

A SELF-SUPPORTING THEODOLITE TARGET

FIELD OF THE INVENTION

The present invention relates to a self-supporting theodolite target.

BACKGROUND OF THE INVENTION

Targets of various kinds for use in conjunction with a theodolite for surveying positioning of certain points are known. The conventional target that has been used by surveyors is the sight rod which must be held in a true vertical position during measurement. To ensure that the sight rod is in true vertical position, a leveling means is used. For this purpose, a spirit level may be affixed or built into the rod.

A problem associated with such surveying is that line-of-sight may sometimes be obstructed by some objects present at the site. Where such obstructions exist, the surveying equipment such as the theodolite and/or the sight rod can be repositioned and through known trigonometry calculations can allow for such an obstruction to be circumvented yet still allow for the determination of the relative disposition of one point relative to the other. Whilst a repositioning of the sight rod for such purposes in land surveying may not be of a major influence on the necessary or desired degree of accuracy, when it comes to surveying relative positions of components in a factory or for example in the construction of ships, the repositioning of a sight rod to allow for the circumvention of obstacles may introduce inaccuracies which are significant. Furthermore with traditional forms of land surveying where the sight rod is held by a person in position during the taking of measurements from the sight rod by the theodolite, slight movement by the sight rod normally does not influence the results of the survey to any significant degree. However where the positioning of machinery or components on a vessel is dependent on a high degree of accuracy for their placement, it may not be practical to use a handheld sight rod for such purposes.

Hence, it is accordingly an object of the present invention to provide a self-supporting theodolite target which addresses the abovementioned disadvantages or which will at least provide the public with a useful choice.

BRIEF SUMMARY OF THE INVENTION

Accordingly in the first aspect the present invention consists in a self-supporting theodolite target comprising;

an elongate standard having a ground engageable end and at least one target at a predetermined distance away from the ground engagement end,

means to support said elongate standard in an upright condition, said means to support including a base member having at least three spaced apart adjustable ground engageable legs arranged in a manner to allow stable support of said base member above the ground to (in use) hold said elongate standard, said base member including a holder adapted to support said elongate standard in a manner to allow it to move in its elongate direction relative to said base member.

Preferably said elongate standard includes a means to aid in leveling of said standard to position in use the target vertically above said ground engageable end.

Preferably said base member includes a means to aid in leveling of said standard to position in use the target vertically above said ground engageable end.

Preferably said means for leveling is disposed at an end opposed to said ground engageable end of said elongate standard.

Preferably said means for leveling is a fluid containing reservoir with transparent convex cover onto which a circular marking is provided, said reservoir including a bubble which is to become positioned within said circular marking when said self-supporting theodolite target is leveled.

Preferably said elongate standard includes a recess disposed on its longitudinal surface, said recess including a flat surface defining said target.

Preferably said elongate standard includes a longitudinally extending section of a circular cross sectional perimeter at where said elongate standard is engaged with the base member of said means to support.

Preferably said elongate standard is substantially of a longitudinally extending section of a circular cross sectional perimeter save for a portion thereof defining said target.

Preferably said elongate standard includes at least two O-rings provide thereabout and at spaced apart locations intermediate of which said elongate standard is engaged with said base member, said o-rings preventing said elongate standard from disassociating from said base member.

Preferably said elongate standard includes at least one first O-ring positioned above said holder and at least one second O-ring positioned below said holder to prevent said elongate standard from sliding off said holder.

Preferably said elongate standard passes through an aperture of said base member, said aperture being of a size barely larger than the maximum diameter of said elongate standard thereby holding said elongate standard in a sliding yet laterally fixed relationship with said base member.

Preferably said elongate standard includes a cylindrical section, said cylindrical section passing through an aperture of said base member of a size to allow said cylindrical section to slide within said aperture of said base member.

Preferably said elongate standard passes through said aperture of said base member and can rotate about its said elongate axis to present said target in use to different directions without moving said base.

Preferably said ground engageable end is substantially pointed.

Preferably said target is positioned at a fixed and predetermined distance away from the ground engagement end.

Preferably said target is at or towards the distal end away from said ground engageable end of said elongate standard.

Preferably there is provided a plurality of targets each at differing predetermined heights away from the ground.

Preferably said means to support is a tripod.

Preferably said base member is of a triangular plan shape.

Preferably said base member is of a quadrilateral plan shape.

Preferably said adjustable ground engageable legs are threaded to allow height adjustment of said base member.

Preferably said adjustable ground engageable legs each have a first pointed ground engageable end.

Preferably said adjustable ground engageable legs having second end which includes an external thread, threadingly engaged with said base member.

Preferably an aperture is provided through said base member and is defined by a hollow sleeve of a length which cover a substantial portion of said elongate standard save at least for a portion thereof defining said target.

Preferably said sleeve and said elongate standard are in threaded connection.

In a second aspect the present invention consists in a self-supporting theodolite target comprising:-

an elongate standard having a ground engageable end and at least one target at a predetermined distance away from the ground engagement end;

means to support said elongate standard in an upright condition, said means to support including a base member having at least three spaced apart adjustable ground engageable legs arranged in a manner to allow support of said base member above the ground arranged to (in use) stably support said elongate standard, said base member including a holder adapted to support said elongate standard in a manner to allow it to rotate about its longitudinal axis.

Preferably said holder also allows for movement in longitudinal direction.

In a further aspect the present invention consists in a theodolite target comprising

a tripod assembly including three adjustable in length supporting legs disposed from a platform to support said platform above the ground onto which it is to be placed, said platform including a means to hold an elongate standard,

an elongate standard engaged with said platform by said means to hold in a manner to allow said elongate standard to move in its elongate direction relative to said platform and to engage a ground engagable end of said elongate standard with the ground adjacent to said legs, said elongate standard including a theodolite target disposed at a surface thereof away from said ground engagable end.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred form of the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a plan view of the self-supporting theodolite target,

Figure 2 is a top view of the self-supporting theodolite target of Figure 1,

Figure 3 is a plan view showing the positioning of the self-supporting theodolite target when the device is in use,

Figure 4 illustrates an alternative form of the self-supporting theodolite target,

Figure 5 is a plan view of the elongate standard,

Figure 6 illustrates a side view of the elongate standard in threaded engagement with the base member,

Figure 7 is a plan view through part of the self-supporting theodolite target,

Figure 8 is a top view of the elongate standard illustrating its engagement with the holder,

Figure 9 is a top view of the elongate standard illustrating its alternative engagement with the holder,

Figure 10 is a side view showing the engagement of the holder with the base member,

Figure 11 is the side view of the cutout,

Figure 12 illustrates an alternative form of the cutout,

Figure 13 illustrates another alternative form of the cutout,

Figure 14 illustrates an alternative form of the engagement between the elongate standard and the holder, and

Figure 15 is a plan view of the elongate standard with the protective cover.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and more specifically to Figure 1, there is provided a self-supporting theodolite target 1 comprising an elongate standard 2 and a base member 3 for supporting the elongate standard 2.

The elongate standard 2 is of a cylindrical member having a first end 4 and a opposite second end 5. The elongate standard is preferably of a solid and largely cylindrical shape. It may alternatively be of a tubular configuration or it may include or be a perimeter shape of a constant cross section of a non circular configuration. However a non circular configuration may only have limited versatility and to which reference will hereinafter be made. The first end 4 of the elongate standard 2 is pointed and when in use, the pointed end engages with the ground at the place to be measured. The elongate standard 2 will in use be in an upright position and with the opposing second end 5 of the elongate standard 2 disposed away from the ground.

The elongate standard 2 includes a target 6 disposed between the first end 4 and the second end 5 and preferably, at a predetermined distance H away from the first end 4 as shown in Figure 4. The target 6 is preferably positioned within a cutout 7 provided to the longitudinal surface of the elongate standard 2. The cutout 7 has a flat vertical base 8 onto or at which the target 6 is positioned. In the preferred form, the flat base 8 is of a quadrilateral shape and the top 9 and bottom 10 walls of the cutout 7 taper outwardly from respective edges of the flat base 8 (as shown in Figure 11) such as to provide a bigger cutout 7 surface area to allow a better sight of the target 6 from the point where measurement is taken. The cutout 7 can be of any suitable depth but not equal to the diameter of the elongate standard 2.

It is appreciated by a person skilled in the art that other configurations of cutout may also be provided. For examples, the top 9 and bottom 10 walls of the cutout 7 may be perpendicular to the flat base 8 as shown in Figure 12 or the cutout 7 may be of a concave configuration as shown in Figure 13. In the latter example, the target 6 will not be lying on a flat base 8.

The target 6 for use in this invention may be of any standard and industry known target. Preferably the target is of the conventional circular target having two circles, with one lying symmetrically within the other, and a horizontal and a vertical lines extending from the center of the circles. To aid in locating the center of the target from a distance and for better visibility of the target, the flat base 8 is preferably provided with surface markings of a web-like design with colour contrasting to the colour of the target 6. In the most preferred form, the web-like design is in white and the target

In the preferred form, the predetermined distance H between the center of the target 6 and the first end 4 of the elongate standard 2 is fixed such that this distance H is known to a user prior to taking any measurements. This allows for the user to use it for computing the vertical distance desired to be measured.

A plurality of targets may be provided with each being a predetermined distance away from the first end 4 of the elongate standard 2 (see Figure 16). The plurality of targets may be arranged in line with one above the other or they may be positioned with each offsetting each other such that measurements can be taken using any one of the targets which is in line with the theodolite or which the line-of-sight is visible, not obstructed by any object.

As can be seen from Figure 1, the elongate standard 2 is supported in use uprightly by a base member. The base member 3 is preferably of a triangular plate 11 (as shown in Figure 2) having at least three threaded apertures 12 adapted to receive threaded legs 14. The threaded apertures 12 and correspondingly the threaded legs are each disposed near the respective corners of the triangular plate 11. It is envisaged that the apertures 12 and correspondingly the adjustable legs 14 may be provided anywhere within the surface area of the triangular plate 11 or even along side edges of the triangular plate 11 sufficient to support the base member 3 above the ground. Additional apertures and legs may also be provided to provide additional support for the base member 3 if desired. In the most preferred form, the base member and the adjustable legs define a tripod. While only a triangular base member 3 is depicted in Figure 1, it should be appreciated by a person skilled in the art that other shapes of base member 3 may also be adopted.

As can be seen from Figure 1, each leg has a pointed end that engages with the ground and an opposing end 18 that is disposed above the base member 3. The threaded engagement of the adjustable leg 14 and the base member 3 allows height adjustment of each leg for the purposes of leveling the base member 3. To aid in the operation of adjusting the height of each leg, a nut 20 is provided on the opposing end 18 of the adjustable leg 14 to serve as a means for holding onto when turning the legs for adjustment of height. Other forms of means, such as a cap or an elongate bar may also be used.

In an alternative form, the adjustable leg 14 is disposed below the base member 3 with the opposing end 18 of the adjustable leg 14 affixed to bottom surface of the base member 3. In such case, each leg 14 is of a two-piece threaded construction. The upper piece is in fixed engagement with the base member 3 and the lower piece is in threaded engagement with the upper piece. The height of the leg 14 is adjusted by turning the lower piece of the leg 14. It is appreciated that the adjustable leg 14 is not limited to the two configurations as described above. Other suitable form of legs that permit height adjustment may also be adopted.

The elongate standard 2 may be supported by the base member 3 via a through hole of the base member 3 through which the elongate standard 2 engages. In such configuration, the base member 3 preferably has a thickness sufficient to support the elongate standard 2 in an upright position. To provide sufficient tight fitting of the elongate standard 2 to the through hole, the diameter of the hole should preferably be the same or if not, slightly bigger than the diameter of the elongate standard 2.

In the most preferred form, the base member 3 includes a cylindrical holder 22 adapted for receiving the elongate standard 2 to support it in an upright position. The cylindrical holder 22 preferably encompasses the outer peripheral of a substantial cylindrical portion of the elongate standard 2. However, it is appreciated by a person skilled in the art that the holder 22 may also be of a construction as shown in Figure 14, i.e. with a cross-section of an incomplete circle.

The whole of the holder 22 may be positioned above the base member 3 or part of which may be disposed below the base member 3. In either configuration, the

holder 22 is preferably of a length sufficient to support the elongate standard 2 which in use will be in an upright position. The holder is of a length that is shorter than the predetermined height H.

With reference to Figure 2, the holder 22 is provided proximate to one of the legs as shown in Figure 8. In the most preferred form, the holder 22 is provided at one of the side edges of the triangular base member 3 as shown in Figure 9. It is envisaged that the holder 22 may be provided anywhere within the planar surface of the base member 3.

The holder 22 and the base member 3 may be of an integral construction, fabricated from materials such as plastic or they may be of a two-piece construction with the holder 22 welded to the base member 3 as shown in Figure 10.

The engagement of the holder 22 and the elongate standard 2 allows the elongate standard 2 to move in its longitudinal direction when desired. Alternatively and preferably in addition it also permits rotation of the elongate standard 2 about its longitudinal axis. The ability to rotate in its longitudinal axis (where the standard is of circular perimeter) allows for easy positioning of the target elongate standard 2 in sight with the theodolite when in operation and in use. If the theodolite is not in the line of sight with the target, the elongate standard can be rotated about its longitudinal axis to present the target to a different direction. The theodolite can then be repositioned whilst the elongate standard remains in the correct location relative to the point that is wishing to be determined.

To prevent the elongate standard 2 from sliding off the holder, two rings 32 and 34 are provided and engaged with the outer peripheral of the elongate standard 2. The first ring 32 is disposed above the holder 22 and the second 34 is disposed below the holder. The distance between the two rings is the distance within which the elongate standard 2 is able to move in the longitudinal direction. In an alternative form, instead of providing the two rings, the portion along which the elongate standard 2 moves in its longitudinal direction may have a diameter smaller than the other portion of the elongate standard 2 (as shown in Figure 6). The elongate standard 2 of this configuration may be in threaded engagement with the base member 3.

To aid in leveling the self-supporting theodolite target prior to taking any measurements, a leveling assembly 30 is provided. This leveling assembly 30 may be mounted onto the planar surface of the base member 3 or embedded within a cavity provided on the base member. In the preferred form, the leveling assembly 30 is disposed and embedded at the end 5 of the elongate standard 2 as shown in Figures 5 and 6. The leveling assembly 30 may be of any standard leveling devices that are known, such as a spirit level. Preferably, the leveling assembly 30 has a bubble vial and an indicating plane with a circular marking. When the self-supporting theodolite target 1 is leveled, by adjustment of the legs 14, the bubble falls within the circular marking.

Optionally, a protective cap 40 as shown in Figure 15 is provided. When the self-supporting theodolite target is not in use, the protective cap 40 is capped onto the opposing second end 5 of the elongate standard to protect the leveling assembly 30 from breaking.

The method of operation and use of the present invention is herein described. The self-supporting theodolite target is placed over the point that is to be measured, the predetermined height of the target 6 is known. The target 6 is positioned over the point to be measured by engaging the first end 4 onto the point. Levelling of the target 6 is carried out by adjusting the legs of the base member 3 and assuring that the bubble is positioned within the circle to thereby place the elongate standard vertically. Any unlevelled ground can be catered for by adjustments of the legs and the length of the portion of the legs that are disposed below the base member 3 in such case may be different (see figure 3). The standard is free floating to within limits to allow for it to move up and down (in the axial or longitudinal direction) as the adjustment of the legs occurs. Once the bubble of the leveling assembly is within the circle, the target 6 is considered leveled. Measurements can then assumed using the theodolite.

If the target 6 is obstructed, the whole self supporting theodolite target need not be moved but can remain in place. The standard merely needs to be rotated to present the target 6 to a different direction from which a theodolite measurement can be made.

The above description is provided for the purposes of exemplification only and it will be understood by a person skilled in this field that modifications and variations may be made without departing from the invention.

CLAIMS:

1. A self-supporting theodolite target comprising;
an elongate standard having a ground engageable end and at least one target at a predetermined distance away from the ground engagement end,
means to support said elongate standard in an upright condition, said means to support including a base member having at least three spaced apart adjustable ground engageable legs arranged in a manner to allow stable support of said base member above the ground to (in use) hold said elongate standard, said base member including a holder adapted to support said elongate standard in a manner to allow it to move in its elongate direction relative to said base member.
2. A self-supporting theodolite target as claimed in claim 1 wherein said elongate standard includes a means to aid in leveling of said standard to position in use the target vertically above said ground engageable end.
3. A self-supporting theodolite target as claimed in claim 1 wherein said base member includes a means to aid in leveling of said standard to position in use the target vertically above said ground engageable end.
4. A self-supporting theodolite target as claimed in claim 2 wherein said means for leveling is disposed at an end opposed to said ground engageable end of said elongate standard.
5. A self-supporting theodolite target as claimed in claim 4 wherein said means for leveling is a fluid containing reservoir with transparent convex cover onto which a circular marking is provided, said reservoir including a bubble which is to become positioned within said circular marking when said self-supporting theodolite target is leveled.
6. A self-supporting theodolite target as claimed in any one of claims 1 to 5 wherein said elongate standard includes a recess disposed on its longitudinal surface, said recess including a flat surface defining said target.
7. A self-supporting theodolite target as claimed in any one of claims 1 to 6 wherein said elongate standard includes a longitudinally extending section of a circular cross sectional perimeter at where said elongate standard is engaged with the base member of said means to support.

8. A self-supporting theodolite target as claimed in any one of claims 1 to 7 wherein said elongate standard is substantially of a longitudinally extending section of a circular cross sectional perimeter save for a portion thereof defining said target.
9. A self-supporting theodolite target as claimed in claims 7 or 8 wherein said elongate standard includes at least two O-rings provide thereabout and at spaced apart locations intermediate of which said elongate standard is engaged with said base member, said o-rings preventing said elongate standard from disassociating from said base member.
10. A self-supporting theodolite target as claimed in claims 7 or 8 wherein said elongate standard includes at least one first O-ring positioned above said holder and at least one second O-ring positioned below said holder to prevent said elongate standard from sliding off said holder.
11. A self-supporting theodolite target as claimed in any one of claims 1 to 6 wherein said elongate standard passes through an aperture of said base member, said aperture being of a size barely larger than the maximum diameter of said elongate standard thereby holding said elongate standard in a sliding yet laterally fixed relationship with said base member.
12. A self-supporting theodolite target as claimed in claim 11 wherein said elongate standard includes a cylindrical section, said cylindrical section passing through an aperture of said base member of a size to allow said cylindrical section to slide within said aperture of said base member.
13. A self-supporting theodolite target as claimed in claim 12 wherein said elongate standard passes through said aperture of said base member and can rotate about its said elongate axis to present said target in use to different directions without moving said base.
14. A self-supporting theodolite target as claimed in any one of claims 1 to 13 wherein said ground engageable end is substantially pointed.
15. A self-supporting theodolite target as claimed in any one of claims 1 to 14 wherein said target is positioned at a fixed and predetermined distance away from the ground engagement end.

16. A self-supporting theodolite target as claimed in any one of claims 1 to 14 wherein said target is at or towards the distal end away from said ground engageable end of said elongate standard.

17. A self-supporting theodolite target as claimed in any one of claims 1 to 16 wherein there is provided a plurality of targets each at differing predetermined heights away from the ground.

18. A self-supporting theodolite target as claimed in claim 1, wherein said means to support is a tripod.

19. A self-supporting theodolite target as claimed in any one of claims 1 to 18, wherein said base member is of a triangular plan shape.

20. A self-supporting theodolite target as claimed in any one of claims 1 to 18 wherein said base member is of a quadrilateral plan shape.

21. A self-supporting theodolite target as claimed in any one of claims 1 to 20 wherein said adjustable ground engageable legs are threaded to allow height adjustment of said base member.

22. A self-supporting theodolite target as claimed in any one of claims 1 to 21 wherein said adjustable ground engageable legs each have a first pointed ground engageable end.

23. A self-supporting theodolite target as claimed in claim 1, wherein said adjustable ground engageable legs having second end which includes an external thread, threadingly engaged with said base member.

24. A self-supporting theodolite target as claimed in claim 1, wherein an aperture is provided through said base member and is defined by a hollow sleeve of a length which cover a substantial portion of said elongate standard save at least for a portion thereof defining said target.

25. A self-supporting theodolite target as claimed in claim 24 wherein said sleeve and said elongate standard are in threaded connection.

26. A self-supporting theodolite target comprising:-

an elongate standard having a ground engageable end and at least one target at a predetermined distance away from the ground engagement end;

means to support said elongate standard in an upright condition, said means to support including a base member having at least three spaced apart adjustable ground engageable legs arranged in a manner to allow support of said base member above the ground arranged to (in use) stably support said elongate standard, said base member including a holder adapted to support said elongate standard in a manner to allow it to rotate about its longitudinal axis.

27. A self-supporting theodolite target as claimed in claim 26 wherein said holder also allows for movement in longitudinal direction.

28. A theodolite target comprising

a tripod assembly including three adjustable in length supporting legs disposed from a platform to support said platform above the ground onto which it is to be placed, said platform including a means to hold an elongate standard,

an elongate standard engaged with said platform by said means to hold in a manner to allow said elongate standard to move in its elongate direction relative to said platform and to engage a ground engageable end of said elongate standard with the ground adjacent to said legs, said elongate standard including a theodolite target disposed at a surface thereof away from said ground engageable end.