No. 638,846.

Patented Dec. 12, 1899.

O. KELLY.

ENGINEERING INSTRUMENT.

(Application filed Mar. 6, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 2.

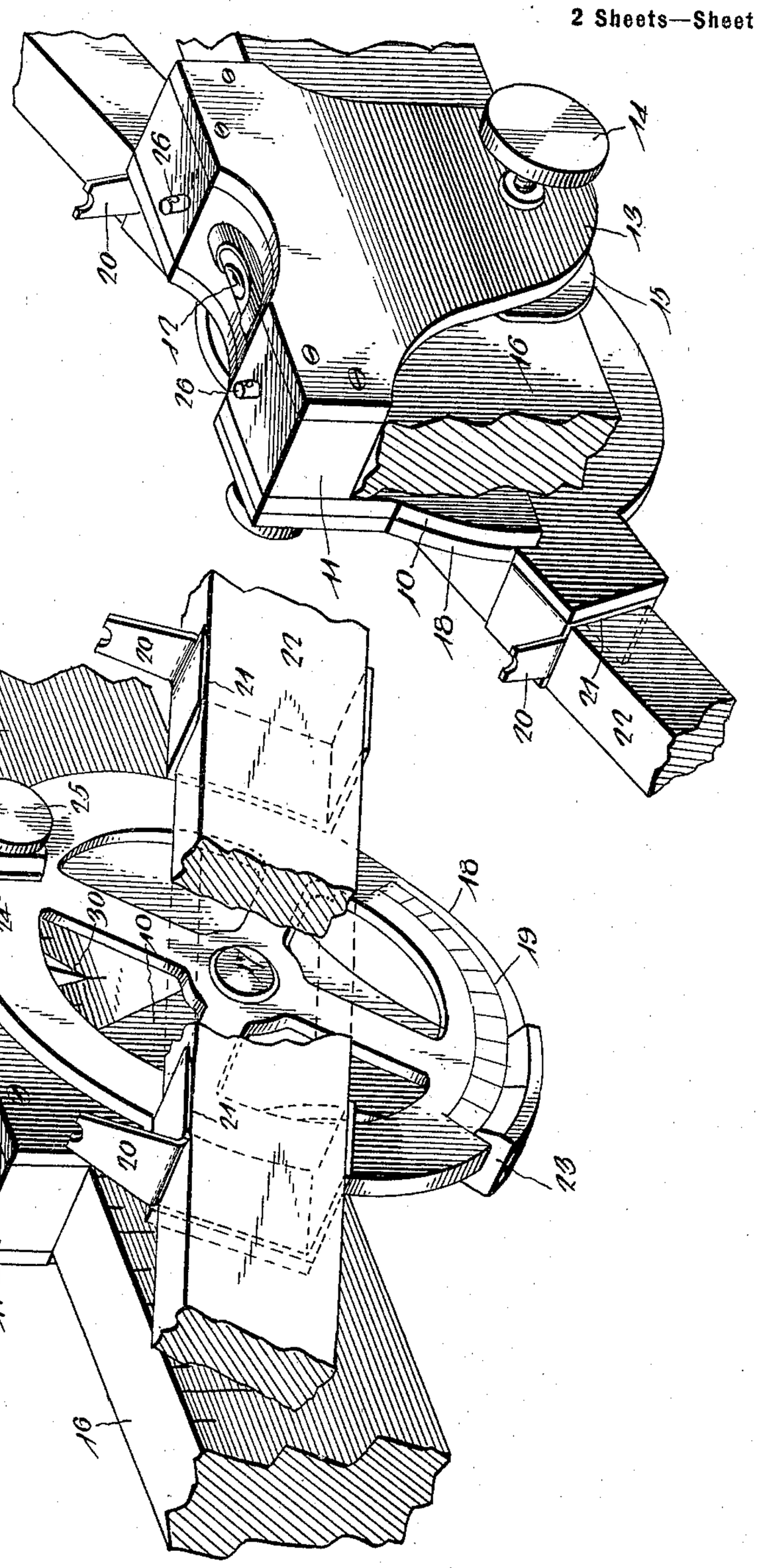

Fig. 1.

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[illegible]

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Fig. 4.

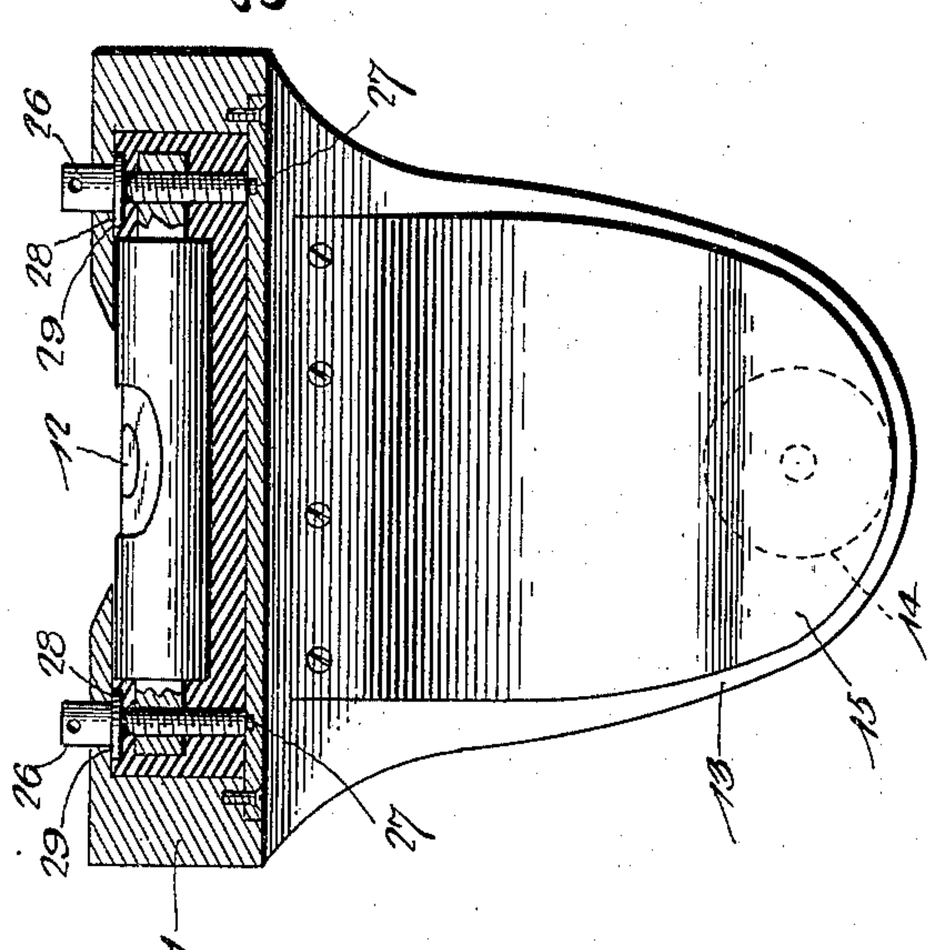


Fig. 5.

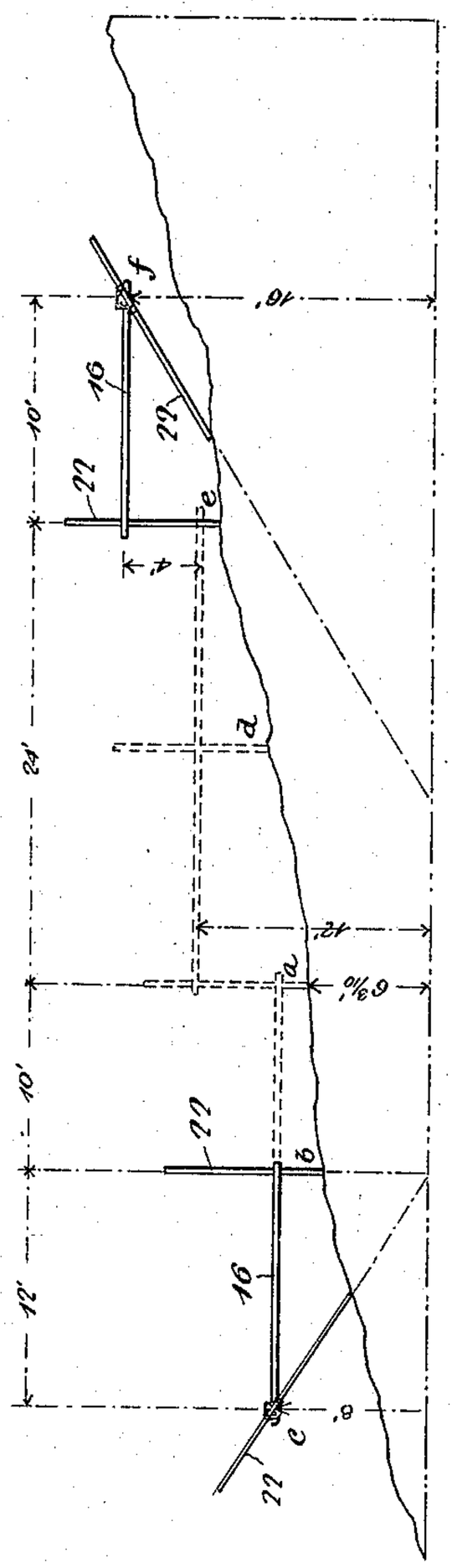
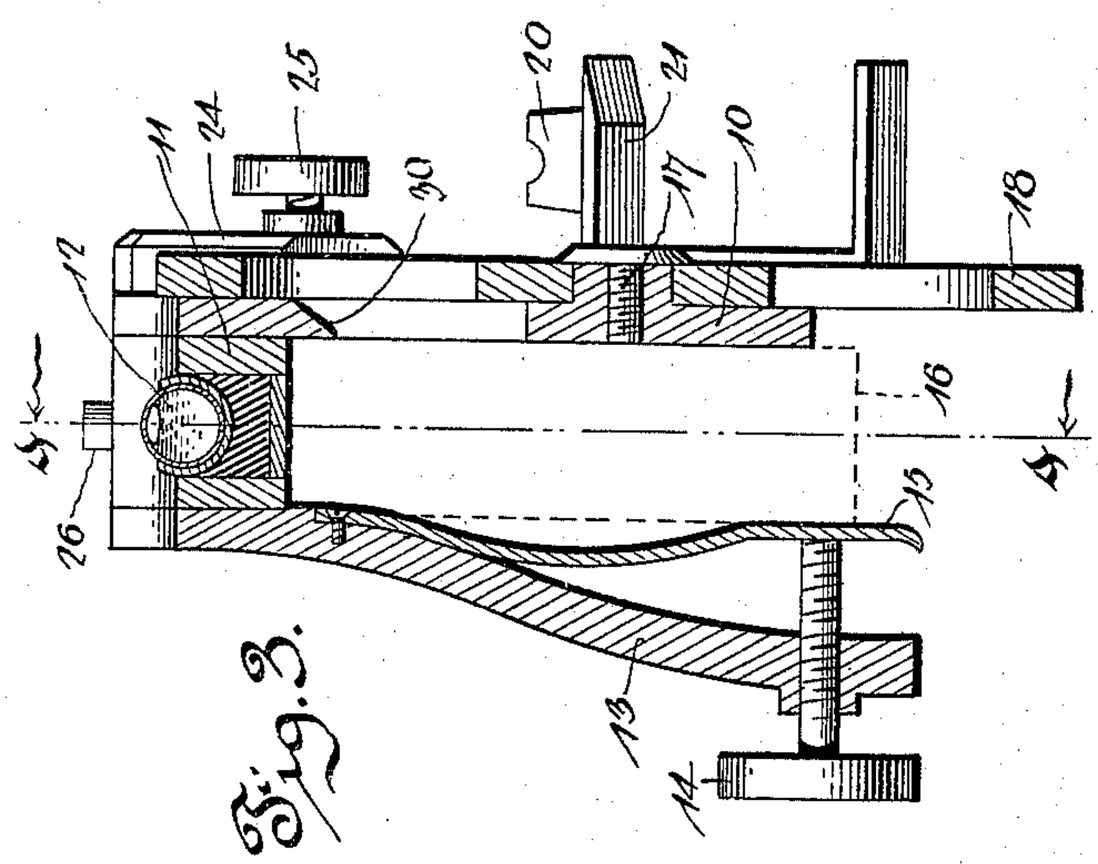


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

ORIN KELLY, OF WELLSTON, OHIO.

ENGINEERING INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 638,846, dated December 12, 1899.

Application filed March 6, 1899. Serial No. 707,962. (No model.)

To all whom it may concern:

Be it known that I, ORIN KELLY, a citizen of the United States, residing at Wellston, in the county of Jackson and State of Ohio, have invented a new and useful Engineering Instrument, of which the following is a specification.

My invention relates to engineering instruments, and particularly to a simple device for use in setting slope-stakes for railroad-cuts, pikes, &c., to guide the excavators, the instrument being of such a construction as to provide for indicating the positions of the slope-stakes with the minimum calculation or computation upon the part of the engineer, and hence provide for accomplishing the desired work with the minimum liability of error.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a perspective view of an instrument constructed in accordance with my invention as seen when in use. Fig. 2 is a similar view of the same as seen from the rear. Fig. 3 is a vertical section of the same in a plane parallel with the axis of the graduated arc or circle. Fig. 4 is a vertical sectional view upon the plane indicated by the line 4 4 of Fig. 3. Fig. 5 is a diagram showing the method of laying off slopes and locating slope-stakes by means of an instrument constructed in accordance with my invention.

Similar reference characters indicate corresponding parts in all the figures of the drawings.

The instrument embodying my invention consists, essentially, of a frame or support provided with means for attachment to a horizontal rod and a sighting member mounted for angular adjustment upon the support or frame and having a graduated arc for reference to a fixed pointer, said sighting member preferably having seats for a vertical or indicating rod. In the construction illustrated the support or frame consists of a plate 10, provided at its upper edge with a head or enlargement 11, in which is mounted a leveling device, such as a spirit-level 12, and depending from this head or enlargement and spaced rearwardly from the plate 10 is a bracket 13, in which is mounted a set-screw 14 for terminal contact with a yielding clamp-jaw 15. This clamp-jaw is supported by the bracket for terminal movement toward and from the plane of the rear surface of the plate, which constitutes a coöperating fixed jaw, and between said jaws may be arranged a horizontal or level rod 16 of the ordinary or any preferred construction employed in engineering operations. The movable portion of spring-jaw preferably bears adjacent to its lower end against the rear surface of the horizontal or level rod to prevent rocking of the instrument with relation to the rod when in use.

Mounted upon the front surface of the plate of the frame or support, as by means of a central pivot 17, is a sighting member consisting of a spider 18, carrying a graduated arc 19, which may be circular, as indicated in the drawings, and sights 20, which may be used by the operator to indicate a point upon the surface of the ground at which a slope-stake is to be inserted. Also preferably carried by the sighting member and preferably adjacent to the sights are seats 21 for an altitude or indicating rod 22, which, as well as the horizontal or level rod, must be graduated to indicate linear measurements in accordance with any unit of measurement which may be selected or may be used in any particular locality in which the instrument is in use. Also engaging the graduated arc, preferably at diametrically opposite points, are guides 23 and 24, upon the former of which is arranged a pointer for coöperation with the graduations on the arc, while the latter carries a set-screw 25, whereby the sighting member may be secured at the desired angular adjustment to suit the angle of the slope at which the embankment is to be cut.

The enlargement or head at the upper edge of the supporting-plate, forming the stationary member of the instrument, is recessed to receive the spirit-level 12, the extremities of the tube of said level extending under overhanging portions of the walls of the recess and being engaged by set-screws 26, whereby the level may be adjusted accurately with relation to the seat, which is provided for the horizontal or level rod, to facilitate position-

ing said rod horizontally in the use of the instrument. The lower extremities of said set-screws are stepped in seats or sockets 27 in the floor of the recess. Also said set-screws are provided with collars or flanges 28 for contact with the under surface of the overhanging walls 29 of the recess.

In operation the instrument is clamped upon the horizontal or level rod at an assumed distance from one end thereof, as indicated by a pointer 30, depending from the head or enlargement 11 in the plane of the plate 10 and adapted to indicate the desired graduation of the horizontal or level rod, and the problem being to locate the slope-stakes, when the center cut is given, the operation is as follows: From the center cut, the width of the cut being known, find the side cuts in the usual way, and by adding or subtracting the difference of reading to the center cut, the instrument being used to level the rod. Then assuming any convenient vertical distance above the road-bed high enough to clear the point at which a desired slope-stake is to be placed, the horizontal or level rod is accurately leveled at that elevation, one end of said rod being vertically above the side cut, and the instrument, which is secured to the rod at the desired distance from said end, having its sighting member adjusted to the desired angle for the slope. The engineer by glancing over the sights or by placing a vertical or indicating rod in the seats upon the sighting member can then point out the exact spot at which a line drawn from the side of the road-bed at the given slope will pierce the surface of the ground, and hence the point at which to drive the stake. Obviously by this method of operation the slopes may be quickly and accurately located in a single operation and without testing or trial; but a still more simple operation, wherein it is unnecessary to find the side cuts and wherein the field computations are reduced to a single subtraction, may be performed as follows: Assuming that the measurements given are one-half width of road-bed, ten feet; cut at center stake, 6.3 feet; slope required, three to two, and that it is required to locate the slope-stakes, A clamps the instrument at, for instance, twelve feet on the horizontal or level rod, (this being the horizontal distance corresponding to eight feet vertical measurement at the given slope, twelve to eight corresponding with the given slope ratio, three to two,) and B takes his position (see diagram Fig. 5) at the center stake at *a* and holds the end of the horizontal or level rod at a distance of 1.7 feet—namely, eight feet minus 6.3 feet—the given cut at center stake) on his vertical or altitude rod. A then levels the horizontal rod and takes a reading on his vertical rod, which we will assume to be 3.1 feet. B then takes A's position at *b* and holds the horizontal rod at 3.1 feet, while A goes at a distance of twenty-two feet from the center stake to the point *c* (twenty-two feet being ten feet, one-half the width of the road plus twelve feet, the measurement assumed upon the horizontal or level rod) and brings the horizontal rod to a level. The sighting member of the instrument (which is now at A's end of the horizontal rod) having been adjusted to the proper angle for the slope at the given ratio of three to two will now indicate by glancing through the sights the point of intersection of the desired slope with the surface of the ground, or by placing the vertical or altitude rod in the seats on the sighting member the end thereof may be caused to touch the surface of the ground at the point at which the slope-stake is to be driven.

Should the cut be deep or the slope of the ground be rapid, it may be necessary to take a second vertical reading, as shown at the right in the diagram Fig. 5. In this case, the instrument being clamped upon the horizontal or level rod, as before described, B takes his position, as before, at the center stake and holds the end of the level-rod at, say, 5.7 feet, (namely, twelve feet minus 6.3 feet, which is the given cut at the center stake,) while A levels said horizontal rod and takes a reading upon his vertical rod of, for instance, three feet. B then takes A's position at *d*, and the operation is repeated, A obtaining at *e* a vertical reading of .7 foot. This elevation being too small to enable A to properly use the instrument, B again takes A's place at *e*, and to vertical reading .7 foot before obtained he adds four feet and holds his end of the horizontal or level rod at that altitude. A now proceeds to a point *f*, which is at a distance of thirty-four feet from the center stake, and levels the horizontal rod at the new assumed elevation of sixteen feet (namely, twelve feet, which is the elevation of the horizontal rod at the first reading, plus four feet, which is the addition made at the point *e*) and sights as above described. It will be seen that the ratio of three to two, which is that given for the desired slope, is maintained throughout. For instance, in the first portion of the operation the instrument is sighted at a point twenty-two feet from the center stake (which is twelve feet plus the ten feet required for one-half the width of the road) and eight feet from the required level of the road, and in the second instance the instrument is sighted from a point thirty-four feet from the center stake (which is twenty-four feet plus the ten feet for one-half of the width of the road) and sixteen feet from the required level of the road-bed.

The advantages of the device as described resides in the fact that the slope-stakes are located accurately and precisely rather than approximately, as in the present practice, and the simplification of the computations reduces the chances of error, the calculations being such as to be entirely within the grasp of the assistant, whereby the work may be checked as it progresses. Furthermore, the use of the

instrument results in a saving of time in laying off a cut in that the necessary computations to maintain the required ratios between the "run" and the altitude may be performed without fractions, and only one trial being necessary to locate a stake.

It will be understood that in practice various changes in the form, proportion, size, and the minor details of construction within the scope of the appended claims may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having described my invention, what I claim is—

1. A device of the class described comprising two plates rigidly connected and separated below said connections by an interspace, a spring clamping-jaw fixed to one of said plates, means connected with the plate to which the jaw is connected for moving the jaw in the direction of the opposite plate to clamp a straight-edge thereagainst, a spirit-level mounted in the connection of the plate and means for adjusting the same therein to correspond with the effective edge of the straight-edge, a dial pivoted to the plate opposite the spring-jaw, a pointer carried by said plate and adapted to coöperate with the dial, a sighting instrument carried by the dial and adapted for adjustment therewith to lie at various angles to the effective edge of the straight-edge, seats carried by the sighting instrument and adapted to receive an indicating-rod, and means for clamping the dial with the sighting instrument at different points of their adjustment.

2. A device of the class described comprising two plates rigidly connected and separated below said connections by an interspace, a spring clamping-jaw fixed to one of said plates, means connected with the plate to which the jaw is fixed for moving the jaw in the direction of the opposite plate to clamp a straight-edge thereagainst, a spirit-level mounted in the connection of the plate and means for adjusting the same therein to correspond with the effective edge of the straight-edge, a dial pivoted to the plate opposite the spring-jaw, a pointer carried by the plate and adapted to coöperate with the dial, a sighting instrument carried by the dial and adapted for adjustment therewith to lie at various angles to the effective edge of the straight-edge, seats carried by the sighting instrument and adapted to receive an indicating-rod, a plate fixed to the plate carrying the dial and extending over the dial, and a set-screw in the over-extended plate and adapted for engagement with the dial to hold it at various points of its adjustment.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ORIN KELLY.

Witnesses:
W. L. EVANS,
J. H. SELLMER.