Feb. 24, 1948. A. DE BISHOP, JR 2,436,635

LUMINAIRE

Filed Feb. 24, 1944 2 Sheets-Sheet 1

Fig. 1.

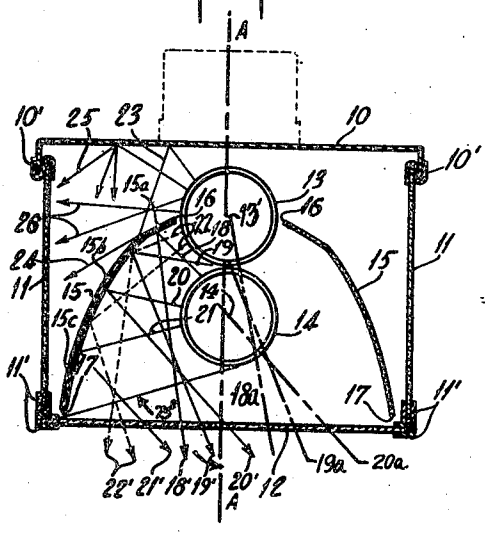

Fig. 2.

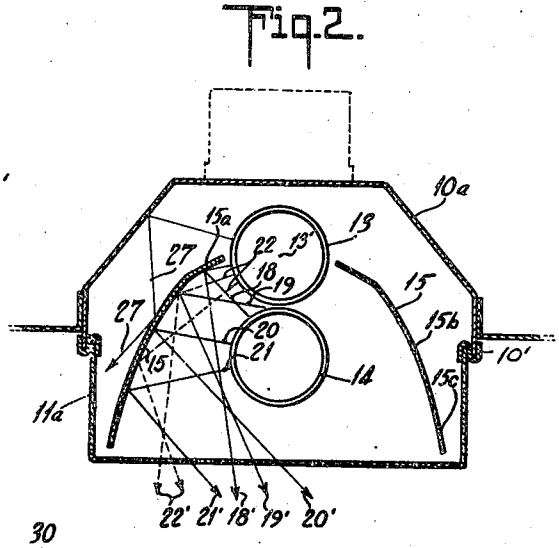

Fig. 3.

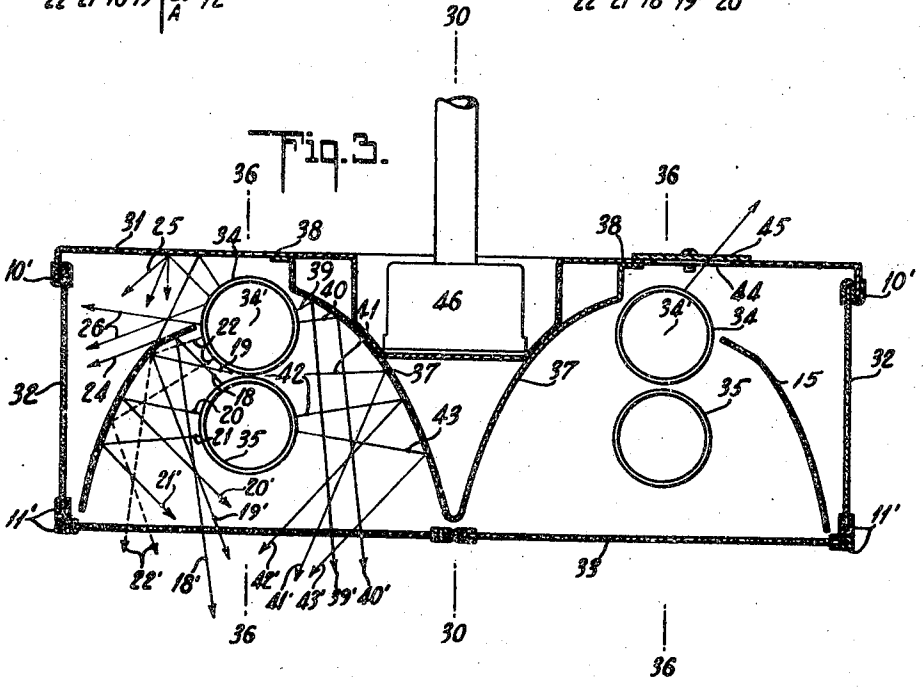

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Fig. 4.

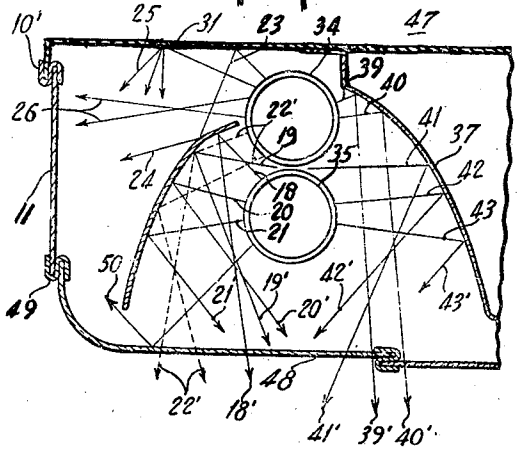


Fig. 4a

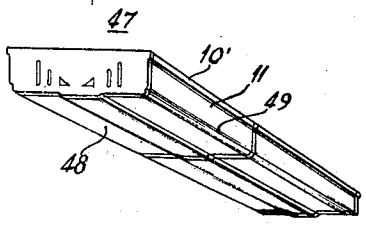


Fig. 5.

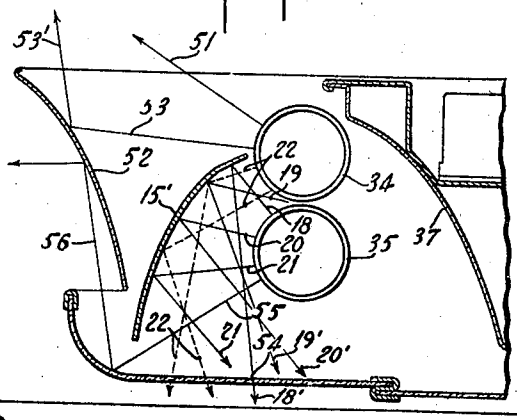


Fig. 5a

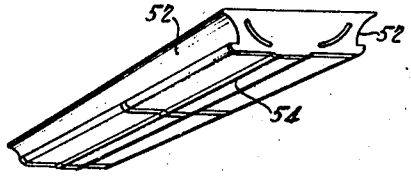
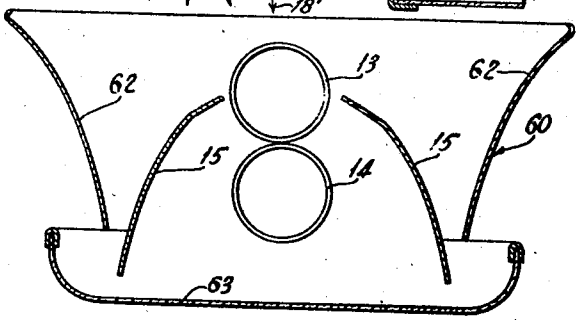


Fig. 6.



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LUMINAIRE

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11 Claims. (Cl. 240—51.11)

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The present invention relates to luminaires, and is more particularly directed toward direct lighting luminaires employing superposed fluorescent lamps received between downwardly acting reflectors, and these luminaires preferably have luminous side walls.

The present invention contemplates fluorescent lighting luminaires wherein the lamps are in pairs and one above the other and received in open mouthed reflectors such that except for reflection losses all of the light emitted by the lower lamp and the half of the upper lamp below the center of that lamp escapes out of the mouth of the reflector as direct or reflected light, while the light originating in the upper part of the upper lamp is largely utilized for either lighting translucent side walls of the luminaire or for indirect lighting.

The present invention relates to improvements over the luminaires of Doane Patent 2,240,179.

Where the invention is embodied in two-lamp luminaires it is contemplated that the luminaires will be symmetrical with respect to a median longitudinal plane through the centers of the lamps and the reflectors terminate at or close to the plane through the center of the upper lamp. Such a construction uses less material than that of the former patent in luminaires of a comparable lamps size and has a well controlled dominant output for direct lighting and either an indirect component or luminous side walls which improve its appearance and light up adjacent ceiling areas.

Where the invention is embodied in four-lamp luminaires, it is contemplated that the luminaire will be symmetrical with respect to a central medial plane and have two pairs of lamps on either side of the central plane and each pair of lamps is associated with downwardly acting reflectors one of which terminates at or close to the plane of the center of the upper lamp, while the other reflector extends higher but does not cross the vertical plane through the lamp centers and the bottoms of the latter reflectors meet at the center of the fixture. Such a construction is similarly economical of material, has well controlled dominant output for direct lighting and the upwardly escaping light may be allowed to go upwardly for indirect lighting or directed toward translucent side panels.

Other and further objects will hereinafter appear as the description proceeds.

The accompanying drawings show, for purposes of illustrating the present invention, several embodiments in which the invention may take form,

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it being understood that the drawings are illustrative of the invention rather than limiting the same.

In these drawings:

Figures 1 and 2 are transverse sectional views through two-lamp luminaires, Figure 1 showing an exposed luminaires mounted at or below the ceiling level, and Figure 2 showing a luminaire partly recessed;

Figures 3 and 4 are transverse sectional views through four-lamp luminaires having luminous side walls;

Figure 4a is a perspective view of the luminaire of Figure 4;

Figure 5 is a fragmentary sectional view of a pendent four-lamp luminaire arranged for direct and indirect lighting;

Figure 5a is a perspective view of the luminaire of Figure 5; and

Figure 6 is a sectional view of a pendent two-lamp luminaire arranged for direct and indirect lighting.

For clarity and simplicity of the drawings lamp and starter sockets, wiring, supports and the like have been omitted, as well as many structural details which a complete luminaire would employ.

Figure 1 illustrates a luminaire adapted to be mounted in an exposed position either pendent or close to the ceiling. The top wall of the luminaire is illustrated at 10. This will generally be a metal wall painted white inside so as to provide a diffuse reflecting surface. The side walls of the luminaire are indicated at 11, 11, and these are typically louvered or diffusing plastic sheet material, or glass. The bottom wall 12 of the enclosure is preferably a louvered plastic sheet which permits direct transmission of light downwardly but limits the longitudinal spread. The framework of the enclosure includes S-shaped metal channels 10' at the top and channels at right angles to one another at the bottom corners as indicated at 11', 11'.

Two fluorescent lamps are indicated at 13 and 14. They are mounted one directly above the other and almost in contact. The reflectors 15, 15, as shown in Figure 1, are alike and have their upper edges 16, 16 close to the upper lamp and at substantially the level of the center 13' of that lamp. The lower edges 17, 17 of the reflectors are substantially one-half the lamp diameter below the lower lamp to provide a cut off angle which may vary, but is here indicated as being about 75° above the nadir, and hence the reflectors intercept light emitted laterally from the upper lamp below the plane through its center and from the lower lamp and allow a certain portion of

the light from each lamp to escape as direct light.

The upper portion 15a of the reflector 15 is designed to act on light from the lower lamp and reflect it downwardly at or near the vertical as indicated by the ray 18—18'; the intermediate portion 15b to downwardly reflect light from the closely adjacent surfaces of the lamps (which are brightest due to reflection of light on each lamp) at steep angles as indicated by the ray 19—19'; and the lower portion 15c to act on light from the lower lamp and reflect it back across the medial plane A—A so as to spread the rays widely, as shown by the rays 20—20', 21—21'. The rays 22 from the upper lamp are reflected downwardly as indicated at 22' in more vertical angles than the widely spread rays 20', 21'. Thus the employment of two lamps one above the other with two reflectors indicated makes it possible to obtain a light distribution which incorporates the high angle light typical of extensive distribution and the vertical light typical of concentrating distributions. The portions 15a, 15b and 15c are typically a succession of parabolic arcs with focal points at and above the center 14' of the lower lamp with the axes tilting more and more from the vertical as will be obvious from the slope of the reflected rays. Typical axes are indicated by dot-and-dash lines 18a, 19a and 20a. The curving contour could also be composed of a succession of circular or elliptical arcs.

The light which is emitted upwardly and to the left of the median plane A—A of the luminaire of Figure 1 escapes and is in part reflected downwardly by the diffuse cover 10 of the luminaire, as indicated at 23, where it strikes the outer surface of the reflector 15 for reflection towards the translucent wall 11, as indicated at 24, or it may be reflected towards this translucent wall as indicated at 25. Also some of the rays escape from the lamp 13 directly to the translucent side wall, as indicated at 26.

In the luminaire in Figure 2 the direct light is controlled in the same manner as in Figure 1, but owing to the depth of the cover 10a of the luminaire and the shallowness of the side walls 11a the only light which reaches these side walls is that reflected by the outside of the reflectors 15, as indicated by the rays 27.

The fixture shown in Figure 3 is symmetrical about a central median plane 30, 30. The luminaire has a top wall 31, translucent side walls 32, 32 and a translucent bottom wall 33. It carries two pairs of fluorescent lamps 34, 35 arranged one above the other in vertical planes 36—36. The portions of the luminaire beyond the planes 36—36 are optically the same as one-half of the luminaire shown in Figure 1 and the same light control takes place, as indicated by similarly disposed light rays. Between the pairs of lamps the luminaire is provided with reflectors 37, 37 which extend from the central plane 30, 30, near the bottom closure, upwardly so as to come close to the outer surfaces of the upper lamps 34 at considerable distances above the plane through the centers 34' of these lamps. The reflectors extend up to and are secured to the cover or top 31, as indicated at 38, 38. The stepped contour indicated is merely for convenience in manufacture.

The reflectors 37, 37 are composed of parabolic arcs similar to those employed in the smaller reflectors previously described. By selecting larger arcs it is possible to have the upper parabolic arc extend above the lamp center 34' rather than terminate at it, and hence more of the light from the upper lamp is intercepted and reflected down through the bottom of the enclosure. The paths of light rays are indicated by the lines 39, 39', 40, 40', 41, 41', 42, 42' and 43, 43'. So far as the control of the light emitted by the lamps below the plane through the center of the upper lamp is concerned, the two reflectors act substantially alike. For the down lighting from each pair of lamps the optics are symmetrical even though the structure is asymmetrical. The luminaire is much narrower than it would be if all four of the reflectors were the size of the central reflectors.

If desired, the top of the luminaire of Figure 3 may be provided with openings such as illustrated at 44 at the right, these openings having light transmitting covers 45 or not as desired so that a small indirect component may be obtained. The space between the reflectors 37, 37 may be employed to receive the ballast indicated at 46.

The luminaire 47 shown in Figures 4 and 4a employs the same arrangement of lamps and reflectors as indicated in Figure 3, and the same reference characters are employed. Instead of having the lower outside corners of the luminaire made up by channels 11'—11' arranged at right angles to one another as shown in Figures 1 and 3, the bottom wall 48 is bent upwardly and is received in an S-shaped channel 49 which also supports the side panel 11. Its side walls 11 will be brighter due to light reflected as indicated at 50.

The luminaire of Figure 5 employs the same pairs of lamps 34, 35 and reflectors 15' and 37 as in Figure 3. Instead, however, of having the top of the luminaire closed as in Figure 3, it is here left open so that light rays such as 51 from the upper lamp may escape upwardly without interference. Instead of having light transmitting side walls the luminaire is provided with reflecting side walls 52 which may be opaque or translucent and are adapted to deflect light rays such as 53 upwardly as indicated at 53'. The bottom 54 is arranged to receive some light rays such as 55 and reflect them upwardly on to the outer surface of the side walls 52 as indicated at 56, so that these walls appear luminous.

Figure 6 shows a luminaire 60 embodying the same arrangement of lamps 13 and 14 and reflectors 15, 15 as illustrated in Figures 1 and 2. It employs two reflectors 62, 62 similar to the reflectors 52 of Figure 5, and the bottom 63 of the luminaire 60 is similar to the outer portion of the bottom 54 of the luminaire of Figure 5 so that in the luminaire in Figure 6 part of the light escapes upwardly for indirect lighting and part of it is diverted so as to illuminate the outer surfaces of the deflectors 62.

The arrangements shown herein provide a well controlled dominant output of light for direct lighting by reason of the use of the reflectors which avoid trapping or blocking off light from the top of the upper lamp, and make it possible to use the light from this part of the upper lamp either for illuminating translucent side walls of the luminaire or for indirect lighting. It is possible to provide a four-lamp luminaire with reflectors for controlling the light output in an effective manner with desirable cut off angles and yet not have the luminaire excessively wide. For example, a luminaire such as illustrated in Figure 3 arranged for four 40 watt lamps may be about 13" wide.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be under-

stood that the particular forms shown are but a few of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. In a luminaire, means for controlling the light output of two parallel fluorescent lamps close together by reflection, comprising two rectilinear reflectors on opposite sides of the median plane through the lamps, the reflectors being concave towards the lamps and having profiles approximating parabolic arcs whose foci are in the median plane at or above the lower lamp center, the lower portions of the reflectors reflecting light emitted laterally from the lower lamp across the median plane to spread the reflected light widely therefrom, the upper portion reflecting upwardly emitted light from the lower lamp substantially vertically downward for concentrating light below the luminaire, the light from the upper lamp being reflected downwardly at angles substantially move vertical than the widely spread reflected light from the lower lamp, one of the reflectors terminating at substantially the level of the center of the upper lamp and close to its surface the other reflector having greater radii of curvature and extending above the plane through the upper lamp center and close to the surface of the upper lamp.

2. The combination with two horizontally extending tubular, rectilinear fluorescent lamps of the same diameter mounted one above the other and close together, of a specular, inwardly concave reflector extending outwardly from close to the surface of the upper lamp at the level of the axis of the upper lamp so as to intercept direct light from the lower portion of the upper lamp and allow the escape upwardly of light from the upper portion of the upper lamp, and also extending downwardly so as to diverge from the median plane through the centers of the lamps and terminating substantially one-half the lamp diameter below the bottom of the lower lamp at an angle of substantially 15° below the same so as to intercept low angle direct light from the upper lamp and direct light from the lower lamp between the upper lamp and the 75° oblique cut off plane defined by the bottom of the lower lamp and the lower edge of the reflector, the upper portion of the reflector profile being at a relatively small angle below the horizontal to reflect light generally vertically downward outside the lower lamp, the lower portion of the reflector profile being relatively steep and reflecting direct light from both lamps across the median plane.

3. The structure of claim 2, having a second similar reflector similarly disposed on the opposite side of the median plane.

4. The combination claimed in claim 2, wherein the upper surface of the reflector is diffusing, and having an enclosure for the lamps and reflector, the enclosure having a light transmitting bottom for downwardly emitted direct light and light reflected downwardly from the reflector, a translucent side wall which screens the reflector, and a top wall which reflects light downwardly onto the side wall and the upper surface of the reflector.

5. The combination claimed in claim 2, wherein the upper surface of the reflector is diffusing, and having an enclosure for the lamps and reflector, the enclosure having a light transmitting bottom for downward emitted direct light and light reflected downwardly by the reflector, a top wall which reflects light downwardly and outwardly,

and a translucent screen extending from the bottom to the top wall and intercepting direct and reflected light originating in the portion of the upper lamp above the reflector.

6. The combination claimed in claim 2, and having a second inwardly concave, specular reflector on the other side of the median plane having the same cut off angle but extending above the horizontal plane through the upper lamp axis to intercept a substantial portion of the upwardly emitted light from the adjacent side of the upper lamp.

7. The combination claimed in claim 2, wherein the upper surface of the reflector is diffusing, and having a second inwardly concave, specular reflector on the other side of the median plane having the same cut off angle but extending above the horizontal plane through the upper lamp axis to intercept a substantial portion of the upwardly emitted light from the adjacent side of the upper lamp, and an enclosure for the lamps and reflectors, the enclosure having a light transmitting bottom for downwardly emitted direct light and light reflected downwardly from the reflectors, a translucent side wall which screens the first reflector, and a top wall which reflects light downwardly onto the side wall and the upper surface of the first reflector.

8. The combination with two horizontally extending tubular, rectilinear fluorescent lamps of the same diameter mounted one above the other and close together, of a specular reflector extending outwardly from close to the surface of the upper lamp at the level of the axis of the upper lamp so as to intercept direct light from the lower portion of the upper lamp and allow the escape upwardly of light from the upper portion of the upper lamp, and also extending downwardly so as to diverge from the median plane through the centers of the lamps and terminating substantially one-half the lamp diameter below the bottom of the lower lamp and at an angle of substantially 15° below the same so as to intercept low angle direct light from the upper lamp and direct light from the lower lamp between the upper lamp and the 75° oblique cut off plane defined by the bottom of the lower lamp and the lower edge of the reflector, the upper portion of the reflector being parabolic with its focus substantially at the lower lamp center and its axis substantially vertical so as to reflect light generally vertically downward, the lower portion of the reflector being parabolic with its axis oblique and crossing the median vertical plane so as to reflect light across the median plane.

9. The combination claimed in claim 8, having a second specular reflector on the other side of the median plane having an upper parabolic portion extending above the horizontal plane through the upper lamp axis and with its axis and focus substantially coincident with that of the first mentioned upper portion and a lower inwardly concave portion with the same cut off angle and a profile to reflect light from the lamps across the vertical median plane.

10. A fluorescent lighting luminaire symmetrical on opposite sides of a median plane and having two pairs of fluorescent lamps, the lamps of each pair being mounted one above the other and close together, inner upwardly and outwardly diverging, downwardly acting, inwardly concave, specular reflectors extending from the median plane of the luminaire at a distance below the bottoms of the lower lamps so as to provide predetermined cut off angles and having their upper

edges close to the corresponding upper lamps substantially above the horizontal plane through the centers of said upper lamps, the upper portions of the reflectors being at relatively small angles below the horizontal and reflecting light generally vertically downward outside the corresponding lower lamp, the lower portions of the reflector profiles being relatively steep and reflecting light across the vertical plane through the corresponding pair of lamps, and a pair of outer downwardly acting specular reflectors converging upwardly and inwardly from points below the lamps to provide the same cut off angles and having their upper edges close to the outer sides of the corresponding upper lamps above the horizontal plane through the adjacent upper lamp, the upper portion of each of the outer pair of reflectors being at relatively small angles below the horizontal and reflecting light generally downward outside the corresponding lower lamp, the lower portion of each of the outer reflectors being relatively steep and reflecting light across the vertical plane through the corresponding pair of lamps.

11. A luminaire such as claimed in claim 10, wherein the luminaire has a translucent bottom below all the reflectors and lamps, a downwardly reflecting top wall, and translucent side walls each illuminated by light escaping from the adjacent upper lamps between the reflectors terminating adjacent thereto.

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