Aug. 24, 1965 M. J. CEGLIA 3,202,814

LIGHTING DEVICE FOR DISPELLING SHADOWS

Filed July 19, 1962 2 Sheets-Sheet 1

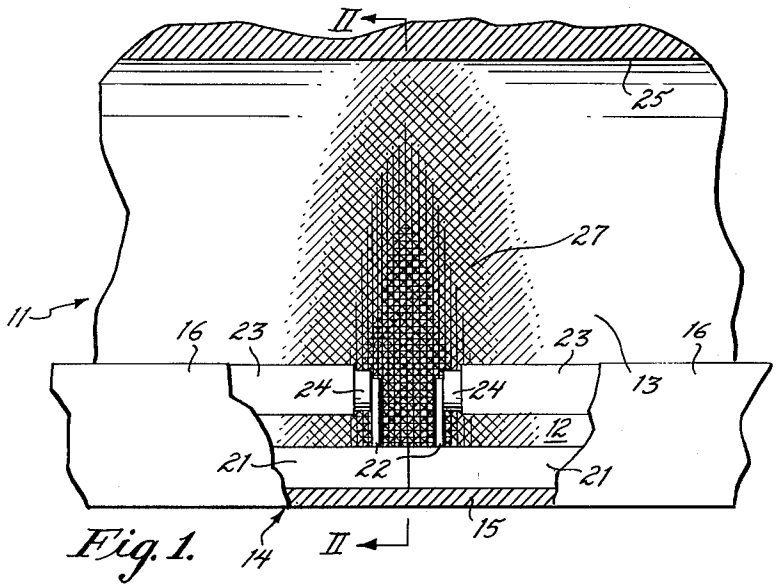


Fig. 1.

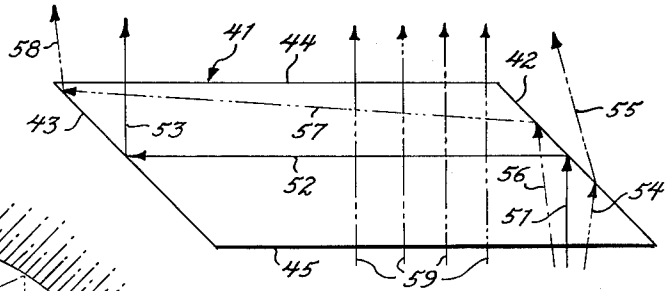


Fig. 6.

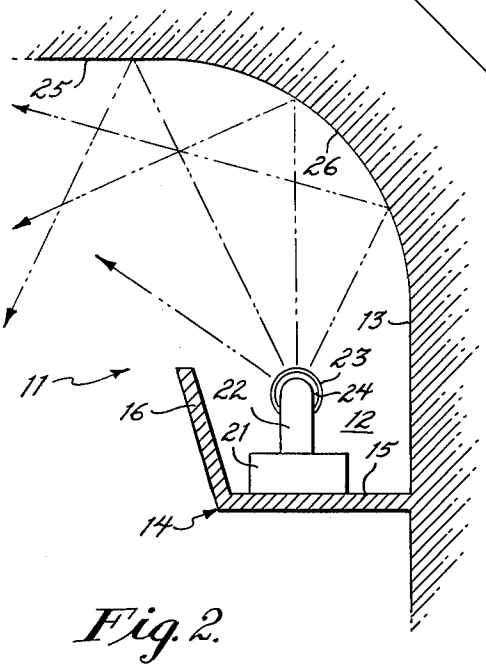


Fig. 2.

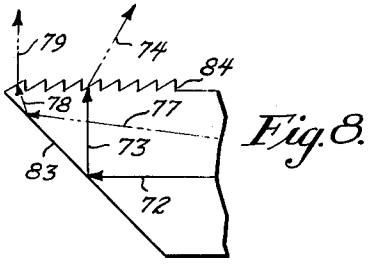


Fig. 8.

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LIGHTING DEVICE FOR DISPELLING SHADOWS

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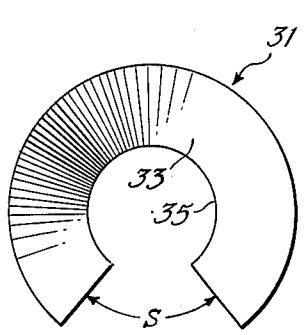


Fig. 4.

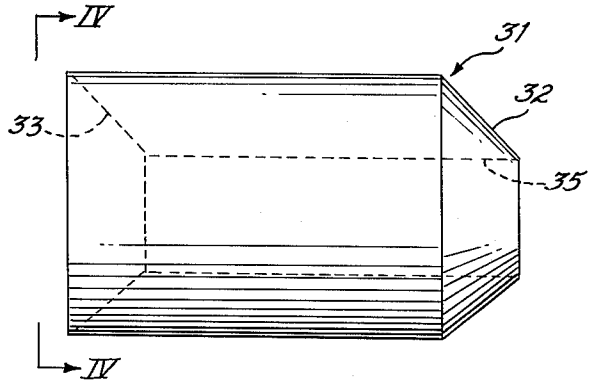


Fig. 3.

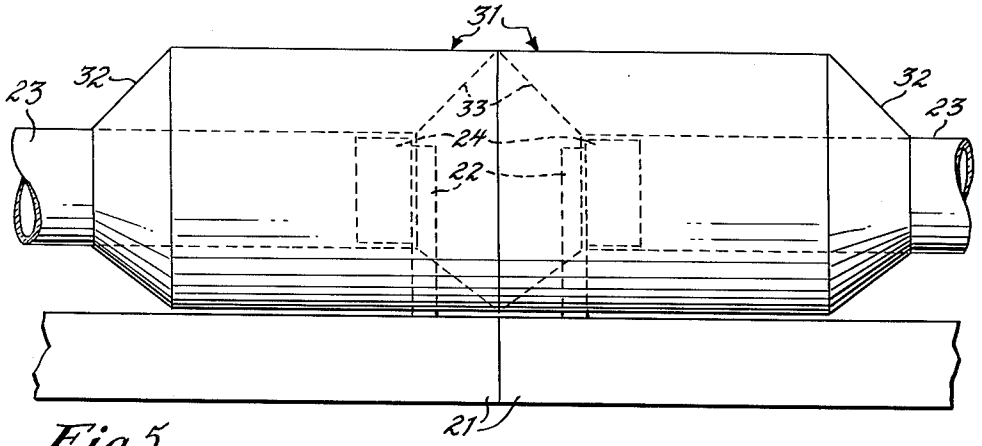


Fig. 5.

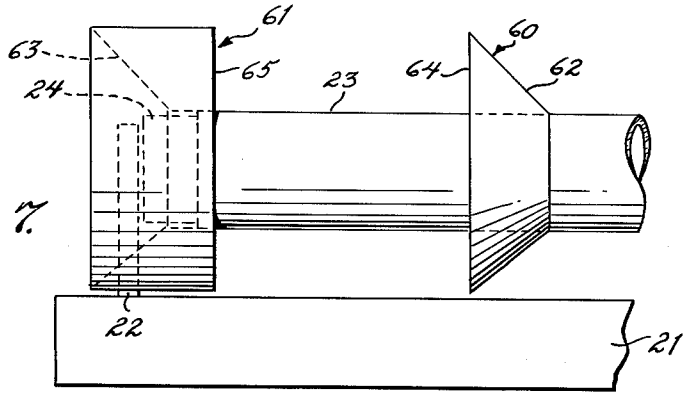


Fig. 7.

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3,202,814

LIGHTING DEVICE FOR DISPELLING SHADOWS

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12 Claims. (Cl. 240—9)

This invention relates to lighting by means of tubular lamps and concerns especially lighting of the space between the ends of such lamps aligned axially and spaced endwise from one another, such as in a cove or trough.

Tubular lamps, whether of fluorescent or incandescent type, usually are supported at their ends and (because of the supporting means) are spaced endwise from one another when employed in axially aligned rows. An undesirable concomitant of such an arrangement, especially noticeable when the lamps are so ararnged in a cove, trough, or other recess, is a shadow or dark space resulting from the lack of illumination from between the ends of the lamps. Sometimes to overcome this the lamps are arranged in a staggered configuration with their ends overlapping, but this involves complications in wiring and supports and not only is more expensive than an axially aligned arrangement but in some instances is not even feasible.

A primary object of the present invention is improvement in the pattern of illumination by a plurality of tubular lamps arranged in axial alignment with their adjacent ends spaced from one another.

An object is provision of a lighting device in the nature of an accessory to a tubular lamp and adapted to extend axially the range of illumination thereby.

Another object is inexpensive conversion of the conventional illumination pattern of an axially aligned and endwise spaced tubular lamp arrangement from a noticeably uneven or discontinuous pattern to an even, relatively continuous pattern.

A further object is an improved cove lighting pattern comparable to that obtained by overlapping, staggered tubular lamps but without altering the conventional axially aligned, endwise spaced arrangement of tubular lamps.

Other objects of the present invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying drawings.

FIG. 1 is a front elevation of a conventional cove lighting arrangement, partly cut away to show portions of the tubular lamps and their supports;

FIG. 2 is an end elevation, partly in section, taken at II—II of FIG. 1;

FIG. 3 is a side elevation of one embodiment of lighting device of this invention;

FIG. 4 is an end elevation of the device taken as indicated at IV—IV of FIG. 3;

FIG. 5 is a side elevation of the lamp ends (and supports) of FIG. 1 equipped with lighting devices of this invention as previously shown;

FIG. 6 is a schematic representation of the redirection of light by such a lighting device;

FIG. 7 is a side elevation of another embodiment of lighting device according to this invention; and

FIG. 8 s a schematic representation of the redirection of light by an embodiment of lighting device with modified external surface according to this invention.

In general, the objects of the present invention are accomplished by means of a lighting device having a pair of conical light-reflecting surfaces similarly inclined to and about a common axis, one of the surfaces being adapted to receive light travelling outward from the axis and reflect it in a generally axial direction to the other surface, and the other surface being adapted to receive

light reflected in a generally axial direction from the first surface and reflect it on outward.

In a particular form preferred according to this invention, such device comprises a generally cylindrical body of translucent material with a refractive index of at least about 1.42 and terminating at opposite ends in mutually parallel conical faces, one of the faces protruding and joining the body proper at an obtuse angle on the order of one and one-half right angles, and the other of the faces intruding and joining the body proper at an acute angle on the order of half a right angle.

FIG. 1 shows in front elevation (partly cut away to reveal the interior), and FIG. 2 shows in end elevation (partly in section), lighting cove **11** having trough **12** formed between vertical wall **13** and extension **14** therefrom. The extension has horizontal bed portion **15** supporting, and outwardly and upwardly inclined edge portion **16** normally concealing from view, inverted channels **21** containing ballast transformers and wiring (not shown, the end of the channel being represented as closed, in the interest of simplicity of the showing) and carrying upstanding supports **22** for the ends of tubular lamps **23**. The lamps have conventional ferrule **24** at each end and contact pins (not shown) extending from the ends into cooperating slots (also not shown) in the upstanding supports.

Ceiling **25** extends horizontally forward above the front portion of the trough, while over the rear portion of the trough curved junction **26** interconnects vertical wall **13** and the ceiling. FIG 2 shows schematically by means of arrows emanating from the lamp visible there (in end view) how the light is multiply reflected and thereby diffused to provide a pleasant indirect lighting arrangement. FIG. 1 shows, however, that because of the lack of illumination from between the ends of the lamps a noticeable shadow **27** appears on the vertical wall and the curved wall-ceiling junction. Such shadow, which also would be visible to some extent on the nearby portion of the ceiling, detracts considerably from the otherwise attractive nature of cove lighting.

FIGS. 3 and 4 show, in side and end elevation, respectively, lighting device **31** of this invention; it has a generally cylindrical body terminating at its opposite ends in protruding conical face **32** and intruding conical face **33**, which are mutually parallel. Axial bore **35** extends from end to end through the device, giving it a generally annular configuration, which is modified into a C-shaped transverse outline (as shown in FIG. 4) by omission of a sector, indicated by angle S. This device is translucent and is adapted to fit over the end of a tubular lamp as conventionally supported.

FIG. 5 shows, in side elevation, substantially the same extent of the ends of lamps **23** and supporting channels **21**, with upstanding supports **22** for the adjacent lamp ends, as in FIG. 1 but on an enlarged scale. In addition, each of the visible lamp ends is equipped with one of lighting devices **31** just illustrated. Protruding conical end faces **32** are directed away from one another at the extreme left and right portions of this view. Respective intruding conical faces **33**, shown in broken lines, adjoin one another to form an enclosure about respective upstanding supports **22** for the lamp ends, similarly shown.

FIG. 6 shows schematically (on a further enlarged scale) the transmission of light by one of lighting devices **31**, specifically section **41** thereof in the shape of a parallelogram, which may be considered to be taken in any plane intercepting the entire axis. Inclined right edge **42** corresponds to protruding conical face **32**, and inclined left edge **43** to intruding conical face **33**. As indicated by upwardly directed arrows, corresponding to location of the lamp (not shown in this view) just below lower or

inner edge 45 of the parallelogram, light emitted in a substantially radial direction from the lamp enters and subsequently re-emerges most often through upper or outer edge 44, at a location dependent upon the angle and location of entry.

Solid arrow 51 represents a radially emitted light ray passing perpendicularly through inner or lower edge 45 and into incidence upon the internal surface of right edge 42 (formed by protruding conical face 32), from which it is totally reflected as being above the critical angle (for transmission from a denser to a less dense medium), which is dependent upon the material of which the device is made. Reflected ray 52, represented by a solid arrow extending from the right internal surface to incidence with the internal surface of the left edge (formed by the intruding conical face), is reflected likewise, and resulting ray 53 is directed radially outward and passes perpendicularly through upper or outer edge 44 at a location displaced axially (from the location of ray 51) the length of either of the edges through which the continuing rays passed.

Rightwardly inclined arrow 54, located just to the right of arrow 51, represents a light ray oriented slightly off the perpendicular to the lower or inner side through which it entered (where it underwent slight refraction not indicated). Striking the internal surface of edge 42 at an angle permitting transmission rather than total reflection, this light ray passes through the surface to emerge in an oppositely inclined oblique direction (as a result of refraction) indicated by arrow 55.

Leftwardly inclined arrow 56, representing a light ray slightly to the opposite side (from arrow 54) of perpendicular to the lower or inner surface, represents a light ray also reflected at the internal surface of edge 42. Because of the different angle of incidence, reflected ray 57 moves obliquely outwardly, rather than axially as ray 52 does, and is reflected obliquely by the internal surface of the left edge. It passes outwardly as ray 58 through (and is very slightly refracted by) upper or outer edge 44 at an angle similar to that at which ray 56 entered.

Light rays 59 entering perpendicularly at a location such that they are not intercepted by the internal surface of the right edge pass straight through to emerge without change in direction, as is also indicated in FIG. 6.

FIG. 7 shows, in side elevation, another embodiment of lighting device according to this invention fitted onto lamp 23, which is supported above channel 21 by upstanding supports 22 as aforesaid. It differs from the previously illustrated (FIG. 3) embodiment by being formed in two separate pieces 60 and 61, shaped and located corresponding to the respective right and left end portions of previous device 31 (with a central cylindrical portion omitted). Right piece 60 has protruding conical face 62 at the right, and left piece 61 has intruding conical face 63 (represented in broken lines) at the left, corresponding to mutually parallel conical faces 32 and 33 of device 31. Adjacent, spaced apart left and right faces 64 and 65 of the right and left pieces, respectively, are parallel to one another and substantially perpendicular to the axis. Though not shown in end view, each of these pieces presents the same C-shaped transverse outline as previously shown for device 31.

FIG. 8 is a schematic representation (similar to FIG. 6 but showing the leftmost portion only) of the redirection of light by an embodiment of this invention having the added feature of modified or sawtooth upper or outer surface 84 adapted to refract light reflected radially (or nearly so) outward from the internal surface of left edge 83, corresponding to left edges 43 and 63 of the previous embodiments, either of which this embodiment may otherwise resemble. Axial light ray 72 incident upon that surface is reflected radially until reaching an inclined portion of the sawtooth edge, through which it passes as refracted ray 74 inclined to the right. Oblique ray 77 (corresponding to ray 57 in FIG. 6) is reflected obliquely as ray 78 by the left internal surface to and through a sawtooth portion, from which it emerges as nearly radial ray 79. The illustrated sawtooth surface represents only one form of modified refracting or diffusing surface that may be used similarly.

Regardless of which embodiment of the lighting device of this invention is employed, the material of which it is made should be translucent, preferably transparent or nearly so, and should have an appropriate refractive index so that light incident on an internal surface thereof at an angle equal to or greater than about 45° to the perpendicular to that surface will be reflected therefrom; this means that the index of refraction of the material should be at least about 1.42. Many materials are suitable, including film-forming high polymers, as well as glasses and many crystals. A suitable polymeric material is composed wholly or chiefly of methyl methacrylate and is sold under such trademarks as "Lucite" and "Plexiglas"; it has a refractive index of about 1.5 corresponding to a critical angle of about 42°, meaning that light incident on an internal surface thereof at 45° (or even several degrees less) will be reflected therefrom, while light incident at a larger angle will pass therethrough (and be refracted thereby). Of course, the material selected must have an appropriately high softening temperature and good resistance to thermal shock. Its coefficient of expansion must be considered also in dimensioning the axial bore with respect to the lamp diameter.

When axially aligned, endwise spaced tubular lamps are equipped with a lighting device according to the present invention the shadow previously noticeable in the vicinity of the ends of the lamps is eliminated or reduced to such an extent that it is not at all or hardly noticeable to the unaided eye. For best results the conical surfaces of the lighting device should form an angle of substantially 45° with the axis, meaning that the protruding face should join the body proper at an obtuse angle on the order of one and one half right angles, and the intruding face should join the body proper at an angle on the order of half a right angle (both angles measured inside the device and in a plane intersecting the entire axis). In order to bridge the entire gap between adjacent lamp ends, each of a pair of such devices should have a sufficient radial thickness that the intruding conical face thereof extends from the intermediate midpoint to the end of the lamp; the ferrule is sufficiently narrow so that the lack of light transmission from or through it may be disregarded, although use of a radial thickness sufficiently great to permit by-passing of the ferrule also is appropriate. Other variations in the dimensions, and combination and separation of parts, are also within the scope of the invention, the full benefits and advantages of which will become apparent and accrue to those undertaking to practice it.

The claimed invention:

1. Lighting device of generally cylindrical configuration having a cylindrical bore therethrough and thereby adapted to receive tubular light-emitting means axially therein and having a protruding conical face at one end and a coaxial intruding conical face substantially parallel thereto at the other end, each conical face being inclined at essentially forty-five degrees to the axis and adapted to reflect at least some of the light incident on the internal surface thereof, whereupon light transmitted substantially radially from the axis onto the internal surface of the protruding conical face is reflected substantially axially therefrom to the internal surface of the intruding conical face and is reflected substantially axially outward therefrom.

2. Lighting device comprising a generally cylindrical body of translucent material bored axially and terminating at opposite ends in mutually parallel conical faces, one end face joining the body at an obtuse angle and the

other end face joining the body at an acute angle supplementary thereto.

3. The device of claim 2 wherein the obtuse angle is about one and one-half right angles and the acute angle is about half a right angle.

4. Lighting device for use at the end of a tubular lamp to receive light emitted essentially radially from the lamp and to distribute it essentially radially outward at a location displaced axially from the lamp, comprising a generally cylindrical body of translucent material with a first end face extending over the lamp and having an oblique internal surface located to receive and reflect incident light from the lamp substantially axially to a location off the end of the lamp and with a second end face at that latter location having an oblique internal surface located to receive the axially reflected light and reflect it substantially radially outward.

5. The device of claim 4 wherein the internal surface of the first face is adapted to transmit some of the light incident thereon from the lamp and thereby refract it.

6. The device of claim 5 having an index of refraction of at least 1.42.

7. The device of claim 4 wherein at least part of the outer surface of the body through which the light redirected radially outward passes has a surface adapted to diffuse the light passing therethrough.

8. Lighting arrangement for dispelling shadow comprising a pair of radially emitting tubular lamps aligned endwise to another, and normally characterized by a shadowy region in the vicinity of the adjacent lamp ends, and a shadow-dispelling device including generally cylindrical means of translucent material bored axially and fitting over the adjacent ends of the respective lamps and terminating at each end in a protruding conical face extending thereover at an angle of about half a right angle to both the radial and axial directions and located to intercept on its internal surface some light emitted radially from the lamps into the device and to reflect it generally axially toward the adjacent lamp ends, the cylindrical means being hollowed therebetween to provide similarly angled intruding conical faces, located to intercept the axially directed light and reflect it substantially radially outward, whereupon the intercepted and reflected light will appear as though it had been emitted into the normally shadowy region in the vicinity of the lamp ends.

9. In a lighting system having tubular lamps aligned endwise and spaced from one another, the combination of a tubular lamp and a generally cylindrical device annular in configuration as viewed along its axis fitting axially onto and extending beyond the end of the lamp and between it and the end of an adjacent lamp aligned therewith and spaced therefrom, the device having in the portion thereof radially adjacent the lamp a reflecting internal surface oriented obliquely with respect to the peripheral surface of the lamp, and the device having in the portion thereof extending beyond the end of the lamp an internal surface oriented substantially parallel to the first internal surface, the respective internal surfaces being thereby adapted to receive light emitted radially from the lamp, to reflect the light successively and to direct it radially outward at a location between the lamp ends.

10. The device of claim 2 wherein for at least part of its axial extent the device lacks a section of its annular configuration, resulting in a C-shaped appearance as viewed along its axis.

11. In a cove lighting system, a pair of tubular lamps aligned endwise to one another and to the cove, means extending into the cove and supporting the lamps at their ends, and translucent means fitting over the adjacent lamp ends and their supporting means and comprising a generally cylindrical body having a first end face extending over one of the lamps, with an oblique internal surface located adjacent the lamp surface to receive and reflect incident light from the lamp, the surface being oriented to reflect the light substantially axially to a location between the ends of the lamps, and having a second face at that latter location with an oblique internal surface located to receive the axially reflected light from the first internal surface and oriented to reflect it outward substantially radially from a location intermediate the adjacent lamp ends, whereby the cove is substantially evenly lighted throughout that part of its length along the lamps and the intervening space.

12. In a lighting system having tubular lamps aligned endwise, the combination of a pair of lamps spaced endwise from one another and a plurality of lighting devices, the adjacent ends of the respective lamps each being fitted with one thereof, each lighting device being effective to receive light emitted essentially radially from the adjacent lamp and to distribute it essentially radially outward at a location displaced axially from that lamp and between the adjacent lamp ends, each lighting device comprising a generally cylindrical body of translucent material with a first end face extending over the lamp and having an oblique internal surface located to receive and reflect incident light from the lamp substantially axially to a location off the end of the lamp and between the lamp ends and with a second end face at that latter location having an oblique internal surface located to receive the axially reflected light and reflect it substantially radially outward.

References Cited by the Examiner

UNITED STATES PATENTS

2,434,951	1/48	Netting	240—51.11
2,837,052	6/58	Viret	240—1 X
2,881,654	4/59	Toffolo	88—57

FOREIGN PATENTS

800,815	5/36	France.
1,021,268	11/52	France.
1,119,731	4/56	France.
846,734	8/52	Germany.
800,553	8/58	Great Britain.

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