Oct. 12, 1954 V. A. MARCO 2,691,719

INDICATOR LIGHT WITH ADJUSTABLE SHUTTER

Filed Oct. 5, 1951

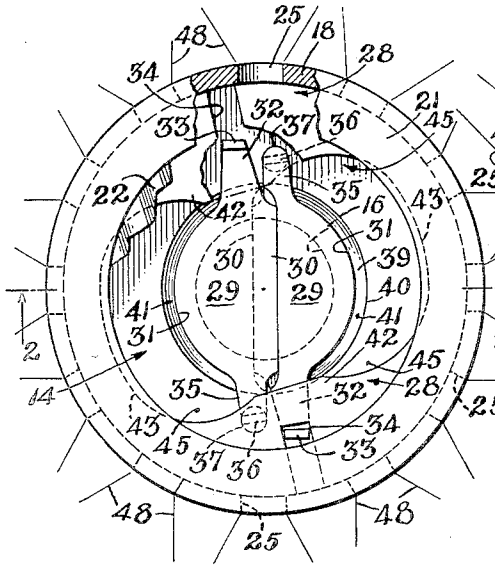


Fig. 1.

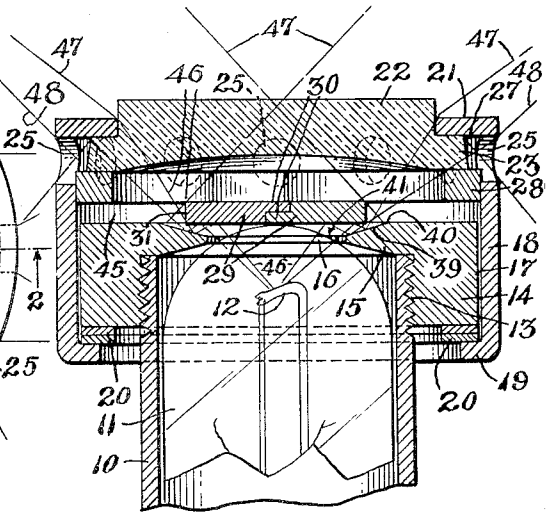


Fig. 2.

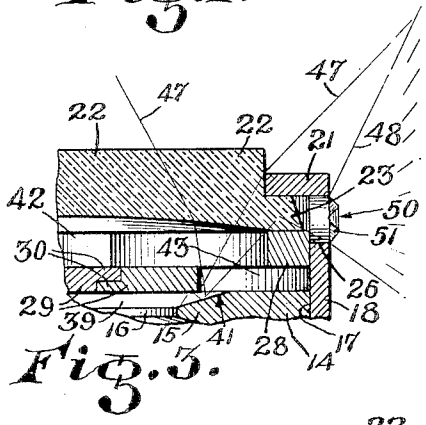


Fig. 3.

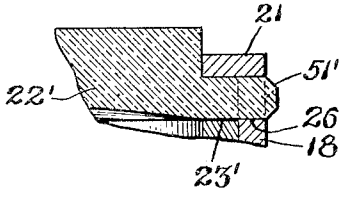


Fig. 4.

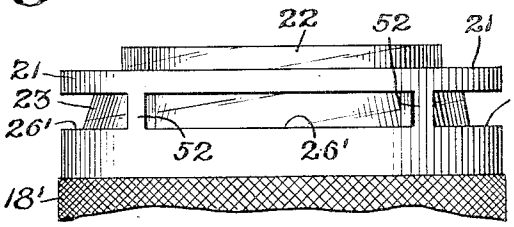


Fig. 5.

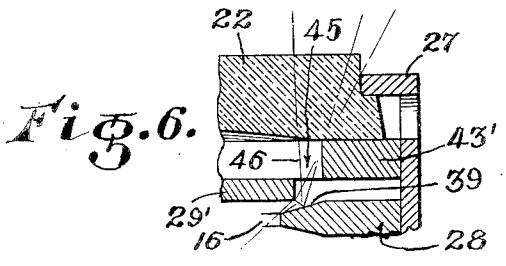


Fig. 6.

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Patented Oct. 12, 1954

2,691,719

UNITED STATES PATENT OFFICE

2,691,719

INDICATOR LIGHT WITH ADJUSTABLE SHUTTER

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Application October 5, 1951, Serial No. 249,885

10 Claims. (Cl. 240—8.16)

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This invention relates to indicator lights of the type commonly employed on instrument panels of aeroplanes, automobiles, and other machines, for indicating the condition of operation of various components of the machine. The invention relates particularly to the type of indicator light with adjustable dimming iris or shutter such as that embodied in the invention of F. J. Aves, covered by U. S. Patent No. 2,424,575, issued July 29, 1947. The present invention is an improvement upon the indicator light shown in that patent. In this type of indicator light, the housing, immediately below the lens, is provided with a plurality of iris members adapted to be moved toward each other to reduce the light emitting aperture, and to be closed together to completely shut off direct light emission. The advantage of such an arrangement arises from the varying requirements for light emission under daylight conditions (when relatively high intensity emission is desired) and conditions of darkness when it may be essential that the eyes of the pilot or operator be adjusted for maximum pupil dilation, in which case the amount of light emitted from the indicator light must be greatly reduced below the daylight requirements.

Indicator lights of this general type are commonly installed in many different positions, some of which may place them so as to present substantially a complete side elevation to the operator, a position in which it may be impossible for the operator to view any illumination whatever in the lens of the device, especially in the dimmed condition thereof. With this problem in mind, the primary object of the present invention is to provide an indicator light of the type under consideration, which is capable of providing light emission throughout a complete 180° range about a center located at the indicator light and in a plane intersecting the longitudinal axis thereof, whereby the operator may see the glow of the indicator light from a viewpoint ranging anywhere from a head-on viewpoint directly in front of the light, around to a viewpoint looking directly at any side of the light, and with the face of the lens completely cut off from the operator's line of vision.

A further object of the invention is to provide such an indicator light which will afford such complete range of light emission not only in the wide open position of the iris but also in the fully stopped down or closed position of the iris.

A still further object is to provide such an indicator light in which the intensity of both front

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and lateral light ray emission will be dimmed down proportionately throughout the entire aforesaid complete range of light emission in all directions.

Another object is to provide such an indicator light having improved heat dispersal qualities, and thereby adapted to operate at lower temperatures than the prior art indicator lights of this general class.

A further object is to provide such an indicator light which in addition to its improved characteristics indicated above, is of relatively simple, inexpensive and yet durable construction, lending itself readily to manufacturing operations so that it may be produced and sold in quantity at a reasonable price.

A further object of the invention, in a modified form thereof, is to provide an indicator light conforming generally to the characteristics outlined above but adapted in the open position to emit the light throughout its entire wide angle range, but in the closed position to emit light only from the front face of the lens.

With the foregoing objects in view, the invention contemplates, in general, an indicator lens and iris assembly in a cap for a light mounting housing, in which cap there is provided a mounting ring for attachment to the housing, said mounting ring having a basic light emitting aperture, a lens in front of said aperture, and a plurality of shutter or iris elements interposed between the lens and the mounting ring, together with a shell enclosing the mounting ring and securing the lens in assembly, said shell having, an addition to a front window through which the forward face of the lens projects, a plurality of side apertures for emitting light in a direction at right angles to the longitudinal axis of the assembly, said side apertures registering with the rim of the lens, and the iris elements being so arranged relative to the mounting ring as to provide for an emission of light rays not only from the front face of the lens but also through the rim of the lens and through said lateral light emitting apertures.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a front view of an indicator light assembly embodying the invention, with parts broken away to better illustrate the construction;

Fig. 2 is an axial sectional view of the same taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view of an

indicator light assembly embodying a modified form of the invention;

Fig. 4 is a fragmentary sectional view of an indicator light assembly embodying another modified form of the invention;

Fig. 5 is a fragmentary sectional view of an indicator light assembly embodying a further modified form of the invention; and

Fig. 6 is a fragmentary sectional view of an indicator light assembly embodying a further modified form of the invention.

As an example of one form in which the invention may be embodied I have shown in Figs. 1, 2 and 3 a portion of an indicator light assembly including a housing or barrel 10 adapted to house a signal lamp bulb 11 having a filament 12. The forward end of barrel 10 is externally threaded to be received in the internal thread 13 of a mounting ring 14 which has a face flange 15 projecting radially inwardly from its outer extremity. Flange 15 has an inner edge defining a light emitting aperture 16 and providing an abutment against which the forward end of lamp bulb 11 is seated under yielding pressure provided by resilient means which, since it is part of the prior art and forms no part of the present invention, is not disclosed herein.

Ring 14 has a cylindrical lateral wall 17 which provides a bearing surface for a retainer shell 18, rotatably mounted thereon. Shell 18 has, at its rear end, an integral inwardly turned flange 19 which abuts, through interposed bearing washers 20, against the rear end of mounting ring 14 to secure the shell in rotatable assembly therewith. At its forward end, shell 18 has an inwardly turned retainer flange 21, which provides an abutment for an offset shoulder in the rim of a lens 22. The above mentioned shoulder is defined as the forward face of an enlarged rim portion 23 of lens 22, the lens having a reduced forward portion which snugly fits within the window defined by the inner edge of flange 21 and projects forwardly from flange 21.

The rear face of lens 22 may be concave as shown or, alternatively, may be flat. The forward face of the lens may be flat or slight convex. The periphery of enlarged rim portion 23 of the lens may be slightly frusto-conical as shown or may be cylindrical, whichever is preferred. The lens may be constructed of glass or other suitable transparent or translucent material although I prefer to employ a lens molded of a plastic material having a relatively high index of refraction so as to have what is sometimes referred to as diffusing characteristics (the ability to trap a large percentage of light rays which enter the lens body at an angle, and to transmit them out to the edges of the lens where they will be emitted from the rim surface of the lens with a scattering or diffusion of the light rays). For example, the thermoplastic acrylic polymer resin commonly known under the trade-mark "Plexiglas," has the mentioned light diffusion qualities, although it is to be understood that it is possible to employ other transparent or translucent materials.

In the lateral wall of shell 18 are a plurality of light apertures 25, arranged immediately behind the retainer flange 21, and registering with the periphery of enlarged rim portion 23 of lens 22, thus to allow the escape of light rays emitted from said rim portion.

Defined between the periphery of rim portion 23 and the inner wall of shell 18 is an annular space 27 in which air may circulate freely for absorbing heat radiated from the rim of the lens. The air in this space is in communication with external atmosphere through apertures 25, and it will thus be apparent that convectional circulation may take place, with air entering the lower apertures, passing upwardly around both sides of the lens through annular space 27 and escaping through the upper apertures 25, to produce a cooling effect which is such that my improved indicator lamp will operate at a lower temperature than prior lamps. The heat dispersal is improved by the conduction of heat from the interior of the cap to the annular space 27 through an annular iris operating and lens mounting ring 28 which will now be described.

Ring 28 has a periphery fitted snugly to the inner wall of shell 18 and is therefore rotatable with shell 18. Its forward face provides a seat for the rear face of lens 22, the rim portion 23 thereof being confined between ring 28 and retainer 21. The rear face of ring 28 is spaced from the forward face of face flange 15 of the mounting ring 14, so as to provide a narrow flat space in which is received a pair of shutter or iris elements 29. Iris elements 29 have straight inner edge flanges 30 adapted to come together in overlapping relation along a diameter of the cap assembly, and have semicircular outer margins 31, whereby when the edges 30 are overlapped as indicated, the two iris elements will cooperatively define a circular disc of somewhat larger diameter than the basic light aperture 16, so as to completely shut off the emission of direct rays from filament 12. Each of the iris elements 29 has at one end a radially extending arm 32 terminating in a forwardly bent finger 33 received in a peripheral, radially extending notch 34 in operating ring 28. Each iris element has at its other end a radially extending arm 35 provided with a rearwardly bent lug 36 which is pivoted in a socket 37 in face flange 15 of mounting ring 14. The arm 32 of one iris member is diametrically opposed to arm 32 of the other. The same is true of arms 35. It will now be apparent that, upon rotation of shell 18 in a counter-clockwise direction as viewed in Fig. 1, the iris elements 29 will be separated radially to provide a parallel sided opening in front of aperture 16, through which direct rays from filament 12 may be emitted forwardly through lens 22. The size of this opening between iris elements 29 may be adjusted to any desired width by the degree of rotation of shell 18, from a point where only a thin, diametral light space is defined between adjacent flanges 30, to a point where most of aperture 16 is uncovered.

Overlapping flanges 30 are adapted to completely seal the iris members together against any possible escape of light rays between them, in the fully closed iris positions.

The inner portion of face flange 15 has a bevelled, frusto-conical, forward face 39 which intersects the flat forward face of flange 15 to define a circular edge 40. Between frusto-conical face 39 and the semi-circular outer edges 31 of iris elements 29, there is defined a pair of arcuate, opposed light passages 41. Light passages 41 terminate at the arms 32 and 35 of iris elements 29.

Operating ring 28, as previously stated, has a circular rim which is snugly fitted within shell 18. Its inner periphery is roughly in the shape of a figure 8, whereby the ring includes two diametrically opposed wide portions 42, accommodating slots 34, and two relatively narrow portions 43, the inner margins of which are disposed along arcs either registering with or having a diameter greater than the diameter of the inner margin of retainer flange 21. The opening thus defined by

the inner margin of ring 28, has a pair of diametrically opposed portions which, spaced radially outwardly from edges 31 of shutter element 29, cooperate therewith to define crescent shaped openings 45 in the closed positions of iris elements 29 shown in Fig. 1. The openings 45, lying immediately forwardly of light passages 41, provide for full visibility of the latter through the lens 22.

It may now be noted that, in the closed position of the iris element, 29 shown in the drawings, a pair of semi-conical bands 46 of light rays from filament 12 will escape through the opposed arcuate passages 41 into openings 45. These rays, reflected in various directions from the inner surfaces of ring 28 iris elements 29, and lens 22, will include many rays falling upon frusto-conical face 39 of flange 15 and illuminating that portion thereof which is visible through passages 41. Thus, in the fully closed iris position, there will be visible two arcuate bands 47 of light rays corresponding to the shapes of passages 41 as viewed from the front (Fig. 1) through lens 22.

These rays are diffused through a wide angle as indicated, whereby the illumination may be seen from any direction in front of lens 22, at any angle of incidence down to an angle less than 45°.

Rays 46 striking lens 22 from passages 41 will be sufficiently spread out to include rays which enter the lens at such an angle as to be refracted out to the rim portion 23 thereof, from which they will be emitted, as indicated at 48, in the form of a series of generally radial rays or spokes of light, each of conical form and spreading sufficiently to intersect the rear extremity of the annular band of diffused rays 47 emitted from the forward face of lens 22.

The lateral light rays 48, in the fully closed positions of iris members 29, are derived solely from the indirect rays 46 passing through arcuate passages 41. However, as the iris elements 29 are gradually separated, bands of direct rays passing directly between the iris members will strike lens 22 and these rays will spread out sufficiently so that some of the outer rays will be refracted out through the rim 23 of the lens from which they will be emitted to form the rays 48 of greater intensity than those emitted in the fully closed position of the iris. The intensity of rays 48 will increase in step with the intensity of the direct beam of light passing forwardly between the iris members and through lens 22. Thus, the visibility of the lateral rays 48 will vary in direct proportion to the visibility of the forward rays 47 emitted from the face of lens 22.

Because the forward rays 47 and the lateral rays 48 are in intersecting relation, the visibility of the glow emitted from the indicator light will be continuous throughout the entire range of vision from a viewpoint directly at any side of the shell 18 around to a viewpoint directly along the axis of lens 22 from the front There will be no "blind spot" in this range of vision. Accordingly, it is entirely immaterial in what position the indicator light is installed. It may be viewed by the operator in any position of possible vision from front or sides, and the intensity of the emitted glow will be dimmed proportionately both at the front and at the sides, as shell 18 is rotated from a full open to a full closed position of the iris member.

In the modified forms of the invention shown in Figs. 3–5, the construction is the same as in Figs. 1, 2 with the exceptions noted: Fig. 3 shows how light apertures 26 instead of being open, may

be filled with small jewels 50 which may be of the same material as lens 22 or of any other light transmitting material. Jewels 50 are preferably provided with faceted faces 51 for emitting rays of light in all directions.

Fig. 4 discloses how, if desired, the jewel elements 51' may be formed integrally with an enlarged rim portion 23' of the lens 22', the entire lens and jewel body being integrally molded into shell 18.

Fig. 5 illustrates how shell 18' may have light apertures 26' which are considerably elongated in a circumferential direction and separated by thin axially extending web members 52 bridging between the body of shell 18' and the retainer flange member 21 thereof.

Fig. 6 illustrates how the parts may be arranged so as to obtain only front emission in the closed position of the iris, with lateral emission cut off, whereas in all open positions of the iris there will be lateral emission as well as front emission, the same as in the other forms of the invention. In this modification, the narrower portions 43' of ring 28' are wider than the portions 43 of Figs. 1–5, thereby cutting off the outer portions of light beams 46 where they pass through openings 45, to an extent such that none of the rays strike lens 22 at a sufficiently spreading angle to be refracted outwardly to the rim 23 of the lens. Light rays passing to the lens through the central aperture between the iris segments 29 in any position of substantial opening thereof will, however, include some rays which will be refracted outwardly to the lens rim.

It may now be noted that in the preferred arrangement of Fig. 2, the portions 43 of ring 28 are sufficiently narrow so that the radially outer limits of light openings 45 are positioned so as to allow a substantial quantity of light rays to enter lens 22 at a sufficiently spreading angle to effect outward refraction to the rim 23, from which these rays will be diffused through openings 26 as previously pointed out.

I claim:

1. In a lens holder and iris cap for an indicator light having a barrel adapted to house a lamp bulb in its outer end: a mounting ring attachable to said outer end and having a radially inwardly projecting face flange defining a primary light emission aperture associated closely with the tip of said lamp; a retainer shell having a cylindrical lateral wall portion receiving and rotatably mounted on said mounting ring, said shell having at its forward end a radially inwardly extending retainer flange defining a forward light emitting window and having in said lateral wall portion, adjacent said retainer flange, a plurality of lateral light emitting apertures; a lens mounted in said window and having a rim portion retained behind said retainer flange and adapted to emit diffused light rays from its periphery through said lateral apertures; an operating ring mounted within said shell immediately behind said lens and rotatable with said shell; a pair of iris segments disposed between said face flange and said operating ring and adapted to come together along a diametral adjoining line to collectively define a cover for said primary aperture to cut off direct light rays from said lamp; connections between said operating ring and said segments for moving them, upon rotation of said shell, between their adjoining positions and separated positions in which they define a central opening for passage of direct rays forwardly from said lamp; said face flange having a forward face spaced axially from the

periphery of said iris in the closed position thereof to define a pair of arcuate passages for the emission of indirect light rays in a pair of semi-conical beams passing forwardly from said lamp to said lens and adapted to emit minimum illumination from both the periphery and face of said lens.

2. A lens holder as defined in claim 1, wherein the periphery of said lens is spaced radially inwardly from the inner wall of said lateral wall portion of the shell to define an annular space in which air may circulate by convection in and out of said lateral apertures and around the periphery of the lens to cool the same.

3. A lens holder as defined in claim 1, including a plurality of small lens mounted in respective lateral apertures for increasing the diffusion of light rays passing therethrough.

4. A lens holder as defined in claim 1, wherein said lens has an integral rim extending radially outwardly to said lateral apertures and having small lens projections integral therewith and extending through respective apertures.

5. A lens holder as defined in claim 1, wherein said lateral apertures are in the form of circumferentially elongated slots separated by narrow web portions of said lateral wall portion.

6. In a lens holder and iris cap for an indicator light having a barrel adapted to house a lamp bulb in its outer end: a mounting ring attachable to said outer end and having a radially inwardly projecting face flange defining a primary light emission aperture associated closely with the tip of said lamp; a retainer shell having a cylindrical lateral wall portion receiving and rotatably mounted on said mounting ring, said shell having at its forward end a radially inwardly extending retainer flange defining a forward light emitting window and having in said lateral wall portion, adjacent said retainer flange, a plurality of lateral light emitting apertures; a lens mounted in said window and having a rim portion retained behind said retainer flange and adapted to emit diffused light rays from its periphery through said lateral apertures; an operating ring mounted within said shell immediately behind said lens and rotatable with said shell; a pair of iris segments disposed between said face flange and said operating ring and adapted to come together along a diametral joining line to collectively define a cover for said primary aperture to cut off direct light rays from said lamp; connections between said operating ring and said segments for moving them, upon rotation of said shell, between their adjoining positions and separated positions in which they define a central opening for passage of direct rays forwardly from said lamp; said face flange having in its forward side a recessed frusto-conical face adjacent said primary aperture and spaced from the periphery of said iris in the closed position thereof to define a pair of arcuate passages for the emission of indirect light rays in a pair of semi-conical beams passing forwardly and radially outwardly from said lamp to said lens and adapted to emit minimum illumination from both the periphery and face of said lens.

7. In an indicator light having a housing and a lamp bulb therein: a lens holder including a shell rotatable on said housing, said shell having a retainer flange defining a front window and having a side wall provided with a plurality of apertures adjacent said flange; a lens having a rim portion retained behind said flange and lying in the common plane of and with the edge of said rim communicating with said apertures; means to intercept and block substantially all direct rays from said lamp bulb to said apertures; and iris means adapted upon rotation of said shell, to define a central light opening for the passage of light rays from said lamp to said lens, said lens being adapted to transmit some of said rays forwardly through said window and to transmit others of said rays laterally to said rim, and to diffuse said laterally transmitted rays from said rim through said apertures.

8. An indicator light as defined in claim 7, including annular means interposed between said iris means and said lamp bulb, defining a primary light opening which, in the fully closed position of the iris means, provides a narrow arcuate light passage at the periphery of the iris means, for transmitting a minimum quantity of light rays to said lens.

9. In an indicator light having a housing and a lamp bulb therein; a lens holder including a shell rotatable about said housing, said shell having a retainer flange defining a front window and having a side wall provided with a plurality of apertures adjacent said flange; a lens having a rim portion retained behind said flange and registering with said apertures; iris means adapted, upon rotation of said shell, to define a central light opening for the passage of light rays from said lamp to said lens, said lens being adapted to transmit some of said rays forwardly through said window, to transmit others of said rays laterally to said rim, and to diffuse said laterally transmitted rays from said rim through said apertures; annular means interposed between said iris means and said lamp bulb, defining a primary light opening which, in the fully closed position of the iris means, provides a narrow arcuate light passage at the periphery of the iris means, for transmitting a minimum quantity of light rays to said lens; and a ring disposed immediately ahead of said iris means and defining a light opening of sufficient radius to allow some of said minimum light rays to spread laterally sufficiently to reach said lens rim and be diffused through said lateral apertures.

10. An indicator light as defined in claim 9, wherein said light opening is of such restricted radius and said ring is so positioned as to intercept the lateral portions of said minimum light rays proceeding in a direct path toward said apertures, while transmitting inner portions of said minimum rays into said lens adjacent said rim for said diffusion.

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