

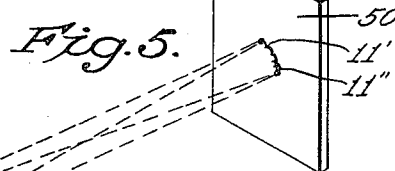
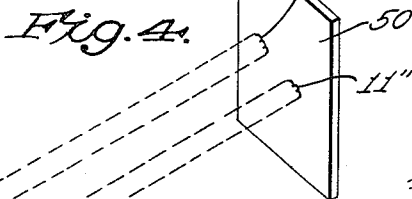
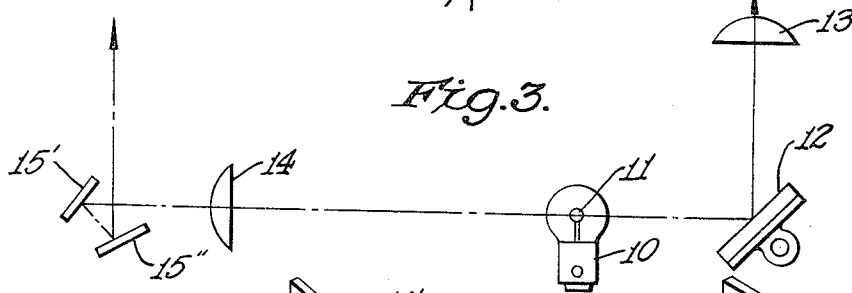
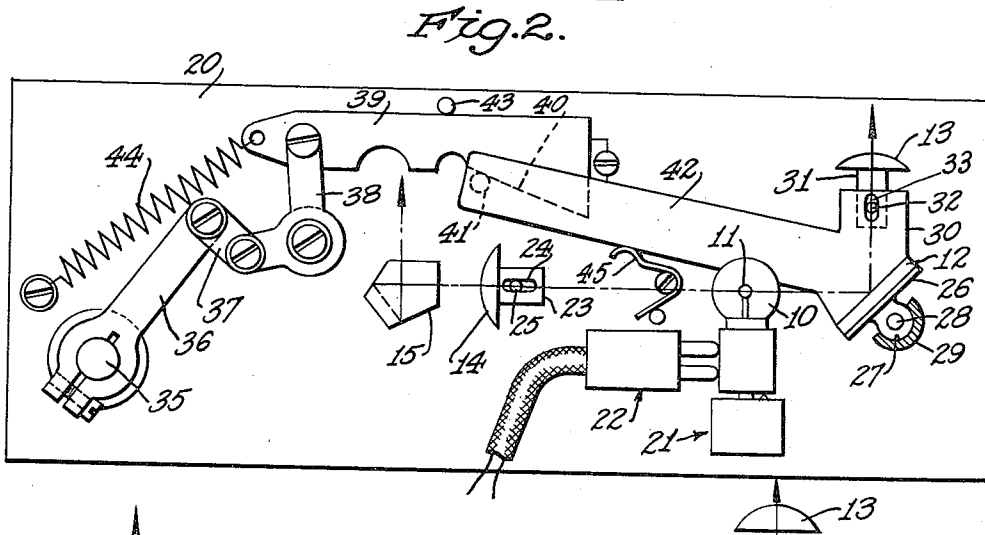
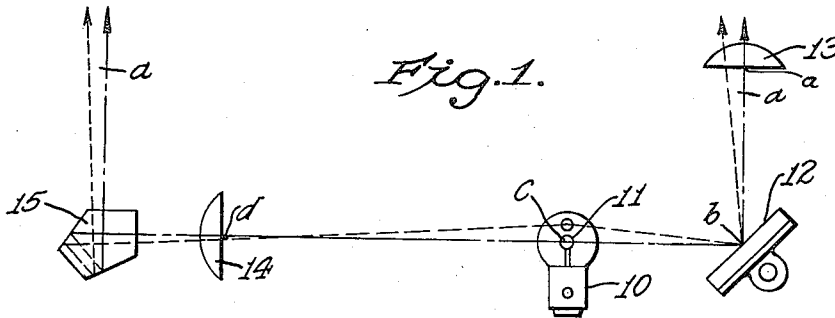
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M. SCHWARTZ ET AL

2,547,232

RANGE FINDER WITH LIGHT BEAM CORRECTION

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INVENTORS
MORRIS SCHWARTZ
WILLIAM CASTEDELLO
BY *Federick G. Haas*
ATTORNEY

UNITED STATES PATENT OFFICE

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RANGE FINDER WITH LIGHT BEAM
CORRECTION

Morris Schwartz and William Castedello, Stamford, Conn., assignors to The Kalart Company Inc., Stamford, Conn.

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7 Claims. (Cl. 88—2.7)

1

This invention relates to light beam projecting range finders, particularly to range finders of the type in which a source of light is positioned between two light deviating means or reflectors, one of which is movable, and in which the angular position of the movable reflector relative to the stationary one is employed, either to ascertain the range of an object or to focus the lens of a photographic camera, the latter type of range finders being sometimes referred to as "lens coupled range finders."

The word "camera," as used herein, is intended to include apparatus for the taking of photographs as well as devices, such as moving picture projectors, television cameras, enlargers, and the like, or in other words, any device comprising a lens to be focused on an object or screen.

In range finders of the type above referred to, the source of light usually comprises an electric lamp having an incandescent filament, two images of which are viewable on the object. The relative position of these images is varied by means of the movable reflector, and the two images are brought into a predetermined position relative to each other which is indicative of the range of the object.

As will be evident to a person skilled in the art, the accuracy of a range finder of the type above referred to will be affected by a variation of the position of the lamp filament relative to the two reflectors because any variation of the filament position will cause the images to be viewable on the object in a different relative position for a given range of the object. It has been found that in electric lamps, as commercially available on the market, the filament is not always in the same position. Furthermore, the lamp will not always be inserted in the socket in the same position. As a result, when a new lamp is inserted, it may be found that the filament of such new lamp is changed relative to a plane parallel to an axis between the two reflectors, and/or that the filament of the new lamp is slightly tilted relative to a plane through the filament of the old lamp. Either such change of the filament position will result in altered light paths.

An arrangement for correction of a tilting of the lamp has been fully described and disclosed in the co-pending application, Ser. No. 648,726, filed February 19, 1946, by Morris Schwartz and William Castedello, which application is now abandoned.

The main object of this invention is to provide means by which any inaccuracy caused by a

2

change of the filament position relative to a plane through or parallel to an axis between the two reflectors is automatically corrected.

Another object of the invention is to provide means which correct a variation of the light paths, as caused by a change of the filament position relative to a plane through or parallel to an axis between the reflectors without requiring an adjustment of any component parts of the range finder.

Another object of the invention is to provide optical means which maintain the two beams projected by the range finder always parallel to each other for all adjustments of the range finder requiring such parallelism of the light beams independently of a variation of the filament position relative to the reflectors.

Other and further objects, features and advantages of the invention will be set forth hereinafter and the novel features thereof defined by the appended claims.

The present application is a continuation in part of the co-pending application Ser. No. 494,872, filed on July 15, 1943, by Morris Schwartz and William Castedello and issued as Letters Patent 2,403,308 on July 2, 1946.

In the accompanying drawings several now preferred embodiments are shown by way of illustration and not by way of limitation.

Fig. 1 is a diagrammatic view of the optical components of a light beam projecting range finder according to the invention.

Fig. 2 is a plan view of a light beam projecting range finder including an electric lamp according to the invention.

Fig. 3 is a diagrammatic view of the optical components of a modification of a light beam projecting range finder according to the invention, and

Figs. 4 and 5 are diagrammatic views of the images produced by a light beam projecting range finder according to the invention on an object, the images being shown in different positions of adjustment.

Referring now to the figures in detail, the optical system of the light beam projecting range finder, as shown in Fig. 1, comprises an electric lamp 10 having a filament 11. This lamp directs a beam of light toward a pivotal light deviating means 12 such as a fully silvered mirror or a prism which re-directs the beam of light toward an object the range of which is to be ascertained. The beam of light reflected by mirror 12 is passed through an image forming lens 13 so that an image of filament 11 is viewable on the object.

A second beam of light from lamp 10 is passed through a second image forming lens 14 toward a second stationary light deviating means 15 which redirects a second beam of light toward the object so that a second image of filament 11 is viewable on the object. According to the invention, light deviating means 15 is a means having constant 90° deviation characteristics and is shown in Fig. 1 as a pentaprism.

As it will be apparent to any person skilled in the art, the relative angle of the light beams projected toward the object and hence the relative position of the two images, as viewable on the object, will be controlled solely by the angular position of mirror 12, assuming the position of filament 11 relative to the optical components of the range finder remains unchanged.

Various arrangements are well known in the art in which the angular position of the pivotal mirror is used, either to measure the range of an object or to focus the lens of a camera, the correct range of the object being indicated or the lens being focused when the two images viewable on the object are in a predetermined position relative to each other, for instance coincide in the plane of the object.

Fig. 2 shows diagrammatically the essential parts of a "lens coupled range finder." A range finder according to Fig. 2 is mounted on a base plate 20 which may be attached to the camera or disposed within the camera casing. Lamp 10 is supported on base plate 20 by means of a holder or mounting generally designated 21. Holder 21 permits an adjustment of lamp 10 and hence of filament 11 relative to a plane vertical to the optical axis between the center of mirror 12 and prism 15 and also in direction of the longitudinal axis through lamp 10. Current is supplied to the lamp by means of a connector generally designated 22, also mounted on base plate 20. Holder 21 and connector 22 are fully described and illustrated in the co-pending application Ser. No. 648,726 filed on February 19, 1946, by Morris Schwartz and William Castedello.

Pentaprism 15 is stationarily fastened to base plate 20 by any suitable means such as a bracket (not shown). Lens 14 associated with pentaprism 15 is supported by a bracket 23 which is slidably mounted on base plate 20 by an elongated slot 24 and a set screw 25 to permit an adjustment of the lens position relative to lamp filament 11 and pentaprism 15. The pivotal mirror 12 is backed by a frame 26 which is pivotally supported on base plate 20 by means of ears 27 and a pivot 28 rotatable in a bearing 29. Frame 26 has an extension 30 which serves to support lens 13. This lens is fastened to an arm 31 slidably mounted on extension 30 by a set screw 32 and an elongated slot 33 to permit an adjustment of lens 13 relative to mirror 12. The distance between the lenses and filament 11 should be selected so that

$$a.b.c.=c.d$$

The angular position of mirror 12 is controlled by a rocking movement of a shaft 35 which in turn may be controlled by the adjustment of the lens support of a camera. However, it should be noted that the invention shall not be limited to the illustrated adjustment of mirror 12.

Shaft 35 carries a lever 36 which is fastened at one end to the shaft by any suitable means. A second lever 37 is pivoted at one end to the other end of lever 36. The other end of lever 37 is pivoted to a third lever 38 which in turn is pivoted to a guiding bar or compensator 39.

Compensator 39 has a wedged portion 40 and engages a pin or projection 41 of a lever or bar 42 fastened to or integral with frame 26 supporting mirror 12. The upper edge of compensator 39 is guided by a lug 43 fastened to base plate 20. A loaded spring 44 supported on base plate 20 urges compensator 39 into engagement with lug 43 and a second loaded spring 45 urges wedged portion 40 of compensator 39 into engagement with pin 41. As will be apparent, a rocking movement of shaft 35 in either direction will be transmitted to lever 42 and cause a corresponding pivotal movement of mirror 12.

In light beam projecting range finders of the type, as herein referred to, the light deviating means 12 and 15 are always so constructed and adjusted that the two light beams projected by the range finder are parallel to each other when the pivotal light deviating means (mirror 12) is in an angular position corresponding to the maximum measuring range of the range finder and beyond such range, whereas the two light beams are at an angle to each other when mirror 12 is turned for range finding within the measuring range of the range finder. As was previously explained, range finding is accomplished by moving mirror 12 into an angular position in which the two images viewable on the object appear in a predetermined position relative to each other. Consequently, the angular position of mirror 12 for a given distance between the range finder and the object must be a fixed one in order to attain accurate indications. Such fixed angular position of mirror 12 for a given range presupposes that the two light beams are always parallel when the range finder is adjusted for maximum measuring range. In case of lens coupled range finders, mirror 12 is usually so adjusted that the two light beams are parallel to each other when the lens is in its infinity position. As previously mentioned, the adjustment of the optical components of the range finder requires a definite and unchanged position of filament 11 relative to mirror 12 and prism 15. Any variation of the position of filament 11 will result in an alteration of the light paths which in turn will upset the adjustment of the range finder causing inaccurate indications. As previously mentioned, in electric lamps, as commercially available, the filament is not always in the same position. When the lamp which was inserted in the range finder at the time the range finder was adjusted is replaced by a new one, it will be frequently found that the filament of the new lamp is in a position different from the filament of the old lamp, either due to a variation in the manufacture of the filament or due to the fact that the lamp is inserted into the socket in a manner somewhat different from the manner in which the old lamp was inserted. Variations in the filament position resulting in a displacement of the filament toward the left or toward the right (as seen in Fig. 1) can be compensated for by the adjustable lamp holder as fully disclosed in the aforementioned pending application. The main purpose of the present application is to compensate for alterations of the light paths caused by a displacement of the filament in axial direction, that is by a higher or lower position of the filament (as seen in Fig. 1). It should of course be understood that terms "higher" or "lower" are correct only when applied to position of the optical components, as shown in Fig. 1 and are used herein merely to define a variation of the filament position relative to a

5

plane parallel to the optical axis between mirror 12 and pentaprism 15.

In order to facilitate the understanding of the invention, it be first assumed that pentaprism 15 be replaced by a reflector such as mirror 12. It will then be evident to a person skilled in the art that a variation of the filament position in axial direction, say a higher position of filament 11, will result in two light beams that are no longer parallel to each other when mirror 12 is placed in a position corresponding to the maximum measuring range of the range finder, thereby causing faulty indications throughout the entire measuring range of the range finder. Let it be now assumed that filament 11 be in a higher position in a range finder according to the invention in which light deviating means 15 consists of a means having constant 90° deviation characteristics. As a result of a higher position of filament 11 which is indicated in Fig. 1 by dashed lines, the light beam (shown in dashed lines), as reflected by mirror 12 will constitute an angle (α) with the light beam (shown in dashed-dotted lines), as reflected by mirror 12 when filament 11 is in its original position, (shown in full lines). The second light beam will also be reflected by prism 15 at an angle to the light beam as reflected by the pentaprism when filament 11 is in its original position. Due to the constant 90° deviation characteristics of prism 15, this angle will be always the same angle (α) as the angle between the light beams reflected by mirror 12. Consequently, parallelism between the light beams as projected by the light deviating means will be maintained in any higher position of filament 11. The same is true when the filament 11 is in any lower position, the only difference being that then the dotted light beams will be at the opposite side of the dashed-dotted light beams.

It will of course be understood that the corrective properties of pentaprism 15 are limited by the size of the pentaprism, but experience shows that variations in the filament position are rarely if ever beyond the corrective range of pentaprism 15.

Fig. 3 shows a modification in which pentaprism 15 is replaced by two stationary fully silvered mirrors 15' and 15'' arranged at a relatively acute angle to each other. These mirrors correspond to the reflecting surfaces of pentaprism 15 and hence constitute a light deviating means having constant 90° deviation characteristics. As a result, mirrors 15' and 15'' will always maintain parallelism between the reflected beams independently of a variation of the filament position, as previously described.

It should be understood that the invention is not and shall not be limited to the light deviating means, as herein disclosed but that other light deviating means may be provided having constant 90° deviation characteristics.

Fig. 4 shows an object 50 on which two images 11' and 11'' of filament 11 are viewable. These images are shown separated from each other, thereby indicating that the angle of mirror 12 does not correspond to the correct range of the object.

Fig. 5 shows the two images in a super-imposed position, thereby indicating correct adjustment of the angular position of mirror 12 which in turn will result in a correct focusing of the camera lens in case of a lens coupled range finder, as has been explained in connection with Fig. 2.

What is claimed as new and desired to be secured by Letters Patent is:

1. A light beam projecting range finder com-

6

prising a light source, a first light deviating means receiving light from said light source and directing a beam of light toward an object, and a second light deviating means receiving light from said light source and directing a second beam of light toward the object, said light deviating means being constructed to be movable relative to each other for varying the angular relationship of said light beams, one of the light deviating means having constant 90° deviation characteristics.

2. A light beam projecting range finder comprising a light source, a first image forming lens means receiving light from said light source, a first light deviating means receiving light from said first lens means and directing a beam of light toward an object, a second light deviating means receiving light from said light source, and a second image forming lens receiving light from said second light deviating means and directing a second beam of light toward said object, said light deviating means being constructed to be movable relative to each other for varying the angular relationship between said light beams, one of the light deviating means having constant 90° deviation characteristics.

3. A light beam projecting range finder comprising a light source, a first image forming lens means receiving light from said light source, a first light deviating means receiving light from said first lens means and directing a beam of light toward an object, a second light deviating means receiving light from said light source, and a second image forming lens receiving light from said second light deviating means and directing a second beam of light toward said object, one of said light deviating means being pivotal for varying the angular relationship between said light beams, the other light deviating means having constant 90° deviation characteristics.

4. A light beam projecting range finder as described in claim 2, wherein the light deviating means having constant 90° deviation characteristics comprises a pentaprism.

5. A light beam projecting range finder as described in claim 2, wherein the light deviating means having 90° deviation characteristics comprises a pair of mirrors mounted at a relatively acute angle to each other.

6. In a light beam projecting range finder including a light source, in combination a pair of images forming lenses and reflecting means for directing a pair of images of the light source on an object whose range is to be determined, one of said reflecting means being a movable mirror to effect coincidence of the images on the said object, the other reflecting means comprising a constant 90° deviation prism, whereby a slight displacement of the light source relative to the optical axis of the range finder will result in displacement of the images which are equal and in the same direction.

7. In a light beam projecting range finder, in combination an exchangeably mounted electric incandescent lamp having a filament, an image forming lens and a reflecting means mounted on either side of the lamp in an optical relationship with the lamp filament for directing a pair of images of the filament to an object whose range is to be determined, one of said reflecting means being a movable reflector to effect coincidence of the images on the said object, the other reflecting means having constant 90° deviation characteristics, whereby a slight displacement of the filament position relative to the optical axis between the reflecting means will result

in displacements of the said images that are equal and in the same direction.

MORRIS SCHWARTZ.
WILLIAM CASTEDELLO.

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