March 8, 1949. W. W. SHEFFIELD 2,463,649

SETTING INDICATION DEVICE FOR SEXTANTS

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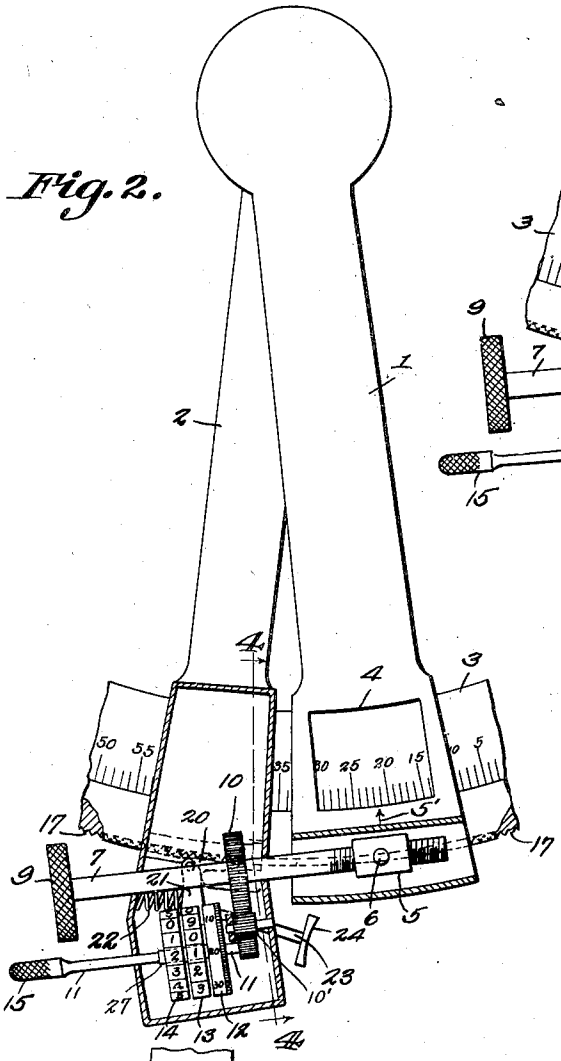


Fig. 2.

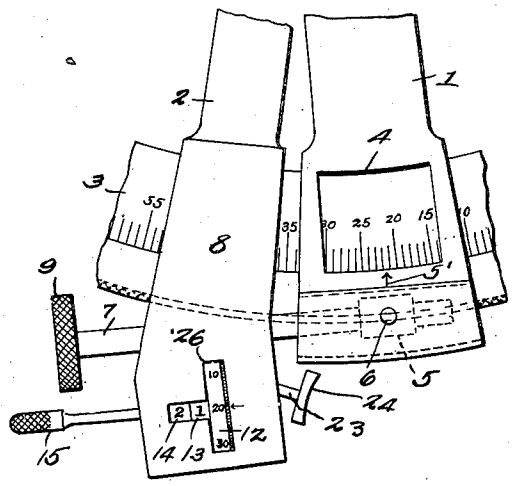


Fig. 1.

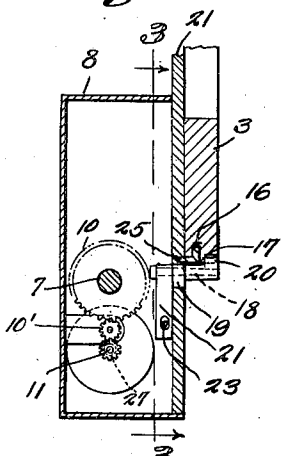


Fig. 4.

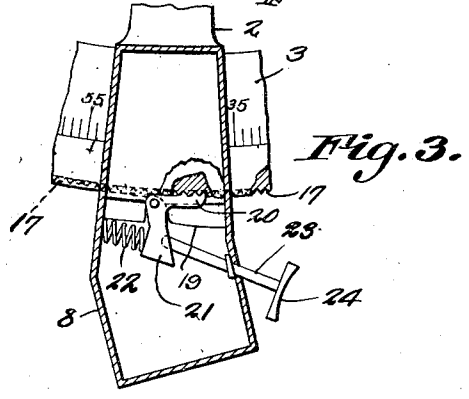


Fig. 3.

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SETTING INDICATION DEVICE FOR SEXTANTS

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2 Claims. (Cl. 116—124)

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This invention relates to sextants and more especially to an attachment thereto, one of the objects being to provide a structure which, when applied to a sextant, permits the quick adjustment of the index arm to indicate a selected graduation on the arc of the instrument after which, in accordance with the invention, the index arm can be advanced or retracted relative to the graduated arc, there being an indicating mechanism associated with said attachment by which an accurate reading can be had of the minutes and seconds of the measured angle.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

In the accompanying drawing, the preferred form of the invention has been shown.

In said drawings:

Figure 1 is a plan view of portions of the index arm and of an arm carrying the indicating mechanism, positioned on a portion of the arc of the sextant.

Figure 2 is a plan view of said arms, showing the case in which the indicating mechanism is mounted in section, the mechanism therein being shown in plan.

Figure 3 is a horizontal section through the case taken below the level of the indicator mechanism on the line 3—3, Figure 4.

Figure 4 is a section on line 4—4, Figure 2.

Referring to the figures by characters of reference, 1 designates the index arm of a sextant mounted for swinging movement relative to an arm 2, that constitutes a carrying arm for an indicating mechanism to be hereinafter described, both arms overlying the graduated arc 3 of the instrument. The index arm 1 has an opening 4 through which a portion of the graduated arc can be viewed and adjacent to the center of the outer wall of this opening 4 is an index or pointer 5'.

A sleeve 5 having a screw-threaded opening therethrough is pivotally connected as at 6 to the index arm, the axis of movement of the sleeve being in line with the periphery of the arc 3. This sleeve is engaged by an adjusting screw 7 which is rotatably mounted in a case 8 carried by the carrying arm 2. By means of a knob 9 or the like the screw can be rotated back and forth

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for the purpose of feeding the sleeve 5 away from or toward case 8, thereby to cause the arm 1 to move away from or toward the arm 2.

Screw 7 carries a gear 10 which can form one of a chain of gears whereby motion is transmitted from screw 7 to the shaft 11 of an indicating mechanism, this constituting a driving shaft for the mechanism, and constituting also a delicate-adjustment shaft, as will be hereinafter described. This mechanism includes a dial 12 for indicating seconds, the periphery of said dial being graduated to indicate 60 seconds, which are suitably designated. The indicator also includes two "minute" dials 13 and 14, the periphery of one of which is divided into 10 spaces designated consecutively from "0" to "9." The other dial, 14, has its periphery divided into groups each consisting of 6 consecutively designated spaces numbered from "1" to "6." Thus one rotation of the dial 12 will indicate up to 60 seconds while the dials 13 and 14 can be automatically operated by the rotation of dial 12 to indicate consecutively the minutes from "1" to "60." No special mechanism is provided for effecting this operation of the indicating dials as it is well known in the art and, therefore, need not be described or shown in detail.

Shaft 11 has a knob 15 or the like for the purpose hereinafter explained and an intermediate or idle gear 10' is included in the train of gears 10 so that the two knobs 9 and 15 will rotate in the same direction. The periphery of the arc 3 is formed with a continuous groove 16 and that portion of the periphery below the groove is provided with teeth 17 each corresponding with one degree. In other words, if there are 60 graduations on the arc 3 indicating 60 degrees, there would be 60 teeth in the same arc, one for each of the indicated degrees.

The case 8 has a pin 18 journaled therein and there is an opening 19 provided in the bottom of the case adjacent to this pin. One end of the pin carries a toothed jaw 20 positioned to engage with some of the teeth 17 and an arm 21 is also extended from the pin. This arm is located in the case 8 and is held normally pressed in one direction by spring 22. A plunger 23 is slidably mounted in one wall of the case, the inner end of the plunger being in engagement with arm 21 while the outer end has a finger piece on knob 24 whereby the plunger can be shifted longitudinally to actuate arm 21 against the spring 22 and disengage the toothed jaw 20 from the teeth 17.

The carrying arm 2 is held to the arc 3 by means of a hooked tongue 25 extending from the

arm 2 and into groove 16, within which it is adapted to slide when said arm is adjusted.

It is to be understood, of course, that the top of the case 8 is provided with an opening 26 through which the peripheries of the dials 12, 13, and 14 are exposed to permit convenient reading of the indicator.

As is well known a circle is divided into 360 degrees, each degree being divided into sixty parts designated by the geometrical term "minutes of arc," and each minute is likewise divided into sixty parts designated as seconds of arc. There are therefore 1,296,000 seconds to a circle and the present invention provides a means for so dividing a circle into single seconds, or 1,296,000 parts, these small divisions being read from the dials 12—13—14. By means of the present invention each of the graduations of arc 3 can be divided into 3600 parts.

It is essential that at the beginning of the operation the dials 12—13—14 all read zero and that the index pointer 5 shall exactly coincide with one of the graduations of arc 3. The sextant is so constructed with a toothed periphery to arc 3, that with the dials 12—13—14 reading zero and the carrying arm 2 clamped, the pointer 5 will so coincide with one of the graduations on arc 3. It is further essential that sixty turns of dial 12 shall be required to move the index pointer 5 one graduation (or degree) on the scale of arc 3. Therefore it is essential that the combination of the gear train 10 and the screw 7 shall be such as to provide a movement of the index arm 1, and pointer 5, through one graduation (degree) of the scale of arc 3 by sixty turns of the dial 12. Consequently, one complete turn of dial 12 will move the index pointer 5 only $\frac{1}{60}$ of one graduation (degree) on the scale of arc 3 and at this point dial 13 will register the figure 1, this 1 representing $\frac{1}{60}$ of a degree, or one minute of arc. Likewise, 21 turns of the dial 12 will move the index pointer 5, $\frac{21}{60}$ of a graduation of scale of arc 3 and dials 13 and 14 will now read 21, this 21 being $\frac{21}{60}$ of a graduation (degree) on scale of arc 3, or 21 minutes of arc, and so on. Any fraction of a turn of dial 12 will be shown by the graduations along the periphery of said dial 12, and as there are sixty graduations the reading of dial 12 will indicate sixtieths of the graduations of dial 13, which, of course, will be "seconds of arc." In reading the angle measured the degree reading is taken directly from the scale of arc 3, while the minute and second readings are taken from the dials 12—13—14. In the drawings the reading on the arc 3 is 21 degrees, while the dials read 21 minutes, 20 seconds. In other words the reading 21 degrees, 21 minutes, 20 seconds in the illustration shows that the arm 2 was clamped at a position whereby index arm 1 (as shown by pointer 5) was exactly at a reading of 21 on the scale of arc 3, and that the screw 7 was then turned a proper number of turns so as to rotate dial 12 twenty-one times as indicated by the reading 21 on the dials 13 and 14, and that the dial 12 was further rotated $\frac{20}{60}$ of a turn as indicated by the reading 20 on dial 12. As the ratio of movement is 60 turns of dial 12 to one graduation (degree) on scale of arc 3, the index pointer 5 will now be advanced to a point between 21 degrees and 22 degrees on the scale of arc 3, the exact amount of movement of index arm 1 and pointer 5 being 21 minutes and 20 seconds of arc as shown by the dials 12—13—14.

In operating a sextant the sun, or any other heavenly body whose altitude we are measuring

is brought down to a point where it appears to just touch the horizon. This is done by a combination of mirrors and a small telescopic eyepiece. Navigators call this point of apparent contact "kissing the horizon." One of the mirrors is attached to the index arm and by the movement of this arm along the arc of the sextant, and the corresponding movement of the "index mirror" the angle is measured. In the final setting of the sextant, the moment of "kissing the horizon" is a very delicate operation, the accuracy of which may mean a difference of many miles in working up a position at sea. Although the knob 9 transmits a slow motion to the index arm 1 by means of the screw 7, it imparts a rather fast movement of the dial 12. Knob 15 is not actually necessary in the operation of the invention, but is added as a means whereby a setting of extreme delicacy may be effected at the final adjustment. As the movement of the indicating mechanism may be actuated by either knob 9 or knob 15, an idle gear has been inserted in the gear train 10 to provide rotation in the same direction on the two knobs 9 and 15. It would be very inconvenient for these knobs 9 and 15 to rotate in opposite directions. Knob 15 and the extended shaft 11 are intended to actuate dial 12 only. The dials 13 and 14 which are mounted on a hollow sleeve or shaft 27 through which shaft 11 extends, are operated automatically by the rotation of dial 12. Shaft 11 carries dial 12 and its motion can be controlled by knob 15. Resetting the dials is effected by either knob 9 or knob 15, thus operating the entire mechanism so that when the dials all read zero the index pointer will again exactly coincide with one of the degree readings on scale of the arc 3.

A pointer 27 is provided in Fig. 1 adjacent to dial 12 to facilitate the correct reading of the graduations along its periphery.

What is claimed is:

1. In a sextant, an attachment for determining fractional values of degrees in minutes and seconds, comprising, in combination with an index arm and a degree-graduated arc along which the index arm is mounted for swinging movement, a carrying arm mounted for swinging movement along the arc, an adjusting screw rotatably mounted on said arm, a threaded sleeve pivotally connected to the index arm, the adjusting screw being threadable in the sleeve, teeth on the arc, there being one tooth for each graduation thereof, a spring-pressed plunger mounted on the carrying arm, a toothed jaw pivotally connected to the carrying arm and operable by the plunger to engage selected teeth of the arc, whereby to removably clamp the carrying arm in any of a number of exact positions of adjustment corresponding to the degree-graduations of the arc, an indicating mechanism on the carrying arm indicative of minutes and seconds of degrees, a shaft, rotatably mounted on the carrying arm, operatively connected to the indicating mechanism for rotation of the indicating mechanism, means on the shaft permitting manual operation thereof as a delicate-adjustment shaft, and a ratio-gear train operatively connecting the adjusting screw and the shaft.

2. In a sextant including an index arm and a degree-graduated arc, a manually operated means for providing minute and second readings, comprising a carrying arm swingable on the arc, a manually operated adjusting screw rotatable on the carrying arm, a threaded connection between the adjusting screw and index arm pivoted

to the index arm, teeth on the arc, there being one tooth to each degree-graduation, a toothed jaw pivotally mounted on the carrying arm, a spring carried by the carrying arm in yielding engagement with the jaw, whereby to retain the carrying arm normally clamped in engagement with the arc in any of a number of positions corresponding to degree-graduations on the arc, a manually operated plunger on the carrying arm movable against the jaw to disengage the jaw from the teeth of the arc, a rotatable delicate-adjustment shaft on the carrying arm, an indicating mechanism on the carrying arm driven by

said shaft, and a ratio-gear operatively connecting the adjusting screw and shaft.

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