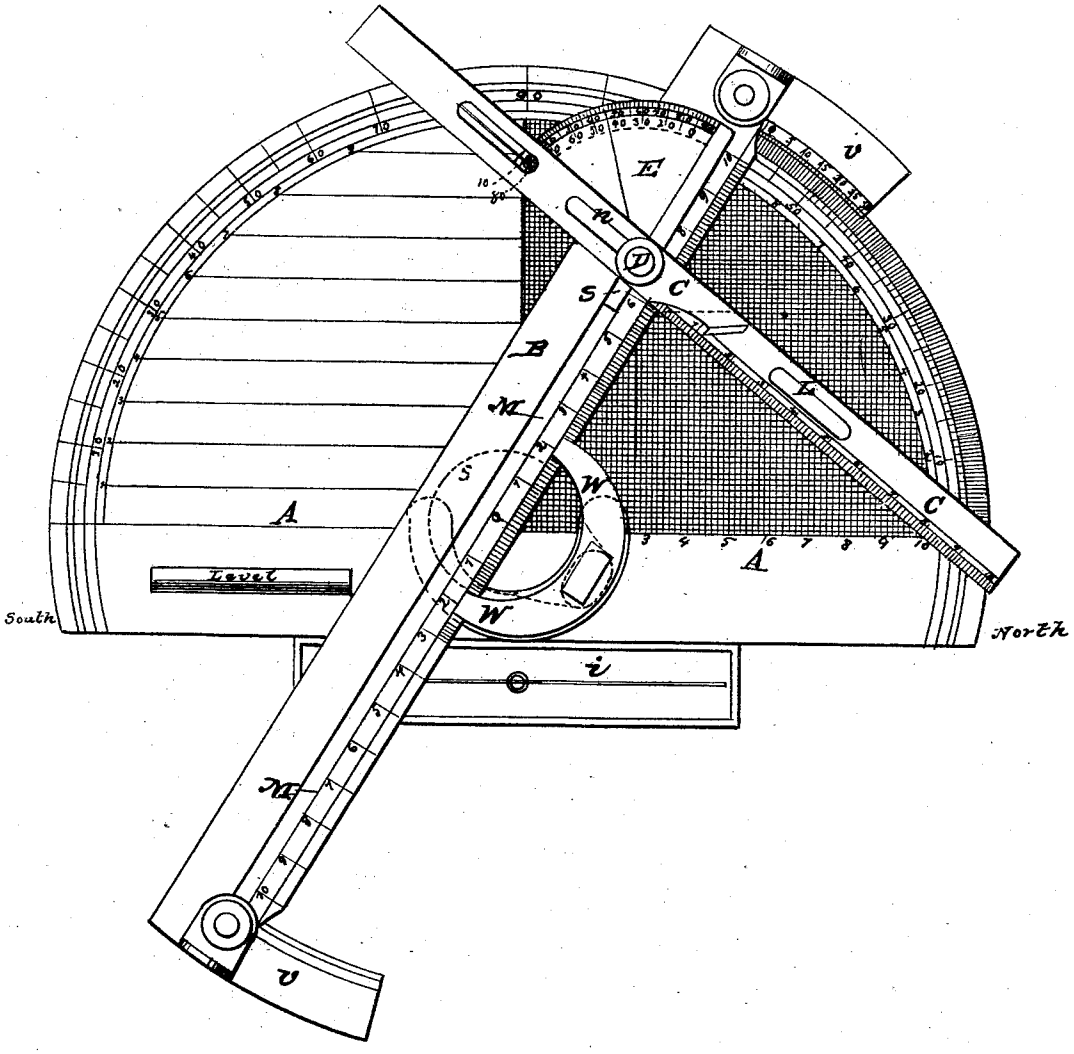
J. M. LILLEY.

Altitude Instrument.

No. 18,608. Patented Nov. 10, 1857.



UNITED STATES PATENT OFFICE.

JAMES M. LILLEY, OF GREENVILLE, VIRGINIA.

IMPROVED INSTRUMENT FOR SURVEYING AND CALCULATING AREAS.

Specification forming part of Letters Patent No. **18,608**, dated November 10, 1857.

To all whom it may concern:

Be it known that I, JAMES M. LILLEY, of Greenville, in the county of Augusta, in the State of Virginia, have invented a new and Improved Compass; and I hereby declare that the following is a full and exact description thereof, reference being had to the accompanying draft.

The semicircle represents a double geometrical or trigonometrical table, numbered from the center of the diameter to the periphery 0 1 2 3 4 5 6 7 8 9 10, both ways, and also from both ends of the diameter along the periphery 1 2, &c., to 10. The movable limb B is placed over the table and traverses the same from either end of the diameter, and having verniers V on each end passing over the graduated edge of the semicircle, any course, degree, or minute of the circle can be readily obtained by counting from the north or south end of the semicircle on the graduated edge, divided into half-degrees when the needle is settled. The edge of the movable limb B has a scale of equal parts coinciding with the scale on the table and numbered from the middle point, the same as the table both ways from 0 to 10, and coincides with the center point on the table and base-line A of the same, and the center point 0 is kept in that position by a brace *w* and hinge *y*, the hinge moving on the under side of the center of the table or diameter when the limb B is traversing the table. There are sights attached to the ends of the movable limb B by screws or otherwise, and also sights on the under side of the plate by screws or otherwise. The sights on the movable limb and those under the plate may be attached so as to coincide with the diameter of the semicircle and center of the table, and by suspending a plumb from the center of the under side of the hinge the same point can be designated on the surface of the ground. There is a projection on the hinge on the under side of the plate and a screw to tighten on the projection to keep the movable limb B firm in any required position. The plate can be placed in a vertical position by means of a ball and socket. The socket having a notch permitting the stem of the ball to fall therein, thereby angles of elevation and depression can be taken equally as easily as horizontal angles. The needle-box *i* and level are placed parallel to the diameter of the semicircle and remain permanent. There is a groove *m* on the top of the movable limb B, in which is fixed a slide *s*, on which is placed a rule C and quadrant, kept in their position by a screw D on the top. The rule C is laid off in the same way that the limb B is, commencing at the point touching the edge of the limb B and numbered from 1 to 10. When those divisions are counted as hundreds the smaller divisions are counted as tens, and when the numbers are counted as tens the smaller divisions are counted as units, and when the numbers are counted as units the smaller divisions are counted as tenths. The rule C, in connection with the movable limb B and the base-line A of the table, all of which are laid off on the same scale, are intended to facilitate the calculation of oblique-angled trigonometry and finding the area of triangles. For example, first slide the quadrant and rule C along the movable limb B, through the groove *m*, until the left side of said rule reaches the graduated number desired on the limb B. Then slide said rule C, by means of its slot *n*, until its lower shoulder rests against the edge of the limb B. For example, slide said rule to the point 6 on limb B and let No. 8 of the rule C cut the point No. 10 on the base-line A of the table. The quadrant at the intersection of the limb B and rule C will give the angle at that point, and the limb B on the verge of the semicircle will give the angle at the center of the table, and by subtracting the sum of those two angles from one hundred and eighty degrees the remainder gives the other angle. Then, tracing the line on the table from the vertex of the angle (formed by the limb B and rule C) to the circled edge of the table will give the perpendicular on the longest side A, the half of which, being multiplied by the base or longest side, gives the area of the triangle; or, by taking the distance 6 on C, 8 on the table A, and 10 on the limb B, will give the same result. As these are both right-angled triangles, suppose the following be taken: the line on the limb B, equal fifty poles, the line on the base A of the table, equal fifty poles, and the angle at the center of the table, equal sixty degrees, to find the line on the rule C and the other two angles, thus: Set

the limb B to 60° on the verge of the semicircle, and adjusting the rule C to 50 on the limb B, and the outer end of rule C to 50 on the base-line A will give the distance 50 on rule C, and the quadrant will give an angle of sixty degrees, which with the angle given, being together taken from one hundred and eighty degrees, leaves the remaining angle equal to sixty degrees, and the area can be obtained in the way above represented for the former triangles.

It will be seen from the construction of my improved compass and trigonometrical calculator that the graduated rule C and quadrant E can be shifted along the groove *m* to either end of the limb B at the pleasure of the operator, and that the position of the slide in the groove will not in the least interfere with the accuracy of the instrument, in which it is believed to differ from all other instruments. In shifting the rule C from one end of the limb B to the other the rule has to be inverted and the slot L in the opposite end placed on the slide in the groove *m* on the limb B. It will also be seen that by the combination of the different parts and the construction of the whole of my instrument the necessity of removing the needle-box from one position to another or removing and replacing the same for any purpose in the operation of surveying is obviated, and the needle-box fastened stationary on the plate and remains in the same position at all times when used in taking courses or running lines.

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

The combination of the three scales A B C and quadrant E, as used, for the purposes already set forth.

JAMES M. LILLEY.

Witnesses:
W. A. BOSS,
JOHN S. HOLLINGSHEAD.