

Dec. 14, 1965

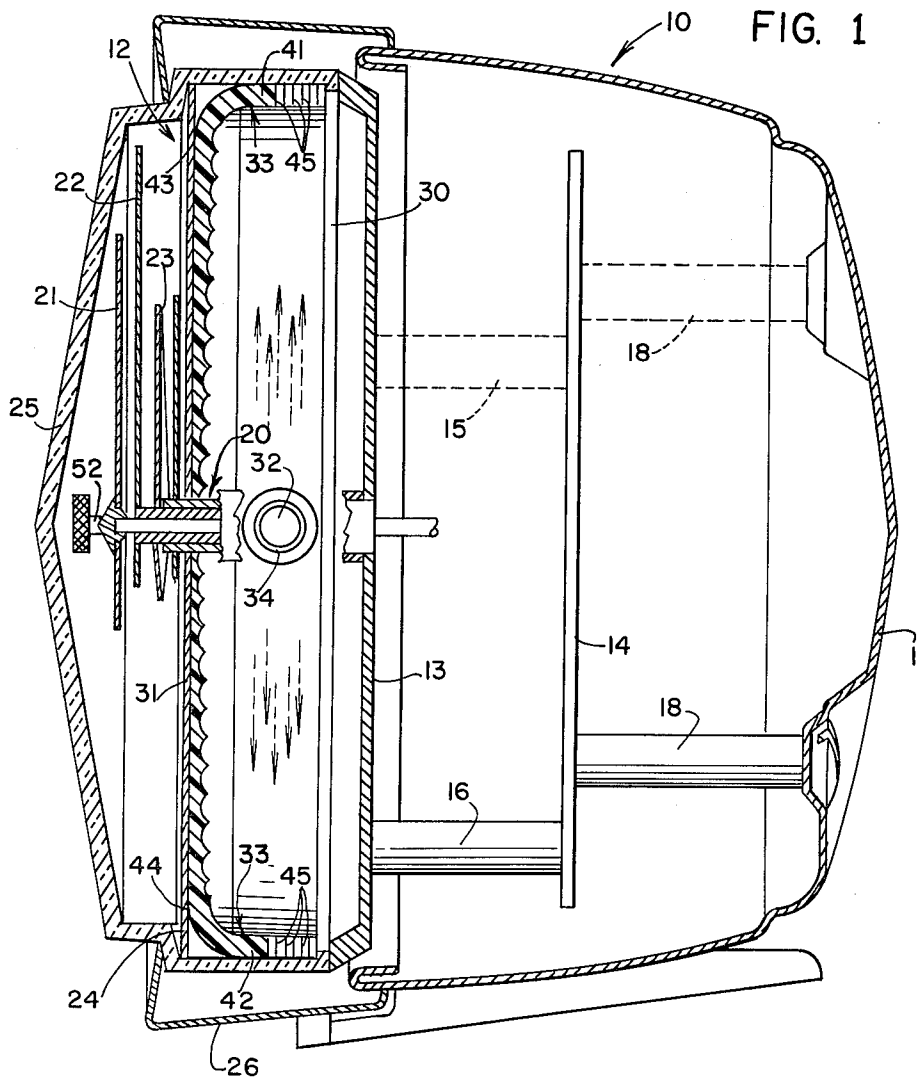
D. E. PROTZMANN

3,223,833

ILLUMINATED DIAL

Filed Dec. 15, 1964

2 Sheets-Sheet 1



INVENTOR.

Donald E. Protzmann

BY *Louis Altman.*

Attys.

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2 Sheets-Sheet 2

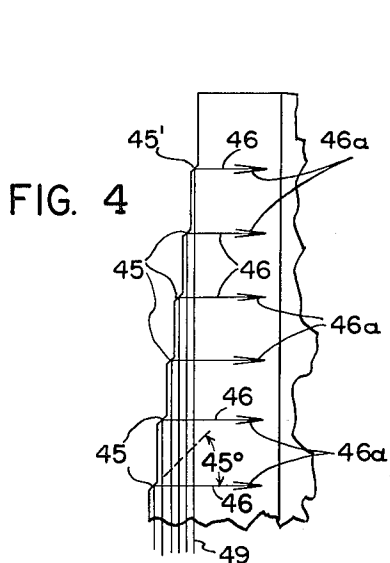
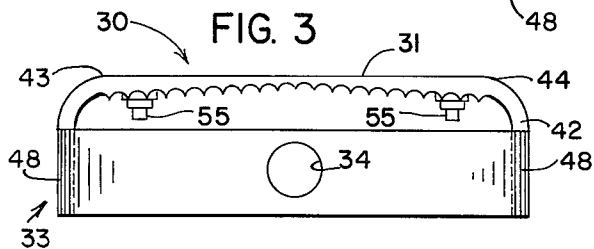
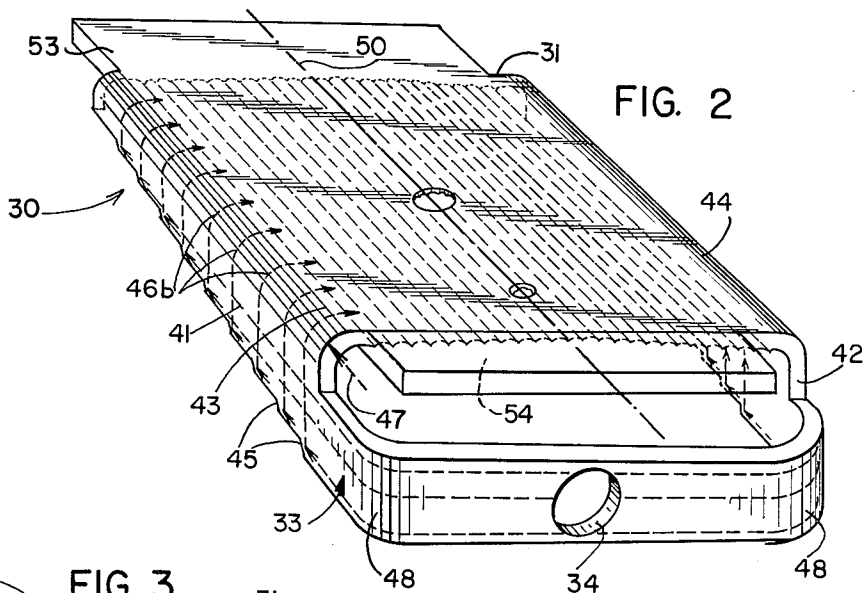
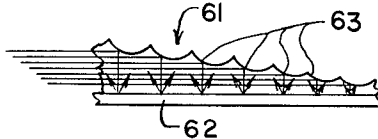


FIG. 5



FIG. 6



INVENTOR.

Donald E. Protzmann

BY *Louis Altman*

Attys.

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ILLUMINATED DIAL

Donald E. Protzmann, Athens, Ga., assignor to General Time Corporation, New York, N.Y., a corporation of Delaware

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6 Claims. (Cl. 240-6.43)

This application is a continuation-in-part of my co-pending application Serial No. 223,416, entitled "Illuminated Dial," filed September 3, 1962.

The present invention relates generally to dial assemblies for clocks or other information displaying instruments and, more particularly, to illuminatable dials of this type.

It is a primary object of the present invention to provide an illuminatable dial assembly utilizing a single light source which develops illumination completely around and across the dial display field without producing shadows from shafts and the like extending through the dial. In this connection, it is an object of the invention to provide such a dial assembly which permits a number of shafts to extend through the dial at a plurality of spaced points without producing shadows from any of the shafts.

It is still another object of the invention to provide an illuminatable dial assembly of the above character which facilitates mounting of the dial assembly on its supporting plate. A related object is to provide such an assembly which permits mounting pins or studs to be molded as integral parts of the light-transmitting member.

A further object is to provide a dial assembly of the foregoing type which substantially increases the ratio of total dial area to lighted area for rectangular dials.

A still further object of the invention is to provide a dial assembly as characterized above which provides increased flexibility in the design of the instrument with which the dial assembly is employed.

Another object is to provide such a dial assembly which is extremely versatile with regard to the variety of illuminative and decorative effects which can be obtained by slight modifications in the basic structure of the dial assembly.

Yet another object of the invention is to provide such a dial assembly which is inexpensive to manufacture and easy to install so as to be suitable for high volume production.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIGURE 1 is a transverse section through a typical clock embodying a dial assembly of the present invention;

FIG. 2 is a perspective of the modified dial assembly employed in the clock illustrated in FIG. 1 with arrows showing the path of light transmission through the rim;

FIG. 3 is an end elevation view of the dial assembly of FIG. 2;

FIG. 4 is an enlarged fragment of the rim portion of the dial assembly of FIGS. 1 through 3 with arrows indicating the direction of light transmission therethrough;

FIG. 5 is an enlarged section of a fragment of the face portion of the dial assembly of FIG. 1 with arrows indicating the direction of light transmission therethrough; and

FIG. 6 is an enlarged section of a fragment of the face portion of a modified dial assembly with arrows indicating the direction of light transmission therethrough.

While the invention will be described in connection with certain preferred embodiments, it will be understood that I do not intend to limit the invention to those embodiments. On the contrary, I intend to cover all alter-

natives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to FIGURE 1, there is shown an information displaying instrument taking the form of a clock 10 comprising a cover shell 11 and an illuminatable dial assembly 12 embodying the present invention. Included within the housing is a clock mechanism (not shown) mounted between a front frame plate 13 and a rear frame plate 14 spaced apart by pillars 15 and 16. The cover shell 11 is preferably generally cup shaped and is telescoped over the rear frame plate 14 and the clock mechanism so as to be supported by pillars 18 secured to the frame plate 14. When so supported, the shell 11 together with the dial assembly 12 form an attractive housing or case for the clock. An electric motor (not shown) is mounted within the housing and is coupled to a shaft at sleeve stack 20 which supports the usual second, minute, and hour hands 21, 22 and 23, respectively. The hands 21 through 23 sweep over a translucent clock dial plate 24 and are enclosed within a transparent lens 25. The lens 25, the dial plate 24, and the front frame plate 13 are all held firmly nested together within a decorative bezel 26 which may be secured to the frame plate 13 by suitable retainer clips as described in U.S. Patent No. 3,025,663 for example.

In accordance with the present invention the illuminatable dial assembly comprises a member of light-transmitting material including a display field face portion having a pair of opposed side edges and a peripheral rim having a lamp receiving opening therein and a pair of opposed side portions integral with the side edges of the face portion, the edges of the two side portions of the rim defining internally deflecting surfaces for directing light from the lamp toward the face portion of the assembly in a direction substantially normal to the side edges of the face portion, the face portion being tapered in thickness inwardly from the two side edges so as to disperse light from the rim over the face portion. Thus, the dial assembly 12 in the embodiment illustrated in the drawings includes a cup-shaped member 30 of light-transmitting material having a substantially flat, rectangular display field face 31 from which light is dispersed and which is peripherally lighted by a single lamp 32. Preferably, the member 30 is unitarily formed of clear polystyrene or of an acrylic resin such as "Lucite" or "Plexiglas." The member 30 includes a generally U-shaped peripheral rim 33 which is curved from the display field face 31 and formed with an aperture 34 which receives the lamp 32. The lamp 32 may be mounted in a socket formed integrally with and within the clock housing. An illuminated portion of the lamp 32 is aligned with the side edges of the aperture 34 so that light from the lamp is carried peripherally about the member 30 within the rim 33.

In accordance with one aspect of the invention, the rim 33 includes a pair of opposed, generally parallel side portions 41 and 42 which are integral with the parallel side edges 43 and 44, respectively, of the rectangular face 31. For the purpose of directing light from the lamp opening 34 toward the face portion 31, the edges of the rim side portions 41 and 42 are stepped or serrated so as to define internally reflecting surfaces 45. In the illustrated embodiments, the reflecting surfaces 45 are spaced evenly along the rim edge at 45° angles with respect to lines 46 that are perpendicular to the display field face 31 (see FIG. 4). The surfaces 45 all have approximately the same surface area and, as a result, the light traveling from the lamp 32 about the rim 33 is reflected by the surfaces 45 so as to define a multiplicity of light rays of approximately equal intensity which are transmitted through the rim portions 41 and 42 to the side edges 43

and 44, respectively, of the face 31. Because of the 45° angle disposition of the surfaces 45, the light is reflected so that the rays move perpendicularly toward the face 31 as indicated by the arrows 46a in FIG. 4.

The curved portion of each of the side edges 43 and 44 of the member 30 between the rim 33 and the display field face 31 has an outer radius 47 (see FIG. 2) that is effective to channel light from the reflecting surfaces 45 into the display field face portion 31, as indicated by the arrows 46b in FIG. 2. If the member 30 is formed of light-transmitting plastics of the type referred to above, this radius should be at least three times the thickness of the material so as to insure total internal reflection. This standard rule of thumb for light-conducting plastics is, of course, also applicable to the curved corner portions 48 of the rim 33.

In order to insure that the light from the lamp 32 is transmitted to the display field face 31 along the entire length of each of the side edges 43 and 44, the rim side portions 41 and 42 decrease in depth going away from the lamp 32 (see FIG. 4) so that there is a path of solid material from the lamp 32 to each of the reflecting surfaces 45, such as the path 49 indicated in FIGURE 4 between the lamp 32 and the reflecting surface 45'. It will be appreciated that the lamp 32 supplies light to the entire series of reflecting surfaces 45 on each rim side portion 41 and 42.

To disperse the light from the reflecting surfaces 45 over the entire area of the display field face 31 between the two side edges 43 and 44, the face portion 31 is tapered in thickness inwardly from each of the two side edges 43, 44. Preferably, the reflecting surface of the face portion 31 is also serrated in parallelism with the side edges 43 and 44 to insure even distribution of the light across the entire area of the face 31. In the particular embodiment illustrated in FIGURES 1 through 4, the back surface of the display field face 31 of the member 30 slopes uniformly from each side edge 43 and 44 toward a center line 50 which represents the line of minimum thickness of the face 31. This uniform tapering results in light beams reflected forwardly from the display field face 31 with substantially uniform intensity over the entire area of the translucent dial plate 24.

One of the most important features of the dial assembly of this invention is that the light is transmitted inwardly toward the center line 50 from opposite directions, i.e., from both the opposed side edges 43 and 44 of the face 31. Consequently, it is possible to have shafts for switches, time sets, alarm sets and the like, such as the shaft 52 in FIG. 1, extending through the dial along the center line 50 without producing any shadows, since they are lighted from both sides. Moreover, since the light rays in the particular embodiment illustrated are directed toward the center line 50 along generally parallel paths, rather than along radial paths toward a single center point for example, it is possible to form unlighted areas such as the plane-like sections 53 and 54 at the edges of the conducting member 30 (see FIG. 2). These sections 53 and 54 may be utilized, for example, to support pins or studs 55 (FIG. 3) for use in mounting the dial assembly on the clock movement front plate or any other supporting plate. In one example of the invention, the pins or studs 55 are mounted as integral parts of the sections 53 and 54 so that the ends of the studs that protrude through the supporting plate may be heat crimped as a simple and inexpensive means of fastening. Furthermore, with the generally parallel transmission of the light rays across the display field face 31, the planar sections 53 and 54 may be open on three sides, as shown in FIG. 2, so as to form pairs of unobstructed, opposed edges to further facilitate the mounting and installation of the dial assembly.

In FIGURE 6, there is illustrated a fragment of a modified display field face for the cup-shaped dial assembly member 30. This display field face 61 is similar to the face portion 31 previously described except that the in-

ward taper and the reflecting serrations are formed on the outside rather than the inside surface of the display field face. This construction is adapted for use with an opaque dial 62 which is mounted on the back rather than the front of the light-transmitting member. For example, this construction is particularly effective for use with multicolored printed paper dials. As illustrated in FIG. 6, the light rays are reflected rearwardly against the dial 62 by the serrations 63 and then are reflected forwardly again from the surface of the dial 62 toward the viewer.

As can be seen from the foregoing detailed description, this invention provides an illuminatable dial assembly utilizing a single light source which develops illumination completely around and across the dial display field without producing shadows from shafts or the like extending through the dial. Since light is directed inwardly toward the center line of the display field face from opposed sides of the face portion, a number of shafts can be projected through the dial at a plurality of spaced points without producing any shadows whatever. Furthermore, since the dial assembly of this invention permits mounting pins or studs to be formed at the edges of the display field face, mounting of the dial assembly on its supporting plate is greatly facilitated. Moreover, this invention provides increased flexibility in the design of the instrument with which the subject dial assembly is employed. For example, this dial assembly substantially increases the ratio of total exposed dial area to lighted area for rectangular dials, since the illuminatable dial assembly may be formed with substantially the same configuration as that of the actual clock face. To light a rectangular dial with a circular illuminatable assembly, it is necessary to make the circular assembly of sufficient diameter to contain the rectangular dial, thus "wasting" a considerable portion of the illuminated area. Similarly, the dial assembly of this invention is extremely versatile with regard to the variety of illuminative and decorative effects which can be obtained by slight modifications in the basic structure of the dial assembly. Finally, the dial assembly is also inexpensive to manufacture and easy to install so that it is specially suitable for high volume production.

I claim as my invention:

1. An illuminatable dial comprising a member of light-transmitting material including a display field face portion having a pair of opposed side edges, and a peripheral rim having a lamp receiving opening therein and a pair of opposed side portions integral with said edges of said face, the edges of the two opposed side portions of said rim defining internally reflecting surfaces for directing light from said opening toward the face portion of said member in a direction normal to said side edges of the face, said face portion being tapered in thickness inwardly from said opposed side edges so as to disperse light from the corresponding side portions of said rim over said face.

2. An illuminatable dial comprising a member of light-transmitting material including a display field face portion having a pair of opposed side edges, and a peripheral rim having a lamp receiving opening therein and a pair of opposed side portions integral with said side edges of said face, the edges of said opposed side portions of said rim being stepped so as to define internally reflecting surfaces for directing light from said opening toward the face portion of said member in the direction substantially parallel to said opposed side edges of said face, said face portion being tapered in thickness inwardly from said opposed side edges so as to disperse light from the corresponding side portions of said rim over said face.

3. An illuminatable dial comprising a member of light-transmitting material including a display face portion having a pair of opposed side edges, and a peripheral rim having a lamp receiving opening therein and a pair of opposed side portions integral with said side edges of said face, the edges of the two opposed side portions of said rim defining internally reflecting surfaces for directing

light from said opening toward the face portion of said member in a direction normal to said side edges of the face, said face portion being tapered in thickness inwardly from said opposed side edges and being serrated parallel to said side edges so as to disperse light from said side portions over said face.

4. An illuminatable dial comprising a member of light transmitting material including a display face having a pair of substantially parallel opposed side edges, and a peripheral rim having a lamp receiving opening therein and a pair of substantially parallel opposed side portions integral with said side edges of said face portion, the edges of said opposed side portions of said rim being stepped so as to define internally reflecting surfaces for directing light from said opening toward the face portion of said member in a direction substantially normal to said opposed side edges of said face, said face portion being tapered in thickness inwardly from said opposed side edges and being serrated parallel to said side edges so as to disperse light from said side portions over said face.

5. An illuminatable dial comprising a member of light-transmitting material having a generally quadrangular display field face portion, a continuous rim having a lamp receiving opening therein and including a pair of opposed side portions integral with a pair of opposed sides of said quadrangular face portion, the edges of the two opposed side portions of said rim being stepped so as to define internally reflecting surfaces for directing light from said opening toward the face portion of said member in a direction substantially normal to said opposed sides of said face portion, said face portion decreasing in thickness inwardly from said opposed sides of the face portion

to a line of minimum thickness extending between said opposed sides of said face, said face portion being provided with at least two openings for shafts on said line of minimum thickness.

6. An illuminatable dial comprising a member of light-transmitting material including a display face having a pair of substantially parallel opposed side edges, said face portion decreasing in thickness inwardly from said side edges to a center line of minimum thickness extending substantially parallel to said side edges, and a peripheral rim having a lamp receiving opening therein and a pair of substantially parallel opposed side portions integral with said side edges of the face portion, the edges of the two opposed side portions of said rim defining internally reflecting surfaces for directing light from said opening toward said center line of said face from two opposite directions, the decreasing thickness of said face portion serving to disperse light from said rim over said face, said face portion being provided with openings for shafts on said center line whereby the light impinging on said shafts from two opposite directions avoids the casting of shadows by said shafts.

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LEO SMILOW, *Primary Examiner.*