Dec. 25, 1928. 1,696,508

W. THORBURN

HAND LEVEL AND ANGLING DEVICE

Filed Jan. 9, 1928

Fig. 1.

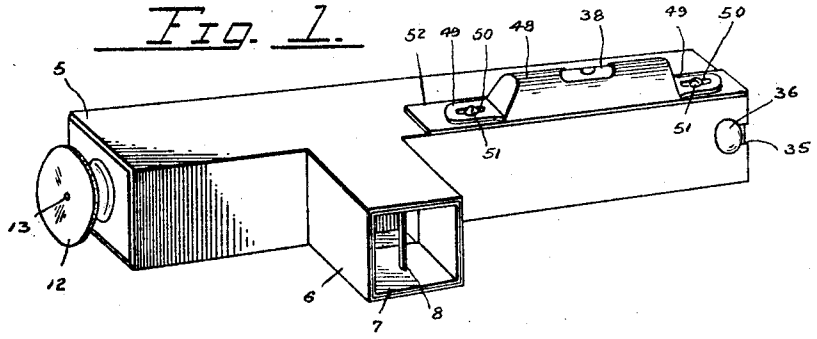


Fig. 2.

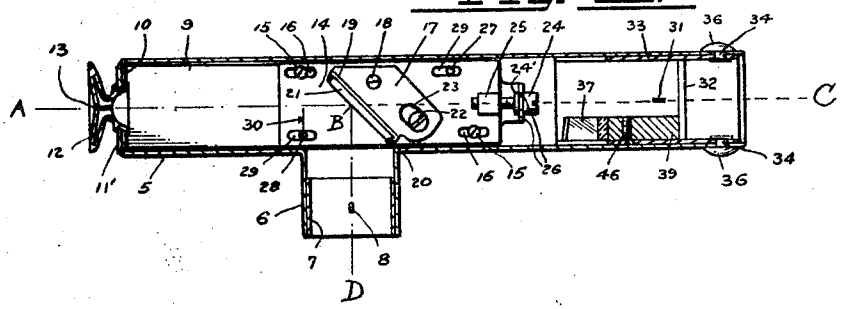


Fig. 3.

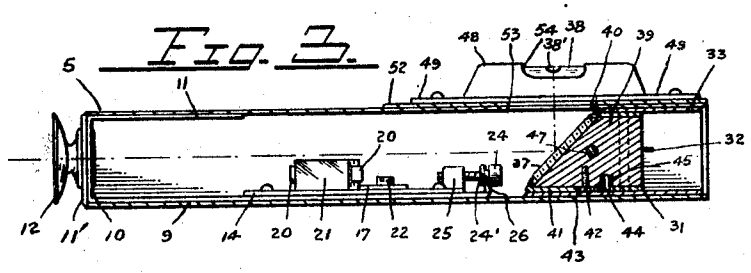
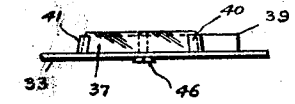


Fig. 4.



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Patented Dec. 25, 1928. 1,696,508

UNITED STATES PATENT OFFICE.

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HAND LEVEL AND ANGLING DEVICE.

Application filed January 9, 1928. Serial No. 245,395.

This invention relates to hand levels, and particularly to hand levels in combination with right angling devices.

The objects of the invention are to provide improvements in my instrument for determining levels at points ahead of the operator, and at the same time to establish points at one side of the operator, as described in Letters Patent of the United States issued to me, No. 857,688, June 25, 1907.

In the use of such devices in the field by surveyors and others, a light compact instrument is desired, and owing to the changes of weather and temperature any glass surfaces frequently becomes clouded; and without glass coverings over the objective ends, dust lodges on the sight wires and reflecting surfaces inside the case, so frequently requiring the removal of parts from the case for cleaning. Again in rough operations in the field, the instruments sometimes are dropped and the level vial slightly displaced from adjustment thereby, requiring the elevation of either end of the vial cap by thin shims, thus reducing the holding means for threads on the vial cap screws. Rough work sometimes causes the horizontal reflector to become out of alignment, and so requiring its adjustment, particularly in longitudinal positions; the adjustment preferably made with the reflector in position in the casing. It is also important to have the inclined reflector of glass, with accurate means for retaining it in place.

And it is among the objects of this invention, therefore, to provide an instrument arranged so that all its parts may be quickly and easily removed and cleaned, and all parts easily, quickly, and accurately replaced. The horizontal reflector adjusted longitudinally while in position in its casing, and a reinforcing plate provided beneath the vial cap, and the inclined reflector beneath the vial constructed with a glass face, held in position positively by suitable clamp jaws.

With these and other objects the invention consists of novel combinations and arrangement of parts hereinafter set out, and claimed.

I have illustrated my invention by the accompanying drawings, of which, Figure 1, is a perspective view of the instrument assembled. Figure 2 is a longitudinal view in section, taken on a plane normally horizontal. Figure 3 is a longitudinal view in section, taken on a plane at right angles to the plane of Figure 2. And Figure 4 is an enlarged detail view of the glass reflector, as mounted between jaw clamps and held in an inclined position in the instrument.

Like numerals on the different figures, represent like parts. 5, is the straight portion of the casing or tube preferably rectangular in cross section, and of suitable proportions to be easily carried in the pocket of any user. 6, is an offset tube of similar cross section and extending out from one side of the tube 5, and closer to the peep sight end thereof. A sleeve 7, is slidably mounted in the outer end of 6, and held in position by friction, but may be easily removed by the operator for the cleaning of a vertical wire 8, which is held rigidly across the opening between the upper and lower walls of the sleeve.

Inside of and on the bottom of tube 5, is positioned a slide 9, with an upturned end 10, the diameter of the tube, and an upper and inwardly projected tongue 11, the free end of which, normally tends to spring upward, and when compressed and pushed into position in the tube 5, aids in holding the slide 9 in position. Both the slide and tongue also impinge against the inner sides of the tube 5 and insure the slide retaining its position in the tube. On the outside of end piece 10 is fixed a cap 11′ of the same dimensions as the outer measurements of the tube 5, and thus it forms a shoulder and prevents the plate 9 being pushed into the tube beyond the predetermined position. An eye piece 12, is projected through both the end piece 10 and cap 11′, and aids in holding the parts together by a riveted edge on the inside; the outer end of the eye piece 12 being enlarged to provide a holding means for removal of the slide 9 when desired. A small peep hole 13 extends through the eye piece 12.

Upon the upper side of the slide 9 is adjustably positioned a plate 14 disposed parallel with the slide, and held in any predetermined position on the slide by clamp screws 15, passing through slots 16 of the plate and into the slide 9. On top of the plate is mounted a block 17 held in position by a pivot screw 18. The block has an upturned edge 19, and the ends 20 of the latter, bent toward each other to form clamp-

ing means for holding securely a horizontal mirror 21, in an oblique position across the plate, and opposite the opening through the offset tube 6. The angular position of the mirror being adjusted by an eccentric headed screw 22 operating in a slot 23 of the block.

The plate 14 is adjusted longitudinally on the slide 9 by a horizontal screw 24, which meshes in a threaded lug 25 affixed to the plate. The outer end of the slide 9 is upturned and bifurcated to provide two shoulders 26 between which the neck of the screw 24 rotates. The screw has a collar 24′ on the inner side of the shoulders, and thus as the screw is turned, the head and collar of the screw on opposite sides of the shoulders, acting as fulcrums, the plate 14 is moved in either desired direction along the slide 9. As the head of the screw projects toward the open end of the tube, the operator may insert a screw driver into the tube and adjust the plate while in position in the tube. The screw 24 acting from its center will not work loose, as is the case when an eccentric screw is used for the longitudinal adjustment.

Suitable guide lugs 27 and 28 extend up from the slide 9 through slots 29 permitting the plate to be adjusted longitudinally but preventing any side motion. When the plate is properly adjusted on the slide, a register line 30 is marked across the top of the lug 28 and extending out on the plate, so that in event of rough usage or otherwise the plate should become slightly moved, the register lines would so indicate.

The ordinary vertical and horizontal cross wires 31 and 32 are held in the outer end of the casing, by a sleeve 33, slidably positioned into the casing and frictionally held therein by the contact of the outer surfaces of the sleeve with inner surfaces of the casing, the position of the sleeve being determined by lugs 34 carried by the sleeve and extending out from the two sides thereof, and which enter the sides of the casing through slots 35, the lugs being pushed to the inner ends of the slots and the relative positions there remaining till the operator desires to remove the sleeve. The removal is facilitated by suitable enlarged heads 36, 36, for the operator's fingers on the outer ends of the lugs 34.

An inclined reflector 37 is carried and held in position at the inner end of one side of the sleeve 33, for determining the true horizontal position of the instrument when in use, in connection with a spirit level 38 mounted above the reflector. As the metallic face of the ordinary reflector soon becomes tarnished and lacks the brightness of a glass mirror, it has been found advisable to use only glass therefor, and I have provided a special means for holding the glass in positive position in the casing, and yet permitting the same to be readily removed from the casing along with the cross wires, to be cleaned at any time when the glass may have become clouded or dust may have collected thereon or upon the wires.

As it is necessary to preserve an opening through the casing for the line of vision, a narrow mirror is preferably used and on one side of the casing only. This is securely held in position on the inclined end of a block 39, with a top clamp 40 attached and extending outward and downward over the upper end of the mirror 37, which is positioned along the inclined face of the block 39. An adjustable clamp 41 is held on the bottom of the block by a screw 42 operating through a slot 43 in the clamp and meshing in the block, with a guide lug 44 attached to the clamp 41 and extending into a slot 45 in the block. The inner edge of the mirror is narrower than the outer edge, and the reflecting side of the mirror is also shorter than the rear side thereof, so that the ends of the mirror are bevelled or slope in two directions, and the extending ends of the clamps are bent to conform with the ends of the mirror as shown in Figure 4. Thus when the mirror is placed between the ends of the clamps it is there held by dovetail contact both from sliding forward from the block, and from sliding inward from the outside of the block, and the mirror is further held from sliding outward from its said position by the adjoining wall of the sleeve 33, against which the block is adjustably held by screw 46 meshing in hole 47 in the block. As glass is easily broken it is difficult to force it tightly in position between the jaws, but by means of the adjusting screw 42 the lower clamp may be loosened and the clamp moved back against the glass, and then tightened and the glass securely held.

The spirit level vial 38, is held in position above the inclined mirror in a cap 48, which has ears 49, extending out from lower edge of each end thereof, with slots 50 therein, by adjustable clamp screws 51. As the casing is preferably of thin material, the screws 51 have but few holding threads therethrough, and as the vial in the cap is sometimes slightly shifted by rough usage, it becomes necessary to adjust the cap 48 by raising either end thereof and placing shims thereunder, and as the rear screw cannot protrude beyond the inner face of the casing, where it would prevent the sleeve from entering, this screw would have still less holding contact with the threads in the top of the casing if partly raised for shims. And in order to meet the difficulties described I have affixed a rib 52, securely to the top of the casing adjoining the cap, which furnishes additional holding threads for the cap

screws, yet does not materially add to the total weight of the device. Openings 53 and 54 are provided through the top of the casing and rib respectively beneath the vial cap, to permit the ordinary bubble 38′ to be reflected upon or from the inclined mirror 37 beneath.

The angular horizontal reflector 21 is beneath the line of vision projected through the hole 13 to the point where the wires 31 and 32 cross. And this reflector is normally positioned at an angle of 45 degrees across the tubes 5 and 6, when right angles are to be determined with the instrument. And when this reflector is so positioned the vertical wire 8, in the offset end, will appear perpendicularly across the reflector as a continuation downward of the front vertical wire 31. Thus any object seen directly in front of the instrument in line with vertical wire 31 will be exactly at right angles with any object seen reflected through tube 6 from one side and in line with the wire 8 reflected on 21 as a continuation downward of the front wire 31. In event that such points at true right angles should not appear in alignment on the reflector, the operator will understand that the reflector is not correctly positioned, and suitable adjustment is made with either or both of the screws 22 and 26 as conditions require.

The horizontal position of the tube 5 is determined by the location of the bubble 38′ reflected upon the inclined mirror 37. The operator when holding his eye to the instrument will see the horizontal cross wire 32, up to the point where it passes behind the mirror 37, will also see the reflection of the bubble 38′ on the inclined mirror, and when the instrument is exactly level, the center of the bubble will appear on the mirror as exactly in line with the cross wire 32. If the instrument is tilted in either direction longitudinally the bubble will be seen to move up or down on the inclined mirror face, and disclose that the instrument is no longer level. When the instrument is in a true level position as determined by the horizontal cross wire and reflected bubble, then any point in front of the instrument on the same level with the cross wire will be known to be on the same level or elevation as the instrument. Thus the ordinary surveyor's rod with markings thereon, when used with this instrument at a distance therefrom will determie the elevations as shown by the markings on the rod on the same level as the instrument.

The instrument is particularly valuable in laying out streets at right angles, as the operator may determine the projected street lines ahead, and those at right angles at the same time. Variations in the topography of the territory do not prevent accurate use of the instrument, for the tube may be retained in its longitudinal level, but rotated on its longitudinal axis so that points may be seen and located through the offset tube at right angles on levels higher or lower than the projected line in front.

By suitable angular adjustment of the horizontal reflector 21, the operator may determine accurately points at various angles, such as diagonal lines for streets when so formed and radial lines, and others as will be readily understood by those skilled in the art.

The diagrammatic lines on Figure 2 indicate the respective points. As A, the point where the operator sights through the hole 13, B, the point over the horizontal reflector where the line of vision will pass when directed to crossing point of the wires 31 and 32 and beyond to point C. D, the line of reflection from any outside point at right angles opposite the offset tube and vertical wire 8, both as reflected on the mirror 21 at point B directly beneath the line from A to C.

Having described my invention, I claim:

1. A combination level and angling device, with a view tube provided with a peep sight opening at one end, and cross wires at the other end, an offset tube opening from one side with a removable sleeve therein carring a vertical wire; a horizontal mirror mounted above a plate the plate adjustably held on a slide, a slide frictionally held within and along the bottom of the first mentioned tube, bifurcated ends on the slide turned up to form a fulcrum, means for adjusting the mirror at various angles across the tubes, and a threaded lug on the outer end of the plate, a screw threaded into the lug, a collar on the screw at the inside of the fulcrum and a head on the outer side thereof, whereby the plate may be adjusted longitudinally on the slide in the first mentioned tube.

2. A combination level and angling device, with a straight tube, provided with a peep hole through one end thereof, and the other end open, and an offset tube extending from one side of the straight tube, with a vertical wire in the offset portion, a horizontal mirror mounted above the floor of the tube on an angle for reflecting the said vertical wire and objects beyond the same; a sleeve frictionally held in the open end of the straight tube with cross wires mounted in the sleeve and removable therewith from the tube, a block adjustably held on one side of the sleeve, with an inclined mirror mounted on the block at the inner end of the sleeve, a fixed clamp on the top of the block and an adjustable clamp on the bottom of the block, with the ends of the clamps extending beyond the face of the block and bent to conform with bevelled ends of the inclined mirror, adjustable means for hold-

ing the lower clamp against the block and the lower end of the mirror, for retaining the mirror in a predetermined position; and a spirit level mounted above the inclined mirror for determining the position of the device.

3. In a combination hand level and angling device, with a straight sight tube, provided with a peep hole in one end thereof, and cross wires at the other end, with an offset sight tube, and a vertical wire across the same; an angular horizontal reflector mounted in the lower part of the straight tube for reflecting the vertical wire and objects beyond the same; with an inclined mirror mounted across one side of the straight tube near the open end thereof, a reinforcing rib affixed over the top wall of the straight tube above the inclined mirror, the rib and wall provided with an opening therethrough; a cap, with a spirit level and bubble mounted in the cap above the opening,—the cap provided with slots in each end for adjusting the same, with clamp screws mounted through the slots and threaded through the rib and into the top wall of the tube for holding the cap in a perdetermined position; said opening through the rib and wall beneath, directly above the inclined mirror, for the reflection of the bubble on the inclined mirror for determining when the device is in a horizontal position.

4. In combination, a hand level and angling device, with a straight sight tube, provided with a peep hole at one end, a sleeve slidably held in the other end, cross wires mounted in the sleeve, an offset sight tube from one side of the straight tube with a vertical wire mounted across the open end thereof, a horizontal reflecting mirror mounted in the straight tube opposite the offset opening and beneath the center thereof, with means for adjusting the horizontal mirror in angular positions, a plate supporting the horizontal mirror, a lug on the plate, with a screw threaded in the lug, the screw provided with a head and collar, fulcrum points in front of the plate against which the collar and head of the screw are operated for adjusting the horizontal mirror longitudinally in the tube; a rib above the straight tube a spirit level with a bubble mounted on the rib, with an opening beneath the level for the reflection of the bubble in the level beneath, an inclined mirror in the straight tube, beneath the opening, with a block for supporting the inclined mirror, clamps on the top and bottom of the block with the ends thereof bent to conform to beveled ends of the mirror, the bottom clamp adjustably held by a screw, for retaining the inclined mirror in a predetermined position.

In testimony whereof I affix my signature

WALTER THORBURN.