Feb. 24, 1959 A. B. CAMPBELL 2,875,320

ILLUMINATED ELECTRIC CLOCK

Filed Sept. 2, 1954

FIG. 1

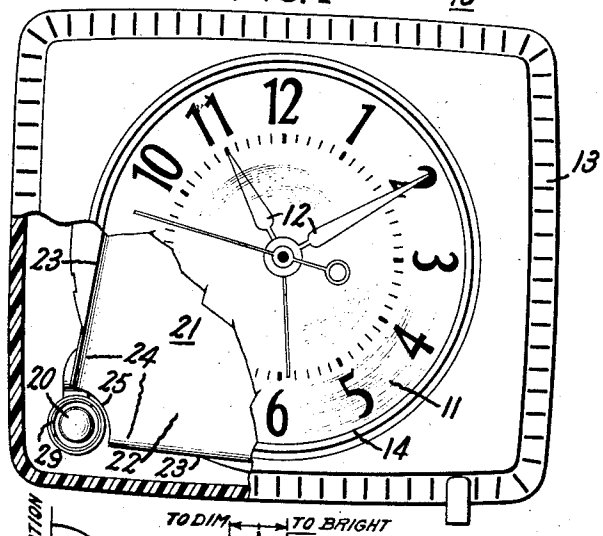
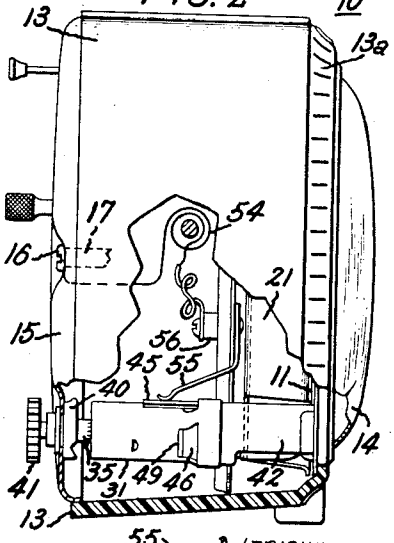


FIG. 2



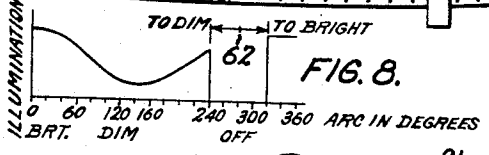


FIG. 8.

FIG. 3.

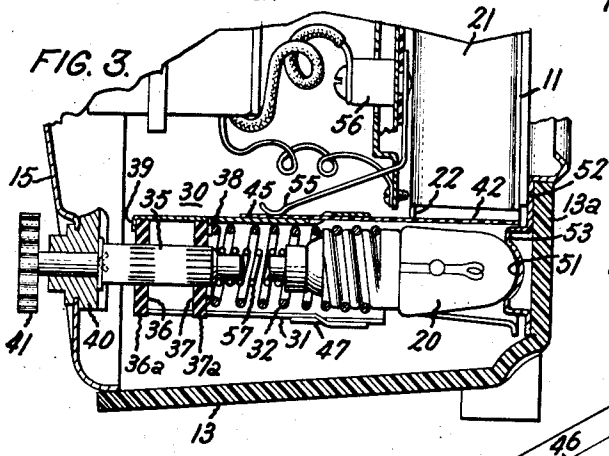


FIG. 5

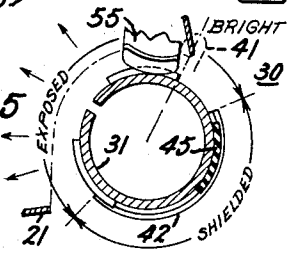


FIG. 6.

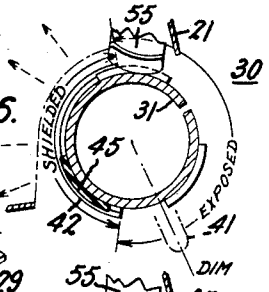


FIG. 4.

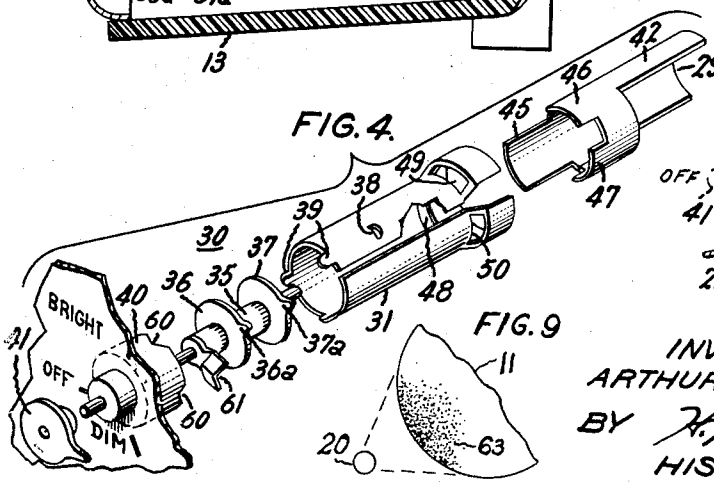


FIG. 7.

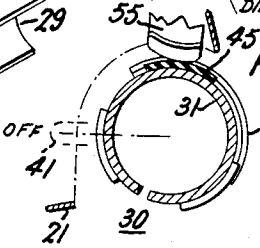


FIG. 9

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ILLUMINATED ELECTRIC CLOCK

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Application September 2, 1954, Serial No. 453,845

13 Claims. (Cl. 240—2.1)

The present invention relates to electric clocks and more particularly to means for providing controlled illumination of the clock face.

The object of the present invention is to provide an illuminating device for the face of an electric clock or the like which supplies an even overall illumination, the intensity of which can be controlled over a wide range and without a visible "hot spot" usually associated with the use of a localized light source. It is a related object to provide an illuminating device which is efficient and which makes maximum use of a low power light source, but which is, nevertheless, compact, using a shallow reflector construction which may be incorporated in a clock casing of conventional size. It is a more specific object to provide a means and procedure for precisely equalizing light distribution over a translucent clock face.

It is another object to provide an illuminating device for an electric clock or the like which is conveniently controllable by a knob at the back of the clock case to vary the illumination gradually from bright to dim and which causes the light source to be turned off completely in one of its positions of adjustment. It is a more detailed object to provide a control which is positionable between "bright," progressively "dim," and "off" positions and which may be continuously cycled between these conditions in either direction.

It is a further object to provide an illuminating device for a clock which accomplishes progressive dimming by use of a shield of colored translucent material, with the illumination variable between a bright "white" condition and a dim, deeply colored condition. It is a still further object to provide an arrangement in which the characteristic color may be easily and quickly changed to conform to the style of the clock and the intended use thereof.

It is still another object to provide an illuminating device for an electric clock or the like which permits easy and rapid replacement of a lamp bulb and in which the entire device is exposed simply by removing the back cover plate and without necessity for disconnecting any electrical connections.

Finally, it is an object to provide an illuminating device which may be cheaply constructed and which adds substantially to the value and utility of an electric clock.

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

Figure 1 is a face view in partial section of an electric clock employing the present invention.

Fig. 2 is a side view corresponding to Fig. 1 and with the casing broken away to show the way in which the illuminating device is mounted within the clock.

Fig. 3 is a longitudinal section of the illuminating device.

Fig. 4 is an exploded perspective of the main parts of the device.

Figs. 5, 6 and 7 are transverse sections illustrating the three conditions of adjustment.

Fig. 8 shows the manner in which the illumination varies upon rotation of the adjusting knob.

Fig. 9 shows the density distribution in an optical wedge formed on the reverse side of the translucent dial.

While the invention has been described herein in connection with the preferred embodiment, it will be understood that I do not intend to limit the invention to such embodiment but intend to cover all of the alternative constructions and arrangements falling within the spirit and scope of the appended claims.

Turning now to Figs. 1 and 2, the clock **10** includes a dial or face **11** and set of hands **12** mounted in an outer shell or casing **13**, the latter having a front wall portion **13***a* which carries a lens **14**. The rear of the casing is enclosed by a thin metallic cover plate **15**, which is held in place by a screw **16** threaded into a post **17** or the like on the clock frame. It will be understood that the clock includes a conventional motor and driving train for driving the hands **12**, although such mechanism does not form a part of the invention.

In carrying out the present invention, the dial **11** of the clock is formed of translucent material and is illuminated by a lamp bulb **20**, which is located just behind the plane of the face and off to one side, hidden by the front wall portion **13***a*. Arranged behind the translucent clock face is a shallow reflector **21** which has a back portion **22** arranged parallel to the clock face and which has an upturned edge or wall **23** which extends around substantially the entire periphery. For the purpose of leading light to the inside of the reflector to the circular area behind the dial **11**, the reflector is provided with a flared lead-in portion **24** which, as shown in Fig. 1 merges smoothly with the circular or back portion. The upturned wall of the reflector is interrupted at the outer end of the portion **24** to provide an opening **25**. The back surface of the reflector is, in addition, scalloped out, for close coupling with the lamp bulb **20**. The interior of the reflector **21** is preferably coated with a white, highly reflective paint, and it is found that the arrangement produces even illumination over the entire area of the dial, notwithstanding the fact that the light originates at a single point source.

In accordance with the present invention, means are provided for gradually interposing a shield, preferably formed of colored translucent material, between the bulb **20** and the opening **25** of the reflector, so arranged that the amount of light may be varied from bright to dim by rotating a manual control at the back of the clock. For this purpose the bulb is mounted in an illuminating assembly **30**, which extends from front to back in one corner of the clock casing and which is rotatable about a central axis. This assembly includes a light shield **29** and a metallic sleeve or barrel **31** into which the base of the bulb **20** is inseretd. For the purpose of mounting the bulb therein and for making electrical contact, a coil spring **32** is provided. Such coil spring fits rather snugly within the sleeve **31**, being electrically connected thereto at its inner end and having its convolutions appropriately spaced at its outer end for threadedly engaging the base of the bulb as shown.

For rotatably mounting the sleeve **31** a shaft **35** is provided, carrying a pair of annular spacers **36**, **37** formed of fiber or the like. Such spacers are axially located within the metallic sleeve by tabs **38**, **39** formed integrally in the sleeve. With the tabs bent inwardly the spacers **36**, **37** and the shaft **35** are held captive, relative rotation being prevented by keys **36***a* and **37***a*, respectively, on the spacers. The shaft **35** of the assembly **30** is journaled in a bushing **40** mounted on the back cover plate **15** of the clock, the shaft terminating in a knob **41**. In the present embodiment the shield **29** forms an exten-

sion of the sleeve 31 and may be made of flat sheet stock bent into cylindrical form. Since the shield extends only part way around the lamp bulb 20, rotation of the knob 41 causes the shield to be gradually interposed between the bulb and the opening 25 in the reflector. For the purpose of anchoring the shield 29, axially extending tabs 45, 46, and 47 are formed in its base portion, registering slots 48, 49 and 50 being provided in the metallic sleeve 31 for receiving the tabs so that the shield and sleeve are securely keyed together.

To insure that the lamp bulb is properly positioned relative to the back surface 22 of the reflector and to provide outboard support for the entire rotatable assembly 30, a shallow recess 51 is provided inside the front surface of the clock casing and in axial alignment with the shaft 35. In the present instance such recess is formed in a thin sheet of metal 52 which lies flatly inside the front wall of the clock and which is defined by an upraised annular boss 53. The circular outer rim of the boss serves as a guide for the front edge of the shield 42 when the assembly is rotated and in addition keeps the tabs on the base of the shield firmly seated in place. Because of the action of the coil spring 32, the lamp is outwardly biased into its proper operating position, substantially independently of the shape of the bulb and even though the bulb may not be fully screwed into the spring 32. The arrangement is also advantageous from a manufacturing standpoint, since the back cover plate 15 need not be precisely spaced from the front surface of the clock, any variations being automatically taken up by the compression or expansion of the spring. The sheet of metal 52 serves the additional function of preventing light from the bulb from passing through the front wall of the casing, particularly when the latter is molded of translucent plastic material.

In accordance with one of the features of the invention a stationary brush is provided for engaging the metallic sleeve 31 and an insulating "island" is provided on the sleeve for turning off the lamp when the rotatable assembly 30 is turned to an "off" position. The brush in the present instance is in the form of a contact spring 55 which is connected to an insulated terminal 56, the latter being energized from an auxiliary coil 54 included in the magnetic structure of the electric driving motor. The return path for the current is completed through a small inner coil spring 57 which contacts the tip of the bulb, the shaft 35, and the metal back plate 15, which is secured by the post 17 to the clock frame. This provides an extremely simple loop circuit requiring a bare minimum of wiring. Conveniently, the insulating island defining the "off" position may be established by elongating the tab 45 on the base of the shield as shown in Figs. 3 and 4 so that it lies flatly adjacent the sleeve 31 and extends into the path of movement of the contact spring 55.

It will be apparent that the arrangement described above provides three distinct conditions—bright, progressive dimming, and off. These three conditions are illustrated in Figs. 5, 6 and 7, respectively, the variation in illumination provided by rotating the manual knob 41 being shown in Fig. 8. In the present instance the shield occupies an arc of approximately 160° and the off position occupies an arc of approximately 60°. With the shield adjusted as shown in Fig. 5, the bright condition is established and light from the lamp is free to pass unobstructedly into the reflector. The shield 42 in this figure is in its rearmost position and serves, incidentally, as a partial reflector of the light which would otherwise be lost from the rear of the lamp. As the control knob 41 is turned in a clockwise direction, the cylindrical shield 42 is progressively interposed between the lamp and the opening 25 in the reflector, causing the intensity of the illumination to drop progressievly as shown in Fig. 8. Minimum light escapes into the reflector when the assembly 30 is rotated around into the "dim" position shown in Fig. 6.

The degree of illumination under the "dim" condition may be conveniently controlled by the density of the shield. I prefer to make the shield of rather deeply colored translucent material so that in the minimum light position the illumination is down to a level which will just permit the face of the clock to be read across the width of a darkened room.

It is one of the rather surprising features of the present construction that progressive edgewise movement of the colored shield does not produce a well-defined fan of color or shadow in spite of the abrupt change in density at the leading and trailing edges of the shield 42. This is believed due to the multiple reflection which occurs in the reflector and particularly in the flared lead-in portion 24. The presence of shadow can be still further reduced if desired by tapering the leading and trailing edges of the shield to a feather edge or, alternatively, by reducing the optical density of the shield along the edge portions.

Upon continued rotation of the adjustment from the position shown in Fig. 6 to that illustrated in Fig. 7, the light is again gradually increased to the point where the insulating tab 45 engages the contact brush 55. This serves to completely turn off the lamp, and since the insulating tab 45 has substantial width, the "off" setting is not at all critical. In order to facilitate setting the adjustment at the three positions shown in Figs. 5, 6 and 7, a three-position detent is provided. This detent includes a stationary portion 60 which may consist of notches formed integrally on the bushing 40. Such notches are engaged by a detent spring 61 which is locked to the shaft 35. Thus, as the knob 41 is rotated, the illuminating device may be adjusted to the most commonly desired positions while still permitting a gradual dimming adjustment of the illumination for intermediate conditions such as a partially darkened room.

The control is particularly convenient, since it may be moved from one of the positions directly to either one of the other two positions. Thus, assuming that the lamp is turned off, as indicated at 62 in Fig. 8, turning the knob in one direction results in a progressively dim light and in the other direction results in full brightness. The cycle is repetitious. Stops are unnecessary and the cycle may be repeated, by reason of the brush 55, without risk of disturbing or "winding up" any internal connectors. The entire assembly may be lightly constructed since it is not possible to apply excessive force during the adjustment.

When it is necessary to replace the lamp bulb 20, the back plate 15 is removed by unscrewing the screw 16. This enables the entire rotating assembly 30 to be removed with the back plate and fully exposed to view. When the assembly is exposed, it is a simple matter to unscrew and replace the bulb 20 after which the entire assembly may be restored to its normal assembled condition. The bulb 20 need not be formed in any special shape and only ordinary care need be exercised in making the replacement. The brush 55 automatically restores contact with the metallic sleeve 31. Replacement of the shield with one of a different density or color is equally simple.

Because of the arrangement of the lamp and construction of the reflector it is found that the intensity of the illumination over the entire face of the translucent face or dial 11 is constant to a high degree, even where the dial consists of nothing more than a sheet of translucent white plastic or the like. I have found, however, that the evenness of illumination over the entire area of the clock face may be still further improved by providing an optical wedge in the form of a light-transmitting mask of non-uniform density at the rear surface of the dial adjacent the lead-in portion 24 of the reflector. Such optical wedge may be provided in several ways, for example, by varying the thickness of the material of which the dial 11 is composed, the thickness varying with the intensity of the incident light. I prefer, however, to create the optical wedge by printing it as a film in half-

tone directly on the back of the dial, the density distribution being indicated at 63 in Fig. 9. The material used for such printing, i. e., ink, is preferably opaque but has a light reflecting surface in order to reflect light back into the reflector 21. Such ink may consist of finely divided aluminum together with a suitable binding agent and presenting a silvery appearance.

In order that full advantage may be taken of the optical wedge, I prefer to form it photographically. In accordance with my procedure, a piece of photographic paper or negative having a light sensitive emulsion is substituted for the usual dial 11 and a short exposure is made. The emulsion is then developed in the usual fashion to produce a negative image of the light distribution. A half-tone plate is made by the conventional screening process from the photographic negative and such half-tone plate is then used to imprint the optical wedge on the back side of the translucent dial using the reflective ink mentioned above. It is found that an optical wedge made as described above exhibits illumination which is, as far as the eye is concerned, perfectly even over the entire clock face regardless of whether the control 41 is set in the "bright" or "dim" position. When the interior illumination is turned "off," the clock face appears entirely conventional and gives no hint of the presence of the optical wedge.

I claim as my invention:

1. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having a shallow lateral wall extending about substantially the entire periphery, said wall having an access opening, a lamp bulb positioned in said opening for casting light into said reflector, a source of current for said bulb, a light shield mounted for progressive edgewise movement between the bulb and the opening, and a manual operator coupled to said shield for adjusting the amount of light cast into the reflector.

2. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an access opening at one edge thereof, a lamp bulb positioned in said opening for casting light into said reflector, a source of current for said bulb, a light shield of cylindrical configuration partially surrounding the bulb and mounted for progressive edgewise movement between the bulb and the opening, and a manual operator coupled to said shield for adjusting the amount of light cast into the reflector.

3. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an access opening at the edge thereof, a lamp bulb positioned in said opening for casting light into said reflector, a source of current for said bulb, a light shield mounted for progressive edgewise movement between the bulb and the opening, a switch for said bulb, and a manual operator coupled to said shield for adjusting the amount of light cast into the reflector, said operator being coupled to the switch so that the switch is turned off in one of the positions of the operator.

4. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an access opening at the edge thereof, a lamp bulb positioned in said opening for casting light into said reflector, a source of current for said bulb, a light shield of cylindrical configuration partially surrounding the bulb, means for mounting the bulb and light shield for rotation about the bulb axis, and a manual rotator coupled to said lamp

mounting means for adjusting the amount of light cast into the reflector.

5. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an opening at the edge thereof, a bulb assembly including a lamp bulb and means for positionnig a lamp bulb in said opening, said bulb assembly comprising a sleeve mounted for bodily rotation, means for retaining the bulb seated in the end of said sleeve, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to said sleeve for effecting adjustable rotation of the shield and progressive dimming of the light passing into the reflector.

6. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an opening at the edge thereof, a bulb assembly for positioning a lamp bulb in said opening, said lamp assembly comprising a metallic sleeve having a shaft insulated therefrom for mounting the sleeve for bodily rotation, means for retaining the bulb seated at the end of said sleeve with the bulb contacts respectively connected to the shaft and the sleeve, a stationary brush arranged to bear on the sleeve for conducting current thereto for lighting the bulb, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to the end of said shaft for effecting adjustable rotation of the shield and progressive dimming of the light passing into the reflector.

7. In an electric clock or the like, the combination comprising a housing, a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an opening for light access, a bulb assembly for positioning a lamp bulb in said opening, said lamp assembly comprising a metallic sleeve having an insulated shaft extending rearwardly therefrom, a conductor back plate on said housing, means for journaling the shaft in said back plate, means for retaining the bulb seated at the end of said sleeve with the bulb contacts respectively connected to the shaft and the sleeve, an insulated brush arranged to bear on the sleeve for contacting current thereto, means for applying voltage between said brush and said brush plate for lighting the bulb, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to the end of said shaft for effecting adjustable rotation of the shield and progressive dimming of the light passing into the reflector.

8. In an electric clock or the like, the combination comprising a housing having a front wall, a translucent clock face in said front wall, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an opening at the edge thereof, a lamp bulb assembly, comprising a sleeve mounted for bodily rotation, a lamp bulb seated at the end of the sleeve, a spring in said sleeve urging the bulb outwardly therefrom, means providing a bulb tip recess on the inner surface of said front wall for positioning the bulb opposite the reflector opening, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to said sleeve for effecting adjustable rotation of the shield and dimming of the light passing into the reflector.

9. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having a lateral opening therein, a bulb assembly including a lamp bulb and means for positioning a lamp bulb in said opening, said bulb assembly comprising a metallic sleeve having a shaft insulated therefrom for mounting the sleeve

for bodily rotation, means for retaining the bulb seated at the end of said sleeve with the bulb contacts respectively connected to the shaft and the sleeve, a stationary brush arranged to bear on the sleeve for conducting current thereto for lighting the bulb, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to the end of said shaft for effecting adjustable rotation of the shield and progressive dimming of the light passing into the reflector, said sleeve being electrically discontinuous so that the bulb is turned off in one position of said knob.

10. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having a shallow lateral wall extending about substantially the entire periphery, said reflector having a lead-in portion of flaring configuration offset from the body of the reflector and smoothly joined thereto, said lead-in portion having an opening in the end thereof, a lamp bulb positioned in said opening for casting light into said reflector, a source of current for said bulb, a light shield of cylindrical configuration mounted for progressive edgewise movement between the bulb and the opening, and a manual operator coupled to said shield for adjusting the amount of light cast into the reflector.

11. In an electric clock or the like, the combination comprising a housing having a front wall and a removable rear cover plate, a translucent clock face in said front wall, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having a back surface and an opening at the edge thereof, a lamp bulb assembly mounted on said cover plate and extending forwardly therefrom, said assembly including a lamp bulb at least partially shielded on one of its sides and arranged in a forwardly projecting position in said assembly, said lamp bulb assembly having adjustment means accessible for manual manipulation at the rear of the cover plate for rotating said bulb about its axis and means at the inner surface of said front wall for engaging the tip of the bulb while permitting the bulb to be rotated by said rotating means.

12. In an electric clock or the like, the combination comprising a housing having a front wall and a removable rear cover plate, a translucent clock face in said front wall, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having an opening at the edge thereof, a lamp bulb opposite said opening, a rotatable mount for said bulb extending from back to front in said housing, means for journaling the mount in said back plate, means including a spring in said mount for engaging the base of the lamp bulb and for pressing it forwardly toward said front wall, means providing a bulb tip recess at the inner surface of said front wall for engaging the bulb and for furnishing outboard support therefor, a light shield, supported by said mount and lying closely adjacent one side of said bulb, and a manual knob connected to said mount for effecting adjustable rotation thereof for dimming of the light passing into the reflector.

13. In an electric clock or the like, the combination comprising a translucent clock face, time indicating means including hands cooperating with said clock face, a dished reflector behind said clock face and having a lateral opening therein, a bulb assembly for positioning a lamp bulb in said opening, said bulb assembly comprising a metallic sleeve having a shaft insulated therefrom for mounting the sleeve for bodily rotation, means for retaining the bulb seated at the end of said sleeve with the bulb contacts respectively connected to the shaft and the sleeve, a stationary brush arranged to bear on the sleeve for conducting current thereto for lighting the bulb, a light shield mounted on said sleeve and lying closely adjacent one side of said bulb, and a manual knob connected to the end of said shaft for effecting adjustable rotation of the shield and dimming of the light passing into the reflector, said shield having an integral extension arranged to extend into the path of relative movement of the brush to insulate the same from the sleeve, so that the bulb is turned off in one position of said knob.

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