F. W. STERLING & R. A. KOCH.

NAVIGATION PROTRACTOR.

APPLICATION FILED AUG. 16, 1913.

1,226,141. Patented May 15, 1917.

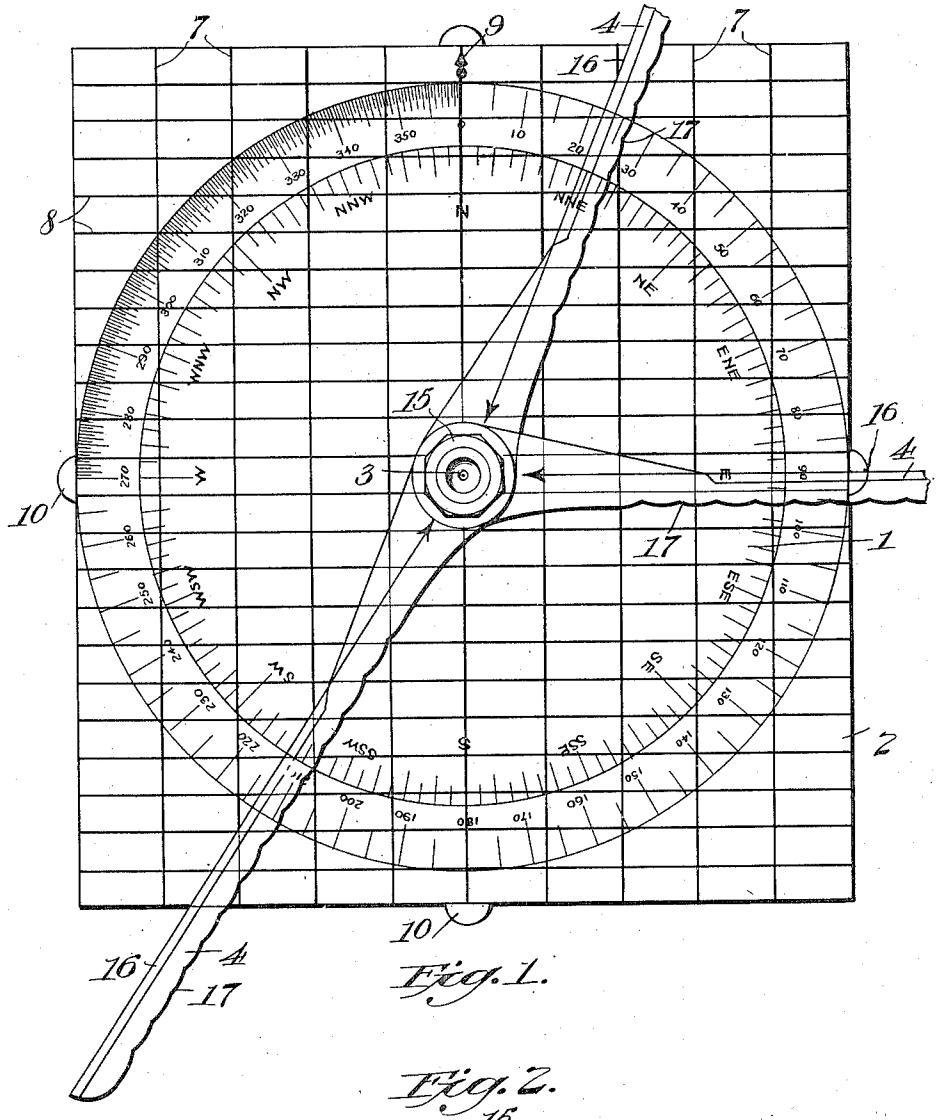
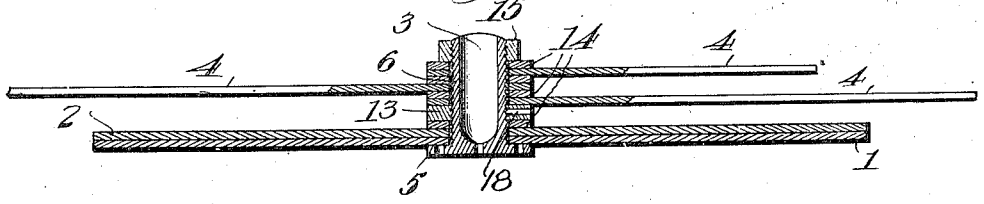


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANK W. STERLING AND RALPH A. KOCH, OF THE UNITED STATES NAVY.

NAVIGATION-PROTRACTOR.

1,226,141. Specification of Letters Patent. Patented May 15, 1917.

Application filed August 16, 1913. Serial No. 785,120.

To all whom it may concern:

Be it known that we, FRANK W. STERLING and RALPH A. KOCH, both citizens of the United States and officers in the United States Navy, have invented a new and Improved Navigation-Protractor, of which the following is a full, clear, and exact description.

Our invention relates to navigation plots and consists of improved means for use in solving on a chart the problems of navigation. The invention herein-described, illustrated and claimed may be made or used by the Government of the United States or any of its officers, employees, or contractors, in the prosecution of work for the United States Government, without the payment of any royalty thereon.

Figure 1 is a plan of our elevation protractor.

Fig. 2 is a vertical section.

Our protractor consists of a transparent, circular compass card 1, carrying the usual markings. Centrally pivoted and preferably superposed thereon is the transparent rectangular card 2 of approximately equal size having two series, 7 and 8, of straight lines parallel to its straight sides extending across its face, and an index mark 9 at the middle of one side, and the tabs 10 for convenience in turning. The cards may be pivotally and centrally mounted in any suitable manner such as around a hollow centrally apertured boss 3 where they are held between a flange 5 at the lower end and a nut 13 screwing on the shank 6 of the boss. If desired the compass card may be attached in any suitable manner to the flange.

While any desired number of pointer arms may be pivoted to the boss, in the drawing illustrating our invention three arms 4, are shown separated by washers 14 and held pivotally mounted between the nut 13 and a nut 15 screwing on the upper end of the shank. It will be seen that the frictional contact between the two cards may be adjusted by the lower nut 13, which has radial holes 18 for a key. The friction between the arms is independently adjustable by the upper nut 15 until any arm can be set without interfering with the other arms, or the arms may be simultaneously locked in set position. One or more arms may be taken off the boss. The pointer arms extending beyond the cards have one edge 16 in line with the center straight and another edge 17 out of such alinement mutilated or indented to avoid all danger of using. Other means such as a dark strip along that edge could be employed.

The construction of the protractor is such as facilitates the setting of the arms and cards, the adjustment of the frictional contact, and the simultaneous locking of the arms. The straight sides of the rectangular card coöperate with the parallel lines on its face, which show through the transparent protractor on to the chart, in enabling the protractor to be easily oriented without the necessity of using the chart compass rose on whatever part of the chart the protractor may be placed.

In determining the ship's position from two bearings the third arm is useless and may be removed the index mark on the rectangular card is set the given amount to correct for compass error, and two pointer arms set to the bearings, accurately shifting the protractor about the chart until the straight edges of the pointer arms cut through the landmarks observed, and the sides and lines of the rectangular card parallel the meridians and parallels of the chart after which the ship's position is easily and quickly plotted through the central aperture of the boss. To reverse the problem and determine the compass error on any course from three bearings, the pointer arms are set and the protractor shifted about on the chart until all the pointer arms cut in. Then by holding the compass card down on the chart the upper rectangular card may be turned until its sides and lines parallel those on the chart when the reading of its index gives the desired compass error. The use of the protractor in determining courses, and in solving other problems in navigation will be apparent.

Having thus described our invention what we claim and desire to secure by Letters Patent is:—

1. In a navigation protractor, a boss, two cards pivotally mounted on said boss, means for simultaneously adjusting the frictional resistance of said cards, a plurality of pointers pivotally mounted on said boss, and means for simultaneously adjusting the frictional resistance of said pointers.

2. In a navigation protractor, a boss, a transparent circular compass card, a transparent rectangular card, a plurality of pointer arms all centrally and revolubly

mounted on said boss, means for adjusting the frictional resistance to rotation of said cards and independent means for adjusting the frictional resistance to rotation of said pointer arms.

3. In a navigation protractor an outwardly threaded apertured boss flanged at its lower end and a transparent circular compass card, a transparent rectangular card superposed thereon, both pivotally and centrally mounted on said boss, a nut screwed on to the boss for adjusting the frictional contact between the two cards, three transparent pointer arms revolubly mounted on said boss above said nut, a plurality of washers separating the pointer arms, and a nut screwed on the upper end of the boss for locking and adjusting the frictional resistance to rotation of said pointer arms.

4. In a navigational protractor a central boss having an outwardly threaded portion, two cards, both pivotally and centrally mounted on said boss, a plurality of radial arms similarly mounted on said boss, and two nuts screwing on said boss, one for adjusting the resistance to rotation of the cards, and the other for similarly adjusting the resistance to rotation of the arms.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANK W. STERLING.
RALPH A. KOCH.

Witnesses for Frank W. Sterling:
H. B. Cook,
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