

Dec. 15, 1942.

E. H. BLASCHKE

2,305,233

SURVEYING INSTRUMENT

Filed July 2, 1941

FIG. 1.

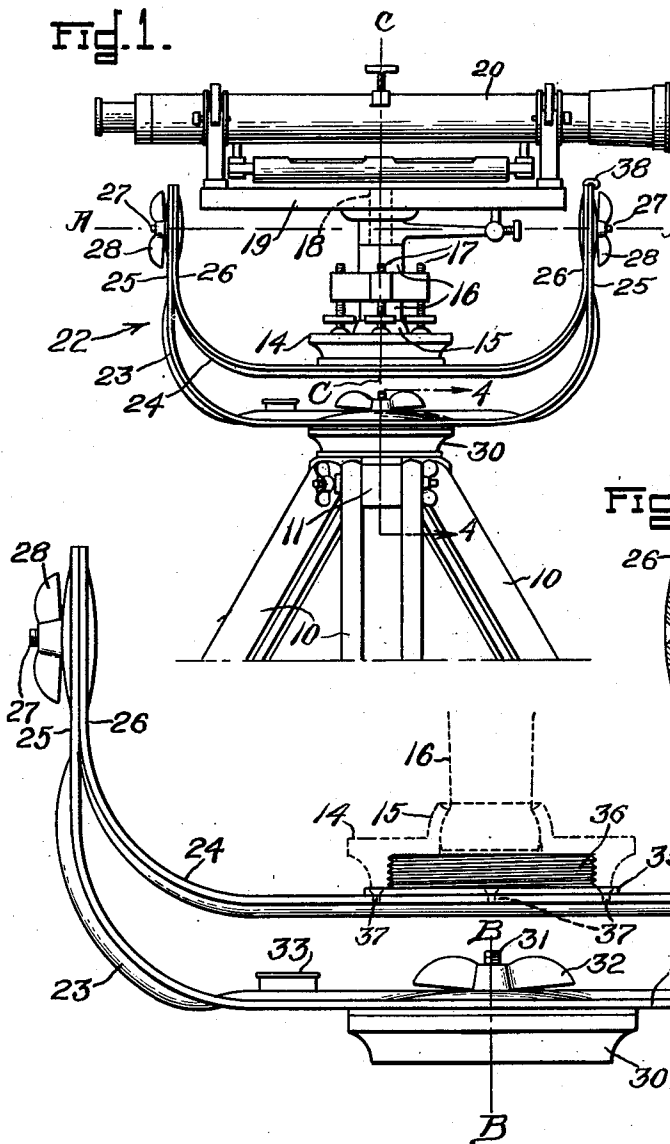


FIG. 2.

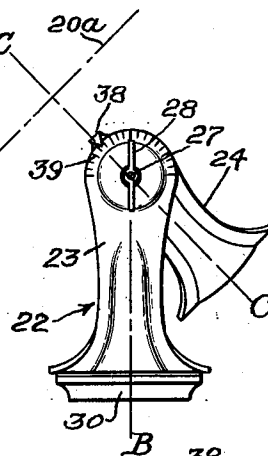


FIG. 5.

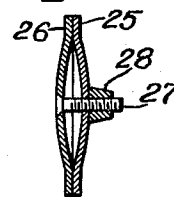


FIG. 3.

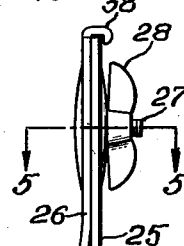
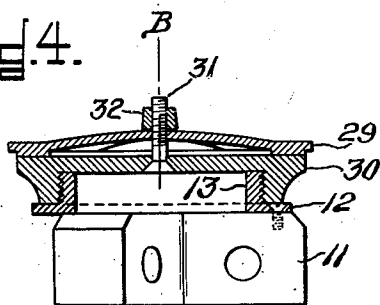


FIG. 4.



INVENTOR.

Edwin H. Blaschke
BY *Arthur F. Randall* atty.

UNITED STATES PATENT OFFICE

2,305,233

SURVEYING INSTRUMENT

Edwin H. Blaschke, Quincy, Mass.

Application July 2, 1941, Serial No. 400,856

6 Claims. (Cl. 33—73)

My invention relates to surveying instruments such as levels and transits and its primary object is to improve the construction and operation of instruments of this class.

It is also an object of this invention to provide an attachment for an existing engineer's level that is in common use at the present time, the installation of which attachment between the telescope assembly and the tripod or other support will make it possible to cant or incline the heretofore fixed vertical axis of the level at a selected angle as is often desirable in connection with the work being carried out. Thus when the telescope is rotated on this inclined axis, the line of sight thereof will generate a plane similarly inclined with respect to a horizontal plane.

To these ends I have provided an improved surveyor's instrument which, in the preferred embodiment of the invention, may be constructed and operate as set forth in the following description, the several novel features of the invention being separately pointed out and defined in the claims at the close of said description.

In the accompanying drawing—

Figure 1 is a side elevation of a surveyor's level equipped with my new attachment.

Figure 2 is an end elevation of the attachment showing the inner yoke element thereof occupying an inclined or canted position.

Figure 3 is a side elevation of my new attachment.

Figure 4 is a section on line 4—4 of Fig. 1.

Figure 5 is a section on line 5—5 of Fig. 3.

The tripod assembly of the surveyor's instrument illustrated in the accompanying drawing is constructed as usual and comprises three legs 10 pivotally connected at their upper ends to a head or spider 11 to the top of which is rigidly secured a fitting 12 in the form of a flanged annulus made with an exteriorly threaded boss 13.

The telescope assembly is likewise constructed as usual and comprises a trivet plate or base 14 that is in the form of an interiorly threaded annulus. In the ordinary level as heretofore organized and assembled the trivet plate or base 14 was screwed down into the position upon the threaded boss 13 of the tripod. Base 14 provides the usual socket 15 for the head 16 that is equipped with the usual leveling screws 17. Also, head 16 is provided with the usual shaft 18 on which a cross-bar 19 is mounted to rotate on an axis C—C intersecting the axis of the telescope 20 adjacent to the middle of the latter, said cross-bar 19 supporting the telescope 20 and the latter carrying the usual spirit level 21.

In accordance with the illustrated embodiment of my invention I provide an accessory attachment which is shown in Fig. 3 and also indicated generally at 22 in Fig. 1. This attachment, as herein shown, comprises an outer yoke 23 within which is fitted an inner yoke 24, the proximate arms 25 and 26 of said yokes being pivotally fastened together by threaded bolts 27 each of which is provided with a winged clamping nut 28. Each bolt 27 has its inner end fastened to the adjacent arm 26 of inner yoke 24 and extends therefrom through an aperture formed through the adjacent arm 25 of the outer yoke 23 with its nut 28 disposed upon the outside of the latter.

The axes of the bolts 27 are horizontally aligned and it will therefore be clear that while nuts 28 are loose the inner yoke 24 may be angularly adjusted on a horizontal axis A—A, Fig. 1, after which it may be fixedly clamped to outer yoke 23 in its adjusted position by setting up the nuts 28.

The yokes 23 and 24 may be made from any suitable sheet metal such as steel, or an aluminum alloy, and are suitably ribbed, recessed or otherwise molded to afford stiffness.

Yoke 23 is formed with a horizontal intermediate portion 29 whose bottom side is seated flatwise upon the flat top of a circular coupling member 30 in the form of an interiorly threaded brass cap fitting that is adapted to be tightly screwed into position upon the exteriorly threaded boss 13 as shown in Fig. 4.

At its middle the coupling member 30 is provided with an upstanding threaded stem 31 projecting upwardly through an aperture formed through intermediate portion 29 of outer yoke 23 to the exterior of said portion where it is provided with a clamping nut 32. It will be clear that when nut 32 is loose the attachment 22 can be rotated horizontally on the vertical axis B—B, Fig. 3, and that this axis is always in vertical alignment with the point of intersection of axes A—A and C—C. In other words, the three axes A—A, B—B and C—C always intersect at one point and since this point is about midway between the top and bottom of the telescope assembly it coincides approximately with the center of gravity of said assembly and therefore the latter is practically balanced on the bolts 27.

At 33 is shown a circular plate level mounted upon the intermediate portion of outer yoke 23 and this level is for use in leveling the tripod assembly.

The inner yoke 24 is made with a horizontal intermediate portion 34 upon the top side of which is removably fastened a coupling fitting

35 made with a threaded boss 36 on to which is tightly screwed the interiorly threaded trivet plate or base 14 of the telescope assembly. As herein shown the fitting 35 is fastened to the intermediate portion 34 by removable screws as indicated at 37, Fig. 3. Fitting 35 is made removable in order that another fitting may be substituted to adapt the attachment to another type of telescope assembly.

One of the arms of the inner yoke 24 is made at its top with an index or pointer 38 co-operating with a graduated arcuate scale 39 provided upon the outer face of the proximate arm 25 of outer yoke 23 to indicate the angular adjustment of yoke 24 relatively to yoke 23.

The construction of the above described instrument is based upon the theory that three points determine a plane and said construction provides for orientation of the instrument to work in an inclined plane with possible accuracies of plus or minus one-hundredth of one foot which is a greater degree of accuracy than is normally required in the field of work for which the instrument is primarily intended. This instrument is primarily intended for use where it is necessary for the engineer or surveyor to furnish a number of points lying in an inclined plane. Such work would include earth or rock embankments for dams, fills for highways, railways, levees and cuts on constructions such as highways, railways, canals, etc.

With the aid of this instrument the engineer may orientate the working plane thereof parallel to the inclined plane of the work which he is controlling. With the plane of the instrument orientated to operate in a parallel plane at a known distance from the desired inclined plane, the engineer may set any number of points in the desired plane with a single setting on a graduated rod and without any further reference to a given base line or elevation bench mark. With very little practice the average engineer can make an instrument set-up in approximately the same time as it would take to make a horizontal set-up with an ordinary level.

One method of using the above described instrument is as follows: Three random points are set which have known elevations with respect to the desired inclined plane by the usual method of slope determination of horizontal and vertical distance measurement and the instrument is set over one of said points and approximately orientated. This is accomplished by loosening wing nut 32 and rotating axis A—A about axis B—B until axis A—A is approximately parallel to the desired inclined plane whereupon nut 32 is set up tight. Wing nuts 28 are now loosened and inner yoke 24 is rotated about axis A—A until pointer 38 indicates approximately the desired degree of inclination on the graduated scale 39 after which the nuts 28 are tightened. The instrument is now ready for final orientation by means of progressive adjustments of the leveling screws 17. A measurement is now made from the point under the instrument to the line of sight of the telescope and then, by means of the leveling screws 17, the telescope is adjusted progressively until the readings on graduated rods held or set on the other two points, correspond to the measured distance at the instrument. Thus the three points in the working plane of the telescope are equidistant from the corresponding original three points and hence determine a plane at a known distance from, and parallel to, the original plane. Thereafter, any

number of additional points may be set in the original plane with a single graduated rod reading.

Proceeding in accordance with another method, three points are set in the desired plane in the usual manner after which the instrument is set up in the vicinity of these three points at such a height that a plane parallel to the desired plane and running through the instrument head, will be above the desired plane so that all graduated rod readings will be positive. The telescope is then inclined as with the first method and final orientation is made by taking successive readings on graduated rods set on the three original points and progressively adjusting the leveling screws 17 until all rod readings are equal. This method is more nearly exact than the first method because inaccuracy in measuring from the telescope barrel to the ground is eliminated.

An advantage derived through the use of the above described instrument is that one surveyor with the aid of a man to hold the graduated rod may control a large field of work from one instrument set-up and with one rod setting, regardless of the range of the work up and down the slope, and without any distance measurements and slope computations.

When using the means and methods heretofore employed in controlling inclined planes, an instrument set-up is limited in its use by the distance vertically which can be reached by the length of the graduated rod. Also, for every point set on the inclined plane, a measurement must be made to a given base line, and a definite known elevation computed for that individual point by means of slope determination arrived at through horizontal and vertical distance ratios.

The common method heretofore employed in staking out excavation lines for cuts through hills was primarily a trial and error method consisting of taking rod readings and computing slope distances until the line of intersection is found between the plane of the side slope of the cut and the earth's surface.

By means of my improvements the instrument is orientated to a plane parallel to the side slope of the cut and a single rod setting will serve to set all necessary points within the range of vision of the telescope for the outline of the edge of the cut.

Figure 2 of the drawing shows the inner yoke member 24 occupying a canted position thus permitting the telescope to be adjusted into a position where its axis, indicated at 20a, is inclined so that when the telescope is swung laterally on shaft 18 (Fig. 1) its line of sight will traverse an inclined plane.

While I have herein shown a tripod as the supporting fixture for the intermediate adjustable yoke structure 23—24 to which the telescope mounting is fastened, it will be clear that any other suitable supporting fixture may be substituted for said tripod.

What I claim is:

1. An attachment for surveying instruments comprising an outer yoke member having an intermediate portion adapted to be secured to a supporting fixture with provision for rotative adjustment of said member on a vertical axis; an inner yoke member having an intermediate portion adapted to have the base of a telescope assembly secured thereto, the arms of said inner yoke member being fitted in position between and paired with the arms of said outer yoke member; means pivotally connecting the arms of each pair

so that said inner yoke member is angularly adjustable on a horizontal axis intersecting said first-mentioned axis and means for clamping said members in their relatively adjusted positions.

2. An attachment for surveying instruments comprising an outer yoke member; a yoke-supporting coupling element pivotally connected with the intermediate portion of said yoke member and on which the latter is rotatively adjustable on a vertical axis; means for clamping said parts in their relatively adjusted positions; an inner yoke member having its arms fitted in position between the arms of said outer yoke member; means pivotally connecting the arms of said yoke members so that the latter are angularly adjustable relatively on a horizontal axis intersecting said first-mentioned axis; means for clamping said arms in their relatively adjusted positions, and a coupling element on the inner side of the intermediate portion of said inner yoke member adapted to be connected with the base of a telescope mounting.

3. An attachment for surveying instruments, said attachment being constructed in accordance with claim 1 and wherein an arm of one of said yoke members is provided with an arcuate angle-indicating graduated scale concentric with said horizontal axis and wherein an adjacent arm of the other yoke member is provided with an index cooperating with said scale.

4. An attachment for surveying instruments comprising an outer yoke member; a yoke-supporting coupling element on which the intermediate portion of said yoke member is supported, said element being provided with a vertically disposed threaded stem extending through an aperture formed through said intermediate portion so that the latter can be rotatively adjusted on the

axis of said stem; a clamping nut on said stem by which to secure said intermediate portion in adjusted position; an inner yoke member having its arms fitted in position between and paired with the arms of said outer yoke member; a threaded stem pivotally connecting the arms of each pair so that said yoke members are angularly adjustable on a horizontal axis intersecting the vertical axis of said first-mentioned threaded stem; clamping nuts on the threaded stems of said arms by which to secure the latter in adjusted positions, and a coupling element on the inner side of the intermediate portion of said inner yoke member adapted to be connected with the base of a telescope mounting.

5. In a surveying instrument of the character described, the combination with a telescope assembly including a telescope and a mounting therefor on which said telescope is mounted for lateral rotative adjustment on an axis that is perpendicular to the axis of the telescope, said mounting having a base, of supporting means for said mounting including a member with which said base is separably connected and a second member on which said first-mentioned member is pivotally mounted so that it is tiltably adjustable on a horizontal axis that is perpendicular to and intersects said first-mentioned axis at a point between the telescope and said base and approximately coincident with the center of gravity of said first-mentioned member and the parts supported by it, and means for holding said members in their adjusted relationship.

6. The combination of claim 5 and wherein there is also provided means for supporting said second member so that it is laterally adjustable on a vertical axis which intersects said horizontal axis.

EDWIN H. BLASCHKE.