No. 630,244. Patented Aug. 1, 1899.

G. LANGER.

RANGE FINDER.

(Application filed Mar. 16, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

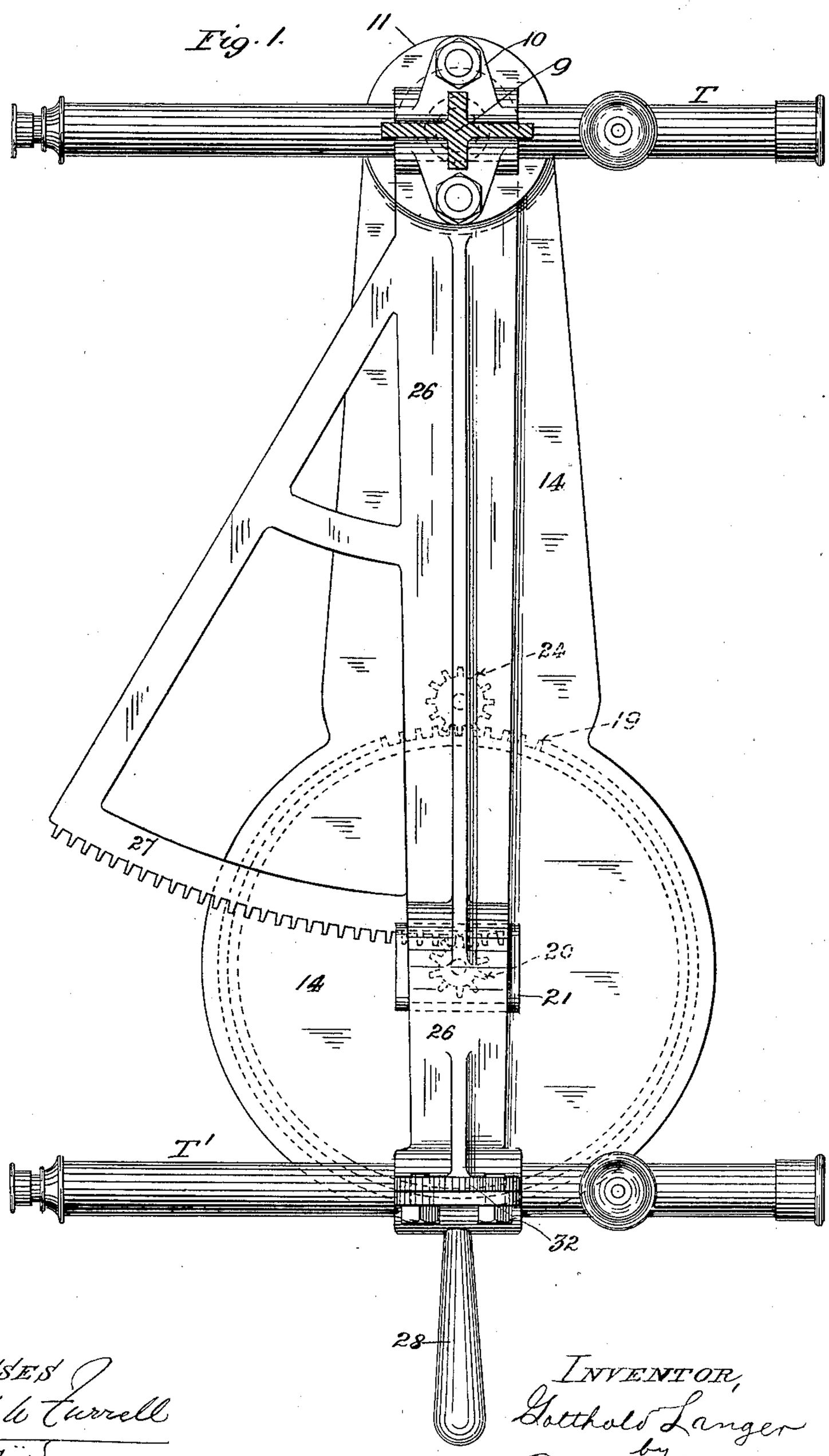

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Fig. 2.

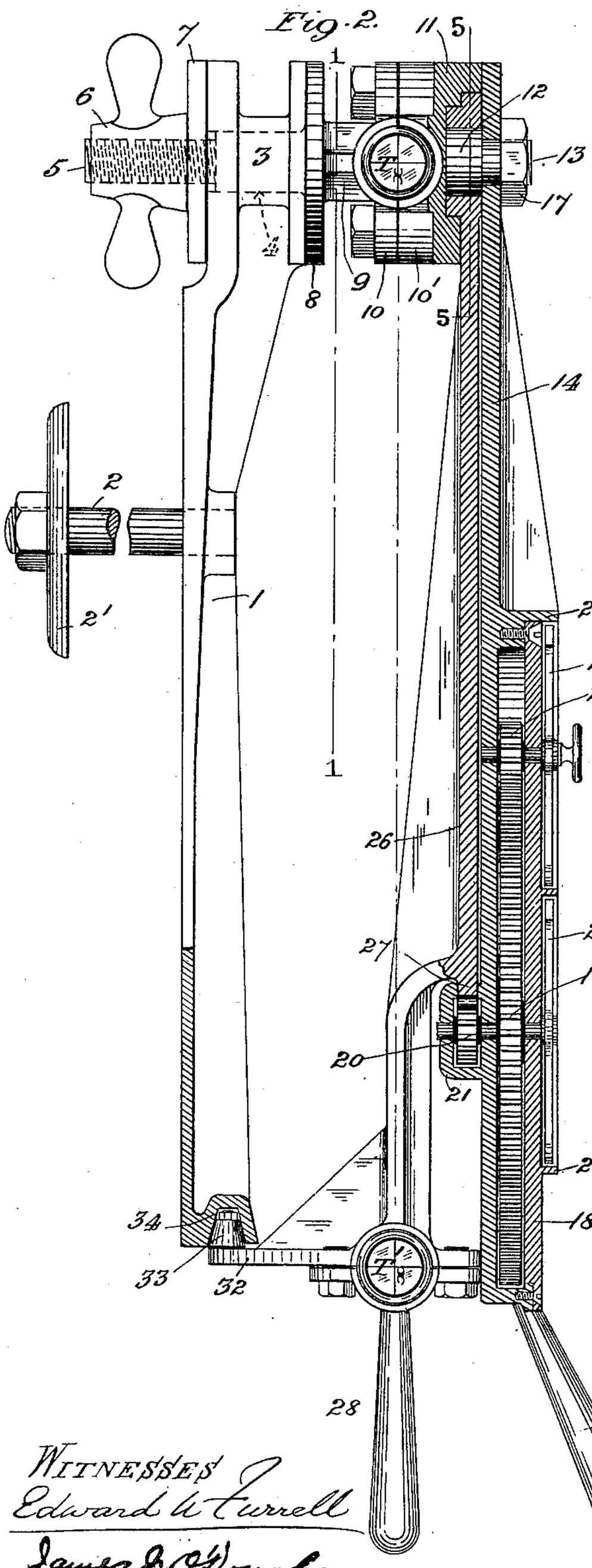
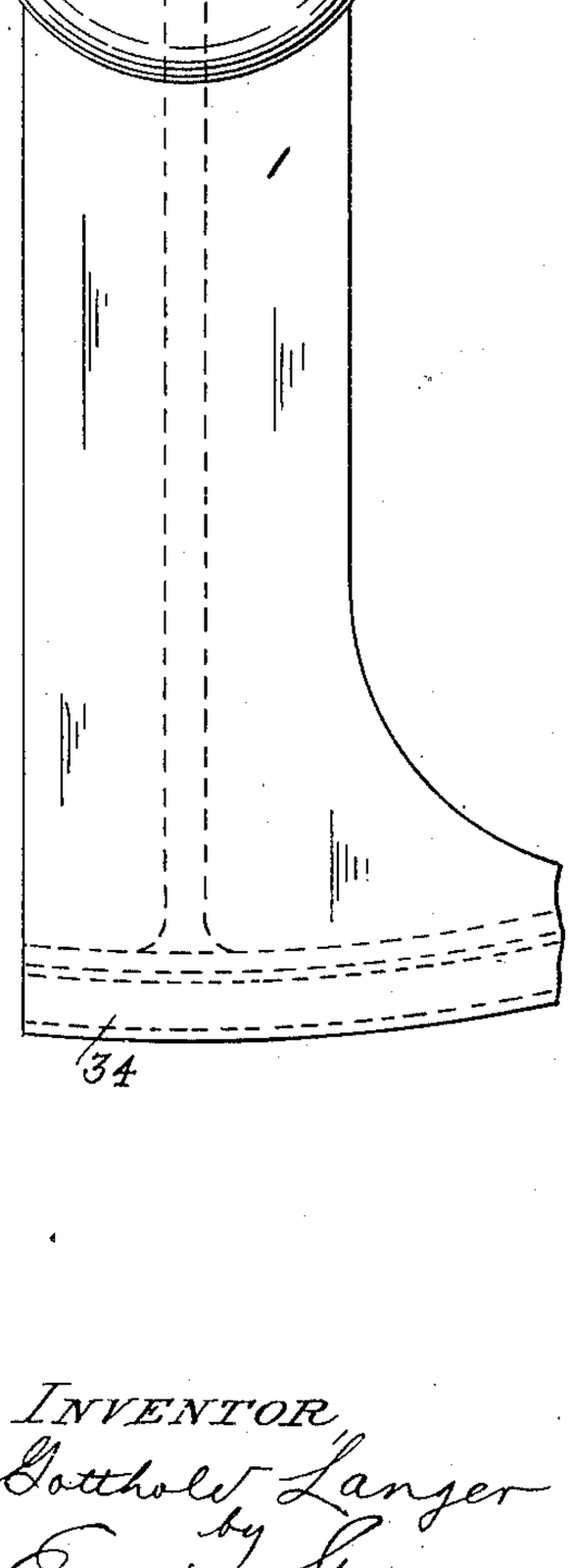


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 4.

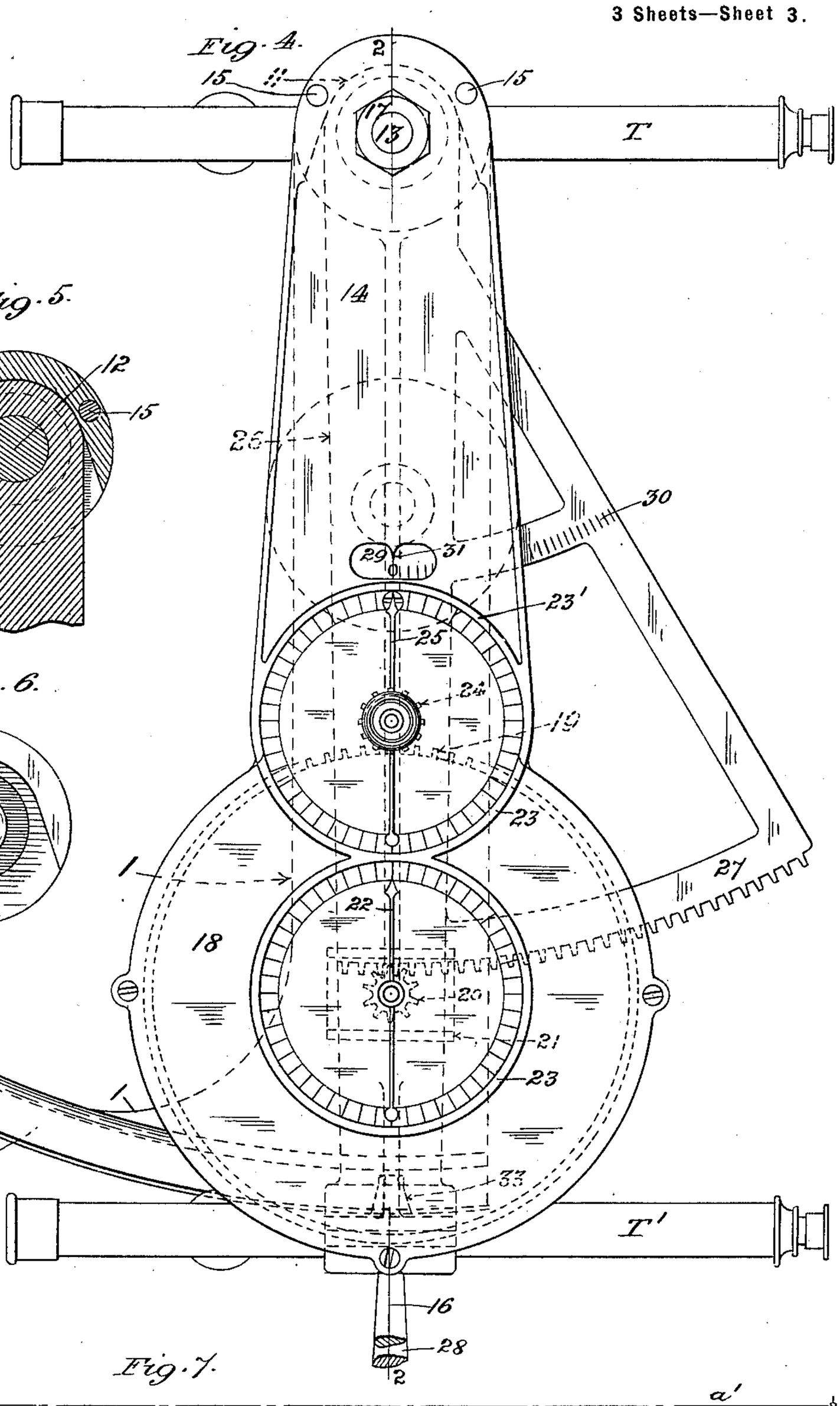


Fig. 5.

Fig. 6.

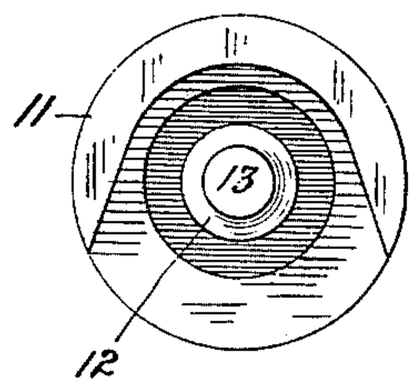
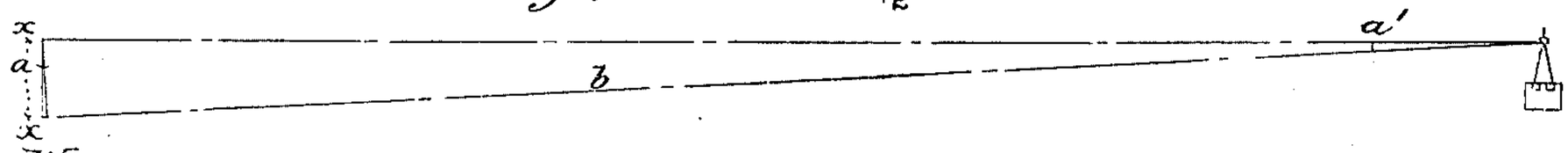


Fig. 7.



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UNITED STATES PATENT OFFICE.

GOTTHOLD LANGER, OF ST. LOUIS, MISSOURI.

RANGE-FINDER.

SPECIFICATION forming part of Letters Patent No. 630,244, dated August 1, 1899.

Application filed March 16, 1899. Serial No. 709,367. (No model.)

To all whom it may concern:

Be it known that I, GOTTHOLD LANGER, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Range-Finders, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part thereof.

My invention has relation to improvements in range-finders; and it consists in the novel arrangement and combination of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a rear elevation of the swinging arm of the device, the roller at the free end thereof being omitted and the upper stud about which said arm oscillates being in section on line 1 1 of Fig. 2. Fig. 2 is a side sectional elevation on line 2 2 of Fig. 4, showing parts in side elevation. Fig. 3 is a rear elevation of the supporting-bracket, a portion thereof being broken away. Fig. 4 is a front elevation of the device. Fig. 5 is a section on line 5 5 of Fig. 2. Fig. 6 is a face view of the terminal cup of the rotatable stud about the stem of which the rear arm oscillates, and Fig. 7 is a diagrammatic view illustrating the application of the range-finder to a distant object.

The object of my present invention is to construct a range-finder with a permanent trigonometrical base, the length of said base constituting the shortest distance between the longitudinal axes of the two telescopes with which my device is provided. In my improvement one of the telescopes is rigidly carried by an arm loosely oscillating about the axis of rotation of the other telescope, the latter being first directed upon the object whose distance is to be ascertained, whereupon the swinging telescope is directed against the same point on said object, the lines of vision of the two telescopes constituting, respectively, the hypotenuse and base of a right-angled triangle and the distance between the axes of the telescopes (measured along the oscillating arm) constituting the perpendicular of said triangle. The calculations are based on the relations subsisting between the various sides of a triangle, the instrument always giving the length of one side and two angles, as will be better apparent from a detailed description of the invention, which is as follows:

Referring to the drawings, 1 represents a ribbed plate or frame adapted to be rigidly secured by means of the bolt and nut 2 and washer 2′ to any standard or base. (Not shown.) Mounted in the upper tubular bearing 3 of the supporting-frame and adapted to rotate within the same is a stud 4, having a rearwardly-extending screw-threaded stem 5, over the outer end of which is passed a tightening-nut 6, adapted to bear against a washer 7, interposed between it and the adjacent wall of the frame.

Formed integrally with the stud 4 is a flange or disk 8, adapted to bear against the front wall of the frame around the bearing 3, the nut 6 being adapted to draw the disk 8 firmly against the frame, and thus prevent rotation of the stud 4 when occasion arises to clamp the latter. The ribs 9, formed integrally with the front face of the flange 8, connect the latter with one section 10 of the telescope-socket, the opposite section 10′ being formed integrally with a cup 11, from the bottom of which projects outwardly a central boss or stem 12, having an outer reduced extension 13, the base of which is smooth and balance screw-threaded. Adapted to be passed over the smooth basal portion of the extension 13 is a ribbed arm 14, being rigidly secured to the cup by pins or screws 15 and being provided at its free end with an outwardly-projecting handle 16. When the tightening-nut 6 is loosened, the operator can, by seizing the handle 16, swing or oscillate the arm 14 about the axis of the stud 4, the latter, together with the cup 11 and telescope T, clamped within the socket 10 10′ and flange 8, all rotating about the same axis as a unit or as one piece. To insure a rigid connection between the arm 14 and cup 11, I pass a retaining-nut 17 over the stem 13, the nut forcing the arm against the annular ledge or shoulder formed between the stem 12 and its extension 13.

Mounted along the front wall of the lower expanded portion of the arm 14 and protected by

a suitable cover-plate 18 is a gear-wheel 19, the shaft of which passes, respectively, through the cover-plate and the arm 14, the rear end of the shaft carrying a pinion 20, confined in a housing 21, cast or formed with the arm, and the forward projecting end of the shaft having secured thereto a needle or index-arm 22, protected by a rib or ledge 23 of the cover-plate, said needle coöperating with suitable divisions or graduations formed on the face of the cover-plate. The gear-wheel meshes with a pinion 24, also mounted between the arm and its cover-plate, the forward projecting end of the shaft or spindle of said pinion having secured thereto a second needle or index 25, likewise protected by the rib 23 and a continuation 23′ thereof formed on the arm, said needle likewise coöperating with a second graduated circle superposed directly over the first circle.

Adapted to swing or oscillate freely about the stem or boss 12 is a second arm 26, the hub portion of which loosely embraces the stem 12, being confined between the rigid arm 14 and the bottom of the cup, the peripheral walls and face of the latter being cut away or recessed sufficiently so as to allow for the free passage and oscillation therethrough of the narrow portion of the said arm 26, the sides of the recess thus formed in the face inclining so as to allow the arm 26 to describe a length of arc as the capacity of the instrument may require, (in the present case about ten degrees on each side of a vertical line passing through the axis of oscillation of the arm,) but limiting its oscillation when the arm comes in contact therewith. (See Figs. 5 and 6.)

The oscillating arm has formed integrally therewith a toothed segment 27, the teeth of which mesh with the lower pinion 20, confined within the housing 21 of the relatively stationary arm 14, the wall of the housing being cut away sufficiently to allow the toothed edge of the segment 27 to mesh with said pinion, the body of the segment projecting laterally and to one side of both arms when both arms are parallel. The arm 26 is provided with a handle 28, the base of which forms one section of the clamping-socket for the retention of the second telescope T′, the other half or section of the clamping-socket being formed directly with the arm 26. The arm 14 is provided with an opening 29, through which may be read the degree graduations or limb 30, marked on the toothed segment, the upper wall of the opening being provided with a pointer or needle 31, in connection with which the limb 30 can be read. When both arms—that is to say, their longitudinal axes—are parallel, the needle 31 will point to zero on the limb 30, the pinion 20 being in engagement with the third or fourth tooth from the adjacent edge of the toothed segment. When once the arm 14 is rigidly clamped to the supporting-frame, then the operator can readily oscillate the arm 26 and segment 27 about the stem 12. When the arms 14 and 26 are parallel and the pointer 31 points to zero on the limb 30, the telescopes T and T′ are parallel, the longitudinal axis of the telescope T′ being perpendicular at all times to the longitudinal axis of the arm 26. The arm 26 is so shaped as to bring the centers of the two telescopes in a line parallel to the plane of oscillation of the arm 26, and hence the shortest distance between the telescopes may be measured along this line. This distance is marked X X in Fig. 2 and serves as the permanent base-line from which the trigonometrical calculation previously referred to can be made.

The relation between the diameter of the pinion 20 and the diameter of the toothed circle of the segment 27 is such that when the latter has been oscillated ten degrees the pinion, and hence the gear-wheel 19, will have made one revolution; and the relation between the gear 19 and pinion 24 is such that one revolution of the gear-wheel imparts ten revolutions to the pinion 24 and needle 25, or, in other words, one-tenth of a revolution of the gear-wheel 19 (which means an oscillation through an angle of one degree for the segment 27 or arm 26) will impart one revolution to the pinion 24 and needle 25. The circumference of the graduated circle with which the needle 25 coöperates represents (with the present arrangement of multiplying-gear) one degree of swing for the arm 26 and telescope T′, carried by it, and hence to read a fraction of a degree the circle referred to may be divided into any number of arbitrary divisions; likewise may the lower circle, or that with which the needle 22 coöperates. Of course it is obvious that the object of the multiplying-gear here described is to enlarge the surface over which a degree of oscillation may be subdivided, so as to make the reading easier and the results more accurate.

The special application of the device as a range-finder will now be apparent. Upon loosening of the nut 6 the cross-hairs of the telescope T are first directed upon an object whose distance is to be ascertained. This is done by seizing the handle of the arm 14 and swinging the latter (there being a rigid connection between it and the telescope T, as already explained) until a particular spot on the object is sighted by the cross-hair of said telescope T. The parts are then firmly clamped by the tightening-nut 6. The handle of the arm 26 is then seized, and the latter is oscillated about the stem 12 until the cross-hair of the telescope T′ sights the same spot on the same object. That the telescope may sight the same spot it follows that their lines of sight must necessarily converge toward such point, and hence the triangle forming the basis of calculation is complete. The perpendicular of this triangle is the distance

tween the axes of the two telescopes, this distance being the line X X and constituting the permanent base-line from which one of the other sides of the triangle can be calculated. The angle through which the arm 26 has been swung to cause the line of sight of the telescope T′ to converge to the same point to which the cross-hairs of the telescope T are directed will be indicated on one or the other of the graduated circles of the front face of the arm 14; but this angle is the same as the angle between the base and hypotenuse of the large triangle to be calculated. Thus, in the diagrammatic view in Fig. 7, let *a* be the angle to which the arm 26 has been swung from its parallel position to the arm 14 to enable the operator to sight the same point as that to which the telescope T is directed. Then from the similarity of triangles the angle *a* is equal to the angle *a′* of the large triangle; but as the angle between the base and perpendicular (line X X) of the large triangle is a constant one—ninety degrees—then knowing the angle *a′* and the length of the perpendicular (X X) one can always calculate the length of the base *b*—that is to say, the distance of the object sighted. It is therefore obvious that the constant base-line under the present invention corresponds to the perpendicular of a triangle whose base is the distance of the object sighted. Of course the distance might be read along the hypotenuse, which could also be calculated, if desired. Having the angle *a′*, it is possible to prepare a table to which the operator could refer and note the distance of the object corresponding to any angle sighted.

That the arm 26 may in its swinging be stiffened and guided I provide the same with an arm or bracket 32, at the free end of which is mounted a roller 33, traveling in a dovetailed groove or way 34, formed at the outer edge of the main frame 1.

In practice instead of compelling the operator to resort to a table of calculated distances each instrument will have the distance corresponding to any angle to which the toothed segment has been swung to sight the common point on any object marked on the face of the graduated circles of the arm 14 in connection with the graduations indicating the degrees and parts of degrees marked on such circles. These distances will be carefully calculated on the testing-grounds and then marked on the instrument so tested.

Having described my invention, what I claim is—

1. A range-finder comprising a telescope, a rotatable stud to which said telescope is fixed, the axis of rotation of the stud corresponding to the transverse axis of rotation of the telescope, an arm rigidly connected to the stud at right angles thereto, and adapted to rotate the latter, a second rigid arm loosely depending or oscillating about the axis of the stud and located adjacent to, and extending in the same direction with, the first arm, a second telescope secured to the second arm, with its longitudinal axis at right angles to the length of the arm, both telescopes being adapted to be directed against a common point of the same object sighted, substantially as set forth.

2. A range-finder comprising a telescope, a rotatable stud to which said telescope is fixed transversely to the axis of rotation thereof, the transverse axis of the telescope and the longitudinal axis of the stud being in the same straight line, a rigid arm connected to the stud at right angles thereto, a second rigid arm adapted to oscillate about the axis of the stud, and located adjacent to the first arm, and extending in the same direction therewith, a telescope carried by said second arm, and adapted to oscillate in a plane parallel to the plane of rotation of the first telescope, the axes of the telescopes being connected by a line parallel to said plane of oscillation, a toothed segment carried by said second arm, multiplying-gearing carried by the first arm and cooperating with the teeth of said segment, index-arms connected to the gearing of the first arm, graduated circles coöperating with said index-arms, a graduated limb on the toothed segment, and means connected to the first rigid arm for limiting the swing of the oscillating arm, the parts operating substantially as, and for the purpose set forth.

3. In a range-finder, a suitable rotatable stud, a telescope fixed thereto, a rigid arm connected to the stud at right angles thereto, means for clamping the stud against rotation, a second rigid arm loosely oscillating about the stud and located adjacent to the first arm and extending in the same direction therewith, inclined walls carried by the stud for limiting the degree of oscillation of said second arm, a telescope secured to said second arm, and means for indicating the angle which the lines of sight of the two telescopes make with one another when converged to a common point, substantially as set forth.

4. In a range-finder, a suitable rotatable stud, a sectional telescope-socket carried thereby, a cup formed integrally with one of the socket-sections, a boss or stem having a reduced extension projecting from the bottom of the cup, an arm passed over the base of the extension of the stem and rigidly secured to the adjacent end wall of the cup, a nut passed over the projecting end of the stem extension, the peripheral wall and face of the cup being recessed to a suitable depth, and the sides of the recesses being inclined toward each other, a series of multiplying-gears mounted on the arm, and having index-arms actuated by the spindles or shafts of the respective gears, the index-arms coöperating with the division-marks of properly-graduated circles marked

on the face of the arm, a second arm loosely oscillating about the stem in the cup and carrying a telescope oscillating with the plane of rotation of the first telescope, a toothed segment coöperating with the series of multiplying-gears on the first arm, a graduated limb on said toothed segment, a pointer on the first or rigid arm coöperating with said graduated limb, the parts operating substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

GOTTHOLD LANGER.

Witnesses:
EMIL STAREK,
JAMES J. O'DONOHOE.