July 10, 1945. J. M. PETROV 2,380,070

DEVICE FOR COMPUTING COMPOUND ANGLES

Filed Feb. 26, 1944

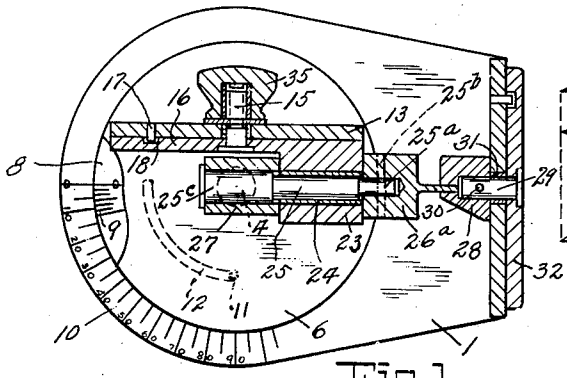


Fig. 1.

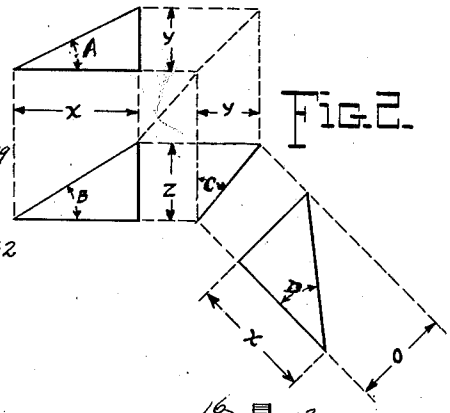


Fig. 2.

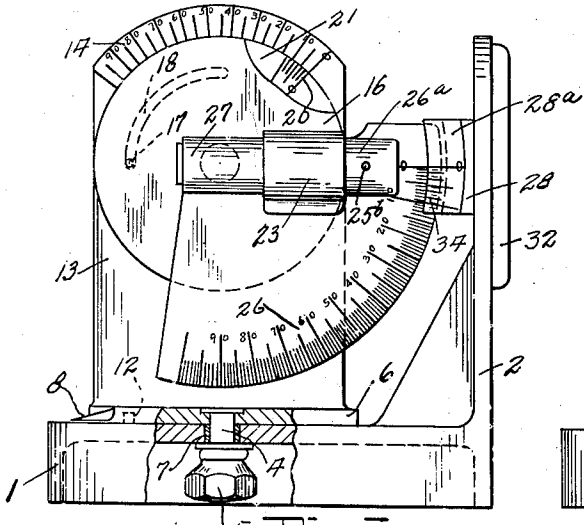


Fig. 3.

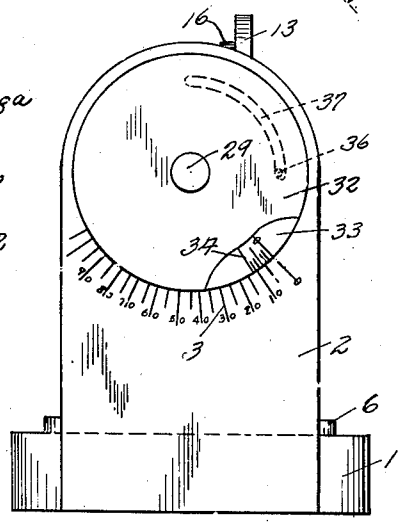


Fig. 4.

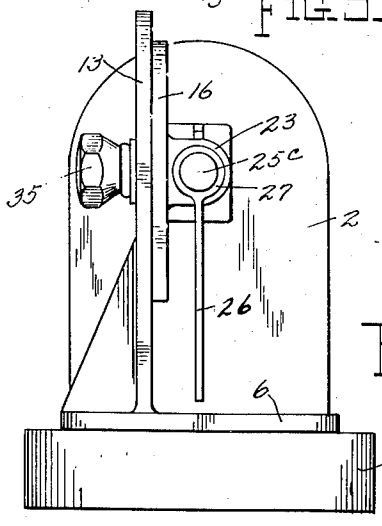


Fig. 5.

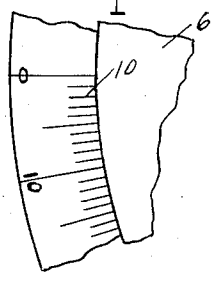


Fig. 6.

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DEVICE FOR COMPUTING COMPOUND ANGLES

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7 Claims. (Cl. 33—1)

The purpose of this invention has been to provide a simple and easily operable computing device for facilitating the mechanical computation of compound angles where the sizes of two angles are known and those of the remaining two angles are unknown.

The common method pursued today is to determine the unknown angles by trigonometric computation, in conjunction with tables giving trigonometric functions of angles. These computations obviously require time and care in the making. The computer of my present invention is designed to eliminate mental calculation and enable quick mechanical determination of the sizes of the unknown angles desired. This result is effected by simple manipulation of certain movable dials and a movable protractor, to set the same preliminarily in accordance with two known angles, the setting of said parts mechanically adjusting others of them to assume positions of the reading of the unknown angles.

For a full understanding of the present invention, reference may be had to the following description in conjunction with the accompanying drawing, in which:

Figure 1 is a longitudinal horizontal sectional view of my computer taken about on the line 1—1 of Figure 3, looking downwardly.

Figure 2 is a diagram of angles later referred to in order to exemplify the operation of the computer.

Figure 3 is a front elevation of the device, the base portion broken away and in section to show the base dial and mounting or axis means therefor.

Figure 4 is a side view of the computer looking toward the same from the right as seen in Figure 3.

Figure 5 is a side view looking toward the computer from the left, or in direction opposite that of the view of Figure 4.

Figure 6 is a fragmentary enlarged view of the detail of the scales of the three stationary protractors not fully illustrated in the other views.

Referring to the drawing, the general arrangement of the parts of my invention is best seen by reference to Figure 3. The device, according to one preferred construction illustrated, is comprised of a base 1 of hollow form at its bottom portion and provided at one side thereof with an upwardly extending integral side member 2. The side member 2 is provided on its outer face with the protractor 3 intermediate its upper and lower ends.

Mounted on the base 1 by means of an axis pin 4 threaded at its lower end to receive a holding nut 5, is the base dial member 6 freely rotatable with the pin 4 as a vertical axis. The pin 4 is journaled in the bushing 7 and the dial member 6 is provided with a chamfered portion or flat 8 having the vernier 9 thereon for cooperation with the protractor 10 on the arcuately curved part of the base 1.

A pin 11 on the base 1 operates in an arcuate recess 12 in the under side of the base dial 6 and limits the turning movement of the dial 6 to a little more than 90 degrees.

Mounted on the upper side of, and preferably integral with, the dial 6, is a standard 13 having its upper edge curved on an arc and provided at said edge with the main protractor 14. The standard 13 carries the horizontal axis pin 15, perpendicular to the axis pin 4, and rotatably attaching to the front face of the standard 13 the indicating and protractor supporting dial 16. The dial 16 is perpendicular to the base dial 6 and is also limited in rotation to a little more than 90 degrees by the pin 17 on the standard 13, said pin engaging an arcuate recess 18 in the rear face of the supporting dial 16. A nut 19 holds the pin 15 and dial 16 in position on the standard 13, permitting rotating of the dial 16 for adjustment of its vernier 20 on the flat 21, relatively to the protractor 14. Pin 15 may operate in the bushing 22. Nut 35 secures the dial 16 in position.

Offstanding from the front face of the dial 16 is a boss 23 bored to provide a bearing receiving the bushing 24 in which is carried the stepped diameter bearing pin 25, the smaller end 25*a* of which enters, and is pin-locked at 25*b*, a socket member 26*a* in the right upper portion of the swinging protractor 26. The member 26 at its left upper portion has a sleeve like bearing 27 that receives the left and larger end 25*c* of the pin 25, the middle portion of the latter being directly rotative in the bushing 24 previously mentioned. The space between the parts 26*a* and 27 is just sufficient to snugly receive the boss 23 alined with the parts 26*a* and 27.

The pin 25 thus provides an axis for the protractor 26 which axis is perpendicular to the verticle axis pin 4 and to the horizontal axis pin 15. Continuations of the lines of the axis of the parts 6, 15 and 25 will intersect, as apparent from the drawing, when the parts are in their normal zero positions as read on the protractors.

The swinging protractor 26 has its body portion in the form of a thin web or vane, the curved edge of which enters a slot or recess in an arm

28 carried by a journal pin 29 to which it is interlocked by cross pin 30. The pin 29 is connected, through an opening and bushing 31 in the side member 2, with the side dial 32 having the flat 33 provided with the vernier 34, the latter to cooperate with the protractor 3 previously described. As seen in Figure 3, the arm 28 has a flat 28a provided with the vernier 34 that coacts with the protractor 26 which is movable relatively to the arm 28, and by swinging movement rotates the latter. Or the protractor 26 may be swung by turning of the arm 28 by the dial 32. Turning of the dial 32 is limited by the pin 36 and recess 37.

The construction of my computing device being understood according to the foregoing description, its method of use may be exemplified by referring to Figure 2, which is a diagram disclosing a problem of compound angles.

In using the device, see diagram of Figure 2, the angle A will be read on the base protractor 10. The angle B will be read on the main protractor 14. The angle C will be read on the side protractor 3. The angle D will be read on the swinging protractor 26.

The normal positions of the various dials 6, 16, 32, will be at zero on the coacting protractors; the swinging protractor will be at zero on the vernier 34 of the arm 28.

It will be assumed that the angles A and B are known or given, and the angles C and D are to be ascertained.

The first step is to set the dial 16 to the angle B read on the protractor 14. This will effect, incident to vertical movement of the protractor 26, the same reading on the said protractor 26 as is obtained by dial 16 on protractor 14.

The second operation is to set the dial 6 at the angle A on the protractor 10. The turning of base dial 6 will simultaneously cause the swinging protractor 26 to rotate about its axis 25, and cause rotation of the arm 28, thus correspondingly rotating the side dial 32.

By the above operation of the protractor 26 with the coincident movement of the dial 32, the protractor 26 will be adjusted to a reading giving angle D and the dial 32 adjusted to a reading giving the angle C.

When the angle A is set on the dial 6, the protractor 26 is swung to some oblique position, depending on the sizes of angles A and B, its swinging movement rotating arm 28 and dial 32.

By turning the side dial 32, and thus swing upwards the protractor 26 according to the sizes of the angle C read on dial 32, and angle D read on the protractor 26, the dials 6 and 16 may be operated to give the readings for previously unknown angles A on dial 6 and B on dial 16.

Given any two angles, after setting the appropriate dials, or protractor 26, to the readings of such angles, the two unknown angles may be mechanically determined by the movement of the remaining dials, or remaining dial and protractor 26, as the case may be.

It will be thus seen that my device is readily usable for finding angles, according to the following combinations:

A and B given; C and D may be found.
A and C given; B and D may be found.
A and D given; B and C may be found.
B and C given; A and D may be found.
B and D given; A and C may be found.
C and D given; A and B may be found.

In reference to the first example of operation herein given, instead of setting the dial 16 first for the angle B, if the protractor 26 is swung to a horizontal position, dial 6 may be turned to the reading of angle A to effect arcuate movement of the protractor 26, and the unknown angle readings thus obtained on the dial 32 and the protractor 26.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an angle computer of the class described, in combination, a base, a protractor thereon, a base dial rotative about a vertical axis on said base, and having a vernier coacting with said protractor, a standard extending upward from the base dial, a main vertical dial rotative on said standard about an axis perpendicular to the axis of the base dial, a protractor on the standard, a vernier on the main dial coacting with the last protractor, a side dial supported in a plane perpendicular to the base dial and having a vernier thereon, a side member on the base supporting the side dial, a protractor on the side member coacting with the vernier of the side dial, a swinging protractor carried by the main dial and having its axis perpendicular to the axis of the main dial and angularly shiftable with the main dial about the axis of the latter, a turning arm connected to the side dial and having a vernier coacting with the swinging protractor, and means connecting said turning arm to the last mentioned protractor whereby swinging movement of the latter transmits rotation to the side dial.

2. A computer as claimed in claim 1, characterized in that the connecting means is formed to cause movement of the swinging protractor when the side dial is turned for an angle reading.

3. A computer as claimed in claim 1, wherein the main dial is provided with a bearing parallel with its computing face and in a plane intersecting the base dial axis, the swinging protractor axis being mounted in said bearing.

4. A computer as claimed in claim 1, in which the swinging protractor is of generally arcuate form having its curved edge slidingly interlocking with the turning arm to establish the connection therewith.

5. A computer as claimed in claim 1, in which the axis of the side dial is rotative about the axis of the main dial, and the swinging protractor is swingable at an angle to the plane of the main dial.

6. A computer as described, comprising a manipulatable base dial having a vernier, a manipulatable vertical main dial having a vernier, a manipulatable side dial having a vernier, protractors cooperative with the verniers of the dials, the main and side dials arranged perpendicular to the base dial, and the axes of the dials in continued lines meeting at a common intersection point in at least one position of all the dials, a swinging protractor normally parallel to the main dial, disposed in the plane of and interlocked with the axis of the side dial, and having its axis parallel to the face of the main dial and in the planes of the axis of the base and main dials, and a vernier associated with the side dial coacting with the swinging protractor.

7. An instrument of the class described, comprising a plurality of protractors including three rotatable dial members having their respective projected axes of rotation normally intersecting at a common point and perpendicular to each other when the dials are each in their zero set-

ting positions, a calibrated protractor member carried by one of the dial members and bodily movable with the latter about its axis, said protractor member being pivotally connected to the dial member on which it is carried for swinging movement relative thereto about an axis always perpendicular to the axis of the dial member, and the protractor member being slidably and rotatably connected with one of the other dial members on the axis of the latter for coordinating the swinging movements of the protractor member with the rotative movements of the respective dial members.

JOHN M. PETROV.