(No Model.)

W. & L. E. GURLEY.

LEVELING INSTRUMENT.

No. 286,606. Patented Oct. 16, 1883.

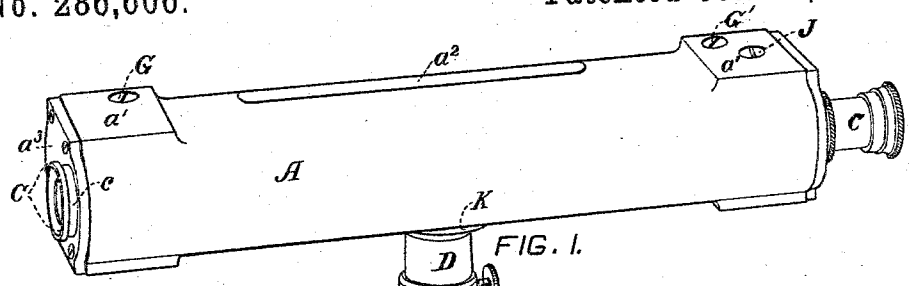
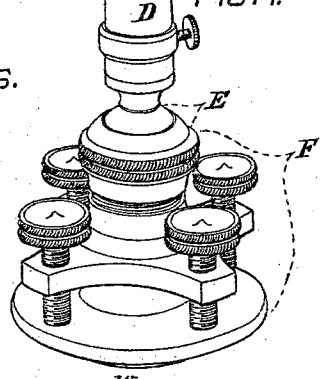


FIG. 1.



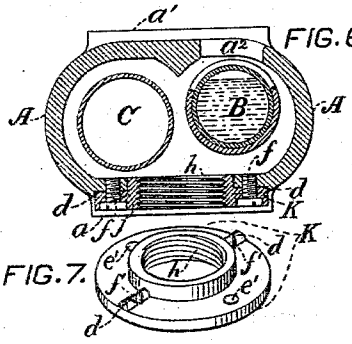


FIG. 6.

FIG. 7.

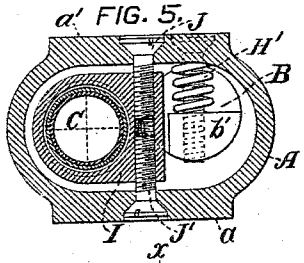


FIG. 5.

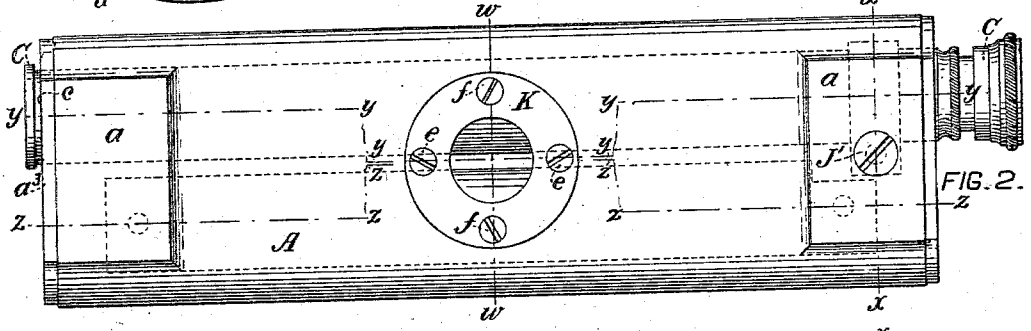


FIG. 2.

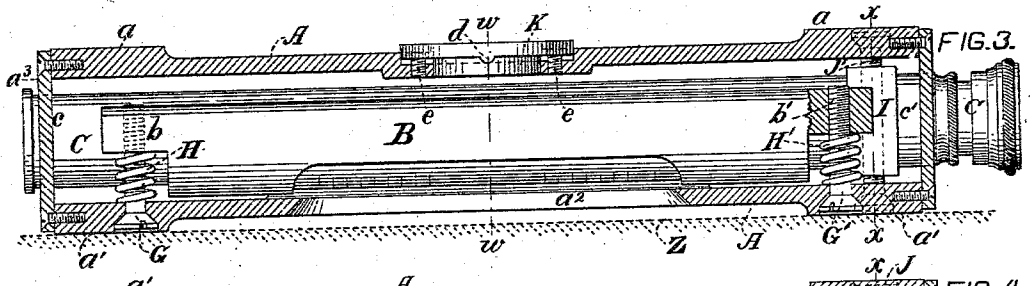


FIG. 3.

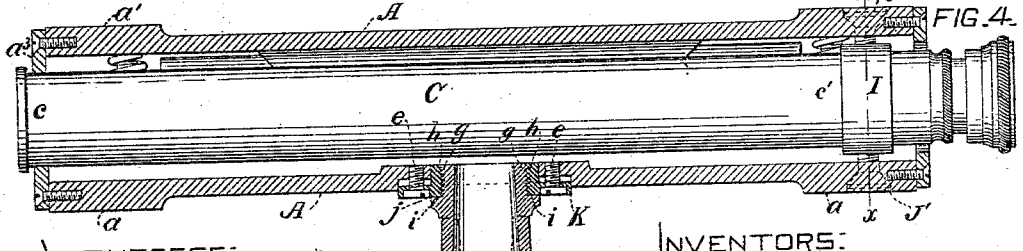


FIG. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM GURLEY AND LEWIS E. GURLEY, OF TROY, NEW YORK.

LEVELING-INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 286,606, dated October 16, 1883.

Application filed September 5, 1883. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM GURLEY and LEWIS E. GURLEY, citizens of the United States, residing at the city of Troy, in the county of Rensselaer and State of New York, have jointly invented new and useful Improvements in Leveling-Instruments, of which the following is a specification.

The general object of our invention is to produce a very simple, compact, efficient, and easily-adjusted leveling-instrument, having a strong outside protecting-case, and adapted for convenient use on a staff or tripod in the field, and on a straight-edge, or directly upon buildings or structures.

In the accompanying drawings, Figure 1 is a perspective view of one of our improved leveling-instruments having on its under side a socket fitting on the ball-spindle of a leveling-head for a tripod, as when mounted for field use. Fig. 2 is a plan of the under side of the same instrument with its socket removed, as when used directly upon a straight-edge or surfaces to be tested. Fig. 3 is a longitudinal section of the outer case of the same instrument inverted, and side view of the inclosed spirit-level and telescope, the section being at about the lines *z z* in Fig. 2. Fig. 4 is a longitudinal section of the case at about the lines *y y* in Fig. 2, and elevation of the telescope of the same instrument with the socket attached. Fig. 5 is a transverse section of the same instrument at the line *x x* in Figs. 2, 3, and 4, and Fig. 6 is a cross-section of the same at the line *w w* in Figs. 2 and 3. Fig. 7 is a perspective view of a coupling-plate for use in securing and adjusting the socket to the case of the instrument.

A is a strong outer case, which can be of cast brass or bronze, or of other suitable material, and which is shown formed at its end parts with raised faces *a a a' a'*, that are parallel to each other, on the top and bottom of the case.

B is a spirit-level, and C is a telescope, both arranged and supported lengthwise in the case. Through the top of the case is a long aperture, a^2, through which the bubble and graduations of the spirit-level can be freely seen. The object-glass and the outer end of the eye-piece of the telescope are exposed to view at the ends of the case, and the telescope has cross-wires in its optical axis to fit it for accurate use.

D is a socket secured to the under side of the case A, and adapted to fit and be revolved on the spindle of a ball and socket, E, Fig. 1, or leveling-head, F, of a jacob-staff or tripod.

For supporting the spirit-level B, and adjusting it parallel to the plane of the faces *a a* or *a' a'* on the case, or at right angles to the axis of the socket D, any suitable known devices can be used. For that purpose we commonly prefer two headed screws, G G', Fig. 3, fitting in and extending through corresponding perforations in one side of the case, and engaging with the end parts, *b b'*, of the spirit-level, with two strong spiral springs, H H', surrounding the screws, and by the latter compressed between the case and the parts *b b'*.

For adjusting and securing the telescope in the case, with its optical axis parallel to the faces *a a a' a'*, or at right angles to the axis of the socket D, various known devices can be used, and may be similar to the means above mentioned, and shown in the drawings, for adjusting and securing in the case the level B in respect to said socket or faces. As a very simple, cheap, efficient, and generally-preferred means for thus adjusting and securing the telescope within the case, and in respect to said faces or socket, we have one end part, *c*, of the main outer tube of the telescope fit tightly in a corresponding perforation through one end plate, a^3, of the case, as indicated in Figs. 1 and 4, and have the other end part, c^2, of the outer tube of the telescope furnished with a stock, I, Figs. 3, 4, and 5, and two headed screws, J J', fitting in and extending through corresponding perforations in the top and bottom of the case, and engaging with the stock I, substantially as represented in Fig. 5, so that by properly loosening one and tightening the other of the screws J J', the end part, *c'*, of the telescope can be moved up and down, and thereby secured at different heights within the case, while the other end part, *c*, of the telescope fits and remains in the perforation in the fixed end plate, a^3.

For adjusting and securing the socket D to the case A, with the axis of the socket at right

angles to the spirit-level B, optical axis of the telescope C, or planes of the faces *a a a' a'* on the case, various known devices can be used. Preferably for that purpose we furnish the socket D or the case with a flange or disk, K, Fig. 4, fitting in a corresponding recess in the under side of the case, with intervening diametrically-opposite fulcrum-bearings, *d d*, Figs. 3, 6, and 7, transverse to the lengthwise direction of the case, and secure the flange or disk K to the case by headed screws *e e f f*, extending through corresponding perforations, *e' f'*, Fig. 7, in the disk, and engaging with the case, substantially as represented in the drawings, so that by properly loosening one and tightening the other of the screws *e e* the disk K and socket D can be adjusted and firmly secured to the case, with the axis of the socket at right angles to the planes of the faces *a a a' a'*, to the spirit-level B, or to the optical axis of the telescope.

To adapt the instrument for ready use, either on the spindle of a jacob-staff or tripod or directly on a straight-edge or surfaces to be tested, we secure the socket D to the case A or disk K by the male and female screws *g h*, Fig. 4, with adjacent shoulders *i j* above the plane of the lower faces, *a a*, on the case, substantially as shown in the drawings, so that the socket can be at any time immediately unscrewed, and thus removed from the instrument to permit the lower faces of the case to be freely applied to a straight-edge, Z, Fig. 3, or to any surface to be tested, and so that the socket can be at once rescrewed fast to the instrument whenever it is to be used on a spindle on a staff or tripod.

The method of proceeding to adjust the level B and telescope C at right angles to the axis of the socket D by means of the adjusting-screws G G' and J J', respectively, and to adjust the socket D at right angles to the level and telescope by means of the screws *e e*, without the use of the parallel faces *a a a' a'* on the case, or when the case shall not have those faces, will be evident, or readily understood, upon inspection, by persons skilled in making, adjusting, and using leveling-instruments. We, however, greatly lessen the work of adjusting the instrument by making the outer case with parallel top and bottom faces, *a a a' a'*, and with its end perforation, in which the end part, *c*, of the telescope fits tightly, just midway between the planes of those faces. Thus in the instrument represented in the drawings the spirit-level B can be adjusted parallel to the faces *a a a' a'* upon a level surface or straight-edge by reversing the instrument end for end on its lower faces, *a a*, and correcting the position of the level by the screws G G', and the telescope C can be adjusted with its optical axis parallel to the top and bottom faces on the case by applying the two opposite faces *a a a' a'* alternately to the same surface, and moving and setting the end part, *c'*, of the telescope by the screws J J', until the telescope cross-wires shall cut the same observed point in both positions of the instrument. Then, when the socket D is secured to the case, to complete the adjustments the socket is adjusted at right angles to the level, and consequently at right angles to the telescope and to the upper and lower parallel faces of the case, by placing the socket on a spindle, as in Fig. 1, and then properly loosening one and tightening the other of the screws *e e*, Fig. 4, until the bubble remains in the center of the spirit-level in all positions of the instrument as the latter is revolved on the spindle.

As a substitute and equivalent for the socket D, a spindle (indicated by dotted lines at D' in Fig. 4, and adapted to fit in a corresponding socket on the head of a jacob-staff or tripod) can be adjustably and detachably secured to the case A by means of the devices above described for detachably and adjustably securing the socket D to the case.

In carrying out some parts of our invention we sometimes make the case A and spindle D' or socket D in only one piece, or with the spindle or socket detachably secured directly to the case by a male and a female screw, without any intervening adjusting part, K, the spindle or socket being then constructed with its axis permanently perpendicular to the parallel planes of the top and bottom faces on the case.

What we claim as our invention is—

1. A leveling-instrument having a spirit-level, a telescope, an outer protecting-case inclosing the telescope and spirit-level, and formed with parallel top and bottom faces, and means for supporting and adjusting the spirit-level parallel to said faces, and for supporting and adjusting the telescope with its optical axis midway between and parallel to the top and bottom faces on the case, substantially as described.

2. A leveling-instrument having a spirit-level, a telescope, an outer protecting-case inclosing the telescope and spirit-level, and furnished with a supporting socket or spindle, and means for separately supporting and adjusting both the spirit-level and the telescope at right angles to the axis of said spindle or socket, substantially as described.

3. A leveling-instrument having an outer protecting-case furnished with a supporting socket or spindle, a spirit-level and a telescope supported in the case, and means for adjusting the spirit-level parallel to the optical axis of the telescope, and for adjusting said spindle or socket with its axis at right angles to the spirit-level, substantially as described.

4. A leveling-instrument having an outer protecting-case formed with parallel top and bottom faces, and furnished with a supporting socket or spindle having its axis at right angles to the planes of said faces, a telescope and a spirit-level supported in the case, and means for adjusting the spirit-level and the

telescope parallel to said faces on the case, substantially as described.

5. A leveling-instrument having an outer protecting-case formed with parallel top and bottom faces, and furnished with a supporting socket or spindle having its axis at right angles to the planes of said faces, a telescope and a spirit-level supported in the case, and means for adjusting the spirit-level and the telescope parallel to said faces on the case, and for readily detaching and accurately reattaching said spindle or socket, substantially as described.

6. A leveling-instrument composed of a spirit-level, a telescope, an outer protecting-case inclosing the telescope and spirit-level, and formed with parallel top and bottom faces, and furnished with a supporting socket or spindle, and means for supporting and adjusting the spirit-level and the telescope parallel to said faces on the case, and for adjusting said spindle or socket with its axis at right angles to the spirit-level and telescope, substantially as described.

7. A leveling-instrument composed of an outer protecting-case formed with parallel top and bottom faces and furnished with a supporting socket or spindle, a spirit-level and a telescope supported in the case, and means for adjusting the telescope and the spirit-level parallel to said faces on the case, for adjusting said spindle or socket at right angles to the spirit-level, and for readily detaching and accurately reattaching said spindle or socket, substantially as described.

8. A leveling-instrument composed of an outer protecting-case, A, having parallel top and bottom faces, *a a a' a'*, spirit-level B, adjustably secured in the case, telescope C, fitting at one end part in an end perforation in the case, and furnished at its other end part with a stock, I, and adjusting-screws J J', extending through the top and bottom of the case and engaging with said stock, substantially as described.

9. A leveling-instrument composed of an outer protecting-case furnished with a supporting spindle or socket, D, a spirit-level, B, adjustably secured in the case, a telescope, C, fitting at one end part in an end perforation in the case, and having the stock I on its other end part, and adjusting-screws J J', extending through the top and bottom of the case and engaging with said stock, substantially as described.

10. A leveling-instrument composed of an outer protecting-case, a telescope, C, and a spirit-level, B, adjustably secured in the case, substantially as set forth, and a supporting spindle or socket, D, furnished with a perforated flange or disk, K, fitting against the case, and adjustably secured thereto by the screws *e f*, and intervening fulcrum-bearings, *d*, substantially as described.

11. A leveling-instrument composed of an outer protecting-case formed with parallel top and bottom faces, *a a a' a'*, and furnished with a supporting spindle or socket, D, at right angles to the planes of said faces, the spirit-level B, adjustably secured in the case, the telescope C, fitting at one end part in an end perforation in the case, and having the stock I on its other end part, and the screws J J', extending through the top and bottom of the case and engaging with said stock on the telescope, substantially as described.

12. A leveling-instrument composed of an outer protecting-case formed with parallel top and bottom faces, a detachable spindle or socket, D, secured to the case—with its axis perpendicular to the planes of said faces—by the male and female screw coupling *g h* above the plane of the bottom faces, *a a*, on the case, and the spirit-level B and telescope C, separately supported in the case by adjusting devices, substantially as described.

13. A leveling-instrument composed of an outer protecting-case formed with parallel top and bottom faces, a spirit-level and a telescope supported in the case by devices for adjusting the telescope and level parallel to said faces, substantially as described, and a spindle or socket, D, furnished with a perforated disk, K, and fulcrum-bearings *d*, and secured to the case by adjusting-screws *e f*, substantially as set forth.

14. A leveling-instrument composed of an outer protecting-case formed with parallel top and bottom faces, a spirit-level and a telescope supported in the case by devices for adjusting the telescope and spirit-level parallel to said faces, perforated disk K, furnished with fulcrum-bearings *d* and secured to the case by screws *e f*, and a detachable spindle or socket, D, secured to said disk by a male and female screw coupling, all substantially as described.

In testimony whereof we hereunto set our hands, in the presence of two subscribing witnesses, this 3d day of September, 1883.

WILLIAM GURLEY.
LEWIS E. GURLEY.

Witnesses:
JAMES T. GOODFELLOW,
AUSTIN F. PARK.