United States Patent

Lasker

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[54] LIGHTING FIXTURES

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[73] Assignee: **Moldcast Manufacturing Company**, Newark, N.J.

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[52] **U.S. Cl.** **240/25**, 240/1.1

[51] **Int. Cl.** **F21p 1/00**

[58] **Field of Search** ..... 240/25, 103 R, 105, 1.1, 41.1

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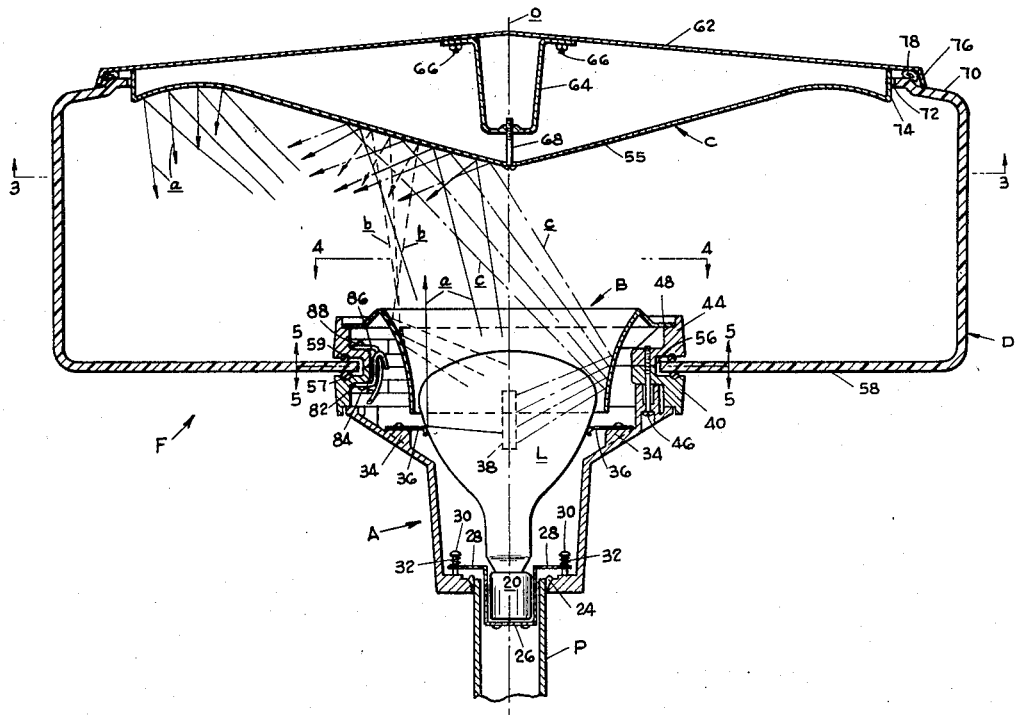
[57] **ABSTRACT**

A lighting fixture employs a pair of reflectors related to a lamp housing which includes socket means for a lamp. One reflector is substantially tubular and extends into the housing to surround a portion of a lamp. The second reflector having a diameter larger than the diameter of the first reflector is positioned above in spaced relationship with respect to the first reflector. An enclosure of light transmitting material extends between the spaced reflectors and has a diameter which is not less than the diameter of the second reflector. The second reflector is formed to distribute light directed thereto from a lamp and from the first reflector through the enclosure.

By selecting tubular reflectors having differently angled inner reflecting surfaces, different illumination patterns are obtained without changing the outer dimensions of the tubular reflector or of the fixture.

9 Claims, 12 Drawing Figures



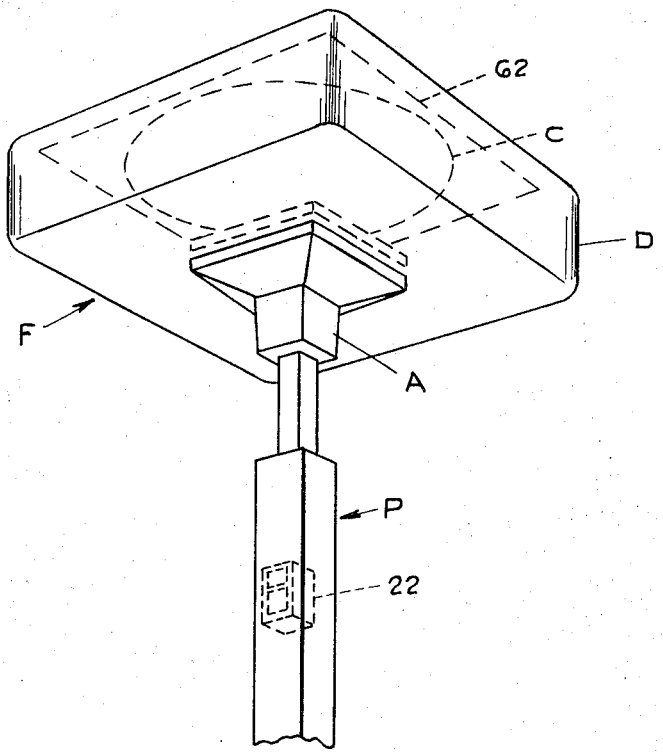


FIG. 1

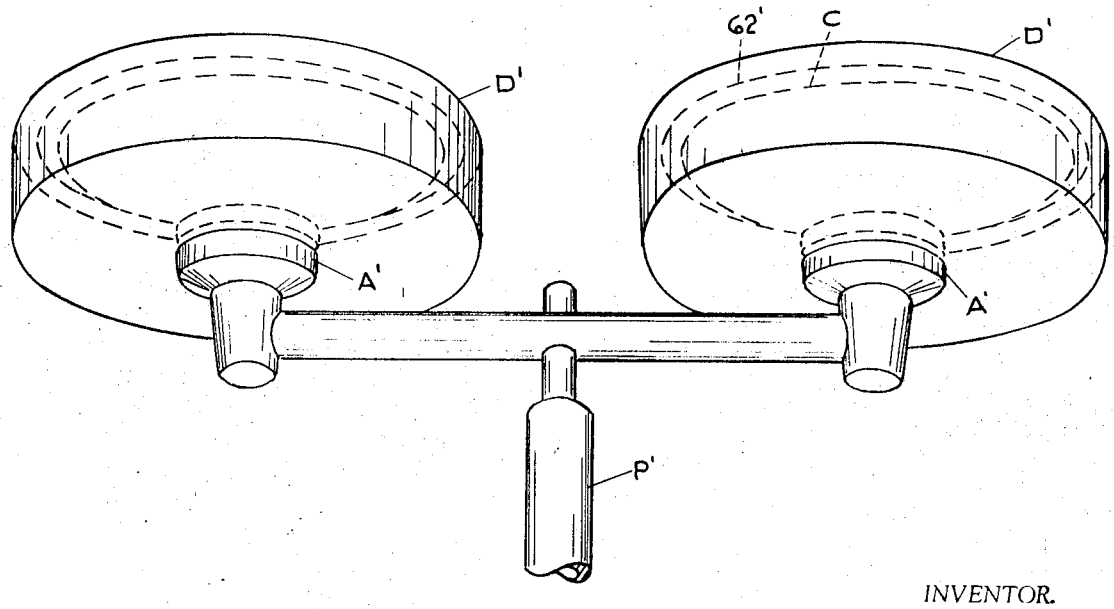


FIG. 8

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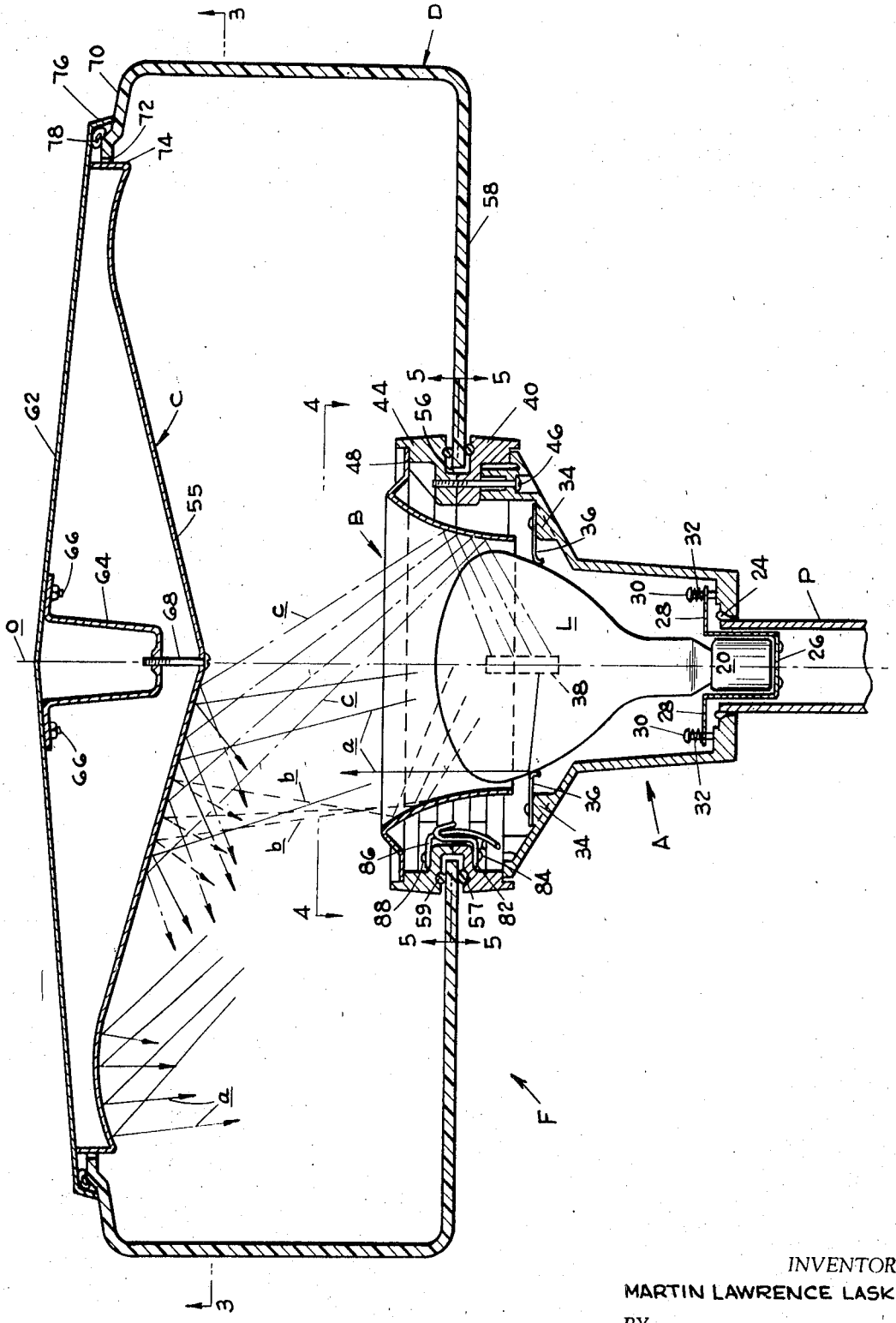

FIG. 2

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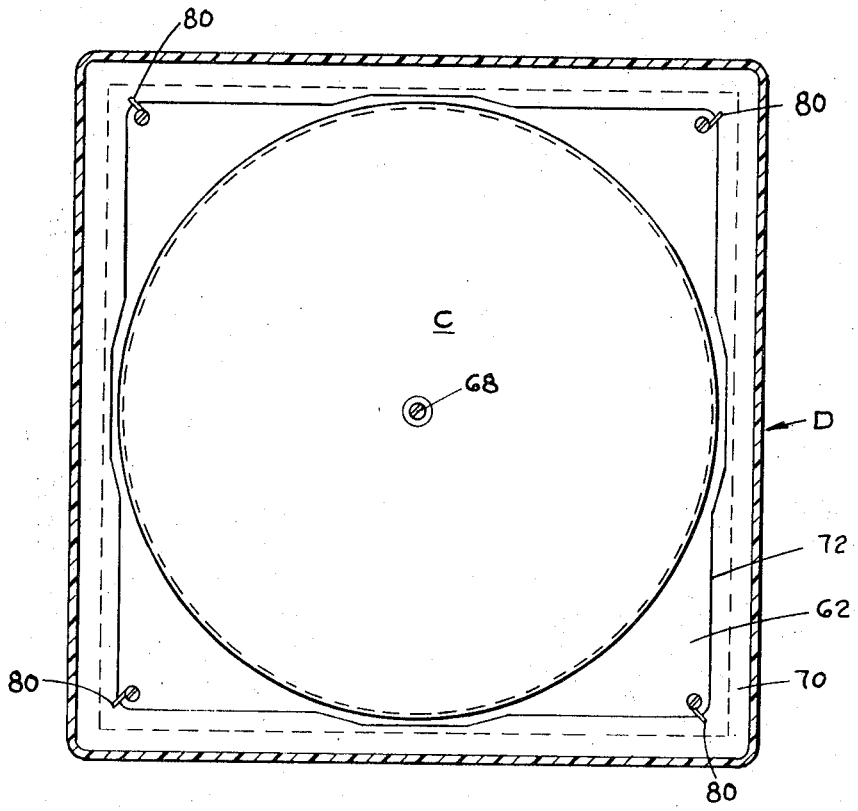

FIG. 3

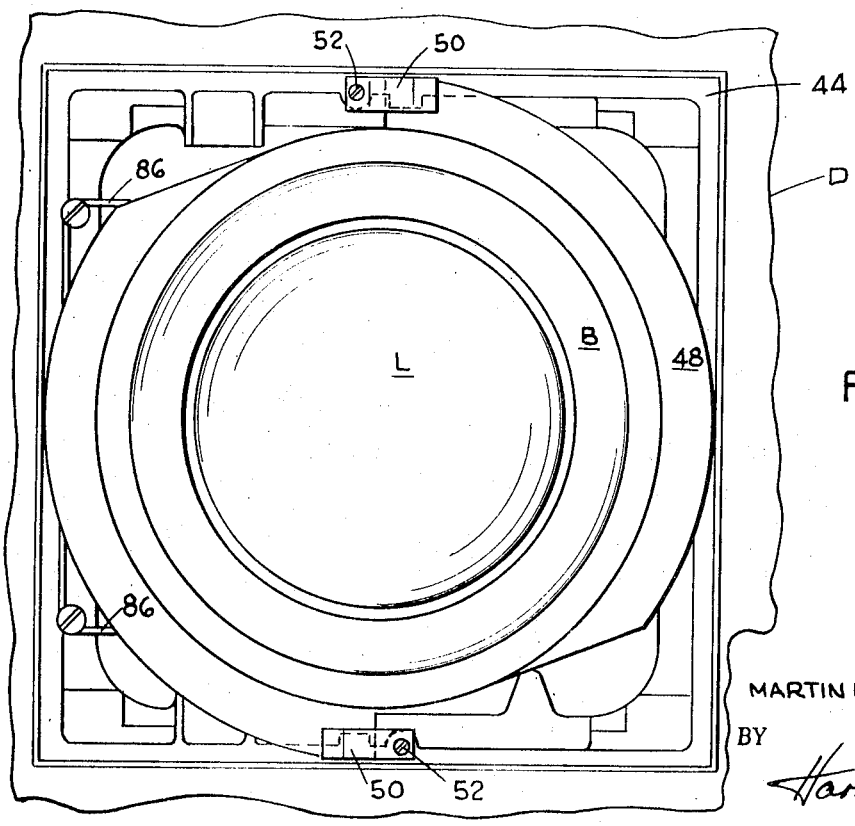

FIG. 4

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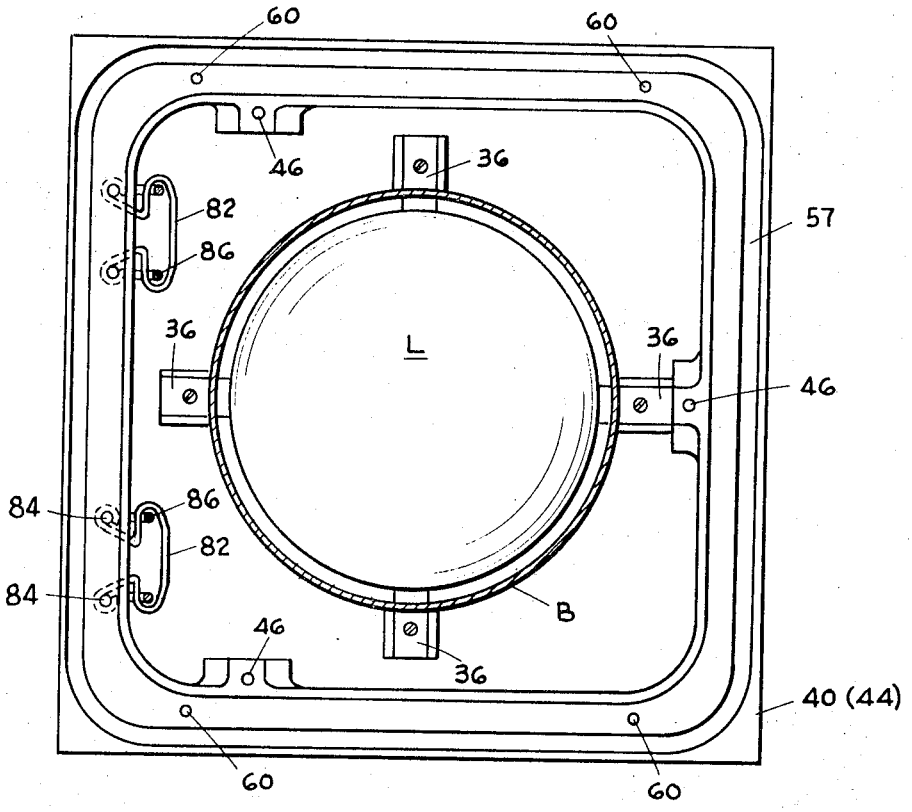

FIG. 5

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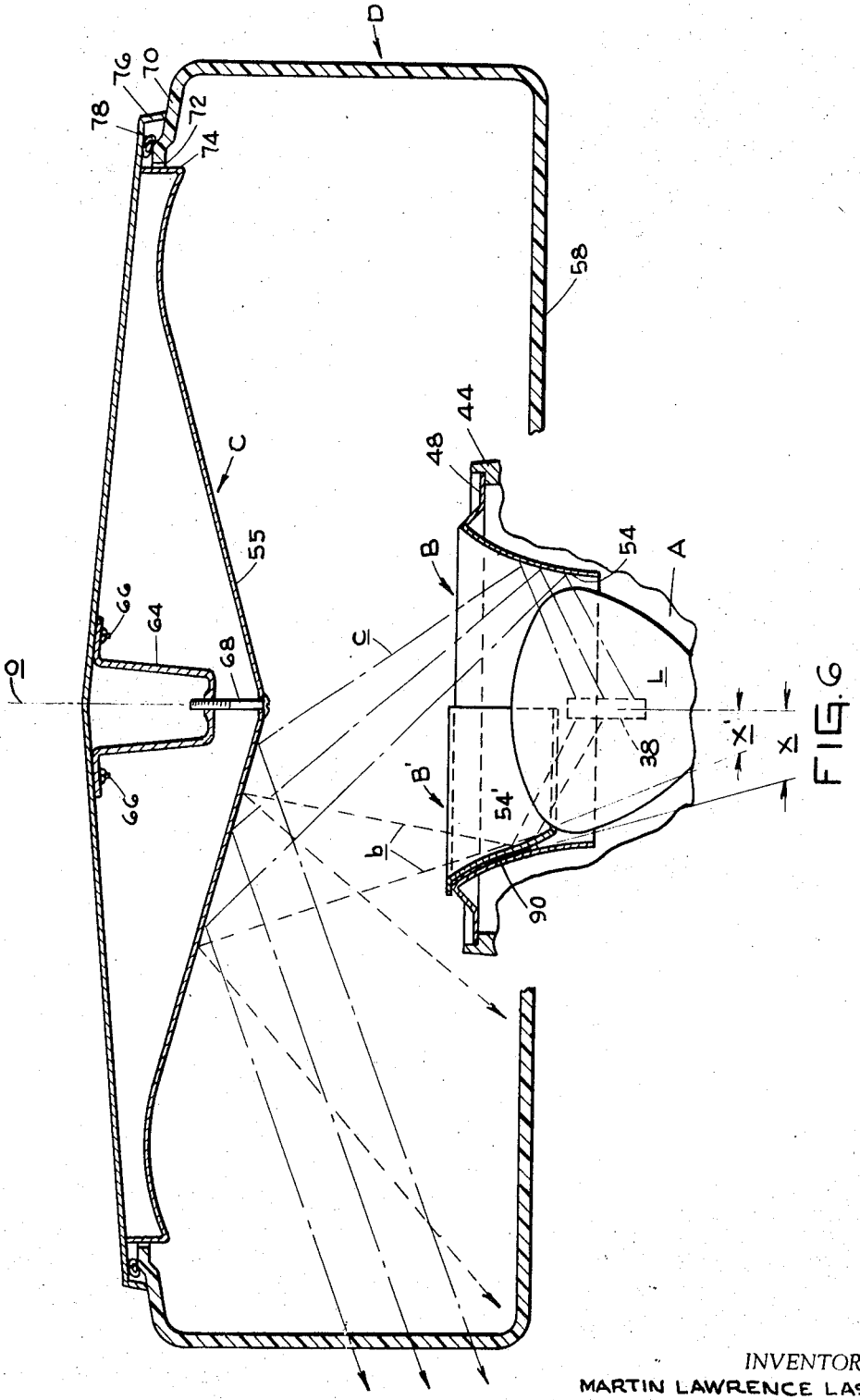

FIG. 6

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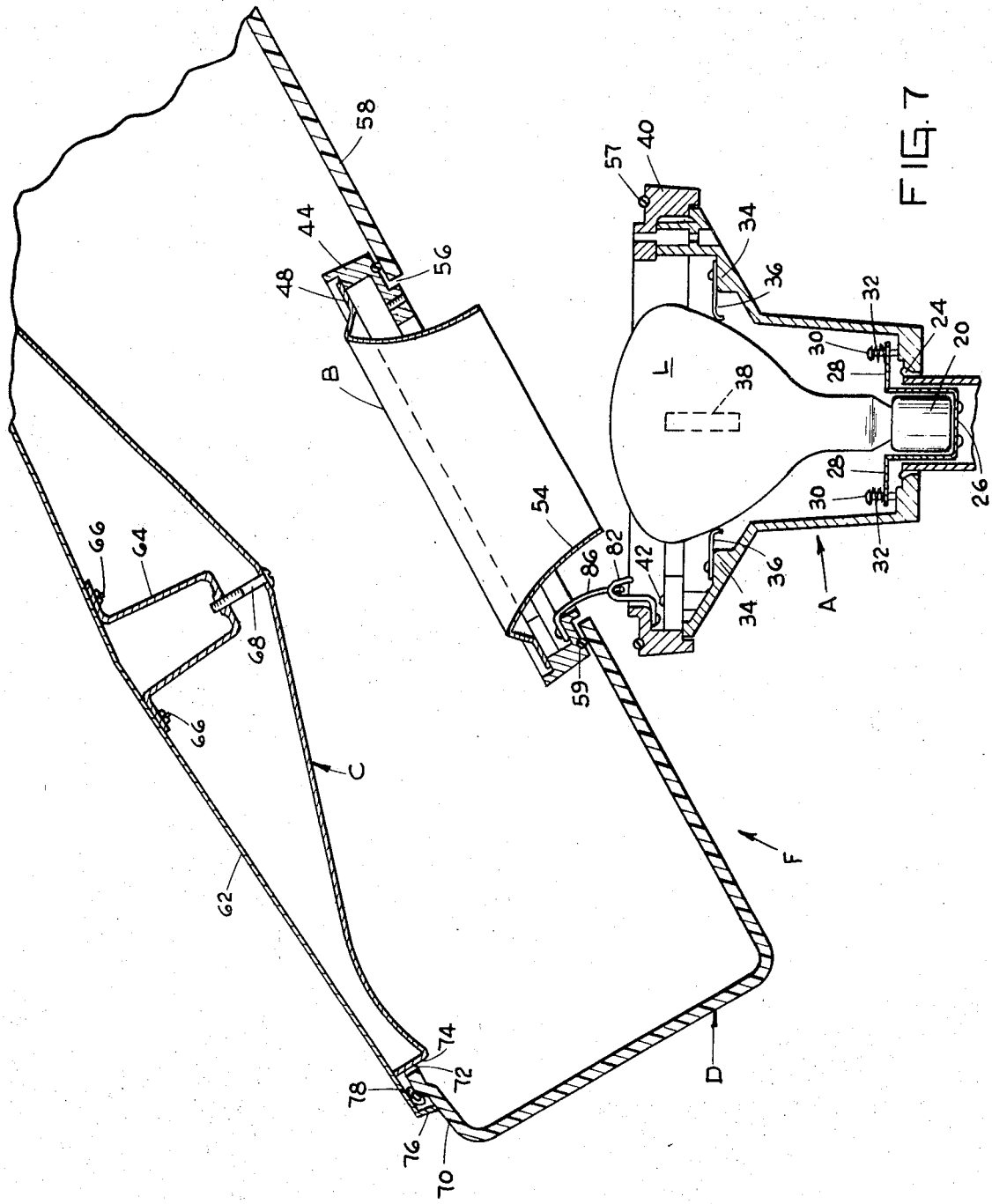

FIG. 7

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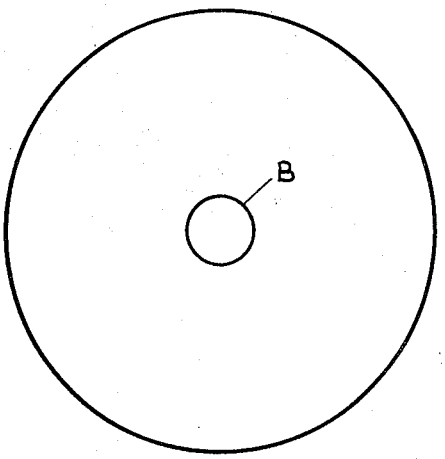

FIG. 9

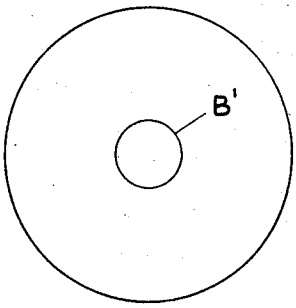

FIG. 10

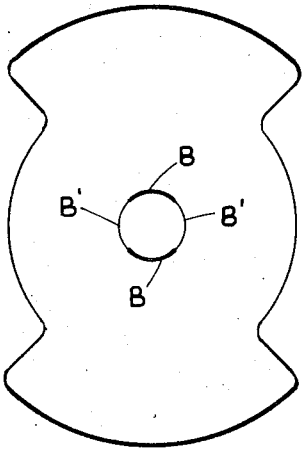

FIG. 11

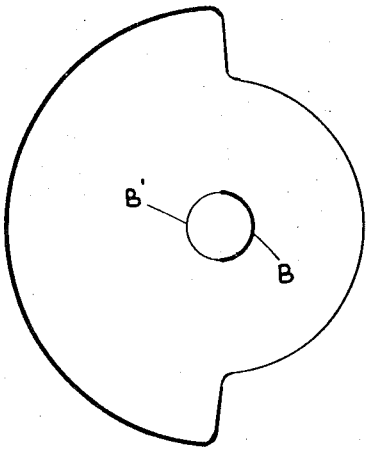

FIG. 12

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LIGHTING FIXTURES

The invention relates to lighting fixtures, and is more particularly directed to improvements in outdoor lighting fixtures of the type wherein the light source is hidden from the viewer.

BACKGROUND OF THE INVENTION

The glare zone of a lighting fixture is the wide angle most common to viewers approaching the fixture. The illumination zone is the area of desired illumination and may be varied in accordance with the shape of the area to be illuminated. In a lighting fixture for indoor or outdoor use, it is desirable to obtain light distribution over a relatively wide illumination zone while retaining an extremely low glare appearance. Such characteristics are of particular concern in outdoor lighting arrangements where it is desired that the fixture illuminate a relatively wide area together with the elimination of glare. Glare causes interference with normal viewing and, in general, detracts from the overall appearance of both the fixture and of the area illuminated.

It also is desirable that a lighting fixture permit simple modification of its structure to enable changing or altering the distribution of light emitted thereby. There are various prior art devices which contain movable parts in order to direct or redirect light to cover selected areas. Such prior art devices include swivel type bases and other mechanically movable means which are subject to wear and generally require maintenance.

Other prior art lighting fixtures of the hidden light source type are provided with various reflector arrangements whereby the light is emitted to a constant predetermined area. While such devices eliminate the mechanical means for altering the light pattern, any change or modification which will furnish an enlarged area of illumination or different light pattern is accompanied by the requirement to change the size of the fixture and the associated reflectors. As a result, the manufacturer or supplier must include a relatively large inventory of various size fixtures to accommodate different lighting requirements.

SUMMARY OF THE INVENTION

In accordance with the invention, a lighting fixture is provided which comprises a lamp housing including socket means for a lamp. A first substantially tubular reflector extends into the housing and is adapted to surround a portion of a lamp. A second reflector having a diameter larger than the diameter of the first reflector is positioned above and spaced from the first reflector. An enclosure of light transmitting material which has a diameter not less than the diameter of the second reflector extends between and is connected to the reflectors. The second reflector lies in a plane substantially transverse of the central longitudinal axis through the fixture; that is, the axis which extends through the socket means, the first reflector and the center of the second reflector. The second reflector acts to distribute light directed thereto from a lamp and from the first reflector, the light being emitted through the light transmitting enclosure.

Without changing the outer parameters of the reflector or lighting fixture, different and enlarged illumination zones are obtained by simply changing the angle of the reflecting surface provided by the first or substantially tubular reflector which acts as a collecting reflector and directs light to the constant second or distributing reflector.

In the preferred form of the invention, the two reflectors and the enclosure of light transmitting material are in the form of a unitary assembly. The enclosure itself acts as the means for maintaining the reflectors is predetermined spaced relationship. The unitary assembly aspect of these essential parts enables the disconnection of the assembly from a lamp housing for relamping when necessary, while maintaining the predetermined fixed spatial relationship of the parts of the assembly and the proper alignment of the parts with the light source.

These, and other advantages and improved results of the invention will be apparent from the following description of a preferred embodiment of the invention, taken in conjunction with the drawings which are on a reduced scale.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a lighting fixture made in accordance with the invention, the fixture being shown atop a pole which is partially illustrated;

FIG. 2 is a vertical, cross sectional view of a lighting fixture shown in FIG. 1, this view also showing various line representations of the patterns of the light rays:

FIG. 3 is a view taken approximately in the plane of line 3—3 of FIG. 2;

FIG. 4 is a view taken approximately in the plane of line 4—4 of FIG. 2;

FIG. 5 is a horizontal, cross sectional view taken approximately in the plane of line 5—5 and in the indicated directions of FIG. 2;

FIG. 6 is a vertical cross sectional view similar to FIG. 2, this partial view including a collecting reflector having a differently angled reflecting surface than the collecting reflector shown in FIG. 2;

FIG. 7 is a view similar to FIG. 2 except that the assembly of the reflectors and the light transmitting enclosure is shown retracted from the lamp housing about a hinge;

FIG. 8 is a partial perspective view of a pair of lighting fixtures having an annular configuration rather than a square contour as shown in FIG. 1, the fixtures being mounted atop a pole partially shown; and

FIGS. 9, 10, 11 and 12 are schematic views illustrating a plurality of illumination patterns which may be provided by a lighting fixture made in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and as best shown in FIG. 2, a lighting fixture F made in accordance with the invention comprises a lamp housing A which includes socket means **20** adapted to receive a lamp L. A substantially tubular reflector B extends into the housing and is adapted to surround the upper portion of the lamp. A second reflector C having a diameter larger than the diameter of the reflector B is positioned above and spaced therefrom. An enclosure D made of a light transmitting material extends between and is connected to the reflectors B and C. The enclosure has an overall diameter not less than the diameter of the reflector C. The reflector C lies in a plane substantially transverse of the central longitudinal axis *o* (also the optical axis) of the fixture, or the axis which extends centrally through the socket means **20** and the centers of the reflectors B and C. The distributing reflector C distributes light directed thereto from a lamp and from the collecting reflector B, the light being emitted through the enclosure D.

The described lighting fixture is particularly suitable for outdoor lighting. As shown in FIG. 1, the fixture F is mounted atop a hollow pole P within which suitable power lines (not shown) are extended to the socket **20**. As is known in the art, a ballast **22** may be positioned within the pole to energize a light source, for example, a mercury vapor lamp. Any suitable light source may be fitted into the socket including an incandescent lamp.

In greater detail, the lamp housing A preferably is made by die casting a suitable alloy such as aluminum or zinc, and is opaque. The housing which is hollow and generally frustoconical in its interior with the larger diameter at the top is formed at its lower end with an opening to receive the top end of the pole P. A sealing gasket **24** is provided between the wall of the pole and the periphery of the opening. The socket **20** preferably is resiliently mounted and together with resilient means for engaging the sides of a lamp, furnishes a universal floating mounting for the lamp which assures that the optical axis of the lamp is centered on the axis *o*, and further accom-

modates lamps of varying length wherein the bulb may also be slightly eccentric with respect to its base.

As shown in FIG. 2, the socket 20 is held in the housing by a bracket 26, the bracket being provided with radially extending flanges 28 through which screws 30 are extended with the ends of their shanks bearing against a wall provided by the housing. The shanks of the screws intermediate the bracket flanges and the heads of the screws accommodate helically coiled compression springs 32. As shown in FIGS. 2 and 5, a plurality of circumferentially arranged shoulders 34 are provided to furnish supports for the connection thereto of respective leaf spring members 36 adapted to engage and centralize a lamp L when positioned within the resiliently mounted socket 20. The described arrangement assures that the grid or filament 38 of the lamp is located on the central axis *o*.

As also shown in FIG. 2, an annular lower support member 40 having a central opening substantially equal to the opening of the lamp housing at its top side is positioned to rest upon the upper edge of the housing. For convenience in manufacture, the member 40 preferably is made as a separate piece by die casting. Actually, the member 40 functions as a part of the lamp housing. As best shown in FIGS. 2 and 7, the member 40 is connected to the housing A by a plurality of circumferentially arranged screws 42 which extend through the member and into tapped holes formed in the lamp housing. As shown in FIGS. 2 and 5, an upper support member 44 substantially identical with the member 40 rests thereon and is releasably connected thereto and to the lamp housing by a plurality of spaced, circumferentially arranged screws 46 extended through the housing, through the lower support member 40 and into tapped holes formed in the upper support member 44.

The support member 44 serves as a mounting for the collecting reflector B. As shown in FIG. 2, this reflector is substantially tubular and of inverted frustoconical form, it being flared outwardly at the top. The reflector is provided with an annular peripheral flange 48 permitting connection to the support member 44 by a pair of clips 50. As shown in FIG. 4, the clips are located to engage the flange 48 on opposite sides of the reflector. The clips are secured by screws 52 extended through the ends of the clips with the shanks of the screws in tapped holes formed in the upper support member 44. The reflector B preferably is made of aluminum and is provided with an inner reflecting surface 54. Any suitable reflecting surface may be provided, for example, a specular anodized finish with a minimum 80 percent reflectance. The reflecting surface 54 as presented toward the central axis *o* of the fixture is convex.

The distributing reflector C is maintained in predetermined spaced relationship above the reflector B by the intermediate connecting enclosure D. The enclosure is made of a light transmitting material, preferably a transparent material such as a clear acrylic resin or glass which may be tinted. Although not as desirable, a translucent material may be used. The enclosure has a wall sufficiently thick to serve as a structural material whereby the reflectors are maintained in predetermined spaced relationship by the enclosure. As will be evident from FIG. 2, the reflector C has a diameter substantially greater than the diameter of the reflector B, and the light transmitting enclosure D has a diameter which is at least as great, and preferably greater than the diameter of the reflector C. For example, and not by way of limitation, the reflector C may have a diameter of approximately 23 inches; the reflector B a diameter of approximately 7.5 inches at the top where it has its largest diameter (exclusive of the connecting flange); and the light transmitting enclosure D may have a diameter of 26.5 inches. It will be understood that the term "diameter" is used in the general sense to include the transverse dimension of a square part since the enclosure, for example, may have a square FIG. 1 rather than a circular (FIG. 8) contour.

As will be subsequently described, the support member 44, the collecting reflector B, the distributing reflector C, and the light transmitting enclosure D preferably constitute a unitary assembly.

As shown in FIGS. 2 and 3, the reflector C, which preferably is made of aluminum, is circular and has an inner reflecting surface 55. Any suitable polished reflecting surface may be provided, for example, a specular anodized finish with a minimum 80 percent reflectance. The reflecting surface 55 faces the reflector B and a lamp L when inserted in the socket 20. As shown in FIG. 2, the reflector C lies in a plane substantially transverse of the central longitudinal axis *o*, and in the preferred embodiment of the invention as shown, the reflector is contoured to provide an annular, rather shallow concave surface intermediate the center and the outer periphery of the reflector.

As shown in FIGS. 2 and 7, the enclosure D is formed with a central opening 56 on its bottom side 58. As shown in FIG. 5, the upper support member 44 is provided with spaced, tapped holes 60 to receive screws (not shown) which are extended through the bottom wall of the enclosure just outwardly of the opening 56 to thereby secure the enclosure to the support member. A sealing gasket 57 is positioned in a groove formed on the top side of the member 40 for engagement with the enclosure wall 58, and a second sealing gasket 59 is positioned in a groove formed on the underside of the support member 44 for engagement with the opposite side of the enclosure wall 58.

As shown in FIGS. 2 and 3, the enclosure D is secured to the distributing reflector C by a dome-like connecting member 62, preferably made of aluminum, and by a supporting bracket 64. The bracket is connected at the top to the dome member 62 by threading nuts onto connecting studs 66 after the flanges 68 of the bracket are positioned on the studs. The lower end of the bracket is provided with a tapped hole through which a screw 68 is extended, the head of the screw being positioned on the inner side of the reflector at its center. The top side 70 of the enclosure D is provided with a large central opening 72 to allow the inturned edge 74 of the reflector C to extend therethrough with a close fit. The dome member 62 has a downturned flange 76 to engage the wall 70 of the enclosure. A gasket 78 is positioned between the parts to provide a seal. The unitary assembly of the two reflectors and the light transmitting enclosure is completed by securing the dome member to the enclosure in any suitable manner. As shown in FIG. 3, a plurality of connector clamps 80 may be utilized for this purpose. The come member may be provided with tapped holes and the clamp members may be held by screws extended into the tapped holes.

To enable ready access to the inside of the lamp housing A for lamping and relamping, hinge means is provided to allow the unitary assembly of reflector B, reflector C and light transmitting enclosure D to be rotated or tilted away from the lamp housing A from the position as shown in FIG. 2 to the position shown in FIG. 7. As shown in FIGS. 2, 5 and 7, a pair of spaced bottom hinge members 82 are secured to the support member 40. The hinge members are in the form of bent wires which are secured in place by screws 84 threaded into tapped holes formed in the support member 40. The upper support member 44 is provided with a pair of aligned, spaced hinge members 86 cooperable with or hooked about the hinge members 82. The hinge members 86 are similarly secured to the upper support member 44.

The assembly of reflectors and light transmitting enclosure movable as a unit about the hinge members assures the concentricity of the reflectors with respect to a lamp mounted within the housing at all times. It will be apparent that to tilt the assembly from the position shown in FIG. 2 to the position shown in FIG. 7, the screws 46 are first removed to disconnect the assembly from the lamp housing, and after tilting and lamping or relamping, the screws are rethreaded into the parts to secure their connection.

With a collecting reflector B having a reflecting surface 54 of a curvature as shown in FIG. 2, the light rays have the paths indicated by the lines *a*, *b* and *c*. Light is shown coming mainly from the light producing element 38 of the lamp, such light rays being indicated by the solid lines *a*. This is not strictly accurate since much of the light bounces off the reflecting inner

surface of the lamp, where the lamp is of the reflector type. However, for the purpose of representing the rays of light or light paths, this manner of illustration is the most simple and is generally indicative of the manner of operation. In any event, the rays of light which are directed to the reflecting surface **55** of the distributing reflector C without striking the collecting reflector B to any appreciable extent are indicated by the solid lines *a*. The rays of light which strike the upper portion of the collecting reflector B are shown by the dash-dash lines *b*, and the light rays which strike the lower portion of the collecting reflector and directed to the distributing reflector are indicated by the dot-dash lines *c*. The direct rays *a* may be divided basically into two types. Those striking the narrow outer return edge of the distributing reflector C are directed generally downward to light up the area directly below the device. The rays striking the greater center portion of the distributing reflector C are directed out at wider angles off the vertical up to a maximum of approximately 60° off vertical. Several of the light rays which leave the distributing reflector at the maximum of 60° are illustrated to show the broad surface area of the reflector which is directing light out, and will therefore appear bright when viewed at a 60° angle off vertical (see the lines *a* following the reflector contour).

The light rays *b* reflected off the upper portion of the collecting reflector B are directed outwardly by the distributing reflector C at angles which generally are between those of the downward component rays *b* and the maximum 60° components of such light rays. The light rays *b* function as fill and support the light between the maximum and minimum angles of these components.

The light rays *c* leaving the lamp L at an angle of 40° to 50° are reflected off the lower portion of the adjoining collecting reflector B, cross over to the opposite side of the center line *o* and are directed out through the light transmitting enclosure D by the distributing reflector C at a high angle, or an angle up to approximately 70° off vertical. Some of the light rays which leave the distributing reflector at 70°, as illustrated, show the broad surface area of the distributing reflector which is reflecting light out, and therefore a bright appearance is furnished when viewed at a 70° angle off the vertical.

The above described light distribution is accomplished with the lamp completely hidden from view, the lamp being surrounded by the opaque housing. No light leaves the fixture at angles higher than approximately 72° vertical. The light leaving the distributing reflector C at near 70° has emanated from the lamp at approximately 45°. With the light distribution afforded by a mercury vapor lamp having a given candle power at 45° from the beam axis which is close to maximum, the lighting fixture of the invention distributes a substantial amount of light below 70° and hardly any light above 72°. This sharp break in light distribution is highly desirable; light is spread over a wide area while complete glare cutoff is obtained at a viewing angle which is as high as possible off the horizontal plane. Also, when the viewer looks at the fixture at angles just within the illumination zone, the brightness on the distributing reflector C is spread over a broad area furnished by its surface. It is therefore less disturbing to the viewer than would be the same amount of light coming from a small source.

When the amount of light is traced which is reflected at various angles from the fixture, it is found that the emitted candle power is lowest near the vertical central axis *o* of the fixture, and increases in a relatively smooth curve out to 60° and then decreases somewhat to 70° at which point the illumination is substantially cut off. Thus, a foot-candle distribution on the horizontal plane which is relatively even from the central vertical axis of the device out beyond 60° is softened at about 70° to eliminate a sharp delineation at the edges of these zones. As a result, the fixture of the invention produces an even distribution of light over a wide area while affording extremely low glare.

With a collecting reflector B having the contour shown in FIG. **2**, a light distribution pattern is obtained as schematically shown in FIG. **9**. Such distribution pattern may be termed a "-wide angle" pattern as furnished by a reflector having its reflecting surface **54** at a relatively narrow angle, the angle *x* as shown in FIG. **6**, with respect to the central axis *o* of the fixture.

The light distribution pattern may be readily changed without changing the dimensions of the fixture by simply substituting a differently angled collecting reflector. The outer diameter of the reflector also is not increased. As shown in FIG. **6**, segments of a reflector B' may be adhered by a suitable cement **90** to the underlying reflector B having the described contour of reflecting surface **54**. The reflecting surface of the reflector segment or segments B' is designated **54'**, and furnishes a "narrow angle" light distribution pattern. As compared to reflector B, a reflector B', or segments B', have a reflecting surface **54'** which is at an increased angle, the angle *x'* (FIG. **6**), with respect to the longitudinal center line *o* of the fixture.

In terms of light distribution pattern, it will be apparent that the entire "wide angle" collecting reflector B may be replaced by an entire "narrow angle" reflector B', whereupon, an illumination pattern, as schematically shown in FIG. **10**, will be obtained. With the narrow angle collecting reflector B', the rays of light are as indicated in FIG. **6**. Essentially, the light rays are prevented from crossing over from one side of the reflector to the opposite side, and in this way, the high angle of light distribution is eliminated. With a narrow angle collecting reflector, the maximum angle of light emitted through the light transmitting enclosure D is at an angle of approximately 60° caused by the light which goes directly to the distributing reflector. Whereas, with a wide angle collecting reflector as shown in FIG. **2**, light emitted at the 60° angle is spread over a wide surface of the distributing reflector C, with a narrow angle reflector, the distribution of light is confined to a reduced surface of the distributing reflector. As in the case of wide angle distribution on the order of 70°, a viewer, nevertheless, looking at the fixture within the illumination zone would be less disturbed by the large area of brightness than he would be by a smaller area having the same total brightness.

Where a plurality of narrow angle reflector segments B' are associated with a wide angle reflector B therebeneath, illumination patterns such as schematically shown in FIGS. **11** and **12** may be obtained. It will be apparent that different illumination patterns may be obtained by changing the positions of the narrow angle reflector segments with respect to the underlying wide angle reflector.

Where, as shown in FIG. **1**, the enclosure has a rectangular or square configuration, the outside contour of the lamp housing A may be made with flat planar surfaces to carry out the esthetic theme of such configuration; also, the dome member **62** which supports the distributing reflector C may also be made of a square outline. Where, as shown in FIG. **8**, the light transmitting enclosure, designated D', is made round or circular, the esthetic theme of circularity may be kept by making the outer contour of the lamp housing A' of such contour, also the contour of the dome member **62'**.

It will be apparent that a lighting fixture having a circular light transmitting enclosure may be mounted on a single pole in lieu of the square enclosure as shown in FIG. **1**. A plurality of lighting fixtures having circular light transmitting enclosures may be mounted on hollow crossbars extending from a pole P' as shown in FIG. **8**. Two or four lighting fixtures may be so mounted; also different configurations of light transmitting enclosures may be used rather than the illustrated square and round.

The advantages and improved results of the invention will be apparent from the foregoing description of a preferred embodiment of the invention. Various changes and configurations may be made without departing from the spirit and scope of the invention as sought to be defined in the following claims.

I claim:

1. A lighting fixture comprising a lamp housing including socket means for a lamp, a first substantially tubular reflector adapted to surround a portion of a lamp, a second reflector having a diameter larger than the diameter of the first reflector spaced from and positioned above the first reflector, and an enclosure of light transmitting material having a diameter not less than the diameter of the second reflector extending between and connected to the reflectors, the enclosure having a central opening on its underside, an annular support member secured to the enclosure extending through the opening, said first reflector being mounted on the support member to extend therethrough and into the lamp housing, the second reflector lying in a plane substantially transverse of a central longitudinal axis extending through the socket means, the first reflector and the second reflector, and means separably connecting the support member to the lamp housing.

2. A lighting fixture according to claim 1, wherein the first reflector is substantially frustoconical and has its largest internal diameter at the end thereof facing the second reflector.

3. A lighting fixture according to claim 2, wherein the inner reflecting surface of the first reflector is at a relatively wide angle with respect to the central longitudinal axis.

4. A lighting fixture according to claim 2, wherein the inner reflecting surface of the first reflector is at a relatively narrow angle with respect to the central longitudinal axis.

5. A lighting fixture according to claim 2, wherein the inner reflecting surface of the first reflector has a segment thereof at a relatively wide angle and a segment at a relatively narrow angle with respect to the central longitudinal axis.

6. A lighting fixture according to claim 1, wherein the second reflector is circular and has an annular concave portion intermediate its center and its outer periphery.

7. A lighting fixture according to claim 1, including means for hinging the support member to the lamp housing.

8. A lighting fixture according to claim 1, wherein the enclosure has a central opening on its upperside, the second reflector being positioned in said opening, and means to secure said reflector to the adjoining wall of the enclosure.

9. A lighting fixture according to claim 1 wherein the socket means is mounted on a bracket having radially extending flanges, resiliency mounted screw means extended through the flanges and cooperable with a wall of the housing.

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