No. 754,897. PATENTED MAR. 15, 1904.

W. G. RUSSELL.

SLOPE STAKE ATTACHMENT FOR ENGINEERS' TRANSITS.

APPLICATION FILED FEB. 9, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

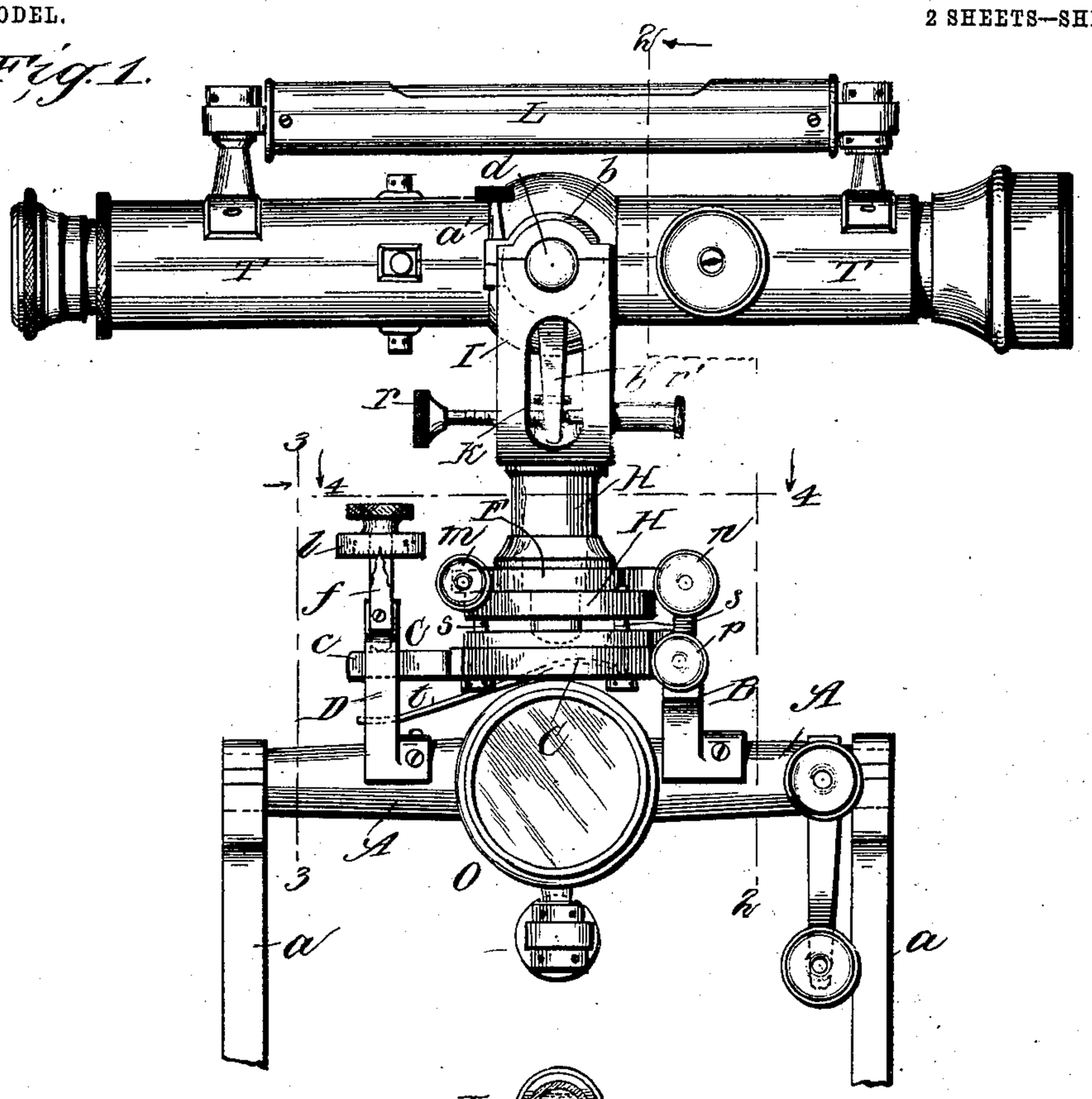
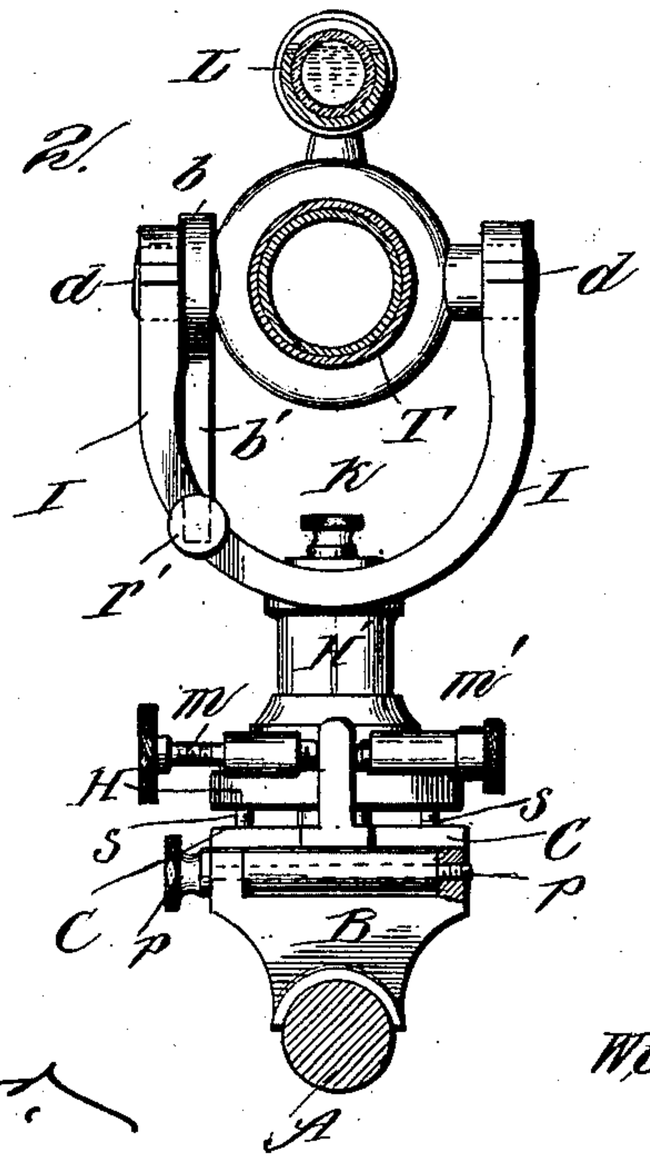


Fig. 2.



WITNESSES:

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

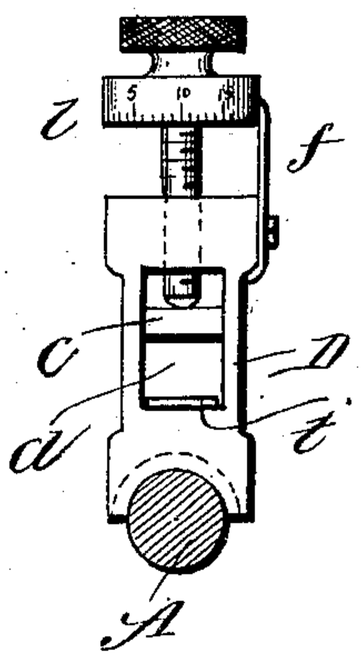


Fig. 4.

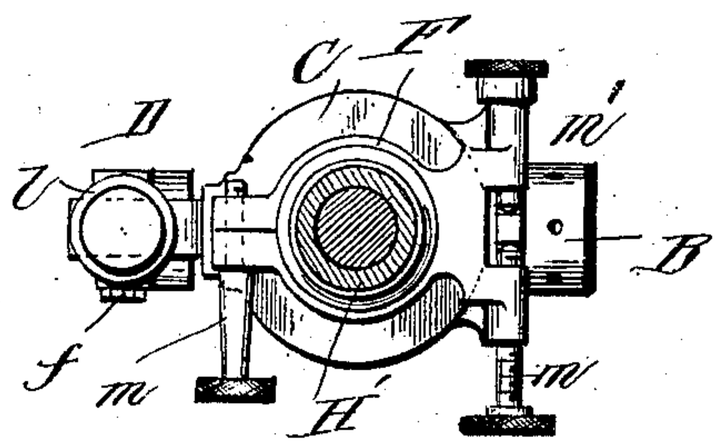


Fig. 5.

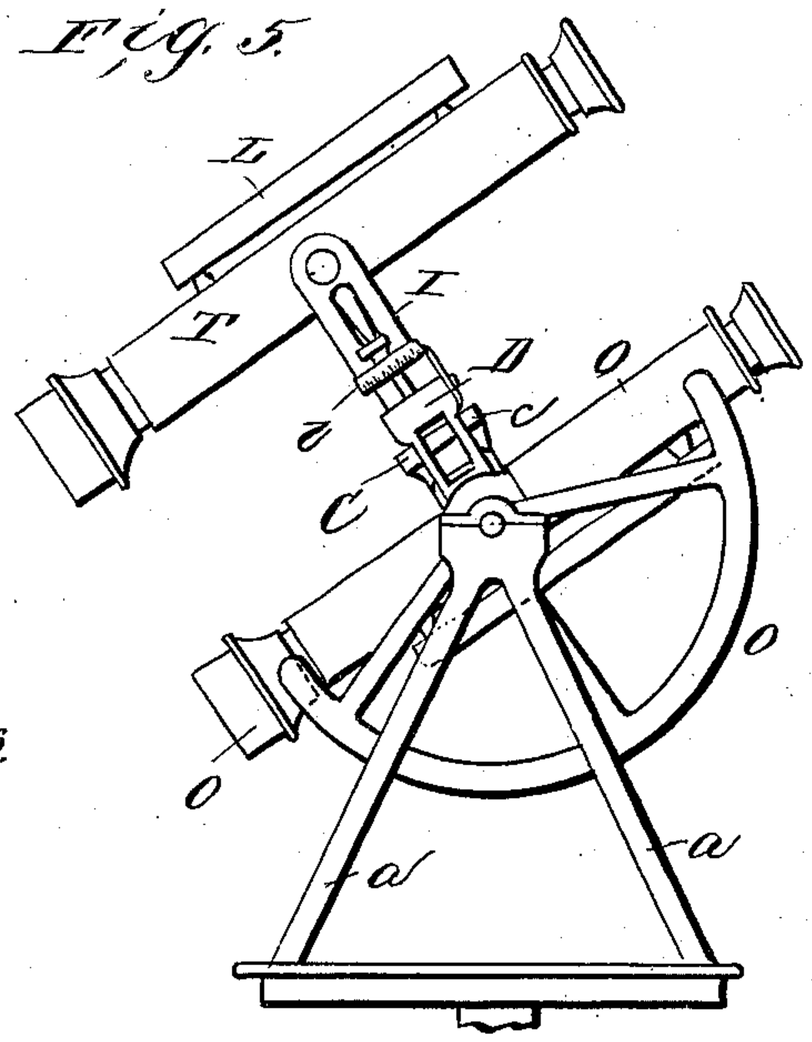


Fig. 6.

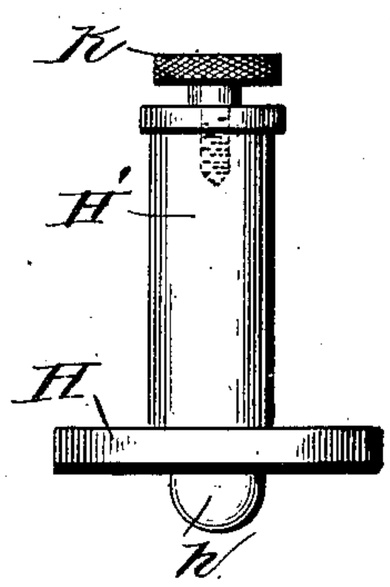
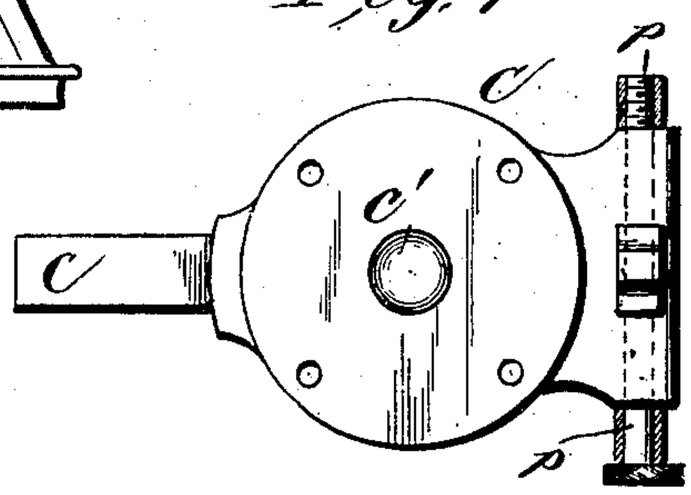


Fig. 7.



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No. 754,897. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM G. RUSSELL, OF RUSSELL, KANSAS.

SLOPE-STAKE ATTACHMENT FOR ENGINEERS' TRANSITS.

SPECIFICATION forming part of Letters Patent No. 754,897, dated March 15, 1904.

Application filed February 9, 1903. Serial No. 142,470. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM G. RUSSELL, a citizen of the United States, residing at Russell, in the county of Russell and State of Kansas, have invented a new and useful Slope-Stake Attachment for Engineers' Transits, of which the following is a specification.

My invention relates to an improved attachment for an engineer's transit, the same being attached to the axis of the transit-telescope, having a level underneath and provided with a graduated vertical arc or circle and clamp and tangent screws applied in the usual way.

The objects of my improvement are to effect the setting of slope-stakes of embankment and cuts in railroad or other work without the use of the Wye level and without any calculations and with much greater speed than can be made by ordinary methods.

The details of construction, arrangement, and operation of parts are as hereinafter described, reference being had to accompanying drawings, in which—

Figure 1 is a side elevation of my transit attachment as applied to an ordinary transit, whose telescope is seen in end view or at right angles to the attachment-telescope. Fig. 2 is a vertical cross-section on line 2 2 of Fig. 1. Fig. 3 is a vertical cross-section on line 3 3 of Fig. 1. Fig. 4 is a horizontal section on line 4 4 of Fig. 1. Fig. 5 is a diagrammatic side view showing my transit attachment and the transit-telescope arranged at an inclination. Fig. 6 is a side view of the perpendicular axis on which the attachment-telescope rotates while being used. Fig. 7 is a plan view of the base-piece upon which the attachment is built.

The horizontal rocking axis A of the transit-telescope is journaled in and supported by diverging legs *a* in the usual way. To this axis is screwed a vertical bracket B, to whose upper end my improved attachment is hinged. This is effected at *p*, where a pintle connects (see Figs. 1 and 7) the base-piece C to the bracket B. The other end *c* of said base-piece is reduced and projects through a vertical slot or guideway *d*, (see Figs. 1 and 3,) formed in another vertical bracket, D, which is set opposite the bracket B and similarly secured to the transit-axis A. A stiff spring *t* (see Fig. 1) is fastened at one end near the center and on the under side of base-piece C and extends through the slot *d* in bracket D, upon which it bears, so as to support the base-piece, as shown.

In Figs. 1 and 5, L represents the level-tube, and T the telescope of the attachment, which is pivoted between the arms of a standard I, extending down in one piece to base H and bored or made cylindrical to fit the perpendicular axis H′, upon which it revolves. F is a clamp around the circular base of standard I, (see Fig. 4,) and *m* is its clamp-screw and *n* its tangent-screw, which has an opposing spring-pressed pin *n*′, the several parts *m n n*′ having enlarged and milled heads, as shown. There are four leveling-screws *s*, by which the attachment can be adjusted and leveled. These are applied as shown in Fig. 1, passing up through base-piece C (see Fig. 7) and through the superposed or supplemental base H.

d, Fig. 1, indicates the horizontal axis or trunnions of the attachment-telescope T; *a*′, its clamp-screw; *b*, the clamp; *b*′, its arm; *r*, a tangent-screw, and *r*′ an opposing spring. The standard I is secured to the axis H′ by a screw *k*, (see Figs. 2 and 6,) which axis is formed integrally with the supplemental base H, supported by the leveling-screws *s*, which serve to set the standard vertical. The attachment may be rotated horizontally upon said standard, whose spherical end *h* is seated in a corresponding socket *c*′ (see Figs. 1 and 7) in the base-piece C.

By removing pivot-pin *p* the entire attachment, except pieces A, B, and D, may be removed from the transit.

Figs. 1 and 2 show a gradienter-screw *l* and pointer *f* applied to bracket D.

The projection *c* from base-piece C fits slot *d* perfectly, so that its movements may be exactly perpendicular. The head of screw *l* is graduated on the edge to fifty divisions, and the threads are accurately cut, so that any grade can be set off by simply turning *l* any number of divisions, as indicated by pointer *f*.

It will be seen that the four leveling-screws are applied to the base of the vertical axis of the auxiliary telescope T, and, when the main telescope O is level as well, then by revolving

the two telescopes each on its perpendicular axis the two horizontal lines of sight lie in two parallel planes. Thus by means of its leveling-screws and the hinged base, the gradienter-screw, and the spring supporting the hinged base at its free end the perpendicular axis of the upper telescope T can be pitched to the right or left and exactly in the plane of the axis of the main or transit telescope O. This enables the stakes to be set on any grade by simply turning the transit-telescope O ninety degrees and turning the upper telescope T back in the line of sight ninety degrees, then putting on the grade required by means of the gradienter-screw. The attachment-telescope T will now revolve on its perpendicular axis in a plane exactly parallel with the top of the grade and at a distance from it exactly the same as the cross-hairs of a telescope T. Now if a level-rod has its target clamped at the distance of the cross-hairs above or below grade then without moving the target wherever the rod is held its lower end will be on the grade when the cross-hairs bisect the target. If the instrument be taken to the edge of the cut or fill and adjusted as directed above and the main telescope O be then pitched to the angle of the slope of the cut or fill as given by the vertical arc, then the attachment-telescope T will revolve in a plane parallel to the face of the cut or fill and distant from it the height of the cross-hairs. If the target be set at this height, as before, then when moving on the ground until the cross-hairs bisect the target the bottom of the rod will be the point for the slope-stakes, no matter what the distance may be. This manipulation is available for cuts as well, and on steep ground by simply pushing the transit-telescope up instead of down.

In Fig. 1 the transit proper with my attachment is supposed to be shown leveled and pointed along the line and at a target set at the height of the cross-hairs above grade, with the transit-telescope O turned at right angles to the line of the embankment or cut.

In Fig. 5 the two telescopes L O are shown parallel and pitched down to the angle of the embankment.

The base-piece C, spring *t*, bracket D, screw *e*, and pivot *p* enable the telescope T to be adjusted parallel with the grade of the top of the fill, (the top of an embankment or bottom of a cut never being level for any considerable distance.)

By my improved transit attachment stakes may be set upon any grade or curve and driven with as much rapidity as on level lines and in any case with much greater rapidity than by the ordinary method. The stakes can be set correctly upon any curve by simply turning off the curve on the main plate of the transit.

With my invention with one setting of the instrument as many station slope-stakes can be set as can be seen on each side of the transit, and this distance will be limited by the power of the attachment-telescope L and the curvature of the earth.

The transit may be set at a center stake or at half-width of road-bed, cut, or fill at each side and is operated as follows: If on a fill, select a convenient station at edge of fill, level up the transit and main telescope, ascertain height of cross-hairs above grade, and set target on the level road at this elevation. Send a rodman back or forward, as the case may be, to the greatest distance to be worked at this setting and have him hold rod or line of the transit, then level and point both telescopes at the rod held vertical and clamp the plates, then turn the plates ninety degrees toward outside of fill and without moving main telescope T revolve the attachment-telescope L on its perpendicular axis, point it on the rod, and see that it is level. Now place the target on the rod at first elevation, place the distance between the cross-hairs of the two telescopes, and add to this or subtract from it the grade of this station from the transit, placing a target at this elevation and elevating or depressing the attachment-telescope to the target by the gradienter-screw. Now pitch the main telescope T down to the slope of the fill as given by the vertical arc *o* and unclamp the attachment-telescope L from its vertical axis and move the rodman to the right or left until the center of the horizontal cross-wire of the attachment-telescope bisects the target, when the foot of the rod will be at the outer edge of the embankment, no matter how far off or how near.

In staking out cuts the operation is similar until you set off the slope, when you pitch the main telescope T up until vertical arc *o* gives the degree of the slope, when you proceed as before. For work on curves turn off the curve on the main plate as in running through curves without disturbing either of the telescopes, except to use only attachment-telescope, as before stated.

In any case it is only necessary to have elevation of center or extreme pegs. The elevation of any peg can be found by multiplying distance out by ratio of slope.

First, by my improved instrument at one setting of the transit without any calculation, except putting the proper elevation on the target, all the center-line grade-stakes may be driven either tangent or curved, both fore and aft, without any distance in the range of the telescope.

Second, at one setting of the transit at the out edge of a cut or fill all the slope-stakes may be driven at the top of the cut or bottom of the fill either on tangent or curve or any distance as above and with equal speed, facility, and accuracy.

What I claim is—

1. The combination, with a transit proper,

of a slope-stake attachment comprising a telescope with level, a vertical pivot-post in which the said telescope is mounted so that it may rotate horizontally and vertically, leveling-screws applied to the base of said telescope, a hinged piece to which the base-piece is attached, and a gradienter-screw arranged for adjusting the hinged piece as shown and described, whereby the perpendicular axis of the attachment-telescope may be pitched to the right or left and in the same plane with the axis of transit or main telescope.

2. The combination, with the transit proper including the main telescope O having a horizontal support upon which it may swing vertically of the slope-stake attachment comprising the telescope and level, a pivot-post in which said telescope is journaled and adapted to rotate and swing, and means for adjusting the telescope which consist of a horizontal pivoted base-plate, a spring secured to said plate, a gradienter-screw for adjusting the spring-supported free end of said base-piece, and means for adjusting the telescope horizontally and clamping it on the base-piece, substantially as described.

3. The combination, with the transit-telescope journaled as described, of the attachment comprising a pivoted telescope and level having a vertical axis, two opposite brackets fixed vertically on the axis of transit-telescope, a base-piece hinged in horizontal position to one of said brackets, and means applied to the other bracket for adjusting the free end of said base-piece vertically, and means for leveling and clamping the attachment as a whole, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM G. RUSSELL.

Witnesses:

MABELLE E. FAULKNER,

T. W. BOWLUS.