May 5, 1925. 1,536,693

F. A. SCHNEIDER

TABULAR CALCULATOR

Filed Aug. 15, 1922

Fig. 1.

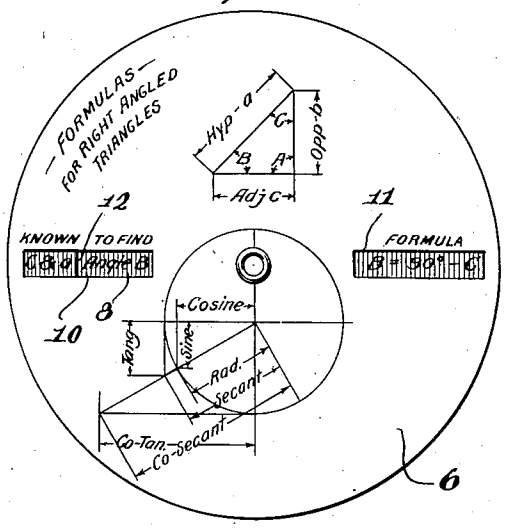

Fig. 2.

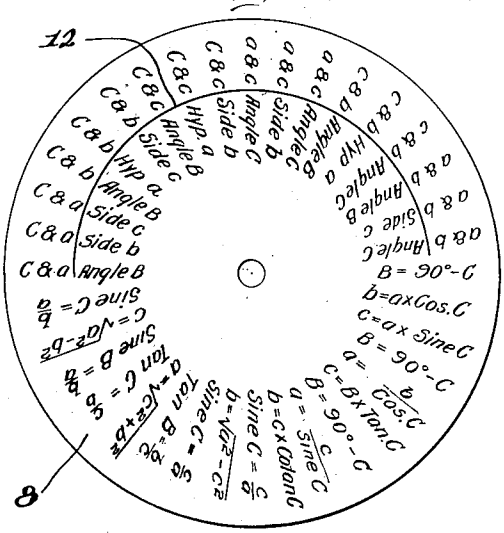

Fig. 3.

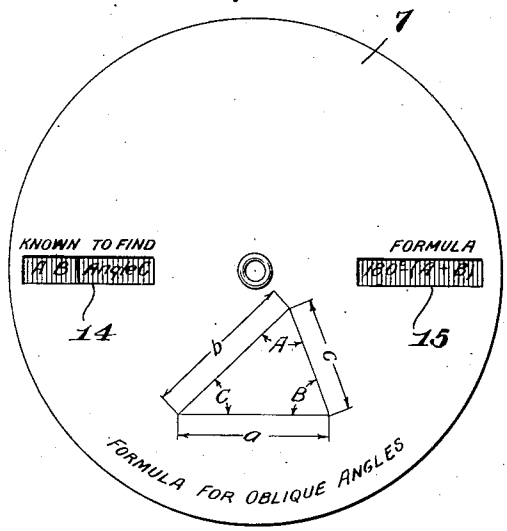

Fig. 4.

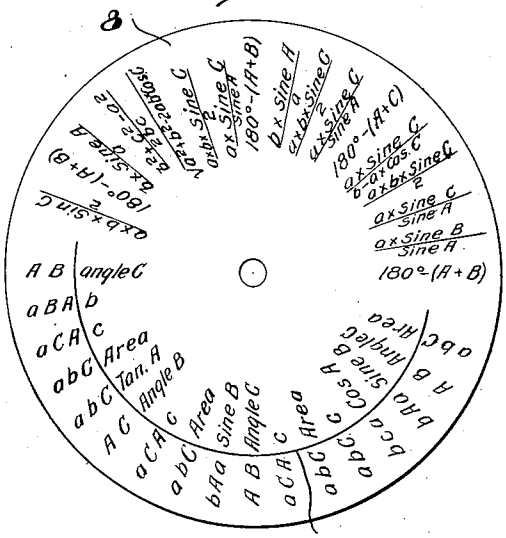

Fig. 5.

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UNITED STATES PATENT OFFICE.

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TABULAR CALCULATOR.

Application filed August 15, 1922. Serial No. 582,021.

To all whom it may concern:

Be it known that I, FRANK A. SCHNEIDER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in and Relating to Tabular Calculators, of which the following is a specification.

The present invention relates to improvements in tabular calculators and more particularly to a device for readily giving trigonometrical formulæ in connection with known quantities and a problem to be solved.

It is an object of the present invention to produce a simple and compact table of formulæ to be used in conjunction with a key geometric figure in which the solution of problems as to the area, length of sides and degree of angles of the geometric figure may be arrived at without intermediate calculation.

Other objects of the invention are to compactly arrange the tables upon discs pivoted together for rotary movement to enable the ready accessibility of the data and formulæ with the use of a relatively small structure; to produce an economical device and one that may be without inconvenience carried upon the person; and to provide an effective and complete instrument for the purpose stated.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a plan view of a tabular calculator constructed according to the present invention.

Figure 2 is a similar view of the intermediate disc at one side.

Figure 3 is a plan view of the device taken from the opposite side as compared with Figure 1.

Figure 4 shows the opposite side of the intermediate disc, and

Figure 5 is a central cross section.

Referring more particularly to the drawings the device comprises outer discs 6 and 7 and an intermediate disc 8, all made of cardboard or some other material possessing sufficient stiffness and body to receive the tables and formulæ and to withstand use.

In the construction shown the three discs are coupled together by an eyelet 9 passing centrally through the discs providing a pivot point or center upon which the disc may relatively turn. The disc 6, as shown in Figure 1 is provided with slots 10 and 11 extending in radial directions and being at diametrically opposite points. The slot 10 is associated with legends "Known" and "To find," while the opposite slot 11 is accompanied by the legend "Formula." These legends are preferably placed above the slots and the legends "Known" and "To find" are arranged side by side. The intermediate disc 8 as shown in Figures 2 and 4 is provided with the data thereon arranged appropriate in tables for exposure through the slots 10 and 11. It will be noted that the data in each case is arranged in two semi-circular series, the upper series in Figure 2 being divided circumferentially by a line 12 while the lower series in Figure 4 is similarly divided by the circumferential line 13.

In Figure 3 the disc 7 is also shown to be provided with radially elongated slots 14 and 15 disposed at diametrically opposite points in order to expose the data tabulated upon the reverse face of the intermediate disc 8.

The discs 6 and 7 are also adapted to contain keys to the data upon the intermediate disc 8 and as shown in Figure 1 the key in this instance is a geometric figure or right angle triangle in which the angles are lettered "A," "B" and "C" and the sides are represented by the symbols "*a*," "*b*" and "*c*." In Figure 2 the upper half of the disc 8 contains as to the outer circumferential column quantities that are known, while the inner circumferential table within the arcuate line 12 shows the unknown quantities or in other words represent the problem. The division line 12 is intended to appear through the slot 10 of the disc 6 between the legends "Known" and "To find" and the data upon the inner and outer circumferential tables may be made to appear successively through the slot 10 and beneath the respective legends upon rotation of either the disc 6 or the disc 8, preferably the disc 8. The lower portion of the obverse face of the disc 8 which is illustrated in Figure 2 contains the lower table in a reverse direction so that it will appear upright through the slot 11 in the outer disc 6, and the arrangement is such that the proper for-

mula will appear diametrically opposite to the corresponding data upon the inner and outer tables occupying the other semicircular portion of the disc.

The same is true of the reverse face of the disc 8. The division line 13 of the lower half thereof moves centrally past the slot 14 and divides the two tables and the two legends to avoid confusing the data. The upper semicircular portion of the reverse face of the intermediate disc contains formulæ disposed diametrically opposite the corresponding data in the two circumferential tables and the disc 7 contains a key geometrical figure which in this case is a triangle having its angles less than right angles. The key is provided with symbols to indicate these angles and sides, the symbols agreeing with the data upon the intermediate disc.

In Figure 1 there is also plotted upon the outside face of the disc 6 trigonometric developments for the functions of a triangle and the data upon the obverse face of the disc is also compiled with a view to its use in this connection.

Now taking the case shown in Figure 1, assume that the angles "C" is known and that the hypotenuse "*a*" is also a known factor. The given problem is to ascertain the degress of the angle "B." Both the known and the unknown factors appear through the slot 10 at opposite sides of the division line 12 and beneath their respective legends. As soon as the problem and its known quantities arrive at the slot 10, the proper formula for its solution is presented at the slot 11. The formula in this case is "B=90°—C." "C" being known, its quantity is substituted in the formula and the subtraction will thus give a quick and ready solution to the problem. In a similar way the illustration in Figure 3 shows that where the two angles "A" and "B" are known and it is desired to ascertain the degree of the angle "C" then the formula presented diametrically opposite in the slot 15 shown that by subtracting the addition of the known factors "A" and "B" from 180°, the solution of the problem is had.

Referring to Figure 4 it will be seen that the known quantity in the second item of the outer lower table is the side "*a*" and the angles "B" and "A," while the problem is to ascertain the length of the longer side "*b*." The formula is diametrically opposite

$$\frac{a \times \text{sine B}}{\text{sine A}}.$$

The table progresses around the disc in sequence so that the formula is always opposite the known and unknown quantities and the data thus correlated will appear opposite the diametric slots in the outer discs and computations may be thus readily made by reference to the key figures upon such outer discs.

Of course it will be understood that other data and key figures may be substituted without involving departure from the spirit of the invention and the right is reserved to make changes and modifications in the hereindescribed preferred embodiment provided such changes fall within the scope of the following claims.

What is claimed is:

1. A tabular calculator comprising a slotted disc having legends associated with the slots and indicating known quantities, a problem, and a formula for solving the problem, a key picture upon the disc with symbols, and a second rotary disc mounted behind said first mentioned disc and having data thereon expressed in terms of the symbols of the key picture arranged in two semicircles, one semicircle being divided to show in tabular form the known quantities and the problem quantities, and the other semicircle showing the formula by which the problem quantities may be found.

2. In a device as specified, a pair of relatively movable discs, one disc having two slots therein and the second disc having separate groups of symbols of known and unknown values and corresponding formulæ based on the symbols for determining the unknown values, said symbols and formulæ adapted to be exposed through said slots individually and relatively as to the finding of said unknown values, and a key diagram on the exterior of said first disc having said symbols in positions to show their respective designations on the diagram and the applications of the known values to the formulæ.

FRANK A SCHNEIDER.