

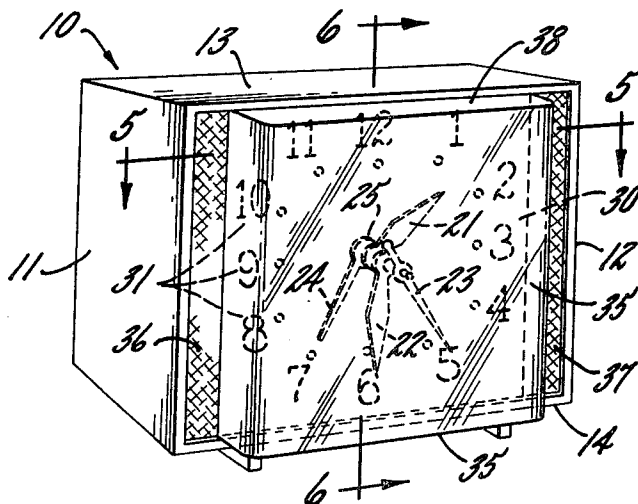
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[54] **ILLUMINATED CLOCK CONSTRUCTION**
13 Claims, 7 Drawing Figs.

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240/2.14, 240/6.43
[51] Int. Cl. **G04b 19/30**
[50] Field of Search **58/50;**
246/2.1, 6.43

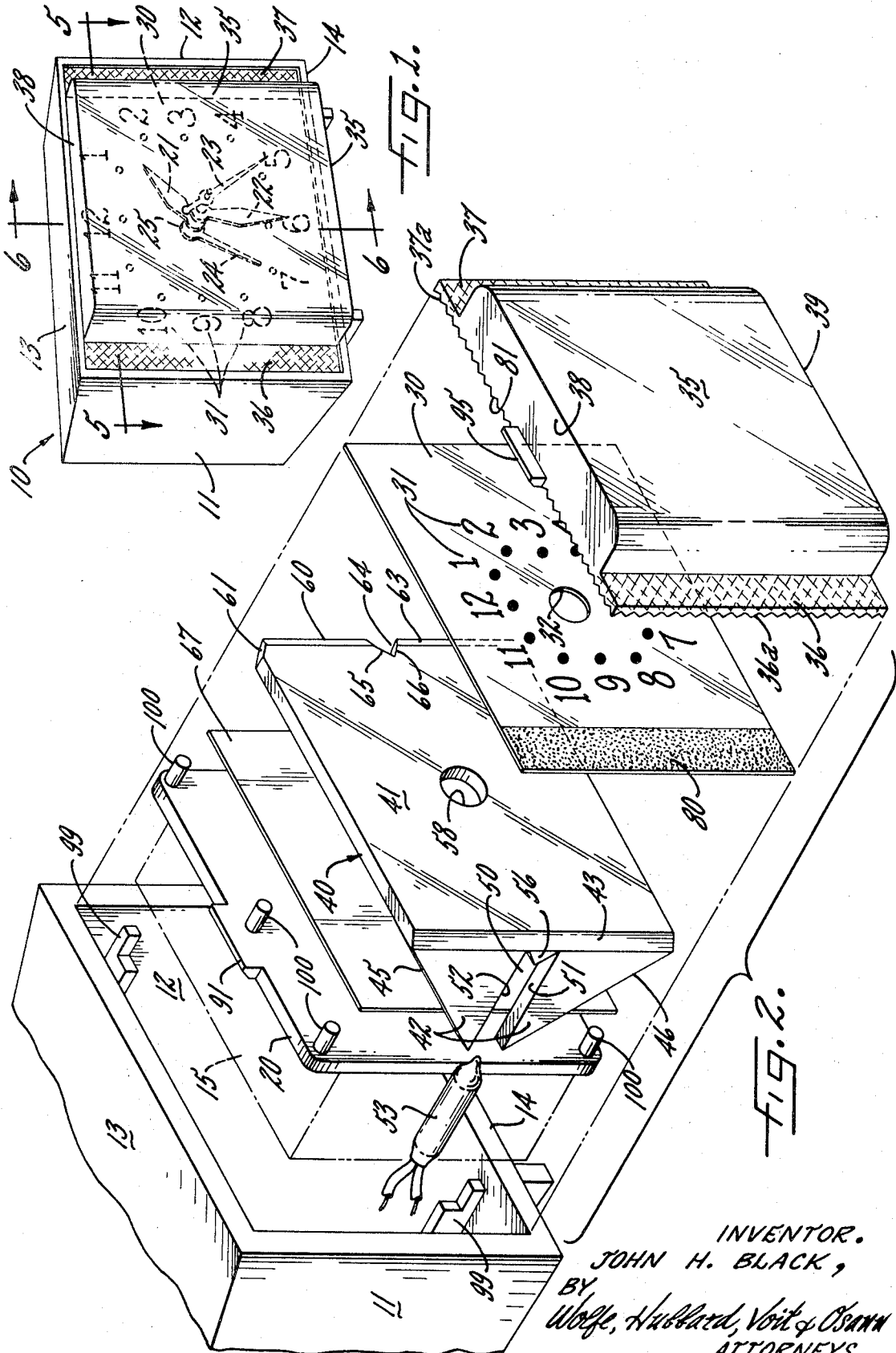
ABSTRACT: A compact illuminated clock intended for constant illumination which includes an especially constructed transparent light diffuser for diffusing light evenly to a translucent dial, the diffuser having an integral rearwardly extending wing for mounting a low intensity lamp, a transparent lens in front of the dial, and adjacent side panels formed with a pattern of pyramidal embossments which pick up the incident light to produce a jeweled appearance during the day and which are illuminated by the diffuser at night.



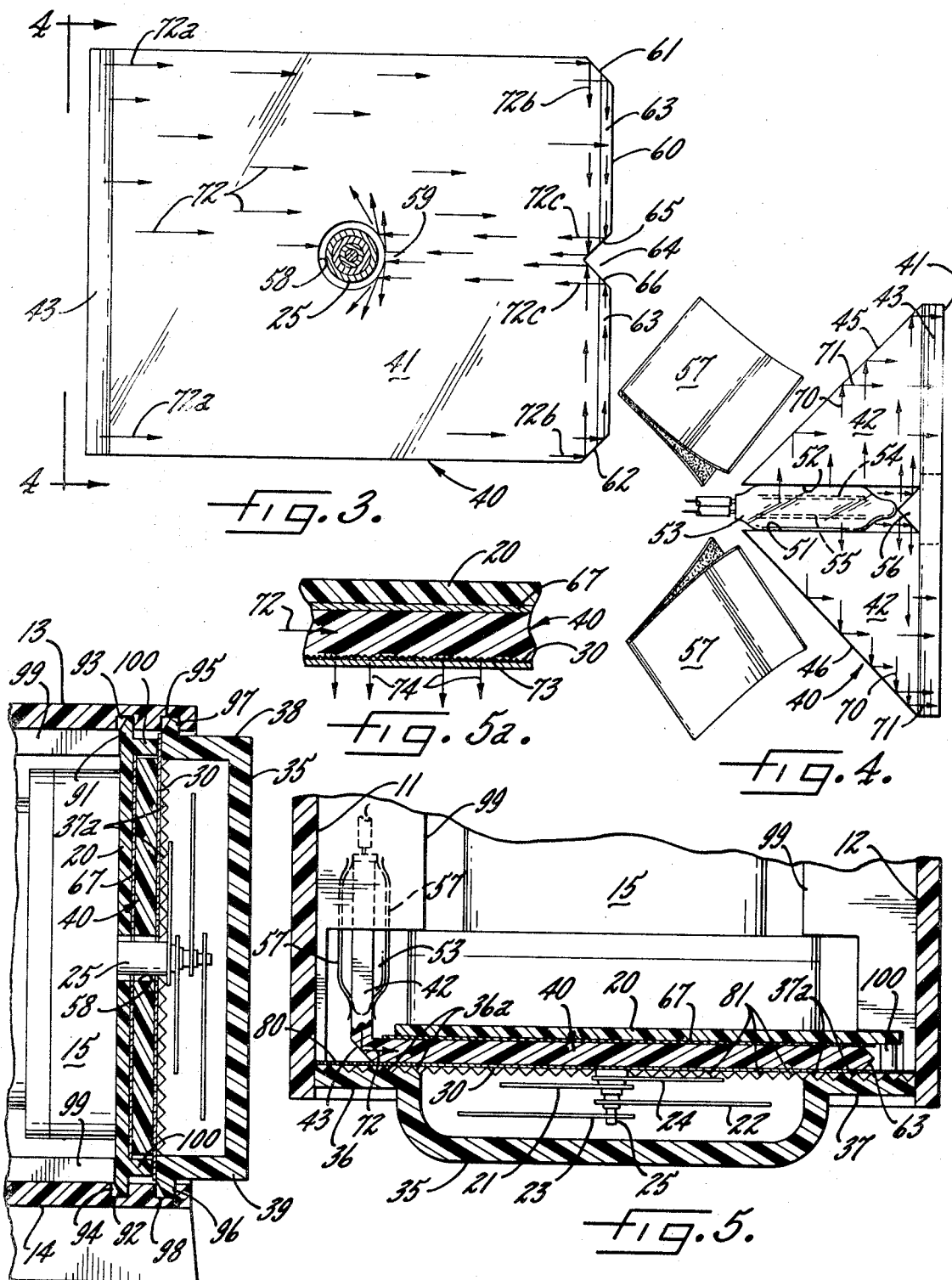
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ILLUMINATED CLOCK CONSTRUCTION

It is an object of the invention to provide an illuminated electric clock having a translucent dial with opaque numerals on the field and in which the field is illuminated, from a concentrated light source, evenly and without bright areas or "hotspots" which have, in the past, required masking of much of the area. It is a related object to provide a clock construction including an evenly illuminated dial which extends over substantially the entire available area and which is particularly well suited for use in clocks of small physical size, with lamp and conduit structure occupying space at the side of the movement which is normally wasted.

It is a more specific object to provide a diffuser construction for an illuminated clock which includes a novel combination of concentrated light source and series of 45° reflecting surfaces which not only provide a high degree of transmission efficiency but which avoid the shadow normally caused by the nest of shafts at the center of the dial.

It is still another object of the invention to provide a clock which is evenly illuminated and easy to read under conditions of light and darkness and which has a rich and distinctive appearance when viewed under both conditions. More specifically, it is an object to provide an illuminated clock assembly including a transparent lens having a clear central area with integral side panels formed with a surface pattern of embossments which, by reason of multiple reflections, results in a "jeweled" appearance by day and a distinctive patterned appearance by night. The embossed areas are illuminated by, and serve to control, the stray light which escapes the diffuser along the primary reflecting edges thereof. It is a related object to provide an illuminated clock in which the dial is illuminated all the way to the edge of the housing and which appears of the same size night and day.

It is a general object of the present invention to provide a clock having illumination features in advance of those in more expensive clocks but which can be manufactured at low cost, of plastic, and which is well suited for use with small synchronously driven plastic movements.

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

FIG. 1 is a perspective view of a clock embodying the present invention;

FIG. 2 is an exploded view of the clock of FIG. 1 for the purpose of showing the components of the illumination assembly;

FIG. 3 is a face view of the diffuser plate;

FIG. 4 is an end view of the diffuser plate looking along the line 4-4 in FIG. 3;

FIG. 5 is a horizontal section looking along the line 5-5 in FIG. 1;

FIG. 5a is a fragmentary section showing the roughened surface on the diffuser plate; and

FIG. 6 is a vertical section taken at right angles thereto, along the line 6-6 in FIG. 1.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment, but intend to cover the various alternative and equivalent constructions included within the spirit and scope of the invention.

Turning now to the drawings, there is disclosed in FIG. 1 a clock 10 having a generally rectangular housing including side panels 11, 12, a top panel 13 and a bottom panel 14.

Mounted within the housing is a movement generally indicated at 15 having a frame plate 20 and controlling hour, minute and second hands 21-23 as well as an alarm setting hand 24, the latter being supported by the usual nest of shafts 25. The hands cooperate with a dial 30 having suitable indicia 31 and a central clearance opening 32. Superimposed on the dial is a boxlike lens 35 of transparent plastic material having integral wings or side panels 36, 37 and upper and lower walls 38, 39.

In accordance with the present invention, a diffuser plate made of transparent plastic material is provided having a front

portion which is positioned immediately behind the dial 30 and an integral illuminated side portion which extends rearwardly from one edge into the space between the movement and the adjacent side of the housing, the junction between the side and front portions having a surface chamfered at an angle 45° so that light reflected at the chamfered surface is evenly distributed to the dial. Referring more specifically to the drawing the diffuser plate indicated at 40 has a front portion 41 and an integral side portion 42 extending at right angles to it, the junction 43 including a reflecting surface which is arranged at 45° (see FIG. 5) for the purpose of reflecting light at 90° for even distribution into the front portion of the diffuser. Further in accordance with the invention, the side portion 42 has a V-shaped profile (see FIG. 4) having side edges 45, 46 arranged at 45°. For feeding light symmetrically to the reflecting edges 45, 46, the side portion has a central cutout 50 defined by edges 51, 52 spaced to receive an elongated lamp 53 which is preferably of the gaseous discharge or "neon" type having elongated parallel electrodes 54, 55 to provide an elongated light-emitting path. An integral triangular piece 56 has surfaces angled at 45° for laterally deflecting the light emitted endwise from the lamp 53. The lamp is preferably held captive within the space 50 by enclosing it, on both sides, with layers of reflective adhesive material 57 which not only support the lamp but which prevent escape of the light at right angles to the plane of the portion 42. At the center of the plate 40 is an opening 58 for clearing the nest of shafts 25 and having a side 59 which is on the opposite side from the source of light and hence normally in shadow.

In accordance with one of the aspects of the present invention, the corners of the diffuser which are remote from the junction 43 are angled or "cut off" to provide corner-reflecting surfaces which serve to direct some of the light backwardly toward the shadow side of the nest of shafts. More specifically, the diffuser is provided with corner-reflecting surfaces which are arranged 45° and which cooperate with complimentary reflecting surfaces, also arranged at 45°, defined by a notch which is formed in the edge of the diffuser which is remote from the junction. Thus in carrying out the invention, the remote edge of the diffuser, indicated at 60, has its corners relieved to form angled corner-reflecting surfaces 61, 62. Centered on the edge 60 between the surfaces 61, 62 is a notch 64 providing cooperating surfaces 65, 66, the surfaces 61, 62 and 65, 66 all being arranged at 45°. To conserve the light which may leak from the back surface of the diffuser plate a coextensive reflector 67 having a flat white surface, and which may be of a thin sheet of plastic, is used.

The result of the above structure, referring particularly to FIGS. 3 and 4 is as follows: Light emanating from the lamp 53 passes upwardly along a broad path 70 striking the reflecting surface 45 for reflection along a similarly broad path 71 in the direction of the surface 43 at the junction. At the surface 43 the light is transmitted evenly into the left-hand edge of the front portion of the diffuser as indicated at 72. The front surface is roughened as indicated at 73 (see FIG. 5a), and when the light strikes the roughened surface a scattering of light is produced as indicated at 74, with the light passing forwardly through the translucent dial 30. This tends to provide an even level of illumination over the surface of the dial. A portion of the light passing along the upper part of the diffuser plate, and indicated at 72a, strikes the corner-reflecting surface 61 and is reflected along the path 72b onto the reflecting surface 65 of notch 64, where the light undergoes a further reflection to pass backwardly along the path 72a for the purpose of illuminating the region 59 lying in the shadow of the nest of shafts. Similarly along the bottom portion of the diffuser plate (see FIG. 3) light 72a is reflected at surface 62 to follow a path 72b, with reflection occurring at surface 66 so that additional light 72c is transmitted to the shadow region 59. The result is to produce even illumination over the entire field of the dial 30 which is free of bright regions or "hotspots" and which is also free of any tendency toward shadowing by reason of the offcenter location of the lamp 53.

In accordance with a further aspect of the present invention, the remote edge 60 of the diffuser plate is chamfered for internal reflection, and so as to match the chamfering 43 at the "near" edge, and the side panels 36, 37 of the lens are especially surfaced and positioned to receive the stray light lost at the chamfers. Specifically the transparent panels 36, 37 are formed, on their backside, with a closely spaced, two-dimensional pattern of pyramidal embossments indicated at 36a, 37a, so as to produce multiple reflection of incident light resulting in a rich "jeweled" appearance during the day and to produce a multiple reflection or breakup of the stray light emanating from the chamfers to produce a distinctive patterned appearance in darkness. Since the chamfer 43 is closer to the light source than the chamfer at the opposite edge, indicated at 63 (FIG. 5), the dial 30 is preferably surfaced with a light reducing coating, for example, in the form of a pattern of halftone dots, as indicated at 80, of sufficient density so that the two illuminated panels 36, 37 appear to be of substantially equal brightness. The rearwardly facing upper and lower edges of the transparent lens, indicated at 81, are preferably finished with a zigzag profile similar to the pyramidal embossments so that the lens, in addition to evidencing "jeweled" side panels shows a thin "jeweled" upper and lower edge as well.

Because of the utilization of the stray light in the panels 36, 37 the entire area available at the face of the clock housing may be utilized as a dial, not only under the incident light of day but also under the artificial illumination of night and the dial is of the same apparent size when viewed under conditions of either light or darkness. This is to be contrasted with conventional illuminated clocks which employ masks, particularly to hide peripheral "hotspots" on the field of the dial, and which result in the dial being of a smaller apparent size when viewed at night compared to viewing during the day.

Means are provided for insuring that the assembly made up of the reflector 67, the diffuser 40, the dial 30 and lens 35 are all compactly sandwiched together against the front surface of the clock frame plate 20 for the purpose of insuring proper transmission and distribution of the light, while keeping the reflector, diffuser and dial uninterrupted by any special securing attachments. This is accomplished by providing integral lugs extending laterally from the longitudinal edges of the frame plate and lens, respectively, and which engage mating grooves formed in the corresponding inner edges of the clock housing, with capture and release being affected by intentional distortion of the lens and housing.

Thus referring especially to FIGS. 2 and 6, the frame plate, which is of plastic, is provided along the upper and lower edges with lugs 91, 92 which fit into registering grooves 93, 94 formed within the upper and lower edges of the clock housing. The lens is similarly formed with lugs 95, 96 which fit into grooves 97, 98. Because of the central location of the lugs and to insure against relative rocking, shoulders 99 are molded integrally within the housing, two of such shoulders being visible in FIG. 2. Short posts 100 integrally formed on the front of the frame plate facilitate assembly by preventing rotation of the reflector and diffuser and serve, as shown in FIG. 6 to firmly clamp the edges of the dial against the presented base of the lens.

This mode of assembly, which avoids the use and expense of separate fasteners, capitalizes upon the fact that the plastic housing and lens are both deformable with fingertip pressure. During assembly, the frame plate and lens are simply pressed into place, facilitated, if desired, by the sloping cam surfaces on the backside of each of the lugs. To remove the lens, fingertip pressure is applied to the top and bottom walls 38, 39 withdrawing the lugs 96 inwardly toward one another and clear of the slots 97, 98. For subsequent removal of the dial assembly and movement, pressure is applied to the housing to "bow" the upper and lower surfaces relatively outward to clear the lugs 91, 92 whereupon the entire assembly may be pulled forwardly from the housing.

While a number of different materials may be used for the diffuser and lens, it is preferred to use a plastic which is

relatively hard and glasslike, highly efficient in the transmission of light, and having a relatively high refractive index. Commonly available clear polystyrene is preferred. While the decorative panels on each side of the lens are preferably of a pyramidal pattern, the surfaces may be embossed in other ways, for example, ridged or fluted, to provide a distinctive and pleasing appearance, the chosen pattern of embossment preferably being distinguished by sharp corners and faceted for light reflection.

I claim:

1. In an electric clock, the combination comprising, a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and an integral side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the side portion having a lamp coupled intimately to the edge thereof, the junction between the side portion and the front portion having a surface chamfered at an angle of 45° for reflection of the light into the front portion, and the edge opposite the junction being formed with angled reflecting surfaces for reflection of the transmitted light back toward the shadow side of the nest of shafts, the front portion of the diffuser having a roughened surface for picking up the light in the diffuser and for transmitting it evenly into the field of the dial.

2. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly at right angles from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the junction between the side portion and front portion having a surface chamfered for internal reflection, the side portion having a V-shaped profile with a central cutout for mounting a lamp so that light from the lamp is first reflected at the side edges for equalized distribution to the chamfered surface and again reflected by the chamfered surface for equalized distribution into the front portion of the diffuser, the front portion of the diffuser having a roughened surface for picking up the light in the diffuser and for transmitting it evenly into the field of the dial.

3. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and an integral side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the junction between the side portion and front portion having a reflecting surface chamfered at an angle of substantially 45°, the side portion having a V-shaped profile with side edges angled at substantially 45° and the side portion having a central cutout mounting a lamp so that light from the lamp is first reflected at the side edges for equalized distribution to the chamfered surface and again reflected by the chamfered surface for equalized distribution into the front portion of the diffuser, the front portion of the diffuser having a roughened surface for picking up the light in the diffuser and for transmitting it evenly into the field of the dial.

4. The combination as claimed in claim 3 in which the lamp is of the gaseous discharge type having a pair or parallel longitudinally extending electrodes.

5. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the side portion having a lamp coupled intimately to the edge thereof, the side portion and the front portion being formed integrally with the junction having a reflecting surface chamfered at an angle of substantially 45° for transmission of light into the front portion, the front portion of the diffuser having a roughened surface for picking up the light and for transmitting it forwardly into the translucent dial, the remote corners of the front portion being cut off at an angle of substantially 45° to provide corner reflecting surfaces, said front portion having a notch with an included angle of approximately 90° centered between the corner-reflecting surfaces for reflecting the light from such surfaces back toward the shadow side of the nest of shafts.

6. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a set of hands and a nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the side portion having a lamp coupled intimately to the edge thereof, the junction between the side portion and the front portion being formed with a reflecting surface chamfered at an angle of substantially 45° for reflection of the distributed light into the front portion, the front portion of the diffuser having a roughened surface for picking up the light in the translucent dial, the edge of the front portion opposite the junction being doubly chamfered to provide closely spaced reflecting surfaces with an included angle of approximately 90° for reflection of the light backwardly toward the junction.

7. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the junction between the side portion and front portion having a reflecting surface chamfered at an angle 45°, the side portion having a V-shaped profile with the side edges angled at 45°, the side portion having a central cutout for accommodating a lamp of longitudinal configuration so that light from the lamp is reflected first at the 45° side edges and again at the junction for equalized distribution into the front portion, the front portion of the diffuser having a roughened surface for picking up the light in the diffuser and for transmitting it evenly into the field of the dial, the corners opposite the junction being cut off at an angle to form a reflecting surface and the edge opposite the junction being formed with cooperating reflecting surfaces for reflection of the light back toward the shadow side of the nest of shafts.

8. The combination as claimed in claim 7 in which adhesive tape having a reflective surface is applied on both sides of the side portion for bridging the cutout and maintaining the lamp

in position in the cutout.

9. In an electric clock the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereof, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating a nest of shafts, the side portion having a lamp coupled intimately to the edge thereof, the junction between the side portion and the front portion having a surface chamfered at an angle of substantially 45°, and the edge opposite the junction having a surface chamfered at an angle of substantially 45°, a lens of transparent plastic material overlying the dial and having side panels spaced close to the dial in the region of the chamfered surfaces for picking up the stray light emitted from the chamfered surfaces, the side panels being formed with a pattern of embossments for breaking up the light to form a decorative pattern when illuminated by incident daylight and when illuminated by the lamp under conditions of darkness.

10. The combination as set forth in claim 8 in which the dial has a light inhibiting surface opposite the junction for equalizing the brilliance of the two side panels.

11. In an electric clock the combination comprising a housing having a front opening, a movement in the housing having a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating a nest of shafts, the side portion having a lamp coupled intimately to the edge thereof, the junction between the side portion and the front portion having a surface chamfered at an angle of substantially 45° and the edge opposite the junction having a chamfered surface, a lens of transparent plastic material overlying the dial and having side panels spaced close to the dial in the region of the chamfered surfaces, the side panels being formed with a two-dimensional pattern of pyramidal embossments for picking up the light escaping from the chamfered surfaces and for multiply reflecting the same to form a decorative pattern.

12. The combination as claimed in claim 11 in which the edge of the diffuser opposite the junction is doubly chamfered to form an included angle of substantially 90° to facilitate internal reflection and containment of light in the diffuser.

13. In an electric clock, the combination comprising a housing having a front opening, a movement in the housing having a frame plate and a set of hands and nest of shafts for coupling the same to the movement, a translucent dial covering the opening and having indicia thereon, a diffuser plate of transparent plastic material having a front portion positioned immediately behind the dial and having a side portion extending rearwardly from one edge thereof into the space between the movement and the adjacent wall of the housing, the dial and diffuser plate having aligned openings for accommodating the nest of shafts, the side portion being coupled to a lamp, the junction between the side portion and front portion having a reflecting surface for equalized distribution into the front portion, the front portion of the diffuser having a roughened surface for picking up the light in the diffuser and for transmitting it evenly into the field of the dial, a reflector behind the diffuser plate, a boxlike lens in front of the dial, the frame plate and lens having lugs integrally formed on opposite edges, the housing having spaced grooves for mating with the lugs for holding the lens, dial, diffuser plate and reflector in compactly sandwiched relation.