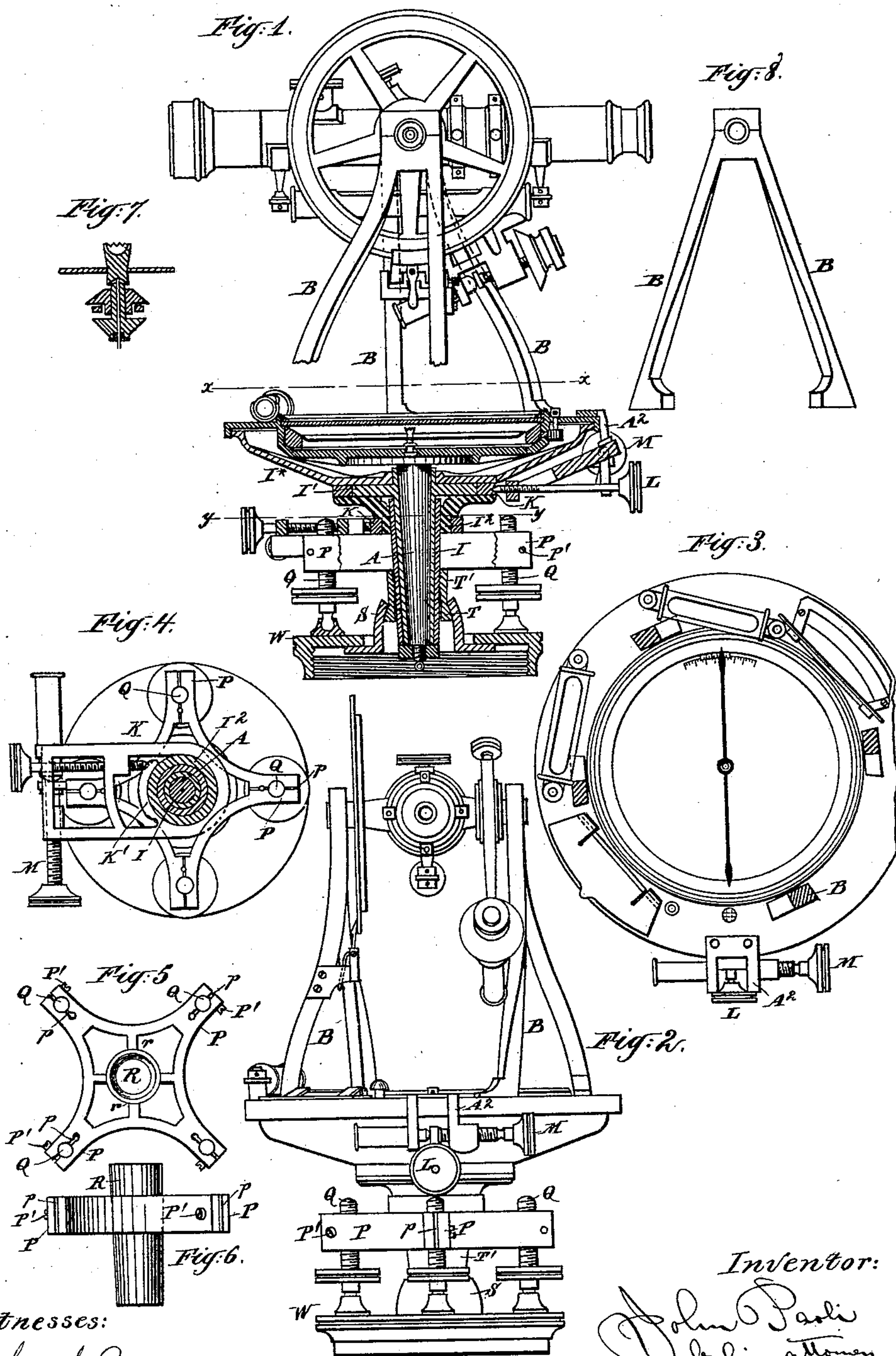


J. PAOLI.
ENGINEER'S INSTRUMENT.

No. 453,160.

Patented May 26, 1891.



Witnesses:

Chas. S. Barber,

Charles R. Searle.

Inventor:

John Paoli
by his attorney
Thomas Dew Stetson

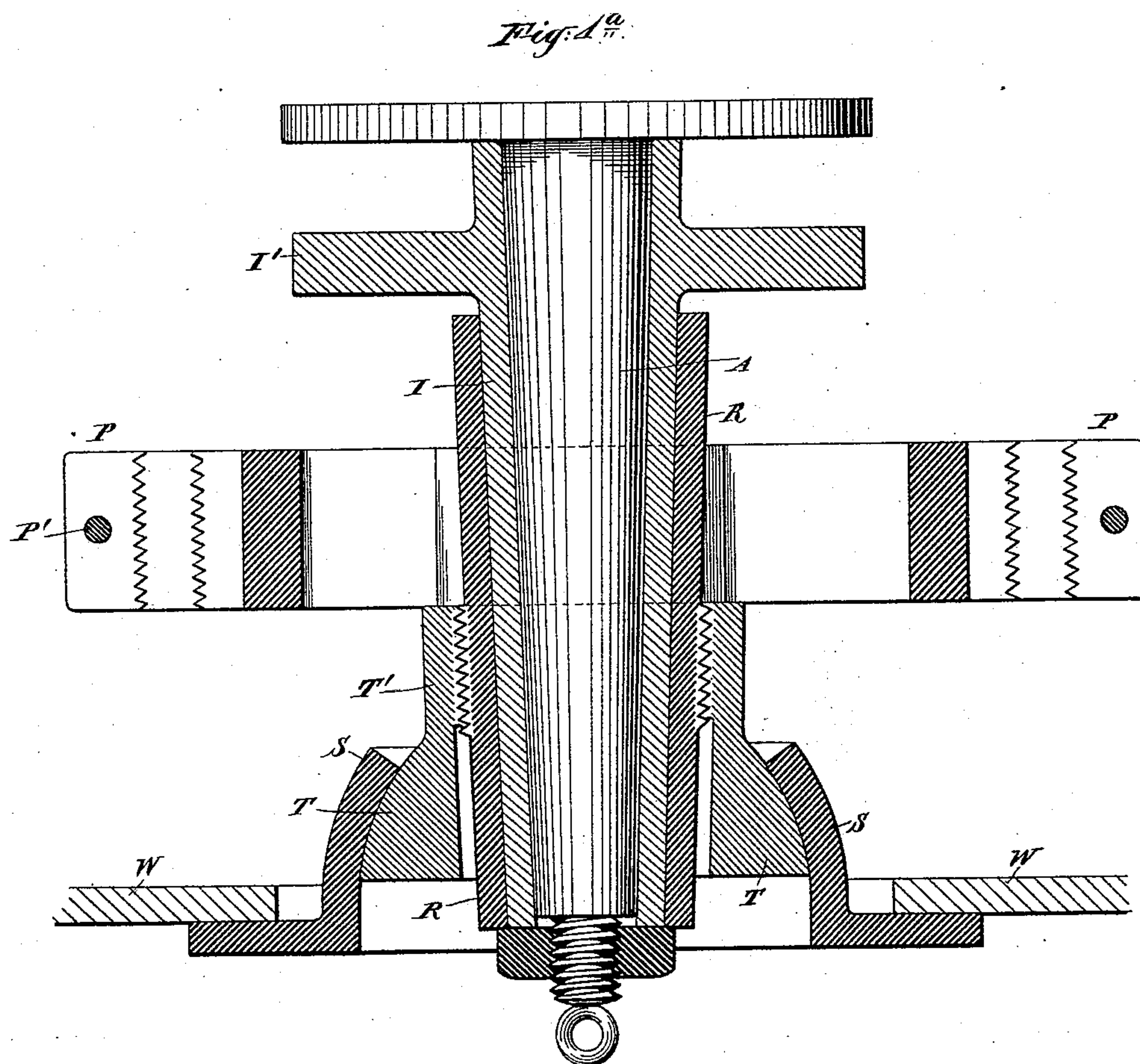
(No Model.)

2 Sheets—Sheet 2.

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Charles F. Searle.
J. Brown.

Inventor:
John Paoli
by his attorney
Thomas Drew Station

UNITED STATES PATENT OFFICE.

JOHN PAOLI, OF HOBOKEN, NEW JERSEY, ASSIGNOR TO WILLIAM KEUFFEL
AND HERMANN ESSER, OF NEW YORK, N. Y.

ENGINEER'S INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 453,160, dated May 26, 1891.

Application filed September 20, 1890. Serial No. 365,611. (No model.)

To all whom it may concern:

Be it known that I, JOHN PAOLI, a subject of the King of Italy, residing in Hoboken, in the county of Hudson and State of New Jersey, have invented a certain new and useful Improvement in Engineers' Instruments, of which the following is a specification.

The elaborate instruments known as "transits," each embodying the capacities of several minor instruments, are in running lines transported on the shoulder of the engineer or of an assistant and are set up and adjusted and again taken up and retransported at short intervals.

My improvement facilitates the transportation by its lightness and facilitates the rapid and correct setting up, and contributes to enable the exact and delicate construction to withstand rough usage. The arms which receive the leveling-screws are split and receive those screws in adjustable holes, which allow the friction to be made uniform under all conditions of wear. The arms are peculiarly formed and are joined to the sleeve not opposite to the arms, but intermediate between them. This divides the force when an arm is overstrained and avoids injuring the central parts.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out in the invention.

Figure 1 is a central vertical section partly in side elevation. Fig. 1^a is a corresponding section of a portion on a larger scale. Fig. 2 is an elevation quartering to the view in Fig. 1. Fig. 3 is a horizontal section on the line $x x$ in Fig. 1. Fig. 4 is a horizontal section on the line $y y$ in Fig. 1. Figs. 5 and 6 represent a portion detached. Fig. 5 is a plan view, and Fig. 6 an elevation. Fig. 7 is a vertical section of a portion on a larger scale. Fig. 8 is a side elevation. It shows a modification.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

The triangular standards B are sufficiently spread at the bottom to afford a reliable support. One side or leg is nearly vertical. The

other branch or leg is inclined beyond the ordinary extent and is twisted, as shown.

I is the nicely-finished intermediate sleeve, sometimes known as the "outer center." It is fitted around the inner center A and carries the important part I*, usually known as the "horizontal limb," or, more briefly, the limb which I make as a substantial casting. The graduations are made on silver or other white material firmly fixed on its upper face.

Collars I' I² receive each a clamp K. The connection in each of these cases is of the ordinary general character, the slow-motion screw M for the lower clamp taking hold of the leveling-arms, which are fixed; and the upper clamp taking hold by the bracket A² on the alidade or the parts mounted on the inner center. These clamps perform their ordinary functions, the lowermost connecting the limb at will with the fixed foundation and the uppermost connecting the limb at will with the telescope, both being equipped with provisions for very delicately turning to small extents after the parts are firmly clamped. These clamps are peculiarly equipped to avoid lost motion. Each is constructed as a single casting, the part K', which is to serve as the bearing-block, being formed integral with the main part of the clamp, but with a space at its back. It is adapted to be sprung slightly inward by the pressure of the corresponding clamping-screw L when required.

The leveling-arms P each receive the corresponding leveling-screw Q in a threaded hole. A split p , produced by sawing with a fine saw, allows this portion of the arm to spring slightly, and a screw P' adjusts the amount of opening of this split. The metal will yield elastically sufficient to allow the split to open and close, so that the contact of the arm P with the corresponding leveling-screw Q may be made just sufficiently frictional for an indefinite period. The leveling-arms P are of more than the usual depth and are joined to the sleeve R at the points r . These points are not radially within the several arms, but within the spaces between the arms. Each arm is made open, as shown. The construction is light and strong. In case one of the leveling-arms is overstrained it

may be permanently set; but the distribution of the points of union to the sleeve R avoids any risk of distorting the latter, and consequently of possibly injuring the delicate centers A and I within.

I provide for the ordinary horizontal movement of the instrument upon the bottom plate W, employing the usual partially-spherical bearing T, mounted within a hemispherical case S, with the usual liberty to rock as far as ever shall be required in practice by the rolling of the part T within the part S and with the usual liberty to adjust in all directions horizontally by the movement of the part S upon the fixed bottom plate W; but instead of mounting the partial sphere T directly on the sleeve R, I attach it by a false sleeve T', which is larger than the exterior of R, so that there is a slight annular space between. The capacity of the false sleeve to spring and bend allows the instrument to endure rough usage without injuring the centers—that is to say, a sufficiently violent blow may change the position of the spherical bearing to one side or the other of the proper axial line, the false sleeve T' yielding to allow such distortion, while the true sleeve R will remain unaffected. The false sleeve is connected to the true sleeve by screw-threads and may be removed for repairs or renewals.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. I prefer to cast the most upright leg in the bent form required and to cast the other and more inclined leg with about the proper degree of curvature, but without being twisted. Then, the considerable twist required being forcibly impressed with the metal cold or nearly cold, the best condition of the particles is obtained.

The leveling-screws Q may have the ordinary caps or shields. (Not shown.)

Parts of the invention may be used without the whole.

I do not in this patent claim the peculiarities of the standards and of the parts carried thereon in the upper part of the instrument, nor the peculiarities of the compass and other parts at the mid-height. Such are made the subjects of separate applications for patents, the first filed April 8, 1890, Serial No. 347,097, and the last filed herewith.

I claim as my invention—

1. In a transit or analogous instrument, the leveling-arms P, having each a split *p* and contracting-screw P', in combination with the bottom plate W and with the sleeve R and with the parts mounted thereon, substantially as herein specified.

2. In a transit or analogous instrument, the open-work leveling-arms P and their adjusting-screws Q, in combination with the outer sleeve R and attached thereto at the points intermediate between the leveling-arms, as herein specified.

3. In a transit or analogous instrument, the spherical bearing T and the true sleeve R, carrying the contained centers I and A and their attachments, in combination with each other and with the false sleeve T', the latter inclosing the true sleeve with a free space between and fixed thereto above the bearing, arranged to allow concussions and shocks by the yielding of the false sleeve, as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

JOHN PAOLI.

Witnesses:

CHAS. S. BARBER,
H. A. JOHNSTONE.