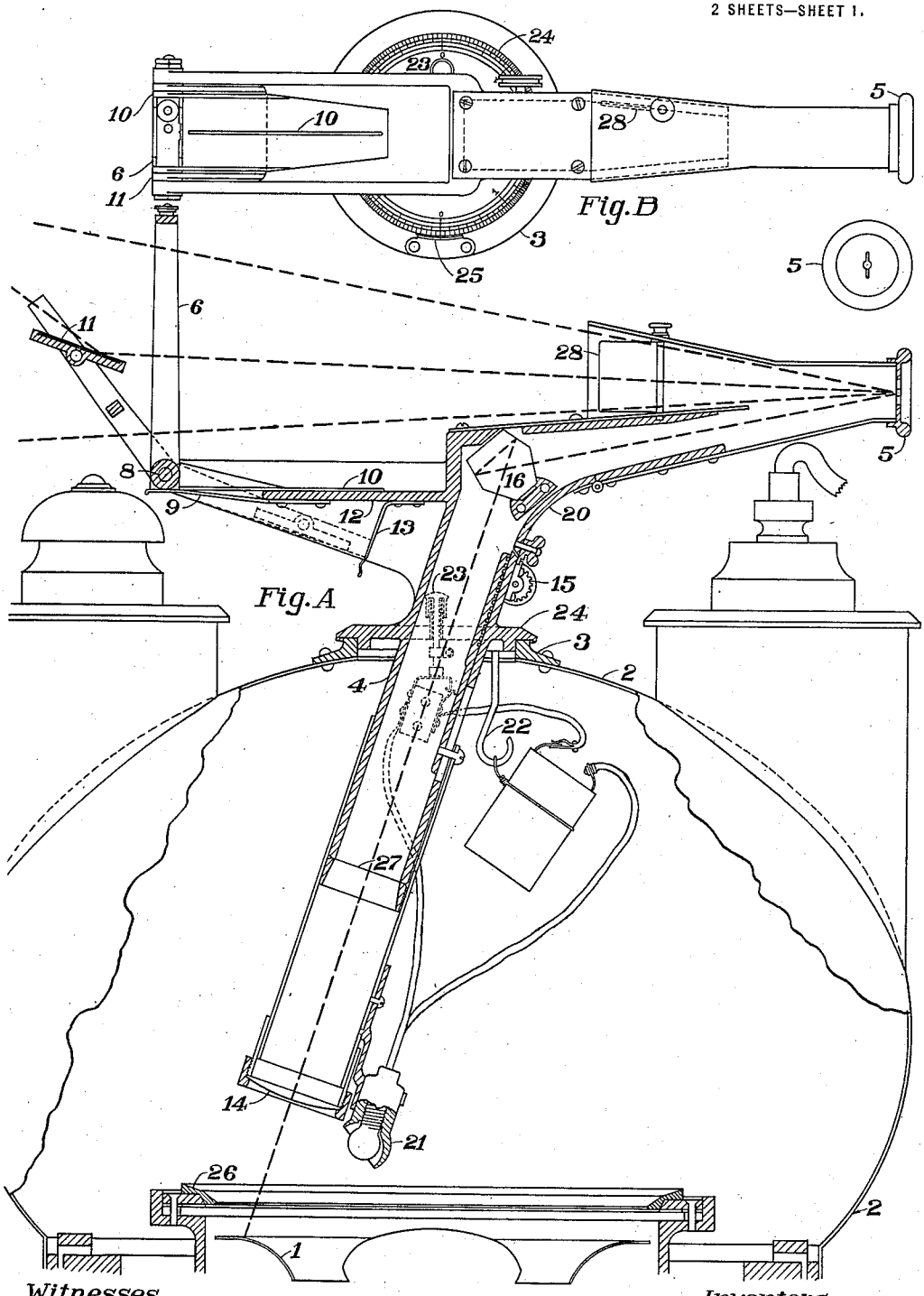
NAVIGATING ATTACHMENT FOR MARINERS' COMPASSES.

APPLICATION FILED JULY 26, 1912.

1,182,473.

Patented May 9, 1916.

2 SHEETS—SHEET 1.



Witnesses

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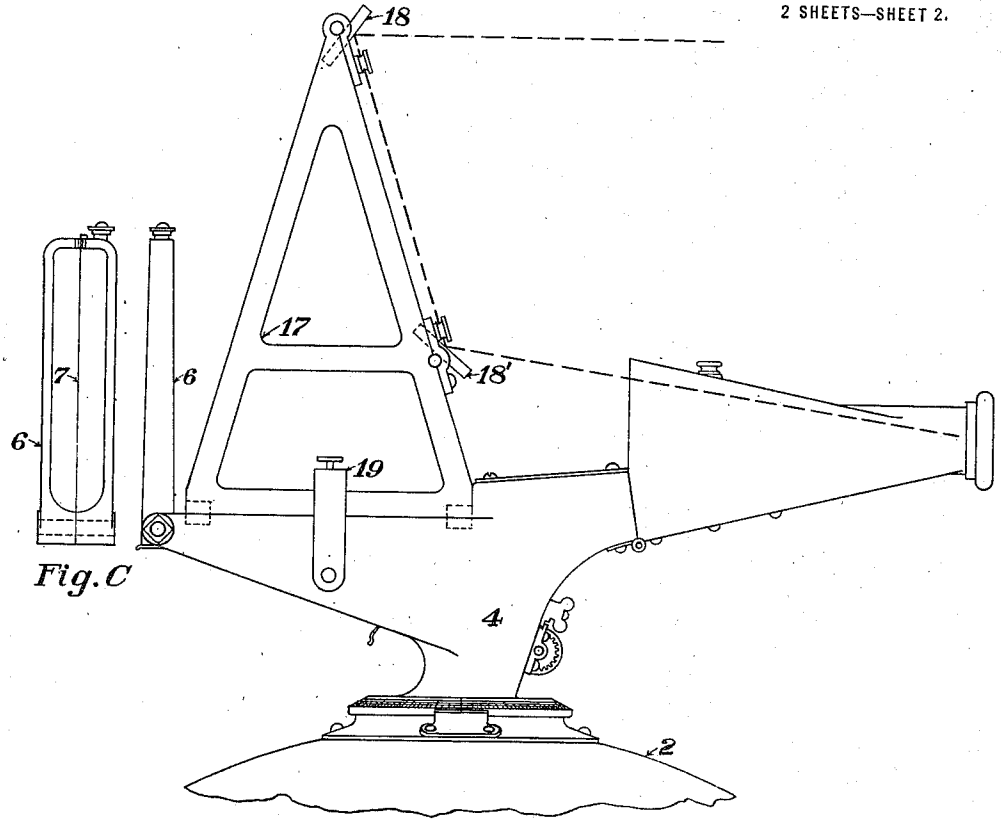


Fig. C

Fig. D

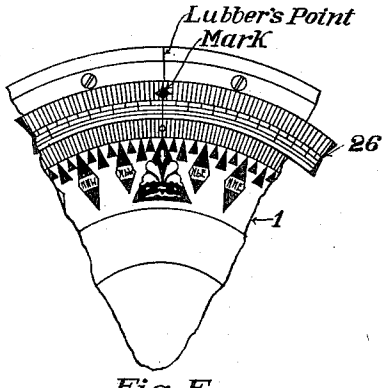


Fig. E

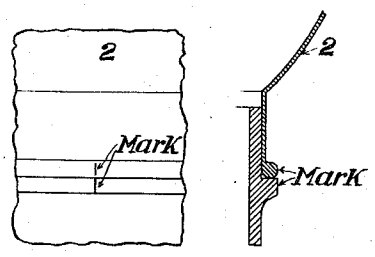


Fig. F

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UNITED STATES PATENT OFFICE.

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NAVIGATING ATTACHMENT FOR MARINERS' COMPASSES.

1,182,473. Specification of Letters Patent. Patented May 9, 1916.

Application filed July 26, 1912. Serial No. 711,765.

To all whom it may concern:

Be it known that we, CARL MELVILLE GREEN, first lieutenant of engineers, and WILLIAM HENRY MUNTER, first lieutenant, both in the United States Revenue-Cutter Service, and both citizens of the United States, at present stationed at the School of Instruction, United States Revenue-Cutter Service, Fort Trumbull, New London, Connecticut, have invented certain new and useful Improvements in Navigating Attachments for Mariners' Compasses, of which the following is a specification.

Our invention relates to improvements in attachments for mariners' compasses and has for its object the production of a simple device (with attachments) which can be fitted to any form of existing compass-hoods and by the use of which the following data can be quickly and easily obtained: *a.* Bearings of objects on or above the horizon or below the horizontal plane. *b.* Azimuths of heavenly bodies. *c.* Reverse bearings of any objects. *d.* When the ship is on a range between any two visible points. *e.* The distance of the ship's course off from a visible fixed point, and the distance to be run until the ship is abeam of that point, also whether there is a set at right angles to the ship's course, toward or away from the fixed point, this information being obtained much in advance of the time when the ship is to be abeam of the point, and the necessary observations being taken at any convenient times when fog or other conditions permit, regardless of the particular angular bearings of the fixed point. *f.* Ship's courses with reference to a heavenly body.

The device can be easily removed from the compass-hood or if kept in place can be used without interfering with the continuous use of the compass for usual purposes of navigation, does not necessitate the removal of the compass-hood for obtaining azimuths or bearings, can be used in bad weather regardless of ordinary rolling of the ship or other conditions excepting those which prevent sighting of objects, can be used at night almost as easily as in day light, and is considerably more accurate, as well as more quickly and easily operated than other attachments for the same purposes.

The invention consists in the novel details of construction and combination of parts fully hereinafter described.

These objects are attained by the device illustrated in the accompanying drawings forming a part of this specification, in which like numerals refer to like parts in all views.

Figure A is a sectional view of an attachment made in accordance with our invention, mounted on an ordinary binnacle hood, Fig. B is a plan showing the top of the attachment, and Fig. C is another view of frame 6 containing the sighting wire 7. Fig. D is an elevation of the upper part of the attachment with the frame 17 mounted in place, showing the line of sight by use of mirrors 18 and 18′. Fig. E shows a partial plan of the compass card 1 and graduated ring 26 in place, the latter being located circumferentially by placing its mark opposite the "Lubber's Point", which is usual on compasses. Fig. F is a partial elevation and section of the lower part of compass-hood 2, where it rests upon the binnacle, showing the marks which are made to coincide in order to bring the mark 25 in the fore and aft line of the ship.

Fig. A shows the attachment mounted on a machined ring which can be properly secured to any compass-hood, it being necessary that the top face and bore of the ring be axially true and in parallel planes with the part of the compass-hood which fits on the machined part of the binnacle around the compass. The compass-hood shown is intended to represent that part of an ordinary ship's binnacle, part of it being broken away, and the attachment is intended to be mounted in a manner similar to that shown on any style of compass-hood.

Referring to Fig. A the numeral 1 designates any graduated compass card mounted

in the usual manner, 2 being the compass-hood, which is provided with the usual sight opening to permit inspection of the compass card from without. The metal ring 3 with its bore and top face machined true with the level or normal position of the compass is properly secured to the compass-hood so as to be coaxial with the compass, that is to say so that its center will be vertically above the center of the compass when the latter is in its normal or level position. Resting on ring 3 is the metal part 4 which can be turned in any direction in a horizontal plane. The upper part of 4 forms a combined sight bar and tube with eye piece 5, and frame 6 containing a vertical wire or thread 7. Frame 6 can be turned in any position on the bolt 8 and is held by the spring 9 when in a vertical position. Plate 10 containing a vertical slot can also be turned up into a vertical position for sighting purposes at night. Mirror 11 can also be turned and held to any position on bolt 8, being ordinarily secured under the bracket 12 by the spring 13 when not in use.

The lower part of the frame 4 extends in the form of a tube down over the compass card as shown, where the lower end is fitted with a cross-wire 27, and may be fitted with a telescope tube and lens 14, being adjustable up and down by the means 15. In frame 4 is secured the double reflecting prism 16 (or two mirrors) by means of which the readings of the compass card, right side up, can be reflected to the eye piece 5, the eye at the same time being able to observe a distant object in line with the vertical wire 7, a light through the slot in plate 10, or an image of a celestial body reflected by adjustable mirror 11. Also by means of the removable attachment 17 (shown in Fig. D) supporting adjustable mirrors 18 and 18′, the image of any object directly in the rear of the observer (on or off the horizon) is thrown to eye piece 5, thus showing alinement between the ship and distant objects in opposite directions. Frame 17 is secured by means 19, and can be easily removed.

The small hinged door 20, is provided for use in quickly cleaning the surfaces of the prism 16 and also to permit the escape of rain water.

Attached to the tube holding lens 14, is a small electric lamp and reflector 21, which is operated by a small dry battery suspended from the hook 22, the circuit being connected to a water tight push button 23, which projects through the flange 24. The flange 24, on its upper side, is graduated and marked in its four quadrants, there being a stationary pointer 25 secured to ring 3 at its aftermost point. The compass-hood is also marked at one point on its lower ring so that the mark can at any time be moved into coincidence with a similar mark on the binnacle see Fig. F. The quadrants of the flange 24 are graduated in cotangents of the angle between the fore and aft line and any position of the sight bar or tube, it being directed toward any distant object. The divisions are marked in numbers and decimal parts. A graduated metal ring 26 may also be laid on the compass, extending around above the glass and outside the projection of the compass card, being centered by the usual ring securing the glass. This ring may be graduated in degrees and also in cotangents of the angles of observation (as above) and the readings thereof may be made through eye piece 5, in the same manner as the compass readings.

A shading means 28 is provided to protect the eye when the sun is observed, this being swung out of the way when not needed.

The operation of our invention is as follows:—This attachment being in place on the compass-hood (where it can be kept at all times, as it is not affected by weather and does not interfere in any way with other uses of the compass) it is only necessary to train the indicator so as to sight any desired object in line with the wire 7 and at the same instant to read the compass through the same eye piece, using the cross wire (27). If the usual binnacle light is not in use (as in the day time) a slight pressure on push button (23) will cause the compass card to be well lighted at the point where the reading is to be taken. Should the ship be rolling the compass reading will swing through a small arc and the mean reading can easily be observed, the wire 7 being meanwhile kept on the observed point. This method of allowing for ship's roll is much more accurate in results than the usual impracticable method of attempting to hold a compass bowl and azimuth circle level in two directions while a double reading is taken. Instead of four eyes and four hands being needed, one eye and two hands are amply sufficient, and the results are much more accurate. Should a distant light be observed at night the slotted plate 10 may be used instead of the wire 7. If the sun or any other heavenly body is to be observed the method is the same except that the mirror is set at such an angle as to reflect the desired image to the eye piece. When the sun is to be observed, the shaded glass (28) may be swung into place to protect the eye, while still permitting the compass to be read clearly. The lens (14) can be properly adjusted before an observation is to be made and need not be moved while taking a bearing or azimuth.

The attachment (17) with mirrors 18 and 18′ permit reverse bearings (of any object behind the observer) to be taken. This can also be used in case the binnacle is so located on the ship's bridge that the observer cannot get on all sides of it. Also by its use in connection with the wire 7 the ship can be brought into exact range between two visible points.

The use of the graduated circles 24 and 26 is as follows: The ship being on a given course, the direction indicator is trained on a point (as a light-house) located at an unknown distance to one side of the course, at the same time that a reading is taken of the ship's log. The angle of the direction indicator is read off on the graduated circle 24 (or through the eye piece on graduated circle 26, if desired) the manner of reading being exactly the same as that used in reading an ordinary slide rule. At a convenient time later a similar set of readings is taken. Then by a simple mental calculation (the difference between the readings of the graduated circle divided into the logged distance) the perpendicular distance of the point (or light-house) from the ship's course is at once obtained, *e. g.* the readings of the graduated circle being (say, 3.5 and 2.3, the distance logged meanwhile being (say, 7.2 miles, the simple problem to be solved is

$$x=\frac{7.2}{3.5-2.3}=\frac{7.2}{1.2}=6 \text{ miles},$$

which is the distance of the point (or light-house) from the ship's course. It is to be noted that these observations can be taken at any convenient time, when fog or other conditions will permit, that it is not necessary to have the observed object a certain number of points off the bow, that if desired the bearings can be taken on a signal given by the man reading the log, that no tables or chart work is required, that the distance can be obtained long before the ship is to be abeam of the observed object, and that the distance can be checked several times before the point abeam. Furthermore, if an additional reading of the graduated circle 24, be taken at the mid-time between log readings (the ship being at uniform speed) two determinations of the distance x can be at once made. Should the first value of x be greater than the second, it will indicate that the ship is being set inshore or that her true course will bring her nearer the object than the course indicated by the compass, this of course possibly necessitating care and a change of course in order to pass sufficiently clear of the point or object. Should the value of x increase instead of decrease as the ship became nearer abeam of the object, it would indicate an off shore set. The distance x multiplied by the last reading of graduations on 24 gives the distance to be run before the ship is abeam of the observed point, *e. g.* using above values

$$6\times 2.3=13.8$$

the distance yet to be run.

Graduated circle 26 is graduated in cotangents of the angle between the ship's heading and the direction in which the sight bar is trained, and readings can be taken from it through eye piece 5. This circle is also graduated in degrees on its outside edge these graduations being also visible through the eye piece. It is intended for use as a pelorus in setting the ship on desired courses by the sun, other heavenly body or distant object while adjusting the compass, and this method, in connection with our invention, is considered to be more accurate (with the ship rolling slightly) than the ordinary azimuth circle. The graduated circle 24 can also be used in the following manner: Assume that on the ship there are two simple sight bars or direction indicators, each being provided with a circle similar to 24, graduated in cotangents, no compass being necessary. These indicators should be located in convenient positions at opposite ends of the ship as far apart as possible, and both on the fore and aft center line or on a line parallel thereto. The accurate distance between these indicators should be known. A simultaneous observation from these two indicators (by signal or otherwise) on any object will give two readings of the cotangent scales. The difference between these readings divided into the distance between the two indicators will give at once the perpendicular distance from the observed object to the fore and aft line of the ship. Also the distance thus found multiplied by the cotangent reading of the forward indicator will give the distance from the ship to the foot of the perpendicular from the observed object. Should the observed object be abeam the cotangent reading of the forward indicator will be negative and the result obtained as before, will be the distance from the observed object to the ship. The arrangement then serves as a simple and very inexpensive range finder, besides giving the distance of a point from the ship's course without a log reading.

The details of construction and the arrangement of parts may be varied by those skilled in the art without departing from the spirit of our invention, and, therefore, we desire not to be limited in such features except as may be required by the claims.

What we claim is:

1. In an apparatus for taking bearings in combination, a compass, a sighting device mounted to rotate around the normal vertical axis of said compass, said sighting

device comprising an eye-piece, a sighting wire, thread, or slot spaced apart therefrom and also double reflecting means spaced apart from the eyepiece, said means being adapted to bring the image of an object, in the rear of the eyepiece, into range of said eyepiece without interfering with the line of sight in front of said eyepiece, and means for simultaneously reflecting into the eyepiece the compass reading lying in the vertical plane of said line of sight.

2. In an apparatus for taking bearings, in combination, a compass, a compass-hood, a sighting device mounted on the compass-hood so as to rotate around the normal vertical axis of said compass without moving the compass-hood, said sighting device comprising an eyepiece and tube with adjustable shading means and a series of frames spaced apart from said eyepiece and arranged to be moved independently vertically into the line of sight from said eyepiece, said frame fitted with sighting wires, threads, slots, or adjustable mirrors adapted to reflect the image of any object in the vertical plane of the sighting device into the eyepiece of said sighting device, and said sighting device comprising a downwardly projecting tube provided with a double-reflecting means and sight wire for projecting into the eyepiece of the sighting device the compass reading which lies in the vertical plane of said sighting device.

3. In a navigating device for vessels, a compass, a compass-hood, a bearing-ring mounted on the compass-hood, having a mark thereon parallel with the fore and aft line of the vessel, the compass-hood and binnacle or compass support having marks which are brought into coincidence when the mark on said bearing ring is parallel with the fore and aft line of the vessel, a sighting-device mounted to rotate on said bearing ring, its vertical axis coinciding with the normal vertical axis of the compass, and having a scale graduated in trigonometric functions of the angles between the mark on bearing ring and any position to which the sighting-device may be turned, said sighting-device comprising means for determining its alinement with an observed object, and means for simultaneously directing into its line of sight or eyepiece an image of the compass reading lying in the vertical plane of said line of sight.

4. In a navigating device for vessels, in combination, a compass, a hood therefor, a sighting-device mounted on said hood, rotatable about a normally vertical axis, and with means for determining its alinement with an observed object, a circular graduated scale and a mark, one being on the hood and the other on the rotatable sighting-device, said circular scale being so graduated in relation to the mark as to read in trigonometric functions of the angle of train of the sighting device from the fore and aft line of the vessel.

5. In a navigating device for vessels, in combination, a casing inclosing the usual compass card, the circular part of said casing around the compass card being graduated adjacent said compass card, in trigonometric functions of the angles measured from the fore and aft line of the vessel, and also in degrees from the fore and aft line of the vessel, a sighting device rotatably mounted axially above the center of said compass having means for alining it with an observed object, and including means for simultaneously reflecting into the line of sight, or eyepiece of said sighting-device the readings of the compass card and of the graduated casing lying in the vertical plane of said line of sight.

6. In a navigating device for vessels, a compass, comprising the usual casing and card and with the usual "Lubber's point" marked on the forward point of the casing, a detachable ring adapted to rest on said casing concentric with the compass card and centered by the upper ring of the casing, said ring being graduated on its inner edge in cotangents of the angle from "zero" in each quadrant and on the outer edge in degrees, there being a heavy mark at "zero" of both sets of graduations which mark may be set at the "Lubber's point" on the compass, a compass-hood, a sighting-device mounted on top of said hood to rotate around the normal vertical axis of said compass card, said sighting-device having means for alining it with an observed object, and including means for simultaneously reflecting into the line of sight or eyepiece of said sighting-device the readings of the compass card and of said graduated ring lying in the vertical plane of said line of sight.

7. In a navigating device for vessels, in combination, a compass, a sighting-device mounted to rotate around the normal vertical axis of said compass, and having means for alining it with an observed object, and means to indicate the cotangential functions of the angles between the fore and aft line of the vessel and any position to which the sighting-device may be turned, said sighting-device comprising means for directing readings of said compass into the eye-piece of said sighting-device.

8. In an apparatus for taking bearings in combination, a compass, a compass-hood, an opening in the hood directly above the center of the compass, a bearing ring surrounding the opening, a sighting-device mounted to rotate on said bearing ring

observer, an electric lamp secured adjacent to the end of said second element and movable therewith so as to illuminate the portion of the compass card to be observed for any given sight, a source of current for said lamp, circuit connections including said source of current and the lamp, and a circuit closer controlling the connection thereof, and itself adapted to be opened and closed at will by the observer.

16. In a navigating device for vessels, in combination, a compass, and a duplex sighting device having one element adapted for direct sighting of an external object, and the other element adapted to project a corresponding reading of the compass card into juxtaposition with the image of the object as received by the eye of the observer, means secured adjacent to the end of said second element and movable therewith for illuminating the observed portion of the compass card and means controlled by the observer for cutting off said illumination at will.

17. In a navigating device for vessels, in combination, a compass, a compass hood having an opening in its top co-axial with the compass card when in its normal position with its axis vertical, a bearing ring around said opening, a companion ring fitted to turn therein, an oblique sighting tube passing through said companion ring with its axis cutting the axis thereof, its lower end lying above the edge of the compass card and its upper end bent at an obtuse angle to approach a horizontal line and terminating in an eye-piece, a horizontal sighting device associated with the upper end of said tube and alined with the same eye-piece, a reflecting device located in the bend of said sighting tube, a lens in the lower part of said tube, means for adjusting said lens, an electric lamp supported on the lower end of the tube, and a circuit closer external to the tube adapted to control the connection from a source of current to said lamp, whereby an observer may sight an external object under a low illumination, and thereafter illuminate the compass card so as to instantly take a reading thereof.

18. In a navigating device for vessels, in combination, a compass, a compass hood, bearing rings on the hood concentric with the compass card when in normal position, and a duplex sighting device mounted on and having one element passing through said rings into the interior of the compass hood, said device and rings adapted for azimuth rotation only, and the lower end of the sighting device sweeping around the periphery of the compass card when the rings are rotated, alining means for accurately sighting through the upper or external element of the sighting device, and means for projecting an image of the corresponding portion of the compass card simultaneously into the eye-piece of the observer.

19. In a navigating device for vessels, in combination, a compass and a duplex sighting device with a common eye-piece, adapted to receive simultaneous and direct images of both an object being sighted and the corresponding reading on the compass card, together with separate means controllable by the observer for determining the transmission of the said image of the compass card, whereby the image of the compass reading may be cut off to permit of a clear sight of the external object, and then rendered visible to give the reading at will.

20. In a navigating device for vessels, in combination, a compass, a pair of associated azimuth rings, with graduations reading in terms of trigonometric functions of the relative angles of displacement of said rings from a normal predetermined position having a direct relation to the fore and aft line of the ship, and a duplex sighting device turning concentrically with said rings, one element of said sighting device adapted to give a direct sight on an object, and the other element a simultaneous reading of the compass card, whereby the absolute bearing of the object may be instantly and accurately ascertained, and by taking successive readings, its distance from the ship may also be obtained without complex calculation.

21. In a navigating device for vessels, in combination, a compass, a pair of azimuth rings mounted co-axially therewith, and a sighting device co-axial with said rings, one ring bearing a predetermined and definite fixed relation to the fore and aft line of the ship, and the other ring rotatable with the sighting device thereon, one of said rings having a scale graduated in trigonometric functions of the angles of displacement of the movable ring and the sighting device from normal or zero position with respect to the fixed ring.

22. In a navigating device for vessels, in combination, a compass, a pair of azimuth rings mounted co-axially therewith, and a sighting device co-axial with said rings, one ring bearing a predetermined and definite fixed relation to the fore and aft line of the ship, and the other ring rotatable with the sighting device thereon, one of said rings having a scale graduated in trigonometric functions of the angles of displacement of the movable ring and the sighting device from normal or zero position with respect to the fixed ring, and means enabling the observer to take a compass reading in connection with the sight, when required.

23. The combination with a compass and compass hood having an opening co-axial with the compass when in its normal position that is to say having its center in the

around a vertical axis, said sighting-device comprising a frame having an eye-piece at one end and a sight at the other giving a vertical variation of line of sight of about 18 degrees, a shading screen which can be interposed between said eye-piece and sight, adjustable mirrors which can be set to project the images of objects in the vertical plane through said sight into said eye-piece, a telescopic tube extending within the opening in the compass-hood and communicating with the eye-piece, and means in said tube whereby the non-inverted image of the compass lying in the vertical plane of the sighting-device is reflected into the eye-piece of said sighting-device.

9. In an apparatus for taking bearings, in combination, a compass, a compass-hood, a sighting-device mounted on said compass-hood to rotate about the normal vertical axis of said compass, without moving said compass-hood, and means for directing the image of that part of the compass card lying in the vertical plane of the sighting-device into the eye-piece of said sighting-device.

10. In an apparatus for taking bearings, in combination, a compass, a compass-hood, a sighting-device mounted on the compass-hood and rotatable about a vertical axis, said sighting-device having an eye-piece and being provided with adjustable reflecting means so arranged as to reflect the image of any object in the rear of the observer at the eye-piece of said sighting-device into said eye-piece without interfering with the line of sight from said eye-piece to any object in front of same.

11. In a navigation device for vessels, a compass, a compass hood, a bearing ring mounted on the compass hood having a mark thereon to indicate its position with respect to the fore and aft line of the vessel, means for adjusting the compass hood with respect to the binnacle or compass support in order to bring said mark on the bearing ring into its proper predetermined relation with said fore and aft line of the vessel, a sighting device mounted to rotate on said bearing ring, its vertical axis coinciding with the normal vertical axis of the compass, and having a scale graduated to measure the angle of displacement of said sighting device from its normal or zero position, as indicated by said mark on the bearing ring, said sighting device comprising means for determining its proper alinement with an observed object, and means for simultaneously directing into its line of sight an image of the compass point then lying in the vertical plane of said line of sight.

12. In a navigating device for vessels, in combination, a compass, a sighting device having an eye-piece mounted over the compass so as to rotate around its normal vertical axis, a branch of said sighting device extending from the said eye-piece, with its axis passing through the normal vertical axis of the compass and also passing through the edge of the compass card at all times, a sight wire or thread cutting the axis of the sighting device vertically, a lens in said branch sighting device, a double reflecting prism in an elbow of the branch sighting device, adjusted so as to reflect axial rays through the branch sighting device into the eye-piece without inversion, and external means for adjusting the lens in the branch sighting device so as to obtain a clear upward image of the compass reading in the eye-piece in juxtaposition to the image of the object being directly sighted.

13. In a navigating device for vessels, in combination, a compass, a compass hood and a sighting device rotatably mounted on said compass hood and comprising the following instrumentalities: a direct sighting element having an eye-piece, and a bracket connected therewith carrying a sighting wire or thread, a branch sighting tube terminating at one end in the same eye-piece, formed with the elbow intermediate of its ends, and with its lower or secondary member passing through and carried by a cap rotating in circular bearings on the top of the compass hood, concentrically with the compass card when in its normal position with its axis vertical, a lens in the lower or secondary part of said branch sighting tube, a double reflecting prism in the elbow of said tube with its faces so adjusted that axial rays through the tube will be reflected into the eye-piece, and means for adjusting the lens on the tube.

14. In a navigating device for vessels, in combination, a compass, and a sighting device mounted over the compass comprising means for directly sighting an external object, and for simultaneously projecting an image of the corresponding compass reading into juxtaposition with the image of said object as received by the eye of the observer, means secured adjacent to said sighting device for illuminating the portion of the compass card within the range of said sighting device, and means adapted to be controlled by the observer, for energizing said illuminating device or deënergizing the same at will.

15. In a navigating device for vessels, in combination, a compass and a duplex sighting device rotatably supported above said compass, one element of said sighting device being adapted for direct sighting of an external object, and the other element extending through the compass hood and adapted to project an image of a portion of the compass card into juxtaposition with the image of the object as received by the eye of the

axis of the compass when said axis stands vertical, and a self-contained unitary sighting device with an element detachably fitted in said opening extending into the hood therethrough, and thereby automatically centered with respect to the compass.

24. A compass for vessels, having a hood covering it, a sight opening in said hood, and a secondary opening in the hood coaxial with the compass when the latter is in normal position that is to say having its center in the axis of the compass when said axis is vertical, an azimuth ring around said opening, a rotatable sighting device, having an element adapted to be inserted into the hood through said ring, and to be supported thereon, and means to close said secondary opening when the sighting device is not in use.

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