

(No Model.)

2 Sheets—Sheet 1.

C. E. TAFT.

SURVEYING INSTRUMENT.

No. 311,386.

Patented Jan. 27, 1885.

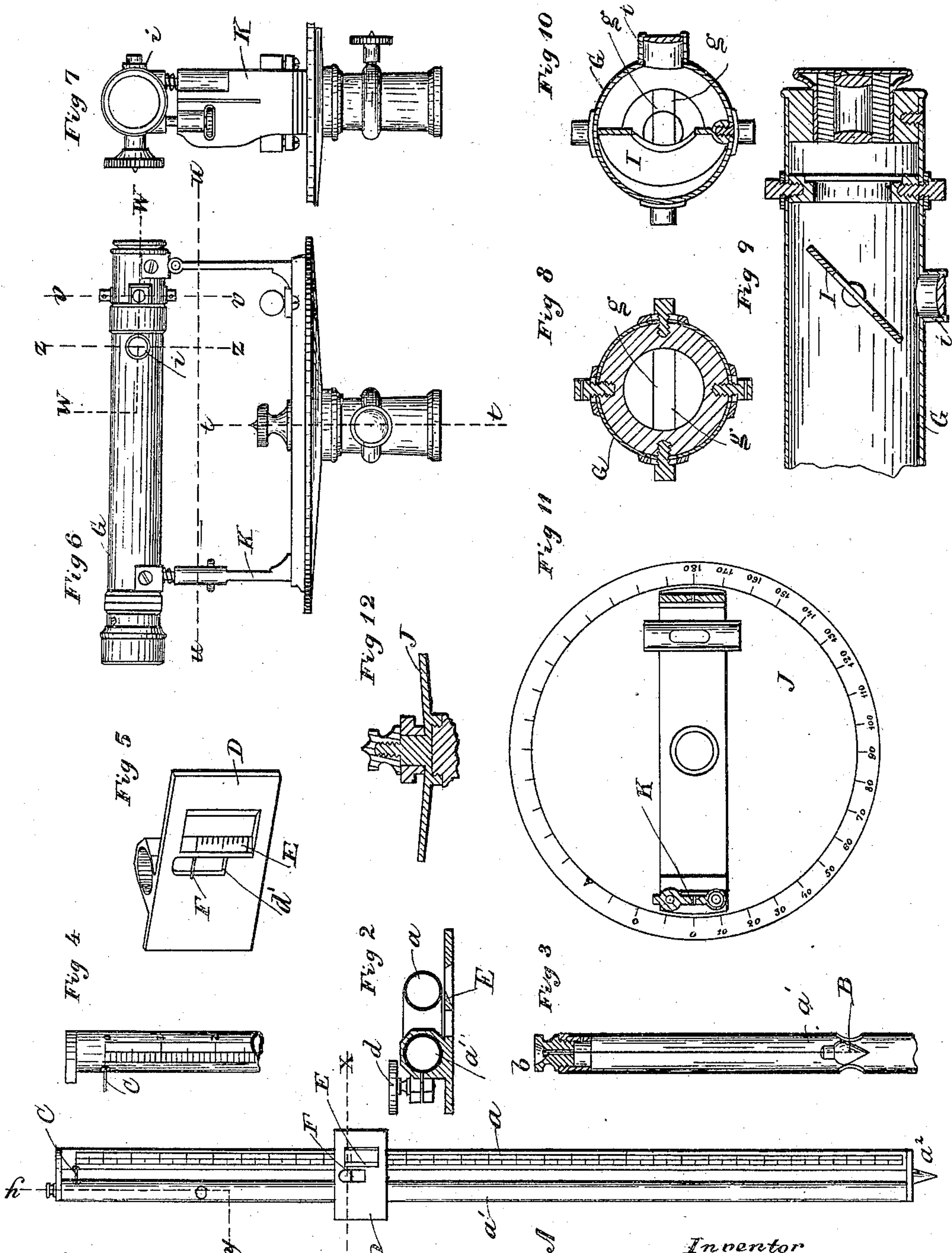


Fig 1

Witnesses

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Inventor

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2 Sheets—Sheet 2.

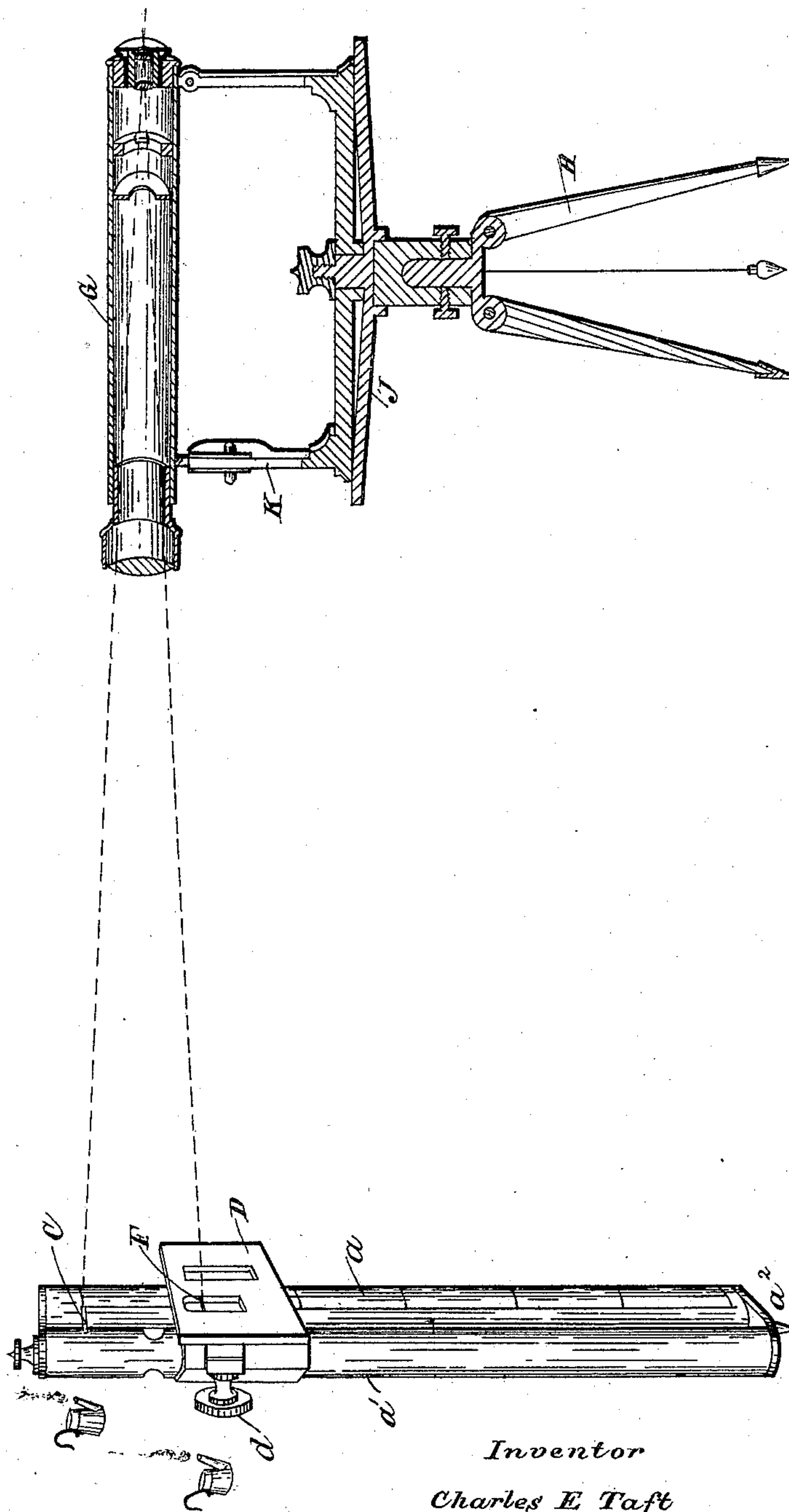
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Fig 13.



Witnesses

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# UNITED STATES PATENT OFFICE.

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CHARLES V. HICKOX, OF SAME PLACE.

## SURVEYING-INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 311,386, dated January 27, 1885.

Application filed March 10, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. TAFT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Surveying-Instruments, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

10 Figure 1 represents a side elevation of the leveling-rod; Fig. 2, a plan section of the same, taken on the line  $x x$ , Fig. 1; Fig. 3, a section of the same, on an enlarged scale, taken on the line  $y y$ , Fig. 1; Fig. 4, a detail front elevation  
15 of the upper portion of one part of the leveling-rod; Fig. 5, a perspective view, on an enlarged scale, of the sliding target of the leveling-rod; Fig. 6, a side elevation of the transit-instrument; Fig. 7, a front elevation of the  
20 same; Fig. 8, a transverse section of the same, taken on the line  $v v$ , Fig. 6, and on an enlarged scale; Fig. 9, a longitudinal section of the same, taken on the line  $w w$ , Fig. 6, on an enlarged scale; Fig. 10, a transverse section of  
25 the same, taken on the line  $z z$ , Fig. 6, on an enlarged scale; Fig. 11, a plan section of the same, taken on the line  $u u$ , Fig. 6; Fig. 12, a detail section of the same, taken on the line  $t t$ , Fig. 6; and Fig. 13, an elevation showing the  
30 instrument in position for actual use.

My invention relates to instruments for making measurements under ground in tunnels, or surveying in mines or other like locations where the work is to be done below the  
35 surface and in the absence of sunlight.

The invention also relates to certain improvements in the construction of the transit-instrument and the stadium or leveling rod, whereby accurate and reliable work may be  
40 accomplished.

I will proceed to describe in detail one way in which I have carried out my invention in practical form, and will then point out definitely in the claims the special improvements  
45 which I believe to be new and wish to protect by Letters Patent.

In the drawings, A represents the stadium or leveling rod, which consists of two rods,  $a a'$ , exactly parallel and about half an inch apart,  
50 connected firmly together at top and bottom by cross-strips, in the bottom one of which is

set a pin,  $a^2$ , directly in the center, so as to indicate the exact center of the space between the rods. These rods may be of any desired form in cross-section, and one of them has suspended within it a small plumb-bob, B, preferably at the upper end thereof, and made visible by a hole drilled through the rod. The other rod,  $a$ , is carefully graduated into feet and decimal divisions, or into the divisions of the meter, and at the top thereof a wire, C, is stretched between the rods at the exact zero division. A target, D, is fitted to slide on the rods, and is provided with the clamping-screw  $d$ , by which it may be fastened to the rods at any point. It is also provided with a vernier, E, by which to read the smallest division of the graduated scale on the rod. An opening,  $d'$ , is cut through the target opposite the space between the two parallel rods, through which a light located behind the stadium can be seen, and across this opening is stretched a wire, F, to mark the zero of the target. The plumb-bob suspended within the tube is attached to some kind of an adjustable fastening to provide for the removal of the bob or the adjustment of the suspending-cord. In the drawings this is a screw stopper or knob,  $b$ , which is fitted to a threaded bushing in the top of the tube.

The transit-instrument consists of a telescope, G, of ordinary construction in general features, which is mounted on a tripod, H. The telescope is provided with two horizontal cross hairs or wires,  $g$ , in its focus, which are accurately adjusted at such a distance apart that they will exactly cover a certain distance on the stadium-rod when it is held at any certain distance off—as, for instance, the wires may be so adjusted as to cover a length of three feet on the rod when it is set three hundred feet from the instrument. The adjustment of the wires being known, any intermediate distance from the instrument is at once shown by the length on the rod covered by the cross-hairs.

In order to use the instrument in mines or tunnels where it is dark, it is necessary to provide for lighting the cross-hairs, and this is accomplished by providing the telescope with a reflector, I, arranged in such a way that the light from a lamp carried by the engineer or



surveyor will be reflected onto the cross-hairs, making them visible to the eye of the observer. At the same time there must of course be an uninterrupted sight through the instrument to the illuminated stadium, and in order to provide for this I make this reflector annular in form by cutting out the central portion thereof, as shown in Figs. 9 and 10 of the drawings. This permits the sight through the reflector, while at the same time the annular reflecting-surface will be sufficient to light up the cross-hairs. Below the telescope is arranged a graduated circle, J, of any usual construction, and for the usual purpose, and from the plate of this circle rise posts K, which support the telescope, which is pivoted at its front end to one of the posts, and at the other end is connected to the other post by any ordinary means which will provide for vertical adjustment. Light is admitted to the reflector within the tube of the telescope through an opening, *i*, in the side thereof, in which a plain lens is fitted. The stadium-rod is of course held by an assistant, and is made visible by a lamp carried by him.

The mode of using these devices is illustrated in Fig. 13 of the drawings. The assistant first sets up the stadium-rod at the required point, and then raises his lamp until it is seen by the observer at the upper cross-hair. This cross-hair is then made to exactly coincide with the zero-wire on the stadium-rod. The assistant then lowers his lamp until it is seen by the observer at the lower cross-hair, and then moves the target on the rod until the cross-wire on the target is seen to be exactly over the lower cross-hair. The target is then clamped to the rod, and the distance read off that the cross-hairs cover, which is from the wire on the rod to the wire on the target, and from this distance may be calculated the distance between

the transit-instrument and the stadium-rod. The space between the two rods of the stadium permits light to shine through between the same from a lamp behind, which enables the target-wire to be seen through the opening in the target, and to be accurately adjusted, as described above.

The use of the graduated circle in determining angles and courses will be understood, as it is the same as usual.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A stadium-rod having graduations thereon, and composed of two parallel rods or bars connected at top and bottom, and arranged with a narrow space between them, in combination with a centering-pin set in the bottom connection at the exact center of this space, substantially as and for the purposes set forth.

2. The stadium-rod A, consisting of the two parallel bars *a a'*, arranged a slight distance apart, and one of which is graduated, in combination with the cross-wire located at the zero-point of the graduated scale, and the sliding target D, provided with the opening *d'*, coinciding with the opening between the rod-bars and the cross-wire across the said opening *d'*, substantially as and for the purpose set forth.

3. The telescope provided with two horizontal wires, in combination with the stadium-rod, the cross-wire arranged at zero-point on the stadium-rod, and the sliding target provided with a central opening and a wire stretched across the same, all constructed and operating substantially as and for the purposes set forth.

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Witnesses:

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