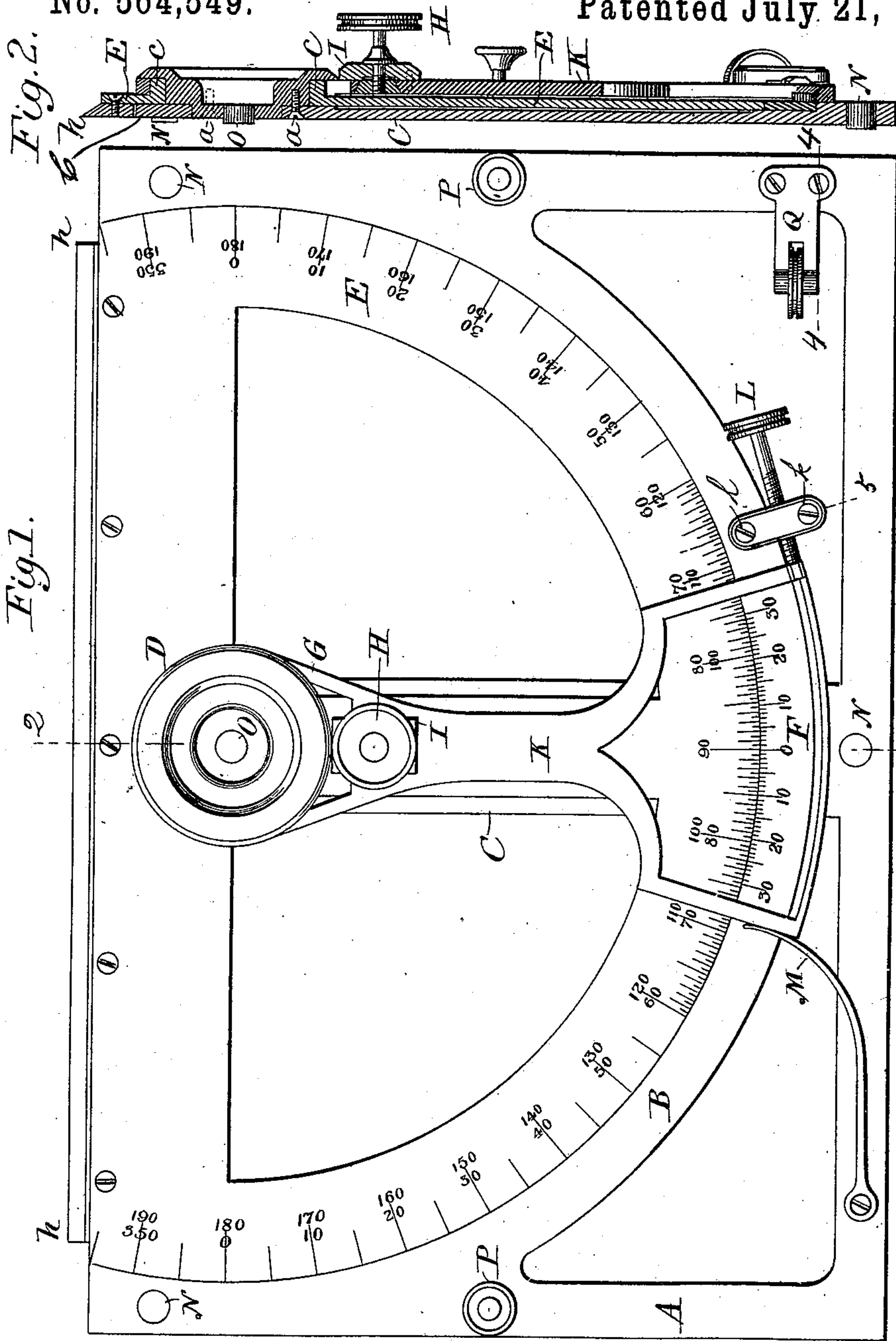


(No Model.)

W. S. AYRES.  
PROTRACTOR.

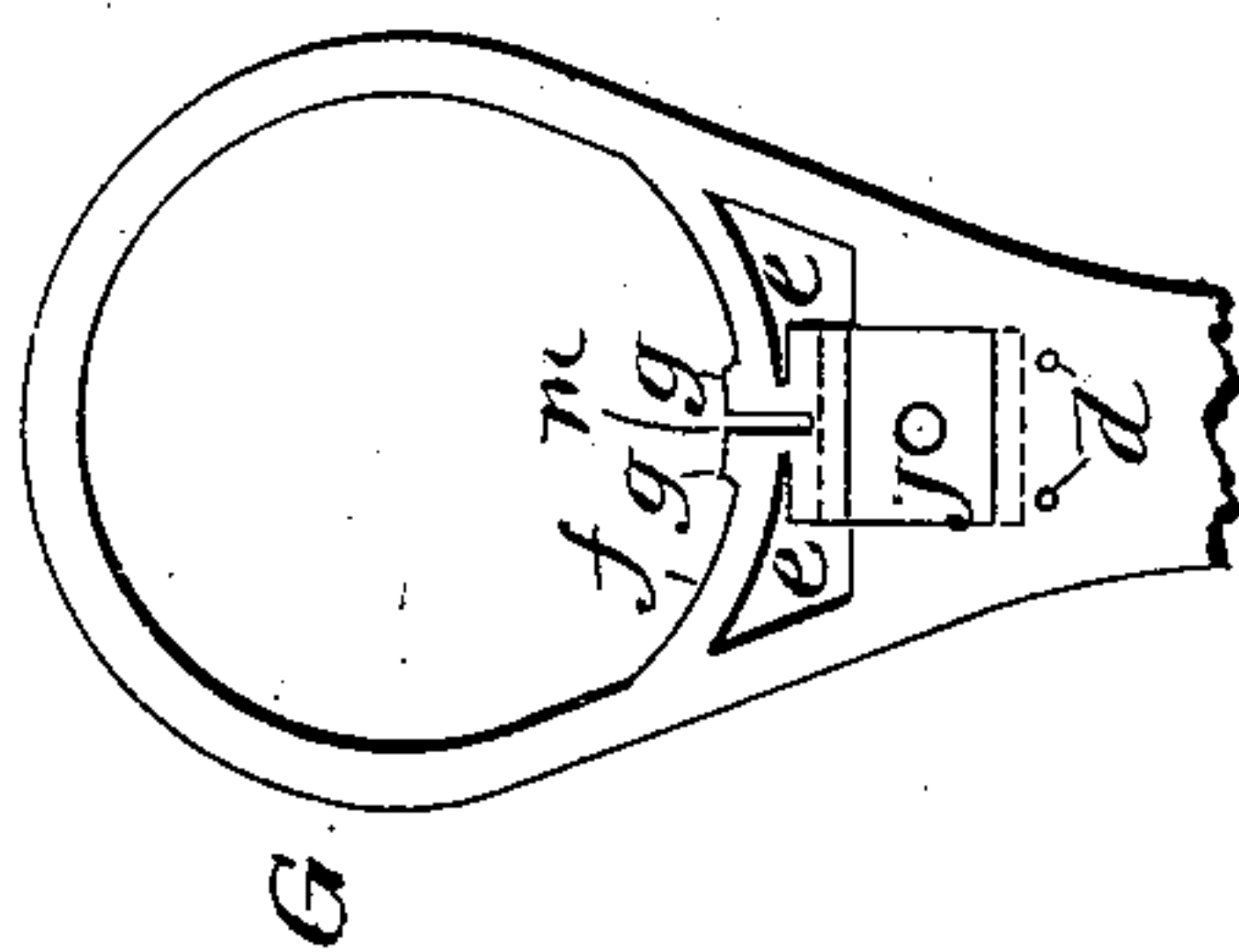
No. 564,549.

Patented July 21, 1896.



Witnesses:  
*J. D. Hutchison*  
*J. E. Anderson*

Fig. 3.



Inventor:  
*W. S. Ayres*



# UNITED STATES PATENT OFFICE.

WALLACE S. AYRES, OF HAZLETON, PENNSYLVANIA.

## PROTRACTOR.

SPECIFICATION forming part of Letters Patent No. 564,549, dated July 21, 1896.

Application filed May 17, 1895. Serial No. 549,694. (No model.)

*To all whom it may concern:*

Be it known that I, WALLACE S. AYRES, a citizen of the United States, residing at Hazleton, in the county of Luzerne and State of Pennsylvania, have invented a new and useful Protractor, of which the following is a specification.

My invention relates to improvements in protractors in which the divided circle or arc is within an outer frame; and the objects of my improvements are, first, to provide graduations on both the circle or arc and on the vernier that will be the same as are commonly found on a transit; second, to afford facilities for more accurate and rapid use of the instrument; third, to provide a clamp that will not obscure any of the graduations, and, fourth, to provide a thumb-movement by which the protractor can be accurately brought up to a line or point without jar or slip. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a plan of the entire protractor; Fig. 2, a section through the center of the protractor on the line 2 2; Fig. 3, a detail of the clamp as it appears when removed; Fig. 4, a section on the line 4 4, showing details of the thumb-movement; and Fig. 5, a section on the line 5 5.

Similar letters refer to the same parts throughout the several views.

The rectangular part A with the circular center B and the arm C constitute the frame of the protractor.

To the arm C the hub D is secured by the screws *a a*, around which the circle or arc E E turns.

The vernier F may be graduated directly upon the metal of the frame or upon a different metal secured to it by inlaying, by solder, rivets, or by screws. A vernier of the same metal as the circle or arc E E is preferable where two metals are to be used.

The circle or arc E E is graduated into half-degrees around its entire outer margin, is flush on its upper surface with the surface of the frame, and is kept in that position by the ledge *b*, Fig. 5, which extends along the entire inner circle of B, and is also provided with a ruling edge *h h*, secured to it by screws, as shown.

The frame can form a closed rectangle, with

the part B forming a complete circle, if desired. The circle or arc E E can also be a complete circle, but I prefer to construct them as shown.

The circle or arc E E, where it fits around the hub D, has an annular boss *c c*, also fitting to the hub D and forming on its outer surface a hub for the tangent clamp G. (Shown in Figs. 1, 2, and 3.) This clamp is operated by the thumb-screw H drawing the wedge J, Fig. 3, toward the yoke I, Figs. 1 and 2. The wedge thus drawn up presses the two faces *g g*, Fig. 3, against the annular boss *c c* and clamps the tangent-clamp lever K, Figs. 1 and 2, to the circle or arc E E.

In order to give flexibility to the parts of the clamp, a slot *m*, Fig. 3, is cut nearly to the edge of the wedge, also the slots *e e* are cut as shown, and the portions *f f* are cut away on the inner circle of the clamp G.

The yoke I is prevented from turning by one or more dowel-pins *d d*, Fig. 3.

The outer end of the tangent-clamp lever K is forked and incloses about thirty-three degrees of the arc, as shown in Fig. 1, and is moved by the tangent screw L, operating against the spring M. This fork inclosing only about thirty-three degrees of the arc with the tangent clamp placed at the center, as shown, permits the protractor and vernier to be divided the same as a transit—viz., the circle or arc into one-half degrees and the vernier to thirty minutes. The great advantage of this graduation over the usual one-fourth degree on the arc and fifteen minutes on the vernier is the distinctness of the divisions and its likeness to the transit.

The tangent screw L is placed on the right side of the fork, so that it can be operated with the right hand while the protractor is held in position with the left. The tangent screw works through a block, Fig. 5, provided with a slot *i* and a screw *k* to take up all lost motion, and is held in position by the screw *l* and the lip *j*.

The tangent clamp G is placed at the center of the protractor instead of alongside the vernier, as has heretofore been done, thus leaving all the graduations about the vernier unobscured.

The thumb-movement Q is represented in Fig. 4, a section on the line U V, and con-



sists of a very flexible spring and a small wheel held by the spring just clear of the paper. This is pressed down upon the paper by the thumb and rolled right or left, as desired, carrying the protractor with it, thus securing an easy and precise movement without danger of slipping. This wheel may be made of any material desired, but I prefer to make it of metal with milled edges.

Two lifting-knobs P P are placed at each side of the frame and at such points that the instrument will balance when lifted by them. These are for convenience in handling the protractor.

Three projections, preferably of ivory, although they may be metal or any other material and may be a part of the frame itself, if desired, are placed at N, Fig. 1, also one or more at the center of the protractor, (marked O, Fig. 2,) preferably only one and of ivory and fixed to the hub D, as shown, although there may be more than one and constructed as described above for N, if desired.

The object of the central projection is to support the circle or arc E E and thus enable it to revolve in a fixed plane with reference to the vernier F, and in conjunction with the three at N allows the protractor to be moved easily over the paper without the metal of any part of it coming in contact with the paper to soil it.

By the tangent clamp being placed at the center of the protractor, by the tangent screw being placed at the right of the vernier, by the thumb-movement above described, and by the lifting-knobs, all in connection with the ivory bearings, greater expedition and accuracy can be attained than heretofore.

I am aware that prior to my invention protractors have been made with rectangular frames within which is a circle or arc. I therefore do not claim such a combination broadly; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. The combination in a protractor of a circle or arc divided into half-degrees, and a frame having a vernier divided into thirty minutes and reading to one minute with a tangent clamp G, all substantially as set forth.
2. The combination of a circle or arc, having an annular boss c c, with the hub D, and clamp G, all substantially as set forth.
3. The combination of a circle or arc with a clamp G, operated by the thumb-screw H, yoke I and wedge J, substantially as described.
4. The combination of a circle or arc having an annular boss c c upon which operates the clamp G, with a hub D having a projection o, substantially as set forth.
5. The combination of a tangent clamp G, with a lever K, spring M, tangent screw L, and block having the slot i and adjusting-screw k, all substantially as shown and described.
6. The combination of a thumb-movement Q consisting of a wheel and flexible spring fastened to the frame, the spring holding the wheel free from the paper and permitting it to be pressed down upon the paper, with a protractor, all substantially as described.

WALLACE S. AYRES.

Witnesses:

J. B. HUTCHISON,  
J. E. ANDERSON.