

Aug. 25, 1959

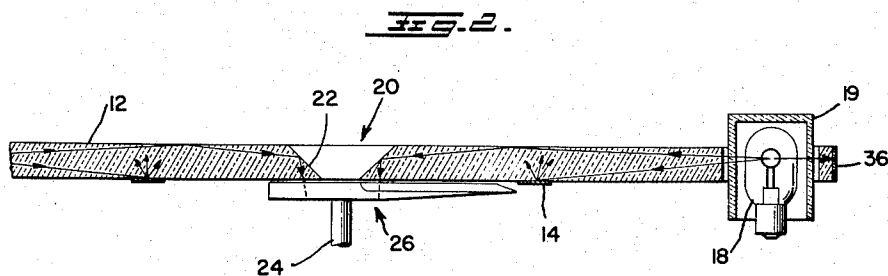
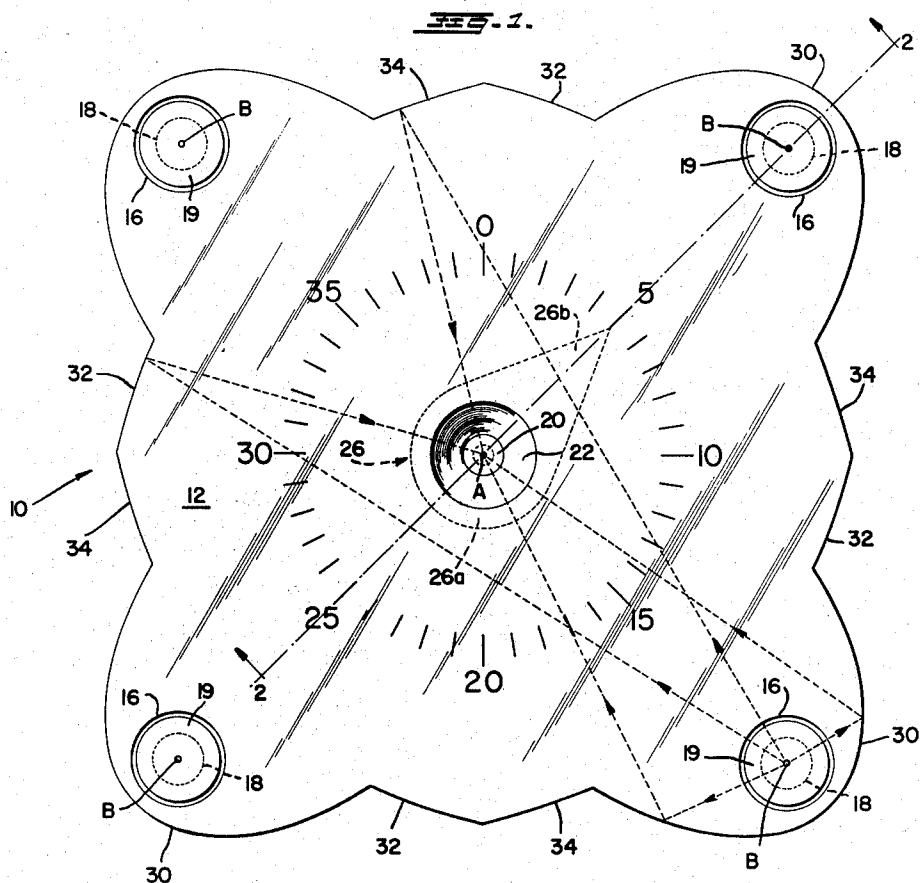
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2,900,949

ELLIPTICAL REFLECTOR FOR INSTRUMENT DIALS

Filed Oct. 4, 1956

3 Sheets-Sheet 1



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FIG. 7.

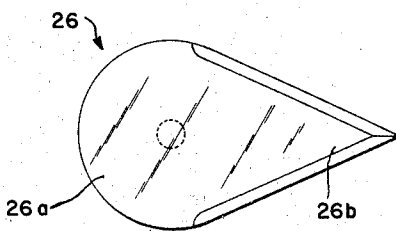
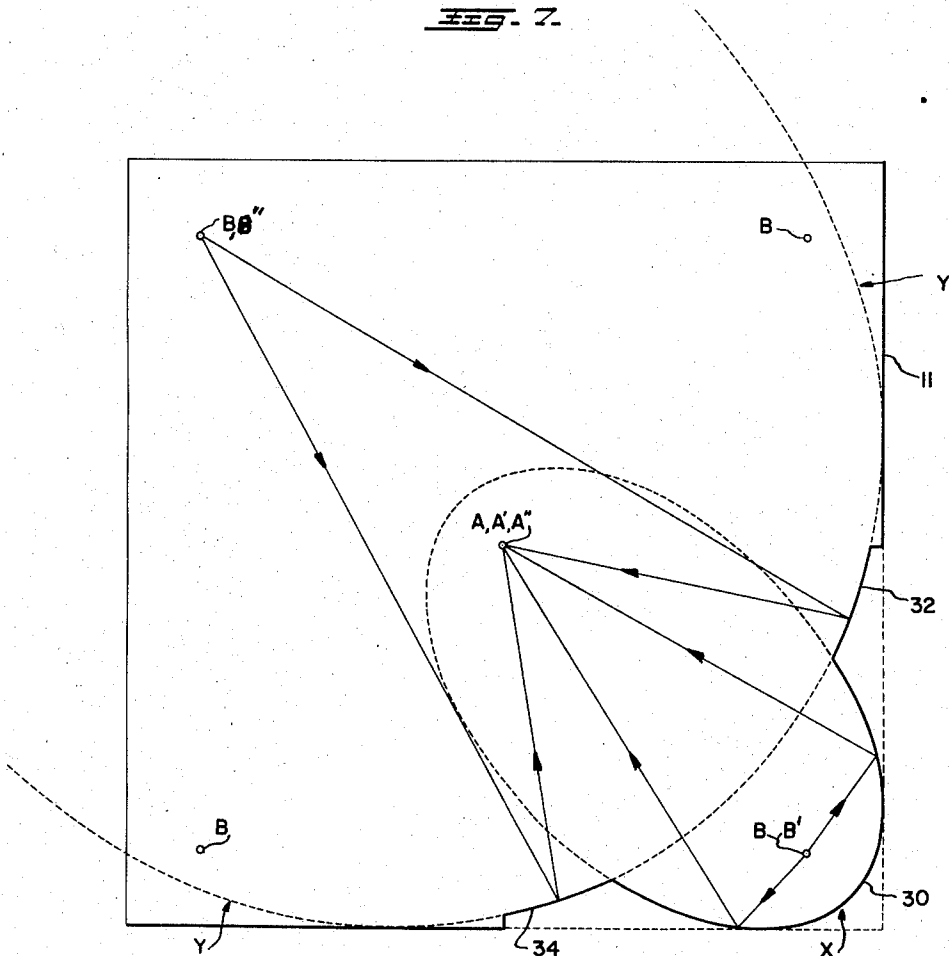


FIG. 3.

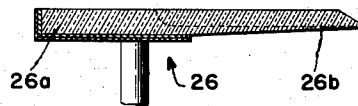


FIG. 4.

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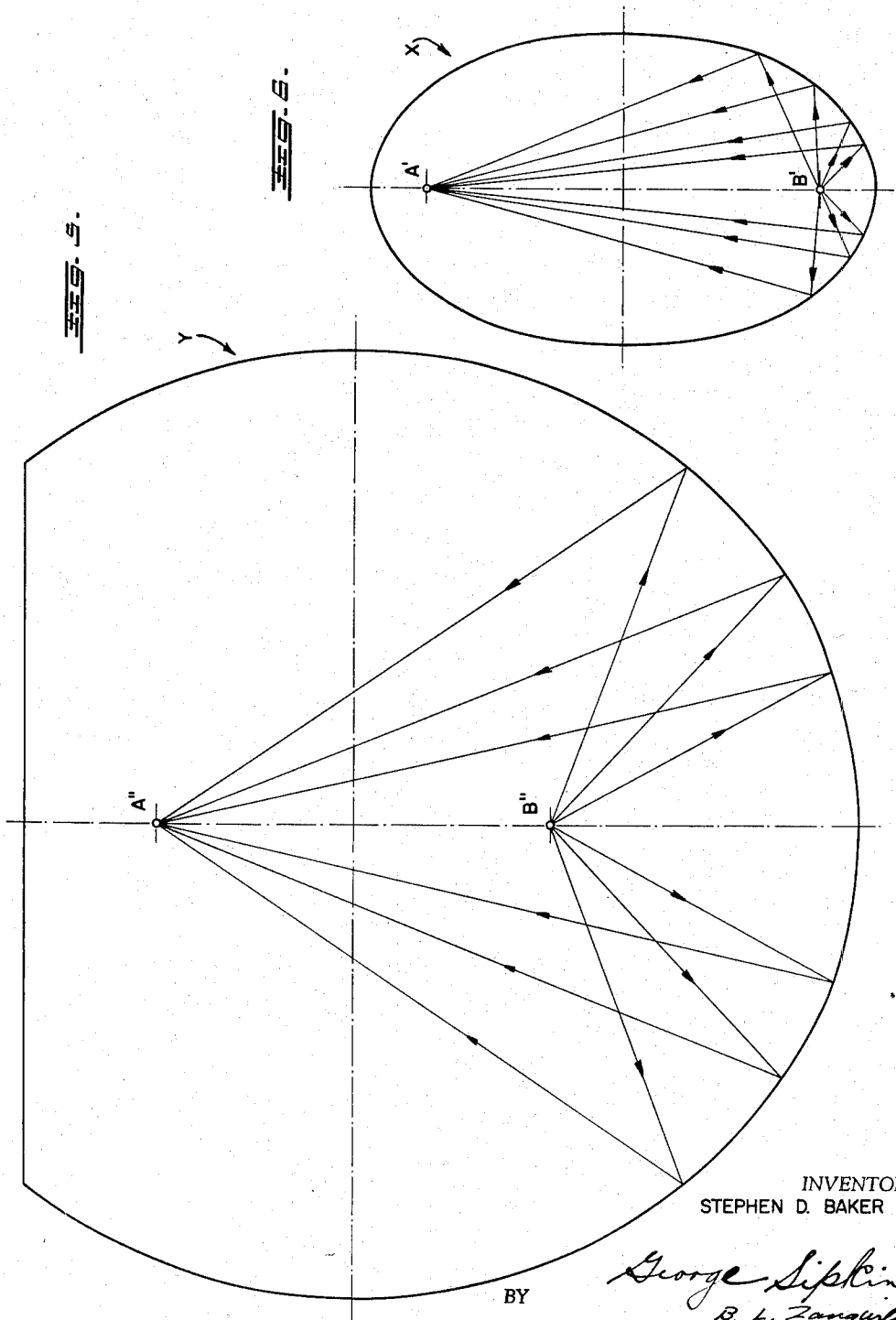
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ELLIPTICAL REFLECTOR FOR INSTRUMENT DIALS

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3 Sheets-Sheet 3



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ELLIPTICAL REFLECTOR FOR INSTRUMENT DIALS

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Application October 4, 1956, Serial No. 614,036

13 Claims. (Cl. 116—129)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to illumination, and more particularly it relates to edge illumination of dials, pointers and the like.

The desire to simplify the illumination of dials and pointers of instrument panels has led to various designs of the dials themselves. One such design, the invention of Perry B. Newton, Jr., disclosed in his patent application Serial No. 614,035, filed October 4, 1956, concurrently herewith, comprises, in simplified form, a single dial and light-transmitting panel formed of a plane highly transparent plate, having its front and back surfaces in parallel relation to each other and polished to provide smooth optical surfaces. The plate, which is preferably rectangular in plan is provided with an opening in each of its corners, in each of which is located a miniature light bulb. Numerals, or other indicia, graduations or the like, are etched or painted directly on the rear or reverse face of the transparent plate. The plate is provided with a beveled opening at its center, which opening is formed as a truncated cone beneath which and centered relative thereto is the hub of a pointer. The pointer is formed of transparent, light-transmitting material and its converging edges are beveled and painted with a suitable light-reflecting material as to harmonize with the indicia painted or etched on the plate. The arrangement is such that the indicia are illuminated directly by light rays from the lamps through the transparent panel, whereas, the pointer is illuminated by light rays reflected from the conical surface in the panel to the hub of the transparent pointer.

The advantages of the simplified dial disclosed in the above Newton patent application are many and it has many uses. However it does have one disadvantage, particularly in installations where uniform brightness is a prerequisite. That is, while the dial characters are illuminated to the desired degree of brightness, the pointer is often less bright, which contrast in brightness is objectionable for certain exacting installations.

It is therefore a specific object of the present invention to provide an illuminated dial and pointer wherein the indicia, graduations or the like on the dial and the pointer, or pointers are illuminated to the same degree of brightness.

A broad object of this invention is to concentrate light rays from one or more sources of light upon a reflecting surface for transmission therefrom.

Another object of this invention is to converge toward a point, light rays diverging from a source.

Another object of the invention is to uniformly concentrate, upon a reflecting surface, light rays from one or more sources of light.

The inventive concept that led to the present invention is based on the geometrical fact that, at any point on an ellipse, light rays from the two foci make equal

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angles with the normal to the ellipse at that point. Hence, if a source of light were placed at one focus of an elliptical mirror, its rays would converge at the other focus. Following this concept, one embodiment of the invention consists of shaping the corners of a plane, transparent light-transmitting panel into elliptical segments each of which, when silvered, reflects light from a lamp located at one focus of each elliptical segment to the center of the panel which is the other or common focus. Thus, the light rays are concentrated at the center of the panel, from whence they may be reflected as by a truncated conical surface located at the center of the panel to, for example, a pointer located either in front of or behind the panel.

In one practical embodiment of the invention, as pointed out in detail hereinafter, an illuminated dial, such as that disclosed in the above patent application of Perry B. Newton, is improved by forming the corners of the light-transmitting panel as elliptical segments each of which segments has one focus at the center of a lamp and the other focus at the center of the panel, which center is formed with an opening having a truncated conical surface. Between the corner elliptical segments, on what would otherwise be straight, marginal edges of the panel, are formed companion or complementary elliptical segments, each having one focus at the center of one of the lamps and a common focus at the center of the panel. Thus, light rays emitted from the several lamps are transmitted to the conical surface at the opening in the center of the panel by both direct transmission through the panel and by reflection from the elliptical segments and then through the panel. From the conical surface, the light rays are reflected, for example, to the hub of a transparent pointer located either above or below the opening in the panel, depending upon the direction of bevel of the conical surface. In this manner, light is conserved and the pointer is illuminated to the same degree of brightness as are the indicia formed on the panel.

The invention, together with the above and other objects and advantages thereof, is set forth in more technical detail in the following description and accompanying drawings, wherein:

Fig. 1 is a top plan view of an illuminated dial and pointer in accordance with this invention;

Fig. 2 is a diagonal section taken on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of the pointer;

Fig. 4 is a longitudinal section through the pointer;

Fig. 5 is a plan view of a larger of two ellipses, partly broken away, illustrating a principle of the invention;

Fig. 6 is a plan view of the smaller of the two ellipses; and

Fig. 7 is a plan view illustrating a use of the two ellipses in practicing the invention.

Referring first to Figs. 1 and 2 of the drawings, in accordance with this invention the dial indicated generally by reference numeral 10, includes a generally square light-transmitting panel 12. The light-transmitting panel comprises a relatively plane highly transparent plate, having its front and back surfaces in parallel relation to each other and polished to provide smooth optical surfaces. The panel is preferably fabricated from an acrylic resin or methyl methacrylate plastic material of the thermoplastic type such as, for example, commercial "Plexiglas" or "Lucite." Suitable numerals, graduations or other indicia or the like, shown in Fig. 1, and indicated at 14 in Fig. 2, are etched or painted, preferably white, on the back or reverse surface of the panel.

Panel 12 is provided with a cylindrical opening 16 at each of its four corners, in each of which openings is centered a miniature lamp bulb 18 provided with a red

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filter 19. At its center, the panel is provided with an opening 20 bound by a beveled surface 22, formed as a truncated cone with a slant or bevel preferably of 45°, as shown in Fig. 2. The beveled surface is polished so as to provide a smooth optical surface. Centered below the opening 20 is a shaft 24 upon which is mounted a pointer 26. Shaft 24 is supported in any suitable manner and is driven by any suitable means, depending upon the intended use of the dial.

The pointer, if desired, may be mounted above the panel, in which case the bevel of conical surface 22 would slant in the opposite direction of that shown in Fig. 2. The pointer is made of clear, light-transmitting plastic with the hub portion 26a thereof (Fig. 4) coated at its side and bottom surfaces first with a white light-reflecting coating upon which is placed a black opaque coating. As shown, the converging edges 26b (Fig. 3) of the pointer proper are beveled, which beveled edges are coated with a white, light-reflecting coating.

Returning to Figs. 1 and 2, in accordance with this invention, each of the corners of panel 12 is shaped as a segment, 30, of an ellipse, each of which ellipses has one focus, B, at the center of the filament of a lamp 18 and its other focus A at the center of the opening 20 in the center of the panel. Intersecting the corner elliptical segments 30 are pairs of side elliptical segments 32 and 34. Each of the side elliptical segments, 32 and 34, has a common focus, focus A, at the center of the panel and its other focus at the focus, B, at one of the lamps, as described hereinafter. Thus, it is seen that the entire marginal edge of the panel is made up of convex surfaces in the form of elliptical segments, and for better light-reflecting qualities these surfaces are polished and are coated with a metallic, light-reflecting coating 36 (Fig. 2), such as aluminum foil. Theoretically, ellipsoids of revolution, which are true aplanatic surfaces, may give more efficient reflection. However, from a practical standpoint, the elliptical cylindrical surfaces, as shown, are preferred and they produce excellent results.

One practical example of producing the panel with marginal edges thereof made up entirely of elliptical segments, is as follows:

Two ellipses X and Y (Figs. 6 and 5) are calculated and drawn so that they fit the dimensions of the desired panel as well as having their foci A'—B' and A''—B'', respectively, the same distance apart. The center, A, of the panel, and the centers, B, of the lamps (Fig. 7) are located on a card 11 of the same size as the desired panel. Ellipse X is then superimposed and oriented on ellipse Y in a manner that foci A' and A'' coincide and foci B' and B'' are equidistant from A'—A'' with the now three foci in a straight line. The ellipses X and Y so superimposed are now superimposed on the card 11 (Fig. 7, only a portion of ellipse Y being shown) in a manner that the common focus A', A'' coincides with the center A of the card, focus B' of ellipse X coincides with center B of one lamp and focus B'' of ellipse Y coincides with the center B of the diagonally opposite lamp. The segment 30 of ellipse X and the segments 32 and 34 of ellipse Y are then marked or traced on the card. Then with A, A', A'' as a center the superimposed ellipses X and Y are rotated 90° as a unit relative to the card and until focus B' of ellipse X coincides with the center B of the next lamp in the direction of rotation and focus B'' of ellipse Y coincides with the center B of the now diagonally opposite lamp, and segments 30, 32 and 34 are traced on this portion of the card. The superimposed ellipses X and Y are rotated in the same direction and in the same manner through two more stages of 90° each and at each stage the segments 30, 32 and 34 are traced on the card. The outline of segments now completed on the card, the panel is cut out by any suitable means, as by means of a pantographic engraver. The elliptical segments are then polished and finally coated with a metallic coating, such as aluminum foil. The

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etching or painting of the indicia, graduations or the like on the panel and the assembly of the lamps and the pointer are obvious steps that need no explaining here.

It should be noted, except for thickness of coatings and the like, which have been exaggerated for the purpose of illustration, the size of the dial (Fig. 1) and of the ellipses (Figs. 5, 6 and 7) are substantially to scale, and the dial is a substantial scale reproduction of an instrument constructed in accordance with this invention. In practice, and for sake of appearance, the sides and rear of the instrument are enclosed by a casing, not shown.

In operation, light rays from the several lamps strike the various elliptical segments from which they are reflected toward the common focus A, the center of the panel. Thus the light rays converge toward the center of the panel. Before reaching the center of the panel, however, the light rays are intercepted by the beveled surface that bounds the center opening. Thus, this beveled surface is uniformly illuminated by the converging rays. From this beveled surface the light rays are reflected into the hub of the pointer. The pointer being made of a clear transparent plastic and the outside surface of the hub being coated with a black opaque lamination on a white reflecting coating, the light rays are piped into the pointer proper to thereby illuminate the white, beveled edges thereof. Thus, the pointer is illuminated to the same degree of brightness as are the indicia, graduations or the like on the panel.

As disclosed in the previously-mentioned patent application of Perry B. Newton, Jr., various means other than the beveled surface at the center opening of the panel may be used for redirecting light rays into the pointer. For example, the opening in the center of the panel may be cylindrical and the hub of the pointer may be beveled and located within the cylindrical opening, or any suitable surface may be used for collecting the converging rays and redirecting such rays to an object to be illuminated.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art to which this invention appertains, and it will, of course, be understood that, while but one embodiment of the invention has been illustrated and described herein, changes in form, proportions and minor details of construction may be resorted to without departing from the spirit of the invention and scope of the claims.

What is claimed is:

1. An illuminated device comprising a panel of light-transmitting material having two smooth plane substantially parallel surfaces, said panel being formed with a first aperture therein normal to said surfaces and spaced from the edges of the panel, a second aperture formed in said panel and spaced inwardly of said first aperture, said second aperture being bound by a beveled surface, a light source in said first aperture, an edge of said panel at least partly surrounding said first aperture being convex and having thereon a light-reflecting surface having one focus thereof at said first aperture and a second focus at the center of said second aperture, whereby light from said source is reflected by said convex surface and converged on the beveled surface of said second aperture.

2. An illuminated device as set forth in claim 1 wherein said convex surface is a segment of an ellipse.

3. An illuminated device comprising a panel of light-transmitting material having two smooth plane substantially parallel surfaces, said panel being formed with a plurality of apertures therein normal to said surfaces and spaced substantially equidistant apart around marginal edges of the panel and inwardly thereof, a light source in each of said apertures, said panel being formed with a center aperture substantially centered relative to said plurality of apertures and bound by a beveled surface, the edges of the panel being formed of convex segments, each having reflecting surfaces thereon and each having one

focus at one of the plurality apertures and another focus at the center of the center aperture, whereby light from each of said light sources is reflected by said reflecting surfaces through the panel and converged on the beveled surface bounding the center aperture for reflection thereby.

4. An illuminated device as set forth in claim 3 wherein the convex segments are segments of ellipses.

5. An illuminating device as set forth in claim 3 which includes a pointer mounted adjacent the beveled surface bounding the center aperture for illumination thereby, and wherein said panel is formed with indicia on one of the parallel surfaces thereof in a path of the pointer for viewing through the other parallel surface.

6. An illuminated dial comprising a panel of light-transmitting material having plane front and back surfaces substantially in parallel relation one to the other and indicia formed on one of such surfaces, said panel being formed with a plurality of apertures around marginal edges thereof normal to the parallel surfaces and spaced inwardly of such edges and an additional aperture formed in the panel centrally of the plurality of apertures and bound by a beveled surface, said plurality of apertures being uniformly spaced from each other and from the central aperture, a light source in each of the plurality of apertures, and a pointer mounted adjacent the central aperture, said pointer being formed of light-transmitting material and including a hub section mounted centrally of the central aperture in position to receive reflected light from the beveled surface bounding such aperture and a pointer section having beveled portions thereof adapted to intercept light transmitted by the hub section, said indicia being uniformly spaced around and concentric with the beveled surface of the central aperture, edge portions of the panel adjacent each of the plurality of apertures being convex and having thereon a light-reflecting surface, each of said light-reflecting surfaces having one focus thereof at its respective aperture and another and common focus at the center of the central aperture, whereby light from each of said light sources is reflected by said reflecting surfaces through the panel and converged on the beveled surface bounding the central aperture for reflection thereby to the hub section of the pointer, said reflecting surfaces, said light sources, said indicia, said beveled surface and said pointer being so constructed and arranged that light from the sources illuminates the indicia and the pointer to substantially the same degree of brightness.

7. An illuminated dial as set forth in claim 6 wherein the entire marginal edge of the panel is formed of elliptical segments each having thereon a reflecting surface and each reflecting surface having one focus at one of the plurality of apertures and each having a common focus at the center aperture.

8. An illuminated device comprising a substantially rectangular panel of light-transmitting material having two smooth plane substantially parallel surfaces, said panel being formed with a plurality of apertures therein one at each corner thereof, and one substantially at the

center thereof, said corner apertures being normal to said parallel surfaces and spaced inwardly from the edges of the panel, said center aperture being bound by a surface beveled relative to said parallel surfaces, a light source in each of said corner apertures, an edge of said panel adjacent each of said corner apertures being convex and having thereon a light-reflecting surface, and each of said convex surfaces having one focus at its respective corner aperture and a common focus at said center aperture, whereby light from each of said sources is reflected from the convex surfaces through the panel and converged on the beveled surface bounding the center aperture for reflection therefrom.

9. An illuminated device as set forth in claim 8 wherein each of said convex surfaces is a segment of an ellipse.

10. An illuminated device as set forth in claim 8 wherein the edges of the panel between the corner convex surfaces are convex and have thereon a light-reflecting surface, and each of said last convex surfaces having one focus at one of said corner apertures and a second focus at the center of the panel, whereby light from each of said sources is reflected from respective ones of the last-named convex surfaces through the panel and converged on the bevel surface bounding the center aperture for reflection therefrom.

11. An illuminated device as set forth in claim 10 wherein each of said convex surfaces is a segment of an ellipse.

12. An illuminated device as set forth in claim 8 which includes a pointer mounted adjacent the beveled surface of the center aperture for illumination thereby and wherein indicia are formed on one of the parallel surfaces of the panel juxtaposed a path of the pointer.

13. An illuminated device comprising a panel of light-transmitting material having two plane substantially parallel surfaces, said panel being formed with a first aperture therein spaced from the edges thereof, a light source in said first aperture, a second aperture in said panel and spaced inwardly of the first aperture, an edge of the panel at least partly surrounding the first aperture being convex and having thereon a light-reflecting surface having one focus thereof at said first aperture and a second focus at the second aperture, whereby light rays from said source are reflected by said convex surface and converged toward the second aperture, and light reflecting means associated with the second aperture for intercepting the converged light rays.

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