Oct. 9, 1951 Z. KOWALCZYK 2,570,458

SURVEYING TARGET

Filed Dec. 18, 1946 2 Sheets-Sheet 1

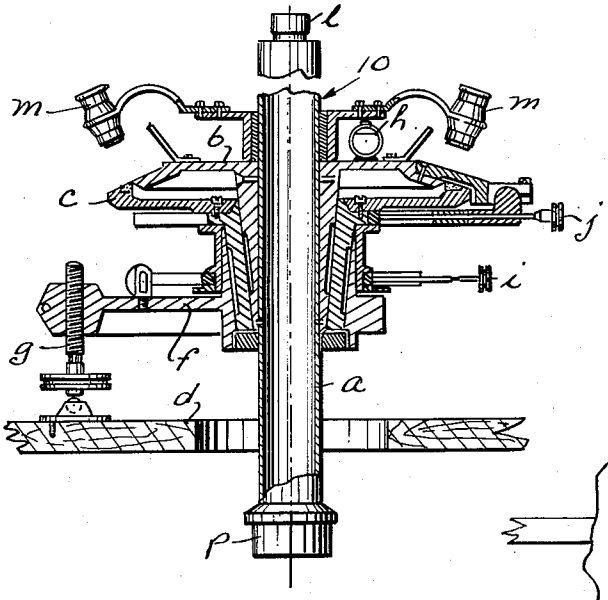


FIG. 1

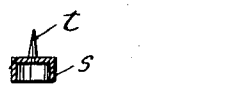


FIG. 1A

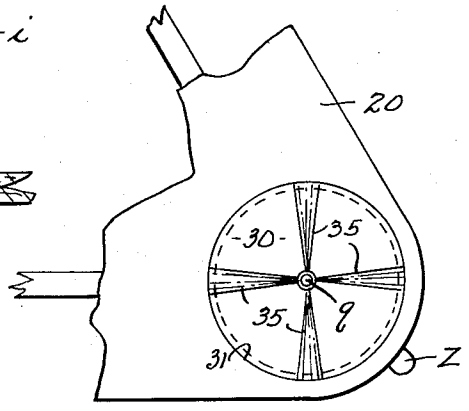


FIG. 3A

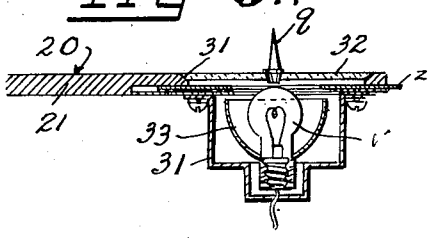


FIG. 3

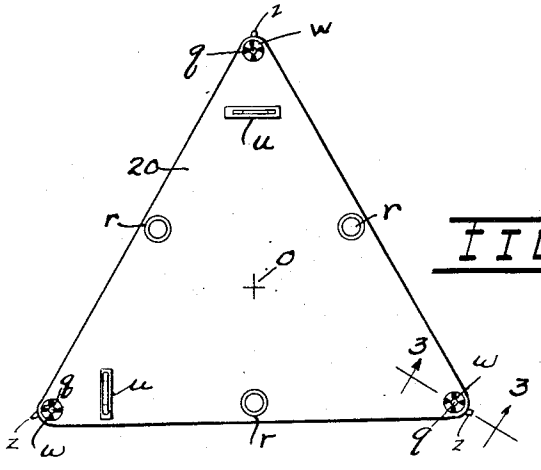


FIG. 2

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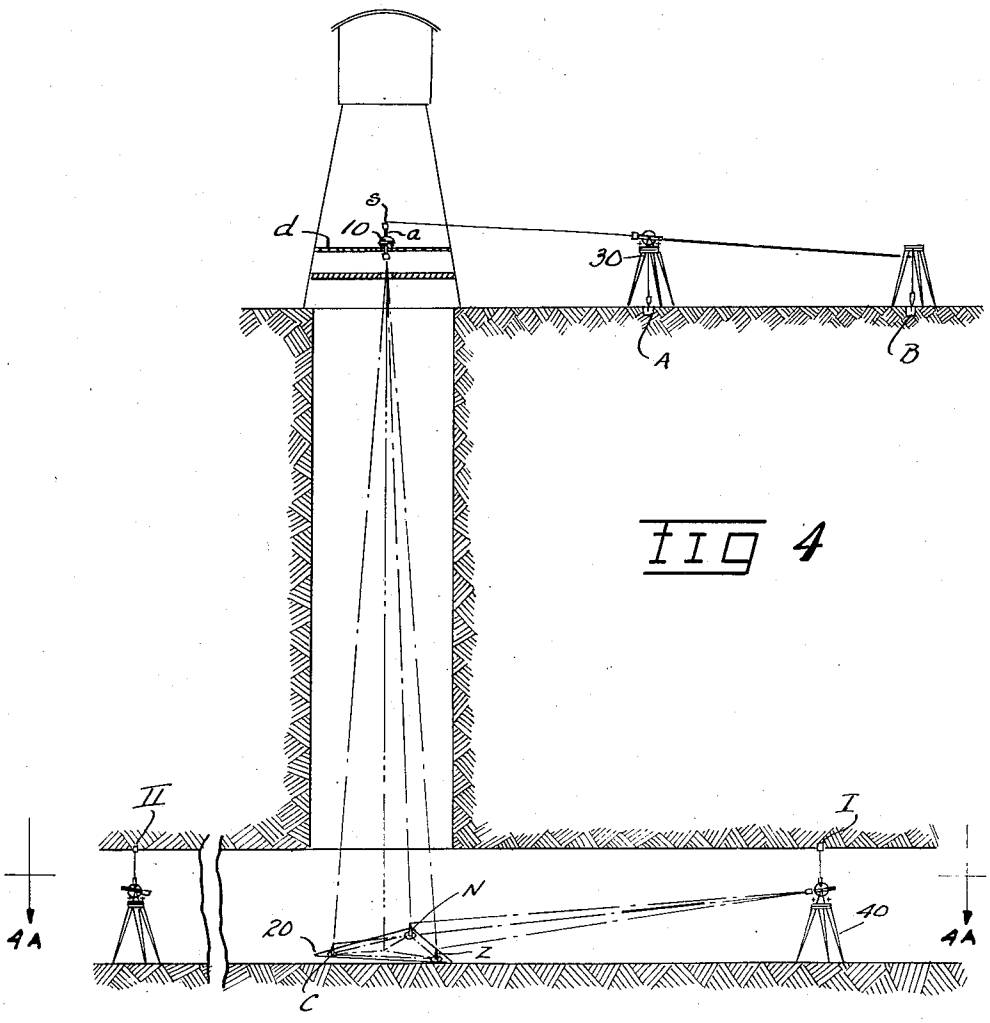


FIG 4

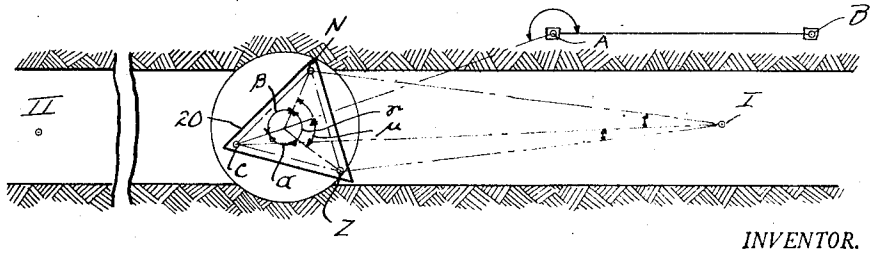


FIG 4A

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Patented Oct. 9, 1951

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UNITED STATES PATENT OFFICE

2,570,458

SURVEYING TARGET

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Application December 18, 1946, Serial No. 717,102
In Poland December 27, 1945

6 Claims. (Cl. 33—74)

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This invention relates to an apparatus for the orientation of mines. The purpose of such orientation is to define or locate on the ground above a mine a point or points vertically above and corresponding with points in the mine. Thus the extent of the mine which lies below the surface of the ground may be accurately located on and in respect to the surface of the ground thereabove.

Heretofore orientation of a mine has been accomplished by the use of optical or mechanical plummets. Such instruments generally consist of a plumb-bob suspended from one edge of a long straight edge and swinging in the mine shaft. These plummets have been positioned at fixed polygonal points above the mine and dropped into the mine shaft to define corresponding polygonal points on the mine floor at the bottom of the shaft. The methods of orientation in use at the present time differ in the manner of connecting the plummet points with measurements both above and below the surface.

The disadvantage of orientation methods using mechanical plummets or plumb-bobs lies in the fact that it is exceedingly difficult to determine the theoretical resting place of the constantly moving plumb-bob because of: the movement of the plumb-bob caused by the motion of the earth; the constantly changing circular and vibratory movement of the column of air in the shaft through which the plumb-bob is suspended; the continual dropping of water in the shaft; the existence of various eddy currents; and a number of other well known minor disturbances.

The main deficiency of optical plummets, as used in the past, is the fact that even the slightest deviation of the vertical axis of the instrument, which is generally located above the ground, causes an error in the determination of the points as transposed to the floor of the mine. Such error increases with the depth of the mine. A deficiency, common to all methods of orientation heretofore used, is the necessity of measuring the distance between plummets, and between plummets and fixed points, the coordinates of which are to be transferred from the surface to the mine or vice versa. The relationship of these distances is such that all errors are increased in magnitude and the result is highly disadvantageous in orientation of the mine.

The deficiencies above referred to are eliminated by use of the present invention and this, therefore, is the principal object of this invention.

Other objects and advantages of the invention

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will become more apparent from the following description thereof, reference being had to the accompanying drawings in which there is illustrated a preferred embodiment of the invention and the manner of its use. The essential features of the invention will be summarized in the claims.

In the drawings, Fig. 1 is a vertically extending axial section through a device or instrument for measuring angles and which is arranged to be positioned at the top of the mine shaft; Fig. 1A is a sectional detail of a center point for the instrument; Fig. 2 is a plan view of a target or objective member which is placed at the bottom of the shaft; Fig. 3 is an enlarged fragmental sectional view through the base as indicated by the lines 3—3 on Fig. 2; Fig. 3A is an enlarged diagrammatical view of one corner of the target; Fig. 4 is a diagrammatic vertical section through a mine and illustrates, diagrammatically, the improved method of orientation; Fig. 4A is a diagrammatic sectional view as indicated by the lines 4A—4A on Fig. 4.

Referring now to the drawings in detail, it will be seen that the present invention includes an improved device or instrument for measuring angles and generally indicated at 10. This instrument comprises a vertically extending telescope *a* which is permanently fixed in an opening formed in the center of alidade *b*. The alidade is rotatably mounted in a horizontal limb or limbus *c* for rotation about the axis of the telescope. The limbus and alidade are provided with the usual scales for reading horizontal angles consequent upon the rotation of one relative to the other. Such scales and their arrangements are generally well known in instruments for measuring angles such as engineers' transits or theodolites, hence need not be described in detail herein.

The limbus *c* is rotatably mounted in an axial opening formed in a base *f* which is supported upon a platform *d* by means of three leveling screws *g*, one of which is shown in Fig. 1, and which serves to permit the limbus to be accurately leveled as indicated by spirit levels one of which is shown at *h* to bring the axis of the telescope *a* to a true vertical position. A micrometer screw *i* is provided for accurately moving the limbus relative to the base and a second micrometer screw *j* is provided for accurately moving the alidade relative to the limbus *c*. Magnifying glasses *m* are provided to facilitate reading of the scales in the usual manner and an illuminating means may be provided if desired. Suitable transparent panes may be provided to protect the scales on

the instrument in the usual manner. To determine the position or locate the coordinate of the instrument a sight member or signal *s* is placed on the eye piece *l* of the telescope. This signal comprises in transverse axial section as shown in Fig. 1A, a cap which fits snugly over the eye piece of the telescope and which is provided with an upstanding sighting pin or blade *t*.

At the base of the mine shaft there is placed a base or target **20**. This base or target is best illustrated in Figs. 2 and 3. As there shown it is represented as comprising a triangular shaped member, although it may take other polygonal shapes. The size of this base depends upon the size of the shaft. It is advisable that this base or target be made of metal, although other materials may be used.

The target **20** is provided with illuminated signals *w* and is levelled by means of three leveling screws *r*. The signals may comprise lamps *v* which are mounted in receptacles positioned below the upper plane of the target which is provided with openings through which the illuminated signal may be observed. Manually operable diaphragms *z* are provided whereby the size of the illuminated targets may be controlled.

As illustrated in Fig. 2 there are three illuminated signals *w* on the base or target **20**, one adjacent each corner of the triangle. The target is also provided with the usual spirit levels *u* to facilitate accurate leveling of the target.

The signals W are best shown in Figs. 3 and 3A. As there shown, the target **20** comprises a substantially flat horizontal plate-like platform or base **21** which is provided adjacent each corner with a circular opening **30**. Secured to the under side of the base **20** with their tops in substantial registration with the respective openings **30** are open top opaque enclosures **31**. A circular transparent disc **32** is seated in and extends across each opening **30** with its upper surface substantially co-extensive with the upper surface of the platform **20**. A vertically extending needle point *q* is secured to each disc **32** and projects vertically upward a predetermined distance from the center of such disc.

The illuminating means *v* is shown as being electric lamps. One such lamp is mounted within each enclosure **31** and is provided with a reflector **33** to direct its ray towards the associated transparent disc **32**. Any suitable source of power, not shown, may be used in connection with these lamps. An adjustable diaphragm Z is interposed between each lamp **33** and its associated disc **32**. Such diaphragm is not illustrated in detail but includes opaque members which restrict the illumination of the disc **32** to circular sectors or areas, indicated at **35** on Fig. 3. The adjustability of the diaphragm permits the size of such sector areas to be increased or decreased as desired.

The method of use of the instrument **10** and target **20** is diagrammatically illustrated in Figs. 4 and 4A. The instrument **10** is placed above the mine shaft and substantially in a line passing through the center of the shaft and is accurately leveled to place its telescope *a* in a true vertical line. The sight or target *s* is placed on the eye piece *l* of the telescope, and using a theodolite **30** the coordinates of the center of the instrument **10** are located.

As heretofore mentioned, the instrument **10** is placed as near as possible over the center of the mine shaft. The target **20** is likewise placed with its center *o* as near as possible in the same vertical line.

The telescope of the instrument **10** is incapable of movement except that about its axis, and a single cross hair (not shown) placed in the diaphragm of the instrument in the usual manner and extending at right angles through the axis of the instrument is used to define a collimatic plane or sight, rather than the intersection of a pair of cross hairs as in the theodolite **30**.

The aiming of the telescope comprises rotating it about its vertical axis. The eye piece *l* is so constructed that the normal field of vision of the telescope *a* embraces the entire base or target **20**. The orientation measurement consists in measurements made above ground from the position of the sight or pointer *s* and of measurements made in the mine from the position I, both of which are effected by use of a theodolite.

The measurement above ground is effected in the following manner: The telescope, which has been adjusted to lie in a vertical line, is aimed so that its cross hair intersects the position S and the illuminated signals C, N, or Z, to measure the angles α, β and γ (Fig. 4A), between these signals. The point S is the axis projected of the telescope *a*. To locate these angles relative to a point above the ground a prism or mirror (not shown) is placed on the objective *p* of the telescope in such manner that it makes an angle of 45° with the objective and diverts the axis or aiming line 90°. A sight is then taken on the point A above which the theodolite **30** is positioned and then removing the prism or mirror the angle *u* is measured by sighting on the signal *z* of the target **20**.

The distances between the illuminated target signals C, N and Z are defined by the manufacturer of the target or sight **20**, as is also the coefficient of expansion of the material from which the target is made, and the temperature at which the measurements given were made. Knowing the difference between such temperature and the temperature at the time of use of the target **20** the distances CN, NZ, and ZC may always be accurately determined. Moreover as the coordinates of the point S and the angles α, β, and γ may be determined as heretofore explained, the coordinates of the signals C, N and Z may be analytically calculated.

Measurements in the mine are made by the use of a theodolite **40** from the point I by measuring the angles **1** and **2**, sights being taken on a needle or thin blade *q* placed in the centers of each illuminated signal. As the coordinates of the centers of the three signals C, N and Z have been determined as previously explained, and the angles **1**, and **2** are now known, the coordinates of the point I may readily be calculated and defined as a "normal cutting backward" or back sight. Analogical measurements are then made and the coordinates of the point II are determined by the usual calculation. The point II may be located on the other side of the mine shaft as indicated in Figs. 4 and 4A. Having the line from point I to point II established, the coordinates of the points I and II are set up as defining the common "cutting-in" for the two points or a base line within the mine. Other points in the mine are located in the usual manner.

From the above description it will be seen that the improved method of orientation of mines has the following advantages:

1. Plummets with all of their attendant errors are entirely eliminated.

2. The orientation is based on the measurement of angles and therefore is more exact than orientation based on measured lengths and thus gives more accurate results than was possible in the past.

3. The improved method is economical because it requires 75% less time than methods used in the past and accordingly the normal operation carried on in the mine shaft are disturbed for but a short time. The measurements above and below ground may be simultaneously made, thus saving additional time.

4. By changing the position of the target 20 and base lines, I facilitate the controlling of the measurements and the adjustment thereof as well as enable rapid checking of the results.

I claim:

1. A target for use in the orientation of mines and the like comprising, a platform having at least three spaced signals, means carried by the platform to level the platform so that its upper surface lies in a horizontal plane, each of said signals being spaced a predetermined distance from the other signals, each signal including a needle point projecting upward from the platform a predetermined height, and means carried by said platform to illuminate said signals.

2. A target for use in the orientation of mines and the like comprising a platform having a predetermined coefficient of thermal expansion, said platform having at least three signals thereon, each of said signals being spaced a predetermined distance from each other under a known temperature condition, each of said signals comprising a transparent member having its upper surface substantially contiguous with the upper surface of said platform, each of said members having a centrally positioned pin extending vertically upward therefrom, and means carried by said platform to illuminate said members.

3. A target for use in the orientation of mines and the like comprising a substantially triangular platform having three spaced signals thereon, said platform having a known co-efficient of thermal expansion, said signals being spaced apart a predetermined distance at a known temperature, said signals each comprising a circular disc of transparent material and having their upper surfaces in substantially the same horizontal plane, an upstanding pin centrally supported by each disc, an illuminating means carried by said platform and positioned below each disc to illuminate respective discs, and an adjustable diaphragm interposed between each illuminating means and its respective disc to control the size of the illuminated portion of the disc, and means to level said platform.

4. A target for use in the orientation of mines and the like comprising a platform having a predetermined co-efficient of thermal expansion and having a planar upper surface, said platform having at least three signals thereon, each of said signals being spaced a predetermined distance from each other under a known temperature condition, each of said signals comprising a transparent disc having its upper surface substantially contiguous with the upper surface of said platform, a centrally positioned pointed pin extending vertically upward from each disc, and illuminating means carried by said platform and positioned below said discs.

5. A target for use in the orientation of mines and the like comprising a platform having at least three spaced signals, means carried by the platform to level the platform so that its upper surface lies in the same horizontal plane, each of said signals being spaced a predetermined distance from the other signals, each signal including a transparent disc having its upper surface substantially co-extensive with the upper surface of said platform, a needle point projecting upward from the center of each disc, means carried by said platform to illuminate said discs, and a diaphragm to restrict the illuminated area of each disc to a plurality of sectors, said diaphragms being adjustable to control the size of said sectors.

6. A target for use in the orientation of mines and the like comprising a platform having a predetermined co-efficient of expansion, said platform having a planar upper surface and at least three spaced openings extending therethrough, hollow open topped opaque enclosures carried by said platform and having their tops in substantial registration with respective openings, said openings being spaced a predetermined distance from each other under a known temperature condition, a transparent disc closing each opening and having its upper surface substantially contiguous with the upper surface of said platform, each of said discs having a centrally positioned pointed pin extending vertically upward therefrom, an illuminating means mounted within each enclosure to illuminate the respective disc, and an adjustable diaphragm interposed between each illuminating means and its respective disc to adjustably control the size of the illuminated portion of the disc.

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