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SELF-LUMINOUS RETICLE

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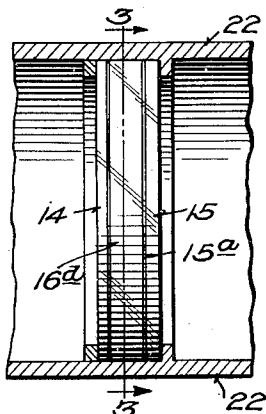


Fig. 1

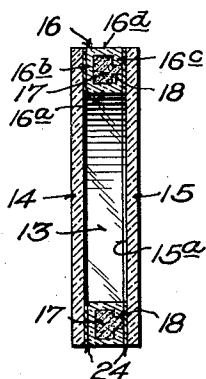


Fig. 2

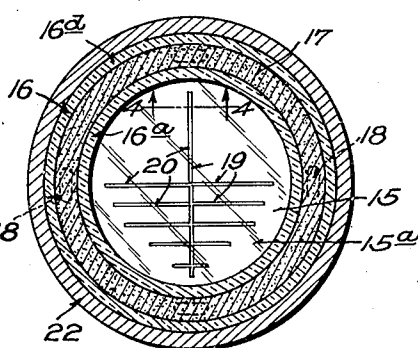


Fig. 3

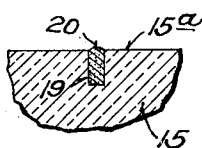


Fig. 4

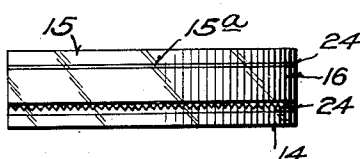


Fig. 5

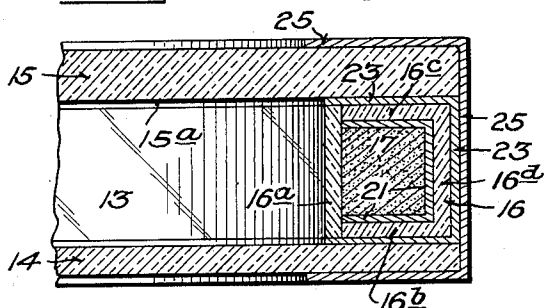


Fig. 6

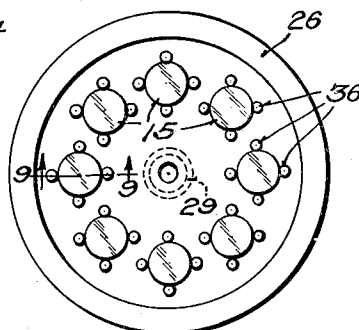


Fig. 7

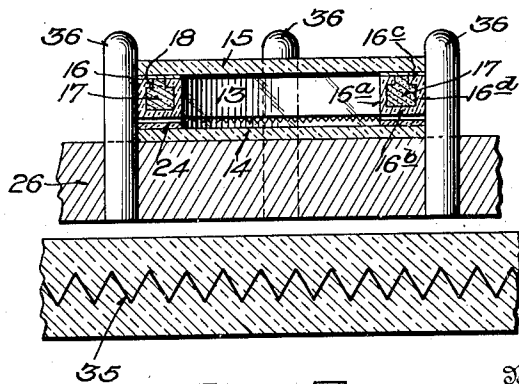


Fig. 8

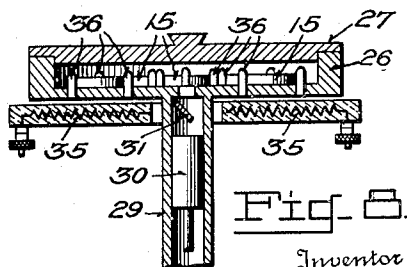


Fig. 9

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SELF-LUMINOUS RETICLE

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1 Claim. (Cl. 250—71)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

My invention relates to reticles for optical instruments and it has special reference to self-illuminated reticles.

One object of my invention is to provide a reticle which is entirely self-luminous.

Another object is to protect the reticle's face from injury.

A further object is to avoid obscuration of vision in optical instruments by light haze or glare in the reticle body caused by the illuminating means.

Reticle units constructed in accordance with my invention utilize a reticle element which constitutes one end of an evacuated box or hollow disc. The reticle grooves are exposed to the vacuum within the box and are filled with a fluorescent substance. Such substance is made visible by radiation from a radio-active substance that is incorporated in a glow ring which defines the unit's periphery. In this way I provide a self-luminous reticle unit which is independent of natural lighting conditions.

One preferred form of my improved reticle unit is shown by the accompanying drawings wherein:

Fig. 1 is a view in side elevation partly in section of the assembled unit containing the glass plate on which the reticle lines are formed;

Fig. 2 is a vertical section view of the Fig. 1 unit showing the unit's glow ring and other features of internal construction;

Fig. 3 is a sectional plan view taken on line 3—3 of Fig. 1 showing further details of the glow ring;

Fig. 4 is an enlarged section on line 4—4 of Fig. 3 showing fluorescent material filling a reticle groove;

Fig. 5 is a side elevation view of the assembled reticle unit showing one manner by which the glow ring may be cemented to the unit's window;

Fig. 6 is a partial sectional view of a reticle unit having additional ray protective and concentrating means;

Fig. 7 is a top plan view of a vacuum chamber (with the cover removed) useful in manufacturing my improved reticle units shown therein as awaiting vacuumizing and final assembly;

Fig. 8 is a view in lengthwise vertical section through the chamber of Fig. 7 showing evacuating and heating apparatus associated therewith; and

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Fig. 9 is an enlarged vertical section taken along line 9—9 of Fig. 7 showing further details of the reticle unit assembling mechanism and process.

My improved self-luminous reticle unit which comprises a cylindrical box having transparent end faces 14 and 15, the latter being shown as a reticle disk. These end faces are spaced by a hollow ring 16 which may have a cross-sectional shape as clearly shown at Figure 2. The ring has openings 18 through its side wall 16c adjacent face 15 and through which openings it may be filled with a radio-active substance 17.

Reticle grooves 19, Figure 3, may be cut or etched into the inner surface of disc 15 and filled with a fluorescent substance 20. This substance is caused to fluoresce by the radio-active substance 17 so that the reticle lines 19 stand out prominently to an observer looking through the telescope or other optical instrument.

In the construction shown, the window 14 and the reticle face 15a are preferably secured to their respective sides of the glow ring 16 by an opaque cement 24 (see Figs. 2 and 5).

In order to obtain maximum benefits of the radio-active substance 17 a coating of silver or graphite 21, Figure 6, may be applied to the internal surface of ring 16 to thereby reflect rays incident therein and increase the emanation effective upon fluorescent material 20.

The external sides of these same walls 16b—16c—16d are preferably covered with a substance 23 such as lead which resists transmission of the rays, and thus adds to the effect of the interior lining in concentrating the rays upon the fluorescent material 20.

Shielding of the observer's eyes from excessive radio-activity may be completed by use of a material similarly impervious to such rays on the outer margin of the window 14 and reticle disc 15, as best shown at 25 in Fig. 6.

To achieve the full benefits of my novel reticle unit, a high vacuum is maintained within the unit for reasons later to be explained.

One such reticle unit as has just been described is illustratively shown in Fig. 1 as mounted in a section of a typical optical instrument comprising a tubular casing 22 in which the line of sight passes through the reticle.

Various known radio-active compounds 17 which may be used to supply the invisible rays that cause the groove marking's filler 20 to fluoresce may be used. Among these are a mixture of radium and zinc sulfide. The fluorescent filler 20 may be any commercially available substance

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having the desired fluorescing properties, such as calcium tungstate, or oxides of titanium, zinc, barium or lead mixed with small amounts of sodium naphthionate, or eosin anthracene, or fluorescein, or other such materials.

Method of making reticle unit

To accomplish the various objects of my improvements, the vacuum box-like or hollow disc unit which I have described may be constructed in a number of ways. One preferred method is illustratively shown in Figs. 5, 7-8-9.

In order to maintain indefinitely a high vacuum within a reticle, the component parts of my reticle unit must be joined together with an air-tight seal. Any suitable cement 24, preferably opaque, capable of making such a seal between glass or plastic parts is satisfactory for this purpose.

By means of such cement 24, the reticle disc 15 is permanently attached to the glow ring 16 which is first filled with the radio-active substance 17 through the openings 18 (see Figs. 3, 9). The manner of cementing the reticle disc 15 to the glow ring 16 is such that the groove markings 19 on the recticle face 15a will face the inside of the completed box. This partially assembled unit is placed upon a serrated ring of the sealing cement 24 which covers the peripheral margin of the window 14, as shown in Fig. 5. The reticle unit is now ready for vacuumization and final air-tight sealing.

Vacuumization of a number of my recticle units can be carried on simultaneously through use of a vacuum chamber 26 and other processing apparatus schematically illustrated in Figs. 7-8-9. The reticle units to be processed are first placed in this chamber as indicated at 15 in Figs. 7-8, and a lid 27 is then positioned over the chamber's open top in an air-tight fitting relation therewith.

The air in the chamber is next exhausted by conventional operation of vacuumizing means shown schematically at 29-30-31 in Fig. 8. Such exhaustion is continued until the chamber's internal pressure has been so reduced to cause an adequate vacuum therein.

As the air is withdrawn from the chamber 26 it is likewise exhausted from the reticle units situated therein by passage through spaces between the serrated ridge of sealing cement 24 (see Figs. 5 and 9) and the glow ring 16 resting thereon. Such spaces result from the original "serrated" placement of the cement on the surface of window 14 in its hardened or room-temperature condition.

When a satisfactory high vacuum has been obtained, heat is applied to the base of chamber 26 in any suitable manner as by the aid of an electric-grid or hot plate schematically indicated at 35 in Figs. 8-9. Well known electronic heating means also may be employed should greater rapidity be desired.

Softening of the serrated cement 24 is thus effected, permitting the glow ring 16 with attached reticle disc 15 to settle down on the window 14. On cessation of heating, cement 24 hardens and effectively seals and completes the unit.

One means of properly lining up the window 14 with the glow ring 16 and reticle disc 15 as they are being joined together is to use three or more alignment pins 36. These pins 36 are affixed to the base of chamber 26 at substantially equidistances around the circumference of a circle having the same diameter as that of each

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reticle unit being processed. Each unit is placed within the area bordered by these pins to maintain the desired alignment as the joining process is being carried on.

The inner wall 16a (again see Fig. 6) of the glow ring may take the form of a glass filter of the type which transmits only infra-red rays and eliminates visible light which would cause glare or haze before the observer's eyes. Such a filter may be made of glass containing oxides of iron or manganese. If ultra-violet rays be desired, a filter appropriate for the transmission thereof may be substituted.

Optionally the glow ring 16 may be constructed of plastic material instead of glass. Cellophane, for example, transmits invisible infra-red rays almost as well as quartz, which is well known to be highly transmissive of these rays. Several plastics now commercially available are capable of high ultra-violet transmission, too.

By a process well known to the optical engineering art, such plastics may be treated so as to be entirely opaque to such light, while leaving the untreated inner side wall 16a still capable of transmitting the desired rays.

As previously mentioned, special coatings may be applied to the walls of the glow ring 16 as shown at 23, and around the outer margins of the complete reticle unit, as shown at 25, to concentrate the radiative effect of the radium substance 17 toward the reticle markings 19. Fig. 6 clearly shows how the lead or other ray-resisting material 25 acts to prevent ray loss to the outside of the unit.

Additional protection is afforded by the similar substance 23 applied to the external sides of glow ring walls 16b-16c-16d. To help reflect the rays and concentrate the rays through the selective ray filter constituting the wall 16a, an internal wall lining may be applied, such as silver or graphitized carbon, as indicated at 21.

The amount of radio-active compound 17 used in the glow ring must of course be dependent upon the size of the optical instrument in which my improved reticle unit is to be used, which factor will, in turn, regulate the size of the unit itself. It is desirable to contain a sufficient bulk of radio-active substance 17 in the glow ring 16 so that the "luminescent-life" will cover a period of years.

I claim:

In a hollow, cylindrical, self-luminous, self-contained reticle cell for an optical instrument, a hollow toroidal ring generally rectangular in axial diametrical cross section, first and second circular transparent plates of substantially the same diameter as said ring and secured to respective sides of said ring in air-tight relation therewith, there being reticle grooves formed upon the inner face of said first plate, fluorescent material filling said grooves, a radio-active substance filling the toroidal chamber of said ring, a lining of silver extending over the inside surfaces of the side walls and radially outward peripheral wall only of said ring, and a sheathing of lead covering the corresponding outer surfaces of said ring, the inner peripheral wall of said ring being transparent to the passage of invisible rays from said radio-active substance, whereby said fluorescent material is rendered self-luminous, the space within said ring between said plates being exhausted of air.

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