(No Model.)

2 Sheets—Sheet 1.

C. L. BERGER.

SURVEYOR'S TRANSIT.

No. 559,117. Patented Apr. 28, 1896.

Fig. 4.

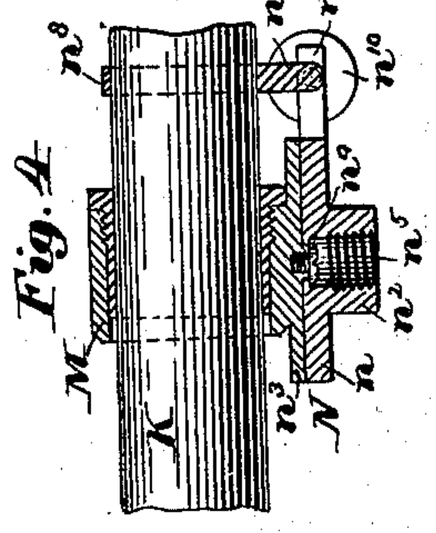

Fig. 1.

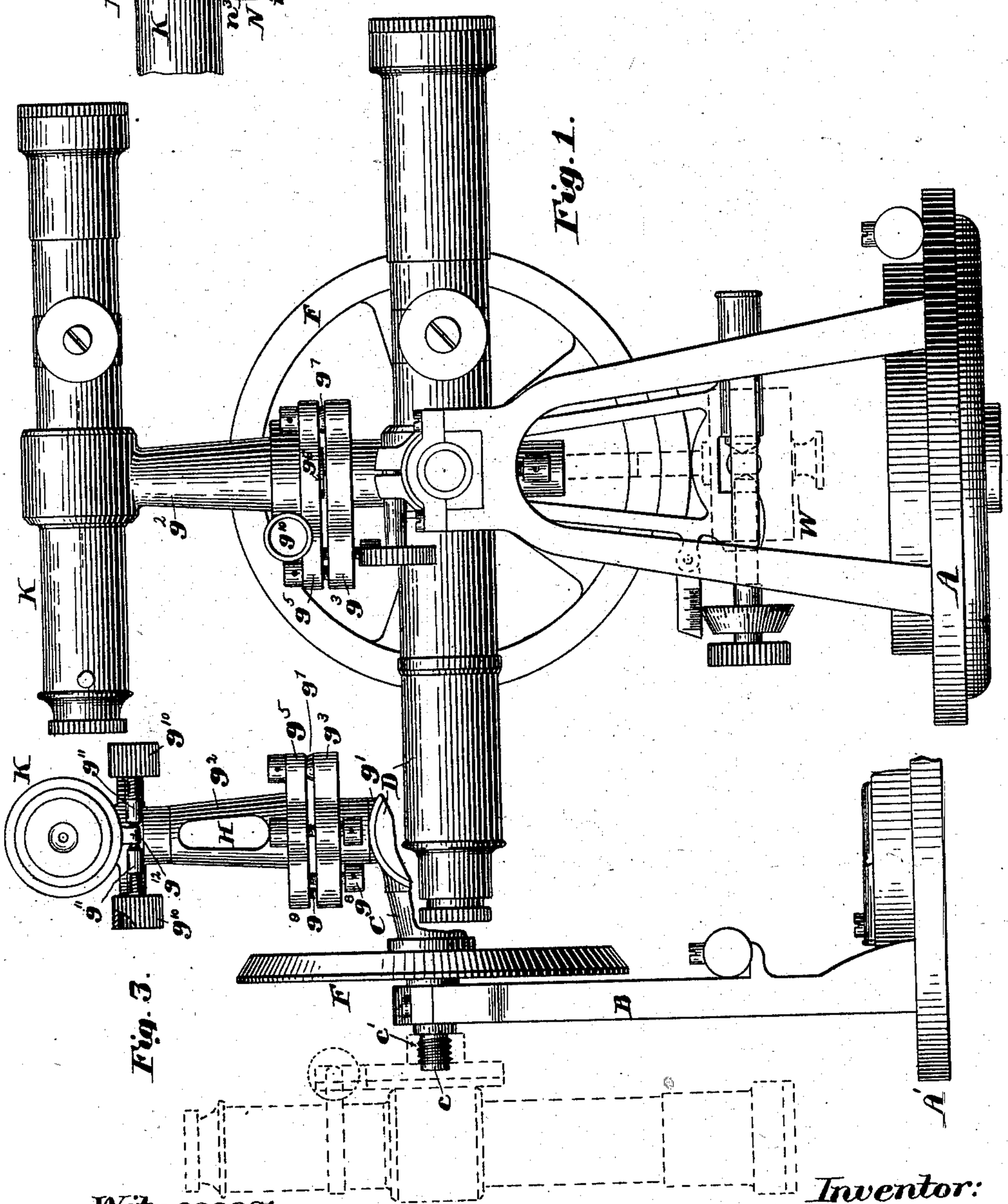

Fig. 3.

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(No Model.)

2 Sheets—Sheet 2.

C. L. BERGER.

SURVEYOR'S TRANSIT.

No. 559,117. Patented Apr. 28, 1896.

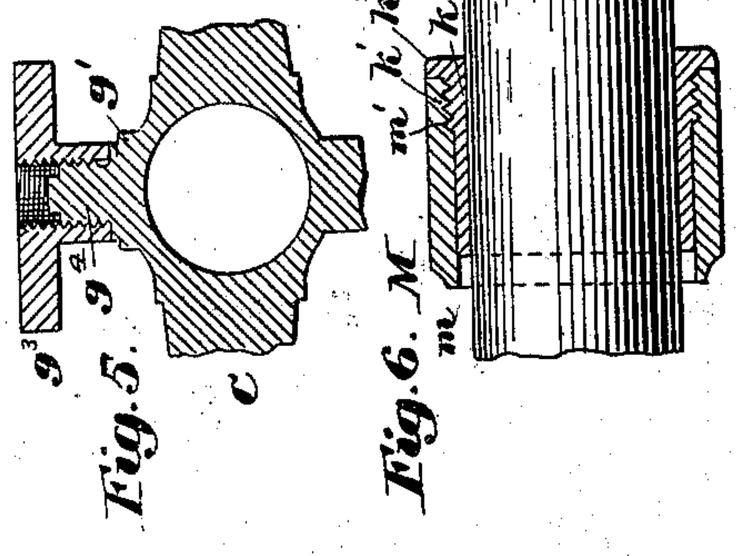

Fig. 5.

Fig. 6.

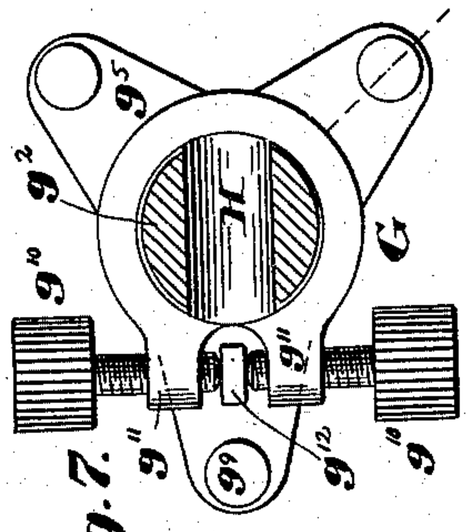

Fig. 7.

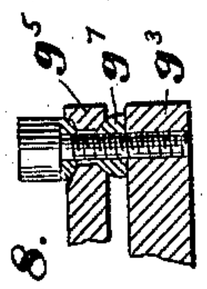

Fig. 8.

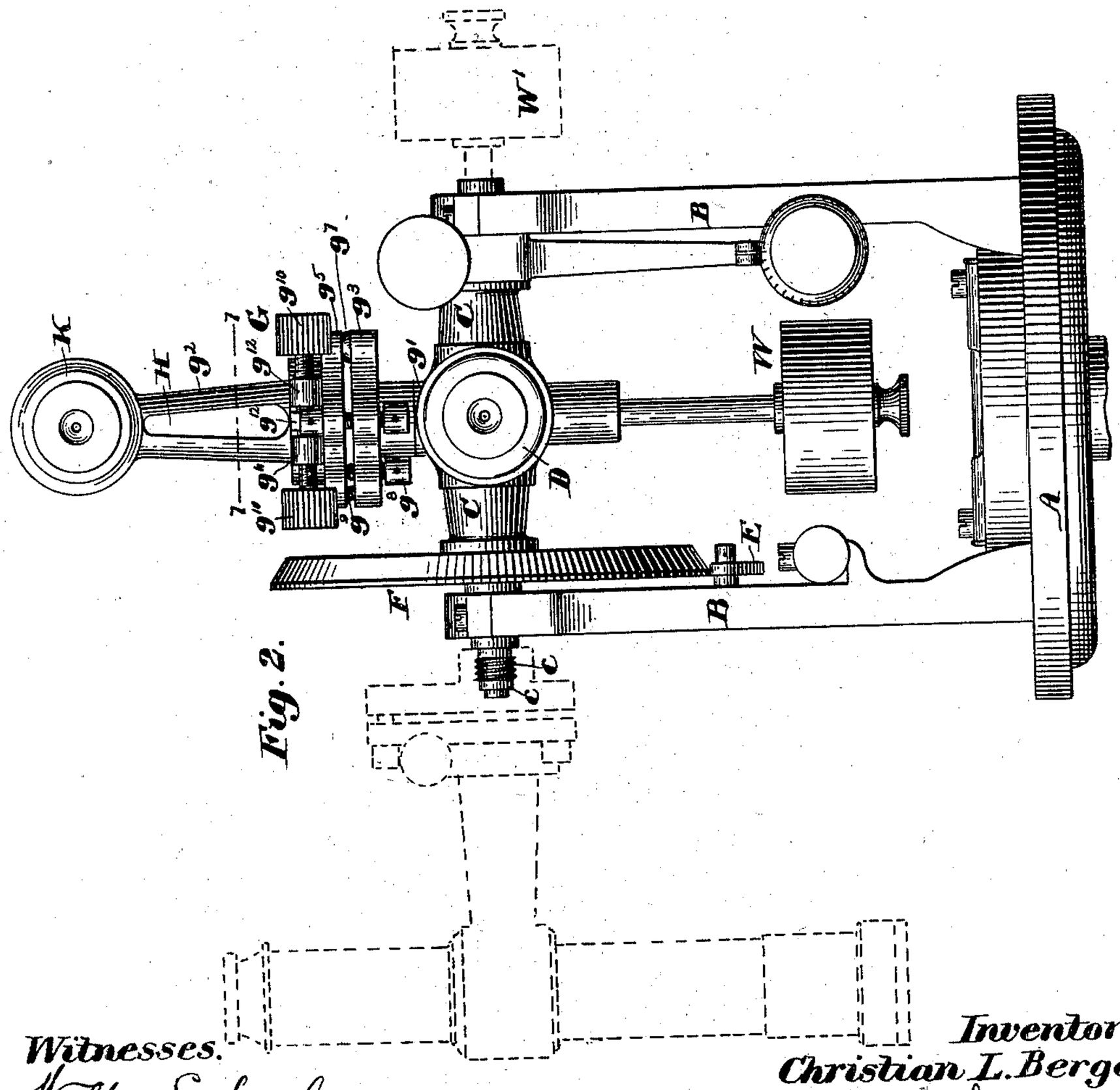

Fig. 2.

Witnesses.
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UNITED STATES PATENT OFFICE.

CHRISTIAN L. BERGER, OF BOSTON, MASSACHUSETTS.

SURVEYOR'S TRANSIT.

SPECIFICATION forming part of Letters Patent No. 559,117, dated April 28, 1896.

Application filed October 14, 1895. Serial No. 565,535. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN L. BERGER, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Surveyors' Transits, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to surveying instruments, particularly to the transit, and has for its object the provision of means whereby the transit may be used for the ordinary plane surveying, and also for mine surveying and similar purposes.

My invention also contemplates improved means for getting the range in sighting long distances.

Various other improvements will appear from the detailed description hereto annexed.

In the accompanying drawings, illustrative of one embodiment of my invention, Figure 1 is a side elevation of the head of the surveyors' transit provided with my improvements. Fig. 2 is a rear elevation thereof, showing the auxiliary telescope in dotted-line position as used for mine surveying. Fig. 3 is a similar elevation, broken away in part, and shows a modified form of the auxiliary telescope attachments. Fig. 4 is a sectional detail of Fig. 3. Figs. 5, 6, 7, and 8 are detail sectional views of various parts connected with the auxiliary telescope.

Referring to the details of construction by letters of reference, A designates the upper plate of the surveying instrument, in this case a transit, from which project the standards B, carrying at their upper extremities the horizontal axis C, journaled therein, which carries the main telescope D. E designates the usual vernier, and F the graduated circle. The above parts are of the ordinary transit variety, to which, for the purposes of illustration, I have shown my improvements attached.

In the present embodiment of my invention, G designates the vertical support provided with the sight-aperture H, and, in this instance, supporting the auxiliary telescope K. This support G is composed of a post g', projecting perpendicularly from the upper side of the main telescope D in the plane of the horizontal axis C, and of a post g^2, depending from and perpendicular to the auxiliary telescope K. At their meeting ends these posts are provided with bearing-plates, the lower one g^3 of which is preferably threaded onto the post g', the upper plate g^5 being pivotally connected to the lower end of the post g^2 by means of a screw g^6. These two plates g^3 and g^5 are adjustable relatively to each other by means of a universal joint g^7 and opposing set-screw g^8 g^9, passed through the respective plates g^3 g^5 and each bearing on the opposing face of the opposite plate.

The post g^2 is provided with limited movement around its longitudinal axis by means of milled thumb-screws g^{10}, which operate through the projecting ears g^{11} and bear on either side against the intervening lug g^{12}. The ears g^{11} may be integral with post g^2 and the lug g^{12} integral with plate g^5, or the parts may be reversed, the lug g^{12} being projected from post g^2 and the ears g^{11} projecting from the plate g^5. The ears or lugs, or both, may be carried by an annular support adjustably clamped around the post.

The post g^2 is provided with a longitudinal slot H, passing therethrough in the plane of the main telescope D. This slot is for the purpose of enabling the surveyor to roughly range a distant object, so as readily to bring said object within the field of the telescope without the necessity of finding said object in the first place through the telescope, as is now the custom. This slot is ordinarily to be used in connection with the long-distance telescope, which, in such case, will be the auxiliary telescope K, although it may be used to advantage in any case for roughly ranging a distant object.

The auxiliary telescope K is secured to the upper end of the post g^2 in the vertical plane of the main telescope. In Fig. 6 I have shown details of my improved means of thus mounting the auxiliary telescope, consisting of a cylindrical sleeve k, soldered or otherwise fixedly secured to the tube of the telescope, and provided at one end with screw-threads k' and an external flange k^2. Coöperating with this sleeve is a collar M, secured to the upper end of post g^2 and cylindrical in form to fit snugly over the sleeve k, having at one end an internal shoulder or annular rib m, and at its opposite end internal threads m' to coöperate

with the external threads k' of the sleeve, when the parts are brought tightly together. In such position the collar M bears against the flange k^2, and the shoulder m bears snugly against the telescope-tube and also against the sleeve k. The horizontal axis C of the main telescope is projected at one end beyond its journal-bearing B to form a stub-axle c. This is provided with threads c' and is arranged to receive the auxiliary telescope K, as shown in dotted lines in Figs. 2 and 3. By means of this removability of the auxiliary telescope K from its central position to the lateral position shown in dotted lines, I am enabled to use the ordinary transit for vertical surveying in the shafts and drifts of mines and in other places where it is necessary to survey in directions closely approaching the vertical.

In order to give ease and precision of movement, I have provided the counterpoise W for the auxiliary telescope when used in its central position, and the counterpoise W' for the auxiliary telescope when used in its lateral position. One counterpoise may be made to answer for both of these places if desired.

In Figs. 3 and 4 I have shown a modification of the connections for the auxiliary telescope, which consists in making the plate g^5 rigid with the post g^2 and providing a pivotal arrangement N at the upper end of the post g^2. This consists of a plate n, similar to the plate g^3 and secured to the post g^2 by a screw-socket n^2. A corresponding plate n^3 is secured to the under side of the collar M and pivoted to the plate n by means of a preferably conical stud n^4 and a headed screw n^5.

Projecting from one side of the plate n are ears n^{11}, which provide bearings for the thumb-screws n^{10} to operate therethrough against the lug n^{12}, depending from the telescope K and secured thereto by any suitable means, as the strap n^8. These parts operate in the same manner as the corresponding parts g^{10} g^{11} g^{12} in Figs. 1 and 2.

It is obvious that the stub-bearing n^4 may be formed on the lower plate n to project into the upper plate n^3 or it may be omitted altogether and the plate n^3 may turn on the screw n^5 as a center. This modified arrangement is of especial advantage by reason of making the apparatus more compact. When the auxiliary telescope is moved to its lateral position, the arrangement is such that the field of the telescope passes in a vertical plane immediatedly adjacent to the edge A' of the base. This not only makes the instrument more compact, but it allows a smaller counterpoise W' to be used and insures absolute steadiness of the parts.

In the use of my improved surveying instrument, when it is used as shown in full lines in Fig. 2, the sight-slot H is adjusted into perfect alinement with the longitudinal axis of the main telescope D by means of the vertical adjusting-screws g^8 g^9 and of the horizontal adjusting-screws g^{10}. The distant object is then sighted through slot H, and when it is brought into approximately correct range by the eye sighting through the parallel sides of the slot H the upper distance-telescope K is then used and the object will be found to then be within the field thereof.

When the instrument is to be used in mine surveying, the auxiliary telescope is removed from its upright bearing and is secured to the stub-journal c. The surveying may then be done in a direct line up or down with ease.

My invention embraces many changes in form, proportion, and arrangement of parts, and I contemplate the provision of other means for removing the auxiliary telescope from its upright bearing to its horizontal bearing. For instance, it may be hinged, or a laterally-sliding bearing might be provided.

Various other modifications are within the spirit and scope of my invention.

What I claim is—

1. In a surveying instrument, a telescope movably mounted on a horizontal axis intermediately thereof, and means for mounting the same at the end of said axis, substantially as described.

2. In a surveying instrument, a main telescope permanently mounted in fixed horizontal bearings, and an auxiliary telescope connected therewith and movable independently of said main telescope into a vertical plane passing outside of the base-plate of the instrument, substantially as described.

3. In a surveying instrument, a main telescope permanently mounted on a horizontal axis in fixed bearings, and an auxiliary telescope removably mounted in vertical parallel alinement thereto, and means for securing said auxiliary telescope on one end of said horizontal axis, substantially as described.

4. In a surveying instrument, a main telescope permanently mounted on a horizontal axis in fixed bearings, said axis having a threaded end extending outside of the adjacent bearing, and an auxiliary telescope secured to said main telescope to move therewith in the same vertical plane, said auxiliary telescope being provided with a threaded connection for securing the same to said threaded end of the horizontal axis, substantially as described.

5. In a surveying instrument, a main telescope mounted on a horizontal axis, and an auxiliary telescope secured thereto to move therewith in the same vertical plane, said auxiliary telescope having means for adjustment relatively to said main telescope in a vertical plane and also in a plane perpendicular thereto, substantially as described.

6. In a surveying instrument, a main telescope mounted on a horizontal axis, a post projecting therefrom perpendicular to said axis, a bearing-plate secured perpendicularly to said post at its outer end, an auxiliary telescope provided with a post projecting therefrom, said post having axially pivotal con-

nection to said plate, and a thumb-screw working in one of said relatively-movable portions to bear against a lug provided on the other of said movable portions, substantially as described.

7. In a surveying instrument, a main telescope mounted on a horizontal axis, a post projecting therefrom perpendicular to said axis, a bearing-plate secured perpendicularly to said post at its outer end, an auxiliary telescope provided with a post projecting therefrom, means for adjusting the alinement of said two posts, said latter post having axially pivotal connection to said plate, and a thumb-screw working in one of said relatively-movable portions to bear against a lug provided on the other of said movable portions, substantially as described.

8. In a surveying instrument, a telescope mounted on a horizontal axis, and a post projecting therefrom in a vertical plane, said post having a narrow slot therethrough in the vertical plane of the longitudinal axis of said telescope for roughly ranging the telescope to sight a distant object, substantially as described.

9. In a surveying instrument, a telescope mounted on a horizontal axis, a post projecting therefrom in a vertical plane, said post having a narrow slot therethrough in the vertical plane of the longitudinal axis of said telescope, and means for vertically adjusting said post relatively to said telescope, substantially as described.

10. In a surveying instrument, a telescope mounted on a horizontal axis, a post projecting therefrom in a vertical plane, said post having a narrow slot therethrough in the vertical plane of the longitudinal axis of said telescope, and means for vertically and horizontally adjusting said post relatively to said telescope, substantially as described.

11. A means for mounting a telescope, consisting of a cylindrical sleeve fixedly secured to the telescope, said sleeve being screw-threaded at one end, and a cylindrical collar adapted to fit snugly over said sleeve, said collar being internally threaded at one end and having an internal shoulder or annular rib at its other end to fit snugly around the telescope and abut against the sleeve when said threaded portions are screwed together, substantially as described.

12. A means for mounting a telescope, consisting of a cylindrical sleeve fixedly secured to the telescope, said sleeve being externally flanged and screw-threaded at one end, and a cylindrical collar adapted to fit snugly over said sleeve, said collar being internally threaded at one end and having an internal shoulder or annular rib at its other end to fit snugly around the telescope and abut against the sleeve when said threaded portions are screwed together, substantially as described.

13. In a surveying instrument, a base-plate and standards thereon, a main telescope mounted in fixed horizontal bearings carried by said standards, an auxiliary telescope mounted thereon in parallel alinement over the same and constructed to swing about its axis parallel to the line of collimation and the horizontal axis of said main telescope, said auxiliary telescope being movable into a vertical plane passing outside of the said base-plate, and adjusting devices to swing said auxiliary telescope about its said axis relatively to said main telescope, substantially as described.

14. In a surveying instrument, a base-plate and standards thereon, a main telescope centrally mounted on a horizontal axis in fixed bearings carried by said standards, an auxiliary telescope, and a support therefor connecting said two telescopes, said support extending perpendicularly to said main telescope in the plane of said horizontal axis, a distance approximately that of the radius of said base-plate, the said auxiliary telescope being movable into a vertical plane passing outside of the said base-plate of the instrument, and adjusting devices to swing said auxiliary telescope on its support parallel to the line of collimation and the horizontal axis of said main telescope, substantially as described.

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

CHRISTIAN L. BERGER.

Witnesses:
FREDERICK L. EMERY,
THOMAS J. DRUMMOND.