2 Sheets—Sheet 1.

W. GURLEY.

Tripod-Head for Surveying-Instrument.

No. 209,562. Patented Nov. 5, 1878.

FIG. 1.

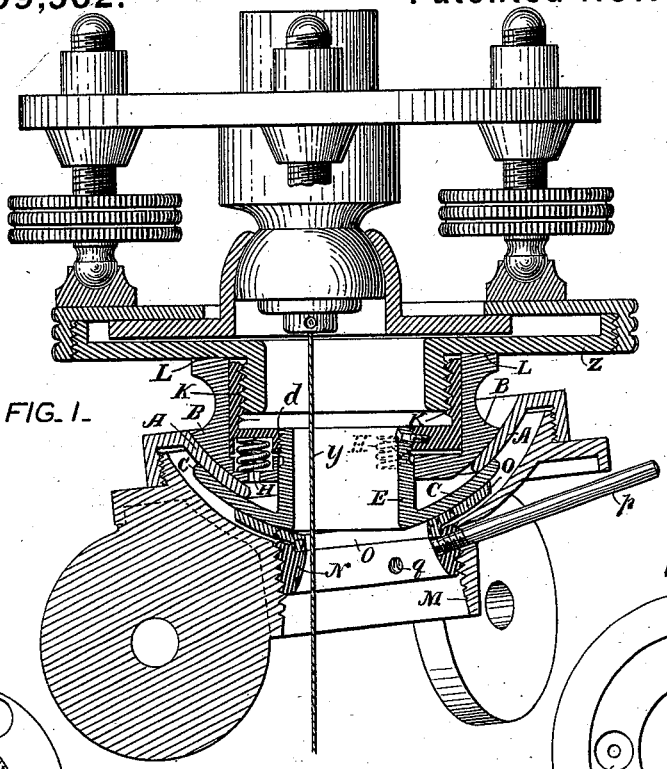


FIG. 2.

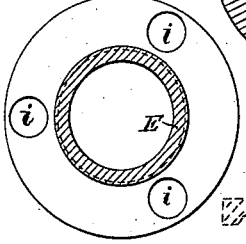


FIG. 3.

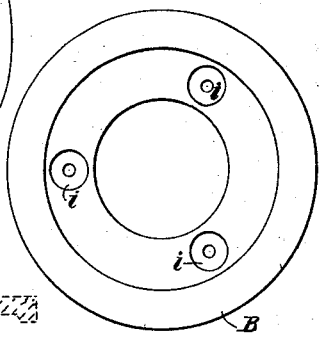


FIG. 4.

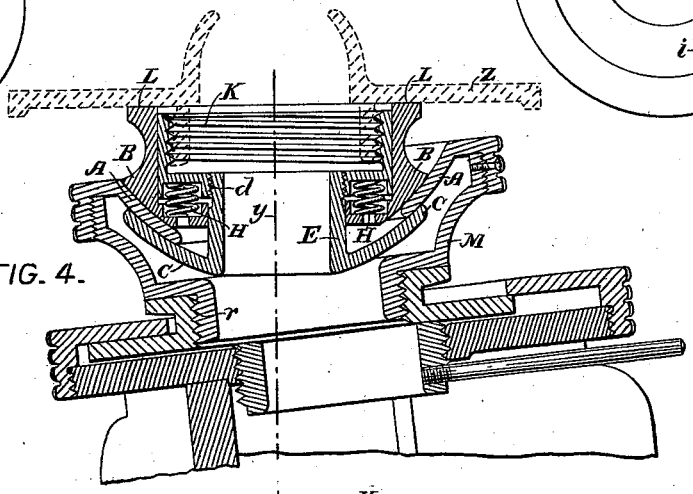
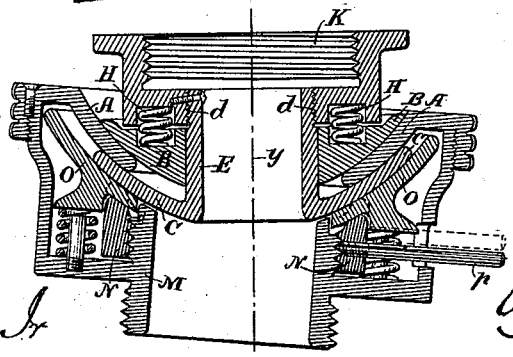


FIG. 5.



WITNESSES:
Paul Cook.
Robert Gregg Jr

INVENTOR:
William Gurley

2 Sheets—Sheet 2.

W. GURLEY.

Tripod-Head for Surveying-Instrument.

No. 209,562. Patented Nov. 5, 1878.

FIG. 6.

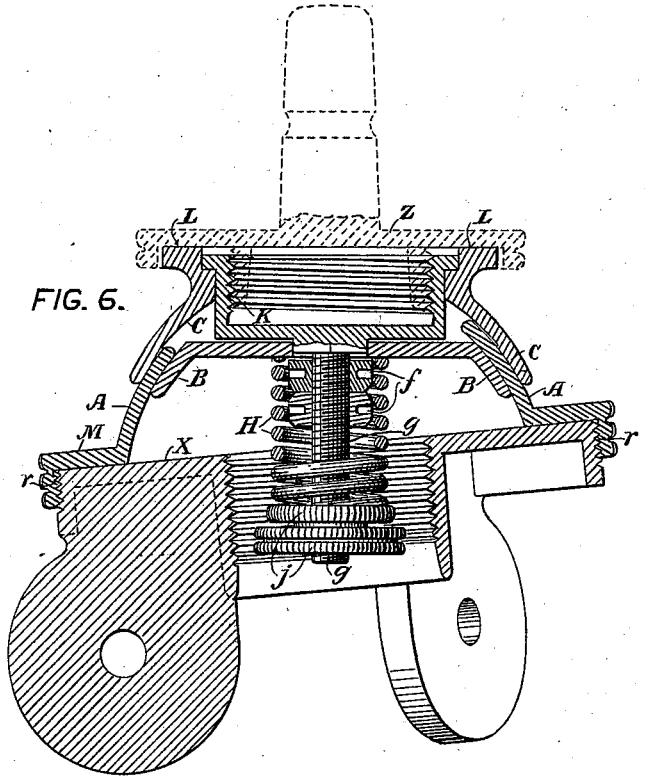
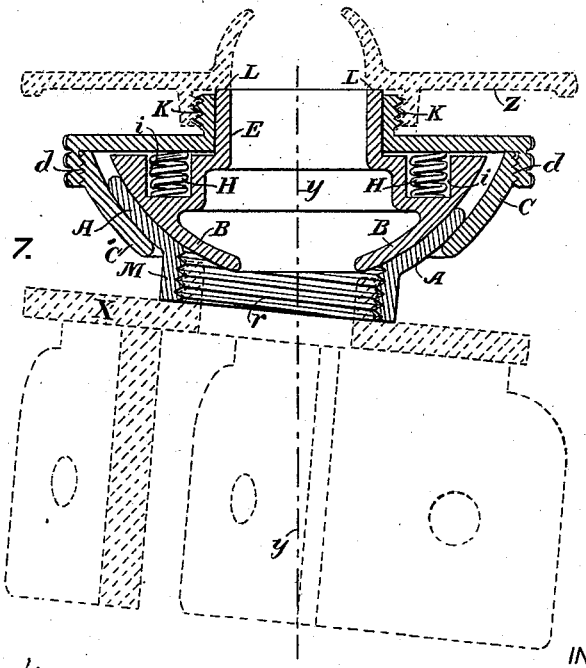


FIG. 7.



WITNESSES:

Paul Cook.
Robert Gregg Jr

INVENTOR:

William Gurley

UNITED STATES PATENT OFFICE.

WILLIAM GURLEY, OF TROY, NEW YORK, ASSIGNOR TO W. AND L. E. GURLEY, OF SAME PLACE.

IMPROVEMENT IN TRIPOD-HEADS FOR SURVEYING-INSTRUMENTS.

Specification forming part of Letters Patent No. **209,562**, dated November 5, 1878; application filed September 25, 1878.

To all whom it may concern:

Be it known that I, WILLIAM GURLEY, of the city of Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Leveling-Supports for Surveying, Engineering, and other Instruments, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a central vertical section of one of my improved leveling devices, which embodies all the essential parts of this invention, and which is there shown mounted on a tripod-plate and supporting a common leveling-head for a surveying-instrument, having an ordinary side-shifting device, for adjusting the plummet of the instrument over a fixed point on the ground. Figs. 2 and 3 are plans of some detached parts of the device shown in Fig. 1. Fig. 4 is a central vertical section of another of my improved leveling devices, which embodies some parts of this invention, and which is there shown mounted on a center-shifting device which is claimed in my application for a patent filed in the United States Patent Office September 9, 1878, and is not herein claimed. Fig. 5 is a central vertical section of another of my improved leveling devices, which embodies portions of this invention. Figs. 6 and 7 are central vertical sections of two of my improved leveling devices, showing modifications of some parts of the same invention.

A is a concentrically concavo-convex plate, which is adapted to be firmly secured to and upon a tripod, or suitable support, for a surveying, engineering, or other similar instrument. B is a convex segment, concentric with and fitting against the concave surface of the plate A; and C is a concave segment, concentric with and fitting upon the convex surface of the same plate. The convex and concave segments B and C are connected and held together closely against the concave and convex surfaces of the stationary plate A by any suitable internal devices, substantially as shown in the drawings, so that the segments B and C can be slid together in every direction across the concavo-convex plate. The connected segments B and C are furnished with a screw, or other suitable means, whereby a corresponding base, Z, of a surveying, leveling, or other instrument can be secured to the connected segments, so as to move to and fro with the latter in arcs across and concentric with the said concavo-convex stationary plate.

It is often necessary to have a plumb-line suspended from the center of the base of a surveying or engineering instrument when mounted on a tripod, and adjustable laterally thereon in every direction, to conveniently adjust the vertical axis of the instrument directly over a fixed point on the ground. In order that such a plumb-line may hang free and be adjustable laterally through and within this improved leveling-support, I construct the aforesaid concavo-convex stationary plate A with a central aperture, and the connected sliding convex and concave segments B and C of annular forms, and make in wide tubular shape the interior connection E, by which the two segments B and C are secured together, all substantially as shown in Figs. 1, 4, 5, and 7, wherein the line *y* indicates a plumb-line.

By having the contiguous concave and convex surfaces of the stationary plate A and connected segments B C very accurately fitted and closely secured together, with very little elasticity in the parts combined as above specified, the connected segments B and C, when supporting a surveying-instrument, can be slid to and fro by hand in every direction across the stationary plate A without great effort, and with considerable smoothness of movement, in thereby quickly leveling the instrument, and will be temporarily held in adjustment with considerable strength merely by the adhesion thus secured between them and the stationary concavo-convex plate. By means of the tight screw-joint at *d* in Figs. 1, 4, 5, and 7, or the check-nuts *f* on the screw *g* in Fig. 6, the segments B and C can be adjusted and constantly held against the plate A with various degrees of tightness.

In order to render the sliding movements of the connected convex and concave segments B and C more smooth, easy, and uniform upon the stationary concavo-convex plate A, and to retain the said connected segments, with an instrument mounted thereon, more securely

in any adjusted position upon that stationary plate, I combine with the said stationary plate A and connected sliding segments B and C a spring or springs, H, substantially as represented in Figs. 1, 4, 5, 6 or 7, so that each and both of the two connected segments B C are simultaneously and constantly pressed by the said spring or springs against the opposite concave and convex surfaces of the said intervening stationary plate, in whatever position the two connected segments shall be placed on that plate.

In Figs. 1, 4, 5, and 7, the spiral springs H are compressed and retained in pockets *i*, Figs. 2 and 3, between parts by which the segments B and C are connected together and secured upon the intervening stationary plate A; and those springs have substantially the same action in pressing both of the segments B and C against the one fixed plate A as the compressed spiral spring H in Fig. 6. The latter spring can be readily more or less compressed by means of the screw *g* and nut *j*, so as to press the segments B and C against the plate A with greater or less strength, as shall be desired; and I make the springs H, in Figs. 1, 4, 5, and 7, of any suitable number and strength to accomplish the same purpose.

In order to provide means whereby the two connected convex and concave segments B and C can be readily clamped fast, and loosened in every adjusted position upon the stationary concavo-convex plate A, by merely turning to and fro, a very short distance, the base of an instrument mounted on the connected segments, I form or secure upon one of those segments a screw, K, and upon the other a circular shoulder or bearing, L, respectively adapted to engage with and bear against a corresponding screw and shoulder or bearing-surface on the under side of the instrument-base Z, substantially as shown in full lines in Fig. 1, and indicated by dotted lines in Figs. 4, 6, and 7. By this construction, with or without the spring or springs H, when the base of the instrument is engaged with the screw K, and is just against the shoulder L, the instrument can then be quickly leveled by taking hold of the instrument or its base by hand, and thereby moving the connected convex and concave segments B C on the concavo-convex plate A; and, when thus adjusted, by then merely turning the base of the instrument so as to tighten it against the bearing L, the segments B and C will be thereby drawn and clamped against the plate A, so as to firmly hold the base of the instrument in adjustment. When thus clamped upon that plate, the parts B and C can be at once loosened thereon by merely turning the base of the instrument a little in the opposite direction, the adhesion between the plate A and segments B and C being sufficient to prevent the turning of those segments on the plate A in thus tightening and loosening the base of the instrument in and against the screw K and bearing L.

The spring or springs H, when present, will increase the adhesion between the plate A and segments B and C, and will thereby coact with the screw K and shoulder L in causing the clamping and loosening of the segments B and C upon the plate A by tightening and loosening the base of the instrument in and upon the said screw and shoulder.

In order to provide very simple means whereby the adhesion between the downwardly-convex surface of the centrally-open stationary plate A in Figs. 1 and 5 and the upper concave surface of the sliding segment C, having an instrument-supporting part, E, extending upward through the plate A, can be at once increased and adjusted to any desired degree, I make the lower surface of the segment C, Figs. 1 and 5, in convex form, concentric with the concave upper surface of that segment; and arranged under that segment and below the plate A, and in or upon the stock M, which supports that plate, a screw-like clamp, N, which, by being turned in one direction, will bear either directly or through a suitable intervening washer or segment, O, against the convex under surface of the segment C, and thereby press or clamp that segment against the stationary plate A with any desired degree of strength, whatever shall be the position of the sliding segment C upon that plate; and by turning the screw-clamp N in the opposite direction, the pressure of the segment C against the plate A will be relaxed.

Secured to the clamp N is a lever, *p*, by which the clamp can be easily turned to and fro by hand. In Fig. 1 that clamp is shown with two screw-holes, in one of which the lever *p* is shown inserted, as when a washer or loose concave segment, O, is between the clamp N and the segment C, as represented in full lines, and the other hole, *q*, is arranged to receive the detachable lever *p* when the washer or segment O is removed or absent, and the upper end of the clamp N bears directly against the segment C, as indicated by dotted lines. In Fig. 5 the clamp N is also provided with the removable lever *p*, and is adapted to press the segment C against the plate A, whether the segment O is present, as shown in full lines, or absent.

By the combination of the stationary centrally-open and downwardly concavo-convex plate A, the internally-connected sliding convex segment B, and concavo-convex segment C, adapted to support the base of a surveying or leveling instrument, and the screw-clamp N, substantially as shown in Figs. 1 and 5, with or without the springs H or the segment O, a surveying or leveling instrument mounted on one or both of the connected segments B C, will be supported wholly or in part by the convex segment B bearing on the upper concave surface of the fixed plate A, while the under convex surface of the segment C may or may not bear upon the clamp N or its washer O, as the segments B and C shall be moved together to and fro across the plate A

in quickly leveling the instrument, which latter, when thus adjusted, can be retained in such adjustment by merely pressing and clamping the segment C against the lower convex surface of the plate A by means of the screw-clamp N.

By the combination of the centrally-open stationary concavo-convex plate A, connected sliding convex segment B, and concavo-convex segment C, furnished respectively with the screw K and bearing L, and the screw-clamp N, substantially as represented in Fig. 1, with or without either the springs H or washer O, the segment C can be pressed against the stationary plate A by the screw-clamp N; and the connected segments B and C can also be clamped against the same plate A by screwing the base Z of an instrument tightly into and against the screw K and bearing L, whereby the sliding segments B and C can be fastened with extreme firmness in every adjusted position; and, by the assistance of the clamp N in pressing the segment C against the plate A, the segments B and C are surely prevented from turning on the plate A in clamping and unclamping those two segments against that plate by turning to and fro, and thereby tightening and loosening the base Z of an instrument in and against the screw K and bearing L.

The combination of the concavo-convex stationary plate A, connected convex segment B, and cancavo-convex segment C, respectively furnished with the screw K and bearing L, the springs H, and the screw-clamp N, with or without the washer O, substantially as represented in Fig. 1, constitutes the most complete device, which I commonly prefer, for use in quickly leveling and surely supporting and retaining in every adjusted position a surveying or engineering instrument upon a tripod in the field.

In carrying out this invention I often make the lower part of the supporting-stock M of the fixed plate A with a male or female screw, *r*, adapted to engage with a corresponding screw on or in the top of an ordinary tripod for surveying or engineering instruments, substantially as indicated by Figs. 4, 5, 6, and 7.

The combination of a sliding annular concavo-convex plate adapted to support a surveying or engineering instrument, two centrally-open connected convex and concave segments fitting against opposite sides of and supporting the said concavo-convex plate, and a screw-clamp, with or without a spring or springs, adapted to press and clamp fast the said sliding concavo-convex plate between the said convex and concave segments, is not herein broadly claimed, the same being a part of the subject of my other application for a patent, herewith filed.

What I claim as my invention is—

1. The combination of the stationary centrally-open concentrically concavo-convex plate A, the annular convex and concave segments B and C, and the interior tubular connecting device E, substantially as described, whereby the said convex and concave segments are adapted to slide together upon opposite sides of the said concavo-convex plate, while permitting a plumb-line to hang and be adjusted laterally therethrough, as set forth.

2. The combination of the stationary concavo-convex plate A, the sliding connected convex and concave segments B and C, and the spring or springs H, substantially as described, whereby the said sliding segments are both pressed against the said concavo-convex plate by the said spring or springs.

3. The combination of the stationary concavo-convex plate A and the sliding connected convex and concave segments B and C, having the screw K and bearing L, respectively arranged thereon, as described, whereby the said convex and concave segments are adapted to engage with a suitable screw and bearing on the base of an instrument, and be thereby clamped fast, and released, upon the said concavo-convex plate, as set forth.

4. The combination of the stationary concavo-convex plate A, the sliding connected convex and concave segments B and C, having the screw K and bearing L, and the spring or springs H, substantially as described.

5. The combination of the centrally-open downwardly-convex stationary plate A, the sliding concavo-convex segment C, having an instrument-support, E, extending through the said stationary plate, and the screw-clamp N, substantially as described.

6. The combination of the concavo-convex stationary plate A, the sliding connected convex segment B and concavo-convex segment C, and the screw-clamp N, substantially as described.

7. The combination of the concavo-convex plate A, the connected convex segment B and concavo-convex segment C, having the screw K and bearing L, and the clamp N, substantially as described.

8. The combination of the concavo-convex plate A, the connected convex segment B and concavo-convex segment C, having the screw K and bearing L, the springs H, and the clamp N, substantially as described.

In testimony whereof I hereunto set my hand in the presence of two subscribing witnesses this 21st day of September, 1878.

WILLIAM GURLEY.

Witnesses:
PAUL COOK,
ROBERT GREGG, Jr.