

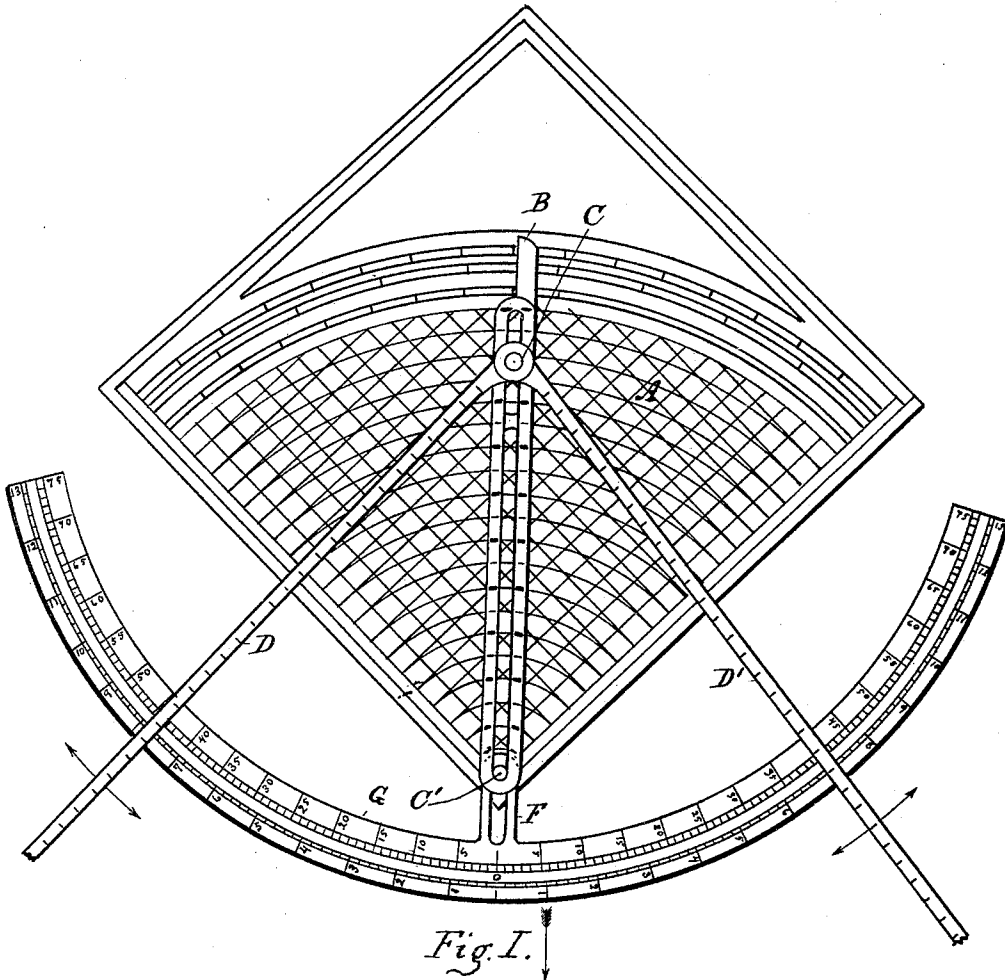
(No Model.)

2 Sheets—Sheet 1.

A. J. LESCHORN.  
TRIGONOMETER.

No. 435,843.

Patented Sept. 2, 1890.



WITNESSES:

*H. S. Millar*  
*Robert Kirk*

INVENTOR :

*Alex. J. Leschorn*  
By *J. S. Zerk*  
Attorney.

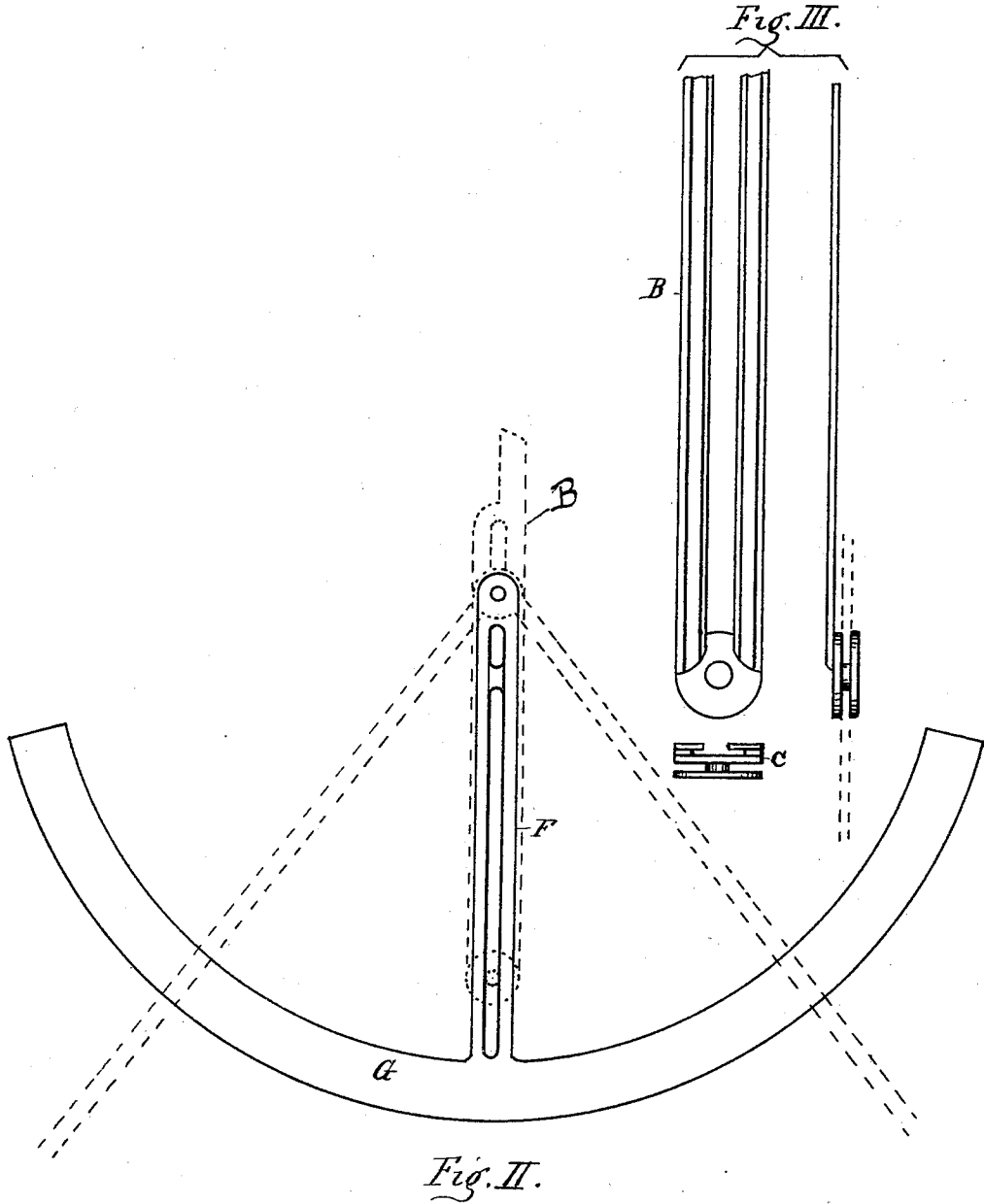
(No Model.)

2 Sheets—Sheet 2.

A. J. LESCHORN.  
TRIGONOMETER.

No. 435,843.

Patented Sept. 2, 1890.



WITNESSES:

*R. S. Millar*  
*Robert Kirk*

INVENTOR :

*Alex. J. Leschorn*  
By *D. S. Zurb*  
Attorney.

# UNITED STATES PATENT OFFICE.

ALEXANDER J. LESCHORN, OF PHOENIXVILLE, PENNSYLVANIA.

## TRIGONOMETER.

SPECIFICATION forming part of Letters Patent No. 435,843, dated September 2, 1890.

Application filed February 25, 1889. Renewed March 15, 1890. Serial No. 344,056. (No model.)

*To all whom it may concern:*

Be it known that I, ALEXANDER J. LESCHORN, of Phoenixville, in the county of Chester and State of Pennsylvania, have invented a new and useful Improvement in Trigonometers, which improvement is fully set forth in the following specification and accompanying drawings, in which—

Figure I is a top view of my improved device; Fig. II, a view of the slotted arm attached to the graduated segment, and Fig. III a top and side view of the slotted radial arm and the sliding block to which it is attached.

My invention relates to improvements in trigonometers or instruments designed to facilitate and expedite the solution of a large class of trigonometrical, graphical, and common arithmetical problems.

This invention is an improvement on my patent, No. 378,257, issued February 21, 1888, and its object is to provide a simple, inexpensive, and accurate device, by which various calculations may be easily and quickly accomplished; and the novelty consists of a quadrant graduated and marked with straight and curved lines, a protractor properly graduated and pivoted to the angle of the quadrant, and two graduated auxiliary arms pivoted to and movable in a slotted arm, said arm being pivoted at the apex of the quadrant and movable over it. By one setting of this instrument all trigonometrical functions are exhibited at one view, viz: the radius, sine, tangent, cosine, secant, cosecant, cotangent, versine, coversine, the length of any arc under any given angle, the sides of any triangle, the four sides of a quadrilateral having one right angle, and all angles for the same, all as will be easily and quickly understood by any one skilled in using instruments of this general character or quick at mathematical computations.

Referring to the accompanying drawings, A designates, as in my said patent, the quadrant-plate, which may be made of card-board, wood, metal, or other suitable material, and, as stated and there shown, should be properly graduated. This is divided into ninety degrees, all of which are again subdivided, according to the size of the plate. The radii,

which form the sides of the quadrant, are also subdivided and connected by concentric arcs of quadrantal shape, and by intersecting coordinates arranged at right angles to said sides and extending to the outermost quadrantal arcs.

A slotted radial arm B is pivoted to the apex of the angle of the quadrant, the slot serving as a guide for a slide C, to which the auxiliary and independently-movable arms D and D' are pivoted. These arms are graduated properly, as in my said patent. The radial arm B may be moved over the quadrant, and the auxiliary arms D D', which are pivoted to the sliding block C, may be adjusted in any position relative to the radial arm which may be required in reading off the measurements.

The graduated protractor G is rigidly connected at its middle or center to the lower end of the arm F, which arm is in turn pivoted at C' in the slotted radial arm B, as shown in Fig. II, and can thus be moved on its pivot and up and down on the arm. By this means the protractor can be suitably adjusted in any desired relation to the quadrant. The protractor may be graduated, as now shown—to wit, in the band or outer part—with numerals extending from the center on each side, commencing at the first point to left or right with 1, and then on in regular series to the ends of the bands. There are between the points four lines. On the inner part or edge of the protractor is another band, provided also at regular intervals with points or lines, as before, but now marked in series of fives and having between each two four lines or points; but I do not confine myself to exactly this detail of marking the protractor. Sometimes this numbering can be reversed and the lesser number placed at the end of each line and increase toward the middle, or it may have more rows of lines and figures to assist in more elaborate computations. According to the illustration now given, I use the outer row for finding the linear length of an arc and the inner for the degrees of the arc; also, in regard to the length of this protractor, it may be merely the size shown or extended around to a greater number of degrees.

Various mathematical computations, which are based on trigonometrical problems, may be quickly and accurately executed by this instrument, which will be found especially  
5 adapted for the use of architects, engineers, and mechanics, as well as all others who may desire assistance in making computations of the class referred to.

The peculiar operation of the device will  
10 be readily understood by those who are in any degree familiar with the science which it illustrates, and it will not fail to commend itself to all who are interested in the branch of mathematics to which it pertains.

15 What I claim as new is—

1. An instrument for trigonometrical computations composed of a graduated quadrant plate or card, a slotted radial arm pivoted to the apex of the quadrantal plate, a slide-piece  
20 guided in the radial arm, two auxiliary arms

pivoted to the said slide-piece, the radial and auxiliary arms graduated to correspond with the graduation of the sides of the quadrant, and an additional arm pivoted on the same center as the auxiliary arms and supporting  
25 a graduated protractor, substantially as herein set forth.

2. The combination, in an instrument as described, of the quadrant A, the movable arms D, the protractor G, the arm F, and slotted radial arm B, substantially in the manner  
30 and for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand, this 22d day of August, 1888, in the presence of witnesses.

ALEXANDER J. LESCHORN.

Witnesses:

I. E. MILLER,  
JOS. L. QUIOLAND.