Jan. 30, 1923. 1,443,390

T. S. SMITH.

METHOD AND INSTRUMENT FOR SURVEYING.

FILED JAN. 17, 1919.

Fig. 1.

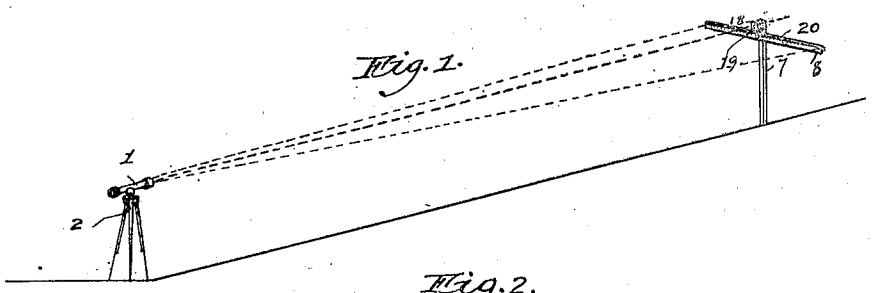


Fig. 2.

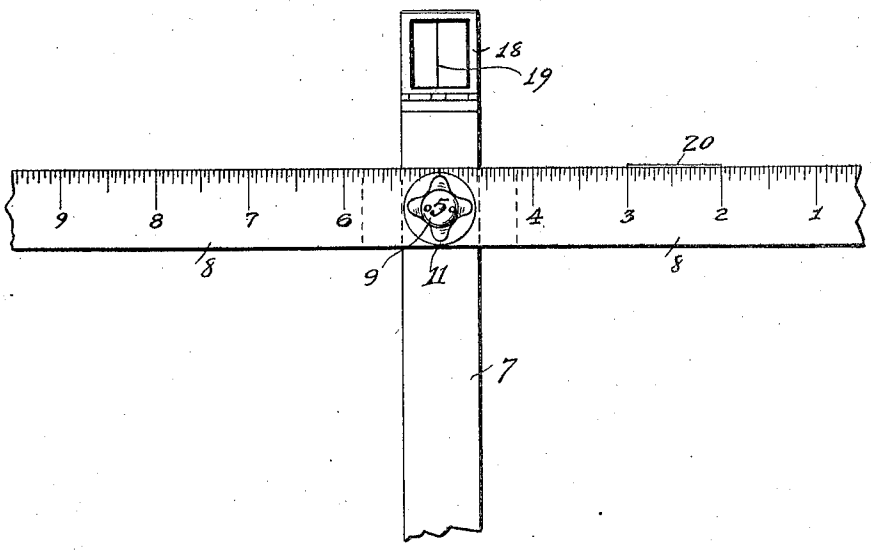


Fig. 3.

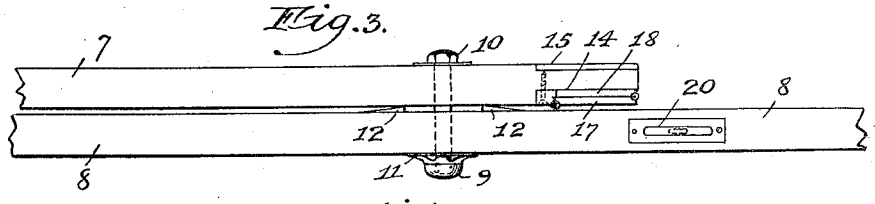


Fig. 4.

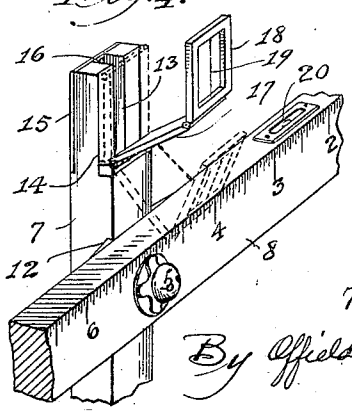


Fig. 6.

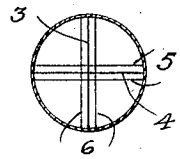
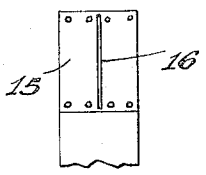


Fig. 5.



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UNITED STATES PATENT OFFICE.

TROW S. SMITH, OF CHICAGO, ILLINOIS.

METHOD AND INSTRUMENT FOR SURVEYING.

Application filed January 17, 1919. Serial No. 271,586.

To all whom it may concern:

Be it known that I, TROW S. SMITH, a citizen of the United States, residing at 5715 Race Avenue, Chicago, Cook County, Illinois, have invented certain new and useful Improvements in Methods and Instruments for Surveying, of which the following is a specification.

This invention relates more particularly to a new method and new apparatus for topographical surveying, although, of course, it may have a more general application to traverses of all kinds.

The principal object of the invention is to provide means for simplifying and expediting the work in topographical surveying by eliminating the stadia corrections which have heretofore been necessary in traverses of this kind, and in the accomplishment of these desired results, the invention includes the provision of a new form of stadia rod and also the provision of vertical stadia lines in the telescope. The invention, therefore, consists in the new method and in the apparatus for carrying out the operation of this new method of surveying, and to the novel construction, combination and arrangement of the parts in the apparatus.

In the accompanying drawing,

Fig. 1 is a view representing a telescope, and a horizontal stadia rod as employed in carrying out this invention;

Fig. 2 is a view of a portion of the stadia rod.

Fig. 3 is a view of a portion of the stadia rod in folded position.

Fig. 4 is an enlarged perspective of a portion of the stadia rod in operative position.

Fig. 5 is a detail view showing a sight plate with a slit in it; and

Fig. 6 is a view showing the arrangement of center and stadia lines in a telescope.

In surveying, the theory of the method of stadia measurements is based on the geometrical principle that the lengths of parallel lines subtending an angle are proportionate to their distance from the apex of that angle, and in practice, the intervals between the stadia wires are frequently arranged so that at a distance of 100 feet a space of one foot shall be intercepted on the rod. This is true, however, only for horizontal sights, and when the stadia rod is held on an elevation, or in a depression, a correction must be made, as the stadia wires or lines will intercept a length on the rod greater than the slope distance, and correction tables are commonly used for obtaining the correct distances.

The present invention proposes to overcome these difficulties by providing vertical stadia wires in the telescope or transit in addition to the horizontal and vertical center lines, and in addition to horizontal stadia lines; and also by providing a stadia rod which can be maintained in a horizontal position at a fixed height and at right angles to the line of sight.

Referring, now, more particularly to the drawing, numeral 1 designates, generally, a telescope of a surveyor's instrument which is mounted upon a tripod 2 or any suitable support, and in the telescope there is provided a diaphragm, as represented in Fig. 6, upon which there is usually a vertical center line 3 and a horizontal center line 4. Horizontal stadia lines 5 may also be provided, but the present invention contemplates as a distinct improvement the provision of vertical stadia lines 6, in addition to the others previously mentioned, and of the same or any well known character.

Supplementing the telescope with these vertical stadia lines 6 is an improved leveling or stadia rod which comprises a supporting member 7 and a graduated bar 8 which are adapted to be secured together in any suitable manner so that they will fold parallel to each other, as for example by means of a bolt 9 which extends through the bar and its support with a nut 10 for drawing the bolt up tightly against the spring washer 11 which permits a relative rotation of the parts to a right angled position, as shown in Fig. 2, in which position they are held by means of the inclined blocks 12. In the folded position, as shown by Fig. 3, it is obvious that the bar itself may be used in the ordinary vertical position.

The upper end of the support 7 is formed with a slot 13 and with a recess 14 on the side adjacent the bar 8. On the side of the support 7, opposite the bar 8, is a plate 15 in which is a narrow sight slit 16. Mounted in the recess 14 is a hinged frame, one part 17 of which is pivoted to swing outwardly from the end of the support 7 and other part 18 which is hinged at the outer end of the first part 17 and carries a hair or wire 19 which is disposed parallel to the slit 16 of the plate 15. As shown by Fig. 3, this hinged frame 17, 18 can be folded into the recess 14 and this is the position which it occupies when the support 7 is folded parallel to the bar 8, so that the frame and the hairline which it carries will be protected when not in use. It is obvious that the outer portion 18 of this frame can be moved up and down in front of the support 7 to sight from a depression or from an elevation through the sight slot 16 with respect to the hair-line 19.

Attached to the bar 8 is a level 20 for determining when the bar is in a horizontal position. It is to be understood, of course, that the support 7 and the bar 8 may be connected to each other in any desired or suitable manner, either temporarily or permanently, but it is necessary that the bar 8 be supported in a horizontal position and at right angles to the line of sight from the telescope 1.

It has been found in practice that heat waves have practically no effect for distances above four feet, and therefore it is contemplated that the bar 8 shall be supported in a horizontal position at a height of five feet. Furthermore, even if there were strata of heat, a horizontally disposed bar would be in the same stratum, and therefore not subject to the error caused by different strata of heat or heat waves.

It is understood, furthermore, that instead of the specific open sight attachment which is shown in connection with the stadia rod, any other suitable sight device such as a telescope might be provided at the center of the rod, as the object of the sight attachment is to position the ends of the horizontal bar 8 so that they will be exactly at right angles to the line of sight from the telescope 1. If desired, the bar 8 may also be mounted upon a tripod, with or without a telescope, these refinements merely conducing to greater accuracy.

In operation, the telescope is placed in position as desired, and the stadia rod is placed at a distance therefrom either on an elevation or depression, or upon level ground, in a vertical position with the bar 8 disposed horizontally and made level by means of the leveling device 20. The rodman then sights through the sight device on the stadia rod, directly toward the telescope, and at this time the arms of the bar 8 will therefore be at right angles to the line of sight from the telescope. The graduations on the horizontal bar 8 are then observed through the telescope and noted, and the distance between the stadia rod and the telescope is then determined by the stadia measurements. No corrections are necessary for the inclination of the stadia rod to the line of sight as this inaccuracy is eliminated.

This method and apparatus may also be used to advantage even in level country where it is difficult to see the lower end of a vertical stadia rod because of bushes, shrubs or the like, or, as noted above, where there is any danger of error due to the presence of heat waves.

It is obvious that various changes can be made in the construction of the apparatus without departing from the spirit and scope of the invention, and still embody the method of operation herein disclosed.

I claim:

1. In apparatus of the class described, a stadia rod comprising a graduated bar, a support for holding the bar in a horizontal position, means for leveling the bar in the horizontal position, and sighting means on said support substantially at the longitudinal center of said bar for positioning the horizontal bar at right angles to the line of sight.

2. In a surveyor's stadia rod, a graduated bar, a support therefor to hold the bar in a horizontal position, means for leveling the bar in the horizontal position, and sighting means in connection with the support intermediate the ends of the bar for positioning the bar at right angles to the line of sight.

3. In a surveyor's leveling or stadia rod, a graduated bar, a support therefor foldable against the bar, and a sighting attachment on the support at the longitudinal center of the bar for positioning the bar at right angles to the line of sight determined by said attachment.

4. In a surveyor's stadia rod, a graduated bar, a support for holding the bar in horizontal position, foldable against the bar, and means on the support for positioning the bar at right angles to the line of sight, said means comprising a member having a vertically disposed slit and a hairline frame movable in front of the slit.

5. In a surveyor's stadia rod, a graduated bar, a support for holding the bar in horizontal position, foldable against the bar, a member in connection with the support having a vertical slit when the support is in upright position, and a hairline supporting frame movable against the support when the latter is in folded position, and adapted to be extended in front of the said slit with

the hairline of the frame at various horizontal angles in front of the slit.

6. In a surveyor's stadia rod, a graduated bar, a support for the bar foldable parallel with it and having a recess and a slit adjacent the folding point, double hinged frame carried by the support in the said recess and foldable forwardly with a wire disposed parallel to the slit and adjustable at various horizontal angles with respect to the slit.

January 13, 1918.

TROW S. SMITH.