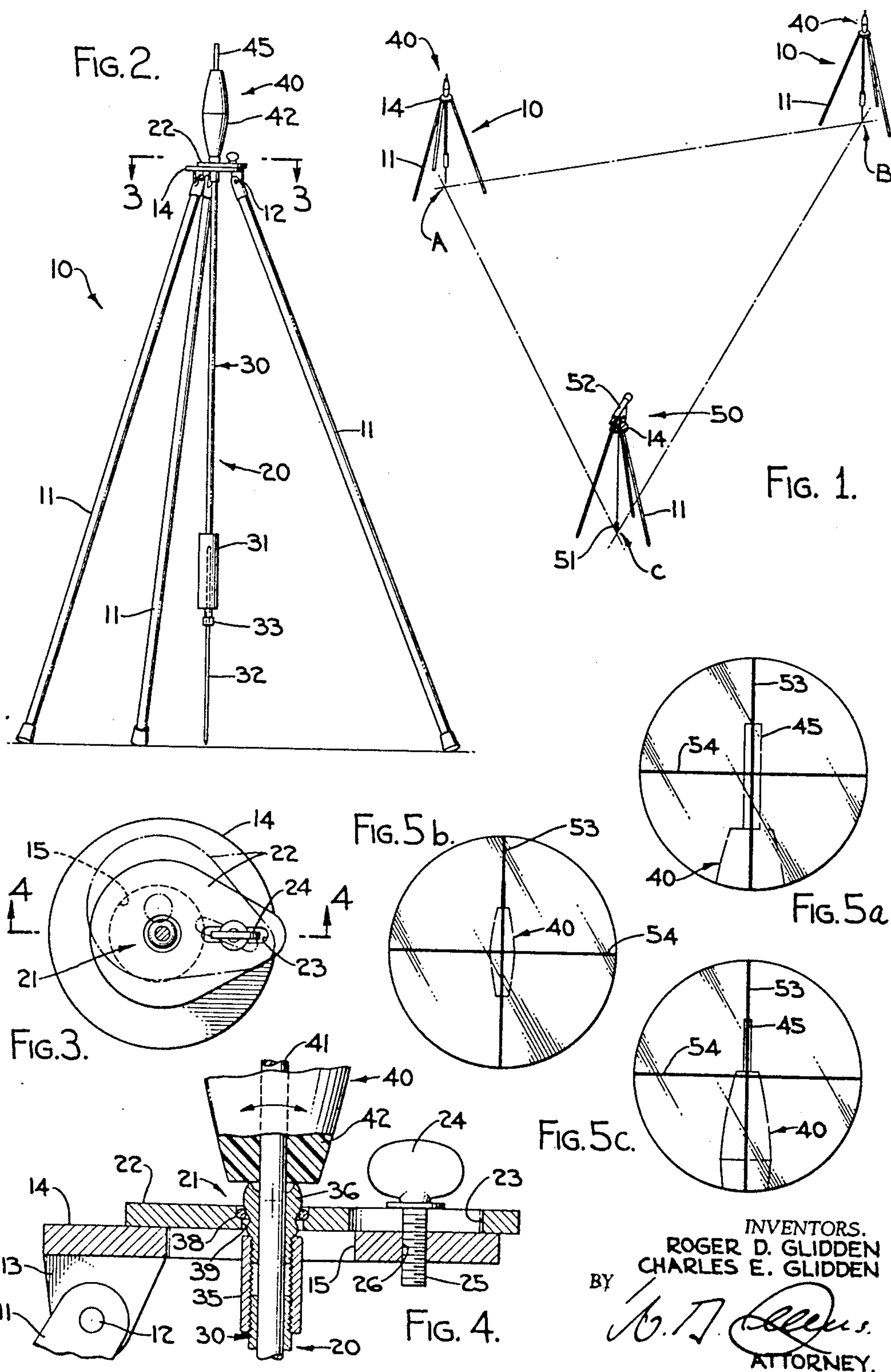


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RANGE ROD ASSEMBLY

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RANGE ROD ASSEMBLY

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This invention relates to range rod devices and more particularly to an improved self-supporting range rod assembly featuring a simplified construction permitting wide range adjustment of the range rod proper relative to its support and incorporating a unique target specially constructed for precision work when viewed from any angle and whether located close to the surveyor or at a distant point.

Range rod devices have been proposed heretofore having a great variety of designs and expedients for expediting the accurate location of a point in the terrain as viewed from the sighting instrument. In general these require the presence of a rodman at the terrain point being located and a second man at the sighting instrument. This has been particularly true as respects locations required to be viewed from different sighting stations owing to the importance of shifting the range rod target to lie normal to the line of sight as viewed from each sighting station.

There have been numerous proposals for target designs to facilitate centering of the instrument cross-hairs on the vertical center of the target. For the most part these have made use of different arrangements of distinctively colored areas of the target lying to either side of the vertical and horizontal divider lines.

These various prior proposals and range rod constructions leave much to be desired and are subject to various disadvantages and shortcomings sought to be obviated by the present invention. For example, the present invention makes use of a simple tripod support for the range rod proper thereby avoiding the need for the presence of a rodman once the rod has been properly set up. This rod utilizes a ball at its upper end journaled on a low friction bearing mounted centrally of a shiftable supporting plate. The latter is provided with an elongated slot for a thumb screw clamping member threaded into a ring forming the head plate of the tripod. This ring has a large opening in its center permitting wide-range lateral shifting or adjustment of the range rod mounting.

A particular feature of the range rod is the provision of a readily detachable target member having a vertically elongated ellipsoid main body and further characterized by its brilliant fluorescent hue and a small diameter cylindrical extension projecting axially from its upper end. This target presents the same identical silhouette when viewed from any angle and is so contoured as to make it feasible and convenient to use different portions of it depending upon the distance between the surveying instrument and the target. Its distinctive brilliant fluorescent hue renders it sharply visible over distances considered quite impractical for targets of prior design. The target is readily removable when not in use to avoid risk of damage to it. And the pendulum-like lower end of the range rod is readily adjustable to present its pointed end in closely spaced relation to the target irrespective of the unevenness of the ground surface at the target point.

Accordingly, it is a primary object of the present invention to provide an improved range rod assembly exhibiting novel features and advantages not possessed by prior constructions.

Another object of the invention is the provision of a self-supporting range rod assembly particularly suitable for use by a one-man survey crew and featuring a target having separate portions appropriately disposed for use

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depending upon the distance between the sighting instrument and the range rod.

Another object of the invention is the provision of a high accuracy range rod having a target presenting the same silhouette from all directions and usable simultaneously with equal facility when viewed from angularly spaced apart sighting stations.

Another object of the invention is the provision of a range rod having a target designed for precision use for both close and distant work and featuring a surface brilliantly and distinctively colored with the same color throughout its surface area.

Another object of the invention is the provision of a range rod assembly having a readily detachable target provided with an elongated surface of revolution and additionally featuring a small diameter cylindrical target at its upper end.

Another object of the invention is the provision of a range rod assembly supported adjustably on a tripod and utilizing a single clamping screw for expediting centering of the lower end of the rod over a fixed point in the terrain.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated:

FIGURE 1 is a perspective view showing the invention range rod assembly set up according to one typical mode of use;

FIGURE 2 is an enlarged elevational view of the range rod assembly according to a preferred embodiment of the invention;

FIGURE 3 is an enlarged cross-sectional view of the tripod head assembly taken along line 3-3 on FIGURE 2;

FIGURE 4 is an enlarged fragmentary cross-sectional view taken along line 4-4 on FIGURE 3; and

FIGURES 5a, 5b, and 5c are representative views of the target per se as viewed through the sighting instrument of the surveyor and showing the target as it appears when viewed from different distances.

Referring more particularly to FIGURE 2, there is shown one preferred embodiment of a range rod assembly designated generally 10 embodying the features and principles of the present invention. This assembly includes a tripod having legs 11 pivotally connected at 12 to lugs 13 carried on the underside of a head ring 14. The latter has a large area central opening 15 providing liberally for the adjustment of the range rod unit proper designated 20 and extending vertically therethrough. This unit includes a universal socket connection 21 located centrally of a plate 22 shiftable crosswise of head ring 14.

As is best shown in FIGURES 3 and 4, the adjustable plate 22 is generally egg-shaped in contour, its pointed end being provided with a generally radially disposed elongated slot 23 receiving an adjustable thumb screw and clamping nut 24. Threaded shank 25 of the latter mates with a threaded opening 26 formed in head ring 14. When thumb nut 24 is loosened plate 22 can be shifted in any direction laterally of the upper surface of head member 14 and as found necessary to shift the pointed lower end of the range rod 20 over a prelocated point on the ground. Once the range rod has been properly centered in this manner thumb nut 24 is tightened to lock clamping plate 22 in its adjusted position.

Range rod 20 comprises a tubular main body member 30 provided at its lower end with a suitable pendulum weight 31. Adjustably supported interiorly of the lower end of tube 30 is a pointed rod 32 adapted to be clamped

in any axially adjusted position by a clamping nut 33 carried by tube 30.

Mounted on the upper end of tube 30 is a threaded sleeve 35 seating therein a hollow ball member 36 forming a part of the universal ball and socket joint 21. The exterior lower end of ball 36 seats against a low friction bearing such as the Teflon ring 38 bonded or otherwise secured in place in a shouldered opening 39 centrally of plate 22.

Demountably supported in the hollow upper end of tube 30 and of the universal joint 21 is the stem 41 of the target proper 40. Desirably, the main body 42 of this target is formed of substantially transparent polyvinyl plastic material and impregnated with a brilliant fluorescent dye of a suitable color. Fluorescent dye known in the trade as "arc yellow" has been particularly effective and efficient for being visible from greater distances than other colors. It is to be understood, however, that other colors are visible with clarity from great distances and may be used, orange having been found quite as effective as arc yellow.

Desirably, main body 42 is contoured to present a surface of revolution, the general configuration illustrated in the drawing and described as generally ellipsoidal being a suitable example. Preferably the upper end is flat and normal to the major axis. Projecting therefrom is a reinforced cylindrical extension 45 of the same plastic material and color as the main body. A reinforcing spindle of rigid material is preferably provided centrally of extension 45 to reinforce and protect it against damage and deflection from its desired axial position. The purposes and mode of utilizing the specially contoured target 40 will be best understood from a consideration of FIGURES 5a, 5b, and 5c, and the details of which will now be described.

According to one typical mode of using range rod assembly 10 and illustrated in FIGURE 1, a pair of identical assemblies are accurately set up and adjusted over spaced-apart reference points A and B in the terrain each distant from another known point C over which a conventional surveyor's sighting instrument 50 is set up. The described arrangement is easily handled by a one-man surveying party who then proceeds to accurately locate and plot each of the distant points over which the range rod assemblies 10, 10 are installed. The identical range rod assemblies are set up in turn, any necessary adjustments being made at each to locate the respective pointed ends 32 of the range rod directly over the points A and B. This having been done the operator adjusts the sighting instrument 50 over the known point C making use of plumb bob 51 for this purpose. This having been done he then trains telescope 52 onto one of the target members 40 and selects the portion of the target best suited to provide the most accurate results taking into consideration the distance between the sighting instrument and the target, viewing conditions and the like factors. Normally if the distance between the target and the sighting instrument is relatively short, it is most convenient to employ only cylindrical portion 45 of the target. The surveyor's field of view through the telescope, represented by the circle in FIGURES 5a, 5b, and 5c, is split vertically by crosshair 53 and horizontally by crosshair 54. Assuming that extension 45 is to be used, most surveyors would locate this portion of the target as shown in FIGURE 5a and would adjust their instrument until the vertical crosshair 53 is deemed precisely to split this portion of the target. When the instrument is so positioned the surveyor reads the scales on his instrument and makes proper entries in his log book.

If range rod assembly 10 is more distantly located, vertical extension 45 of the target appears to diminish in size sufficiently to be substantially concealed by the vertical crosshair and under these conditions it is not feasible to adjust the instrument accurately. Under these circumstances it is convenient to employ a larger diameter portion of the target, as, for example, the relatively

small diameter upper end of main body 40. This mode of use is shown in FIGURE 5 wherein only the upper end of the target is visible above horizontal crosshair 54 and wherein it is a relatively easy matter for the surveyor to judge when this portion is vertically split by crosshair 53.

For still more distant readings, the wider or mid-portions of target 40 are employed, the widest or thickest portion being used under maximum range conditions, as is illustrated in FIGURE 5b.

It is also to be pointed out that several sightings or triangulation readings may be taken for each range rod setup, each being viewed from a different sighting point. These different readings may be obtained simultaneously if more than one surveyor and sighting instrument are available, or a single operator may proceed to set his sighting instruments at the respective different locations and to take readings at each without need for visiting the range rod setup. Owing to the fact that the surface of the target is a surface of revolution and the additional fact that it is colored similarly throughout its surface, the target proper presents exactly the same silhouette and appearance irrespective of the vantage point from which it is viewed.

When the readings have been completed or while transporting the range rod from one location to another, it is a simple matter to demount the target unit 40 proper by simply lifting target 40 from its socketed support in the universal joint assembly 21 and to place it in a carrying case or other suitable place of safe-keeping to avoid risk of damage until the target is again needed and after the tripod assembly has been installed at a new location. At that time it is a simple matter to reinstall the target in its socket mounting.

While the particular range rod assembly herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

We claim:

1. A surveyor's range rod assembly comprising an elongated rigid rod, means for pivotally supporting said rod pendulum fashion from its upper end with its axis disposed vertically, a sighting target mounted on said rod having a surface of revolution centered about said vertical axis and presenting an identical silhouette as viewed from any vantage point laterally of said target, said target including adjacent portions of widely and abruptly differing cross-sectional areas transversely of the longitudinal axis of said target and lying normal to the axis of said rigid rod, the portions of said target of larger cross-section being suitable for use to obtain accurate settings at relatively great distances from a sighting instrument and the smaller portions being suitable for sighting and obtaining accurate settings over short distances from the sighting instrument.

2. A surveyor's range rod assembly as defined in claim 1 characterized in that said sighting target includes an outer surface formed of plastic material impregnated with a fluorescent dye rendering the same clearly and sharply visible from substantially greater distances than is possible using nonfluorescent coloring dye.

3. A surveying range rod target comprising an elongated main body having a circular surface of revolution concentric with the longitudinal axis thereof and which surface of revolution varies in diameter between the opposite ends thereof, and a slender cylindrical projection extending axially from the upper end of said main body to facilitate centering of a sighting instrument crosshair vertically of said target, and means at the lower end of said main body for supporting said target vertically and centered over a fixed base point.

4. A range rod target as defined in claim 3 character-

ized in that at least the outer portion of said main body is formed of clear plastic impregnated with a translucent fluorescent dye of brilliant hue clearly visible from a distant vantage point.

5. A range rod target as defined in claim 3 characterized in that said main body tapers inwardly toward the opposite ends thereof from a section of maximum diameter near the midportion thereof.

6. A range rod target as defined in claim 5 characterized in that said cylinder projection merges with the upper end of said main body at a flat surface lying normal to the axis of said target and effective in aiding the operator of the sighting instrument in aligning and setting the crosshairs of the sighting instrument on said target.

7. A range rod target as defined in claim 3 characterized in that said target includes an elongated rigid reinforcing core centered therein and projecting beyond both ends of said main body, the upper end of said core extending into said cylindrical extension and the lower end of said core being exposed and adapted to be socketed detachably in a tripod support therefor.

8. A range rod target as defined in claim 7 characterized in the provision of a tripod having legs pivotally connected to a horizontally disposed head assembly, and pendulum means pivotally socketed in said head assembly having an upwardly opening well for detachably seating the lower end of said target core.

9. A range rod target as defined in claim 8 characterized in that said tripod head includes a base member having a large area opening centrally thereof, target support means freely shiftable across the surface of said head, means on said support means for pivotally supporting said target and pendulum means respectively above and below said plate means, and a single clamp holding said plate means adjustably secured to said tripod head and for firmly clamping said plate means rigidly in any desired adjusted position.

10. A surveyor's range rod assembly comprising, tubular pendulum means having a mass at the lower end thereof, vertically adjustable pointer means mounted in the lower end of said pendulum means, universal suspension means for the upper end of said pendulum means and having a spherical surfaced ball on the end thereof, said suspension means having an axial passage in alignment with the axis of said pendulum means, target means having a mounting spindle projecting from the lower end thereof having a close sliding fit in said axial passage and serving to support said target spindle firmly but detachably therein, said target having a vertically elongated main body colored brilliantly with fluorescent dye, said main body having a circular surface of revolution concentric with

said vertical axis and being larger at its midsection than at its opposite ends and enabling the instrument man to use the portion of said target which best serves accuracy and convenience.

11. A range rod assembly as defined in claim 10 characterized in that said fluorescent colored main body includes a cylindrical spindle projecting axially from the upper end thereof and colored with a fluorescent dye, said cylindrical spindle being adapted to serve as the target when said range rod assembly is in use relatively close to the surveyor's sighting instrument and being so small in diameter as to be substantially masked by the vertical crosshair of the sighting instrument when spaced more distantly from the sighting instrument.

12. A range rod and supporting tripod assembly comprising, a tripod having three legs pivoted at their upper ends to a connecting ring adapted to be supported horizontally in use, a readily adjustable supporting plate for a range rod extending crosswise of the upper side of said ring and having a flat lower surface resting against the upper surface of said ring and freely shiftable from place to place thereon, a single thumb nut means passing through a slot in said ring seated in a threaded opening in said plate and effective to clamp said plate in any desired adjusted position on said ring, said plate having a shouldered opening centrally thereof fitted with a bearing ring, range rod means extending through said shouldered opening and including an open-topped threaded tube adapted to seat a removable target therein and said tube having a spherical enlargement on its upper end socketed against said bearing, the lower end of said range rod being pointed and adjustable to terminate in a plane closely adjacent the lower ends of said tripod legs, and target means removably supported in said spherical enlargement.

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