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G. E. RICKERT ET AL

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SELF-LUMINOUS RETICLE

Filed Nov. 1, 1963

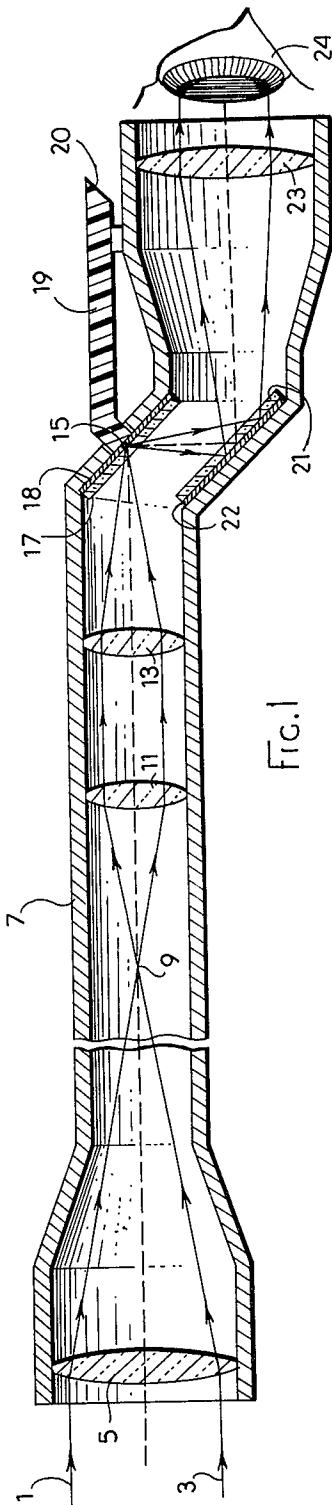


FIG. 1

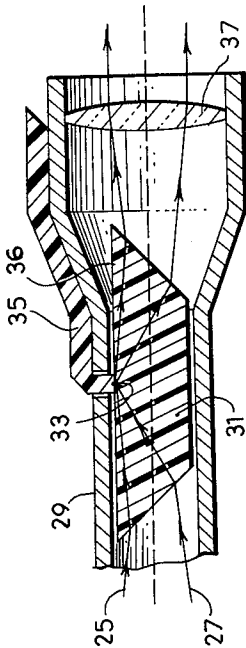


FIG. 2

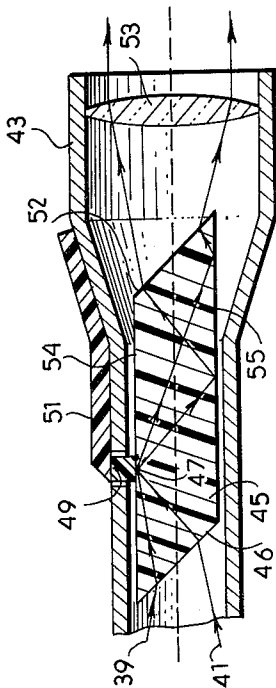


FIG. 3

INVENTORS
GLENN E. RICKERT
ROGER M. RICKERT

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3,230,627

SELF-LUMINOUS RETICLE

Glenn E. Rickert, Community State Bank Bldg., and
Roger M. Rickert, both of Huntington, Ind.; said Roger
M. Rickert assignor to said Glenn E. Rickert
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This application is a continuation-in-part of co-pending application, Serial No. 192,888, filed May 7, 1962, now Patent No. 3,121,163.

This invention relates to a luminous reticle for optical instruments, and more particularly relates to reticles used in rifle telescopes and similar instruments.

Reticles in optical instruments are of two general types. The first type is the silhouette type which is commonly used in rifle telescopes and similar instruments and the marks or pattern of the reticle appear as a black silhouette against the background being viewed. The second type is the electrically illuminated reticle, and the pattern or marks of the reticle are made to appear luminous or to glow, with the energy for the glow coming from batteries or other electrical source.

In the electrically illuminated reticle type, the marks can be very fine in size, and also they can be used in very dim or very bright lighting conditions, still being easy for the observer to see. This type has the disadvantage, however, of being bulky and being expensive to build and maintain because of the light bulb, housing and electrical supply. In fact, in portable instruments such as a rifle telescope, the problems become almost prohibitive, and the silhouette type reticle is generally used.

In the silhouette type, however, a problem is present where the pattern marks must be comparatively large in size or they are too difficult to see against certain backgrounds in good light conditions, and very difficult to see with any background in dim light conditions. Yet when the marks are made sufficiently large to be quickly and easily seen, they tend to hide too much of the view, particularly where critical alignment is needed on small objects, such as is experienced in using a rifle telescope.

The primary object of the invention is to provide a luminous reticle of greater brightness than is known in the prior art, without the use of electrical energy.

A salient object of the invention is to provide a system whereby none of the original target brightness through the optical instrument is lost by the incorporation of the self luminous reticle and at the same time provide a system whereby the reticle also appears in its full brightness to an observer looking through the optical instrument.

Another object of the invention is to provide an improved luminous reticle which can be more easily seen in dim light and poor background conditions, and in addition, be easily seen in very bright background conditions.

A further object of the invention is to provide a means whereby finer reticle marks or patterns may be used than would otherwise be practical by making the pattern appear to glow in a vivid color which contrasts with the colors normally found in the background view.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention, as will be apparent or understood from the following description and accompanying drawing, wherein:

FIGURE 1 is a cross section view of one form of our invention as applied to a rifle telescope.

FIGURE 2 is a cross section view of another form of our invention using one kind of a single reflecting prism, shown in a portion of an optical instrument.

FIGURE 3 is a cross section view of another form of

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our invention using one kind of a double reflecting prism, shown in a portion of an optical instrument.

Referring to the drawings and especially to FIGURE 1, the rifle telescope body 7 holds the objective lens 5, erector lenses 11, 13, mirrors 18, 22, reticle illuminator 19 and eyepiece lens 23.

Rays 1, 3 are converged by lens 5 to focus at focal point 9 to form an inverted image at 9 of an object. Lenses 11, 13 then erect the image and bring it into focus at focal point 15, to reflect on mirror 18. Mirror 18 has a reflecting surface 17, which surface has a transparent or translucent and non-reflecting reticle pattern or indicia near 15. This pattern is lighted from behind the mirror by the illuminator 19 and by passing light through the reticle marks. The reticle is observed by eye 24 by virtue of mirror 22, reflecting surface 21. The image cast by the erector lenses is observed by using mirrors 18, 22, and eye piece lens 23.

The illuminator 19 passes through the body 7 of the telescope to direct its light to the transparent reticle mark near 15 and the angled end 20 aids the brightness by directing the normal overhead illumination through the illuminator into the instrument. The angled end 20 may be omitted if desired.

In FIGURE 2 is shown the use of a reflecting prism 31 in an optical instrument body 29 with object rays 25, 27 reflected at focal point 33 to pass through eye piece lens 37. Reflecting prism 31 has a reflecting surface 36 which surface has a transparent or translucent, and relatively non-reflecting reticle pattern or indicia near 33, which pattern is illuminated by illuminator 35 from behind the reflecting surface, similar to the system used for the mirror 18, FIGURE 1.

FIGURE 3 shows the use of a double reflecting prism 45 in an optical instrument body 43 which also holds the eye piece lens 53, illuminator 51, and illumination conductor 49. Prism 45 has reflecting surfaces 54, 55 of which surface 54 has a non-reflecting reticle pattern or indicia near focal point 47, which pattern or indicia being transparent is illuminated from behind by the illuminator 51 with the help of light conductor 49.

Object rays 39, 41 are deviated by prism surface 46 to reflect from surfaces 54, 55 and to emerge from prism surface 52 to pass through and be focused by eye piece lens 53.

FIGURES 1, 2 and 3 illustrate a basic principle of our invention. The light from the distant object is conducted through the optical instrument in a highly efficient manner without more than the normal loss of light intensity that is regularly encountered in such instruments. The reticle is introduced at a focal point of the instrument by using a highly reflecting surface at this focal point. This reflecting surface efficiently reflects the light from the object in all areas of its surface except that area occupied by the actual reticle pattern indicia or marks themselves. These mark areas are transparent or translucent and are lighted from behind and are observed from the front side of the reflecting surface by the same system that observes the image of the target occurring at this focal point of the instrument. Thus the distant object appears in its full brightness to the observer, while at the same time the reticle also appears in its full brightness to the observer.

The mirrors 18, 22 shown in FIGURE 1 can be replaced by a pair of reflecting prisms, or by a single rhomboidal prism.

The reticle pattern at 15, FIGURE 1, gives windage and elevation information. For example, by the use of a horizontal line for elevation, and a very short stub vertical line crossing the horizontal line at a point to indicate windage information. A broken horizontal line

having a dot, small circle, or other mark located in the break area of the line can instead be used to indicate windage if desired.

If a complete vertical line is desired, in addition to the horizontal line, it can be located at a second focal point. For example, focal point 9, FIGURE 1, by placing a second pair of mirrors ahead of the erector lenses 11, 13 near focal point 9 similar to those shown near focal point 15, but oriented at about a 90 degree angle in reference to those near focal point 15.

A pair of Porro prisms, similar to those used in conventional hand held binoculars, could be adapted to be used instead of the mirrors as shown in FIGURE 1 if at least one surface of one of the prisms was located at a focal point of the optical instrument.

The single reflecting prism in FIGURE 2 will only invert the image of the object, and a second reflecting prism positioned at 90 degrees to the first can be used to revert the image and thus gain complete erection of the view for the observer. The second prism need not be at a focal point.

The double reflecting prism in FIGURE 3 does not change the orientation of the object observed through it and consequently would require the use of a separate erection system if used in a rifle telescope or similar instrument.

Many types of reflecting prisms and many similar mirror systems can be substituted in my invention as long as at least one of their reflecting surfaces is positioned at a focal point of the instrument.

When the angle of incidence of the light pathway to the reflecting surface is large as in the prism in FIGURE 2 reflecting surface 36, the reticle pattern can be scratched or otherwise indented down into the prism surface to aid the brightness of the reticle mark when viewed so obliquely.

The illuminator 19, FIGURE 1, and variations of it are more fully described in co-pending patent application, Serial Number 192,888, now Patent No. 3,121,163. It can be constructed in several efficient forms but is highly effective if made with the principal surfaces being generally parallel and can be made from a rectangular sheet or bar of common commercial Plexiglas fluorescent yellow #2086. Other fluorescent lighting materials may be used and adapted to also be energized by available incident light.

An angled end 20, FIGURE 1, aids in directing overhead light to the reticle when needed, and clear optical material can be used for the illumination conductor 49, FIGURE 3, wherever advantageous.

Reflecting surfaces involved in this invention can be coated with reflective material where desirable, or may be used as reflectors depending upon total internal reflection principles.

The mirror 18, FIGURE 1, is shown to deviate the light pathway through the instrument off to an angle at about 90 degrees to its original direction. This mirror, or a similar one, could of course be angled to deviate the light pathway any angle up to nearly 180 degrees before having it directed to observer's eye 24, FIGURE 1.

A system using a prismatic and focusing lens in place of lens 13, FIGURE 1, can be used to deviate the light pathway to mirror 18, and a prismatic and focusing lens in place of lens 23, FIGURE 1, can be used to straighten the light pathway coming from mirror 22 in order to make

the system a more compact and less crooked appearing instrument. As an alternate, a focusing lens and a prism can be combined to form a prismatic focusing lens effect. The reticle indicia and the reflecting surface can be placed at any desirable focal point.

While we have disclosed the invention with particularity in the best form known to us it will nevertheless be understood that changes in structure and arrangement, and substitution of materials and equivalents, mechanical or otherwise, may be made without departing from the spirit of the invention as here disclosed and as set forth in the appended claims.

We claim:

1. A luminous reticle system for an optical instrument comprising:

- (a) a reflective surface having light transmitting reticle indicia,
- (b) a reticle indicia illuminator means adapted to be energized by available incident light and to emit fluorescent light, and
- (c) means for directing said fluorescent light to pass through said reticle indicia so that said reticle indicia will appear luminous to an observer viewing said reflective surface.

2. A luminous reticle system for an optical instrument comprising:

- (a) a reflective surface having a light transmitting reticle,
- (b) a reticle illuminator means adapted to use available incident light, and
- (c) means for directing said available incident light to pass through said reticle so that said reticle will appear luminous to an observer.

3. A luminous reticle system for an optical instrument comprising:

- (a) a reflective surface having light transmitting reticle indicia located substantially at a focal point of an optical instrument,
- (b) a reticle indicia illuminator means adapted to be energized by available incident light and to emit fluorescent light, and
- (c) means for directing said fluorescent light to pass through said reticle indicia so that said reticle indicia will appear luminous to an observer.

4. A luminous reticle for an optical instrument comprising:

- (a) a reflective surface having a light transmitting reticle,
- (b) a reticle illuminator means adapted to be energized by available incident light and to emit fluorescent light, and
- (c) means for directing said fluorescent light to pass through said reticle so that said reticle will appear luminous.

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ISAAC LISANN, Primary Examiner.