

XR 3,274,392

Sept. 20, 1966

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3,274,392

LIGHT COLLECTOR FOR PHOTSENSITIVE LUMINAIRE CONTROL

CROSS REFERENCE

Filed Aug. 22, 1963

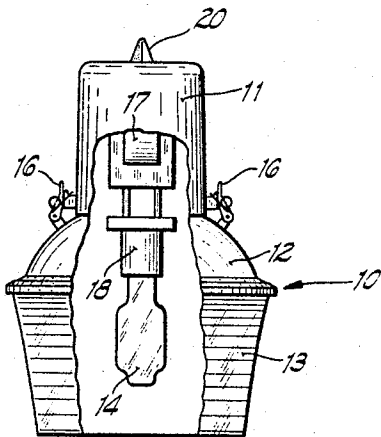


Fig. 1

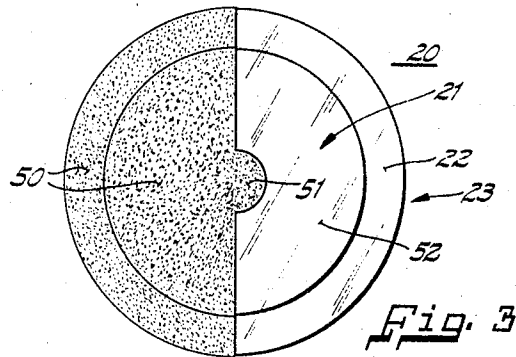


Fig. 3

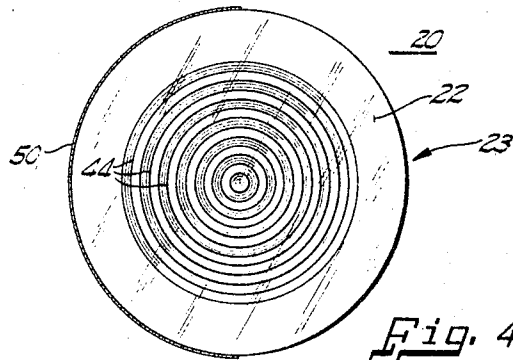


Fig. 4

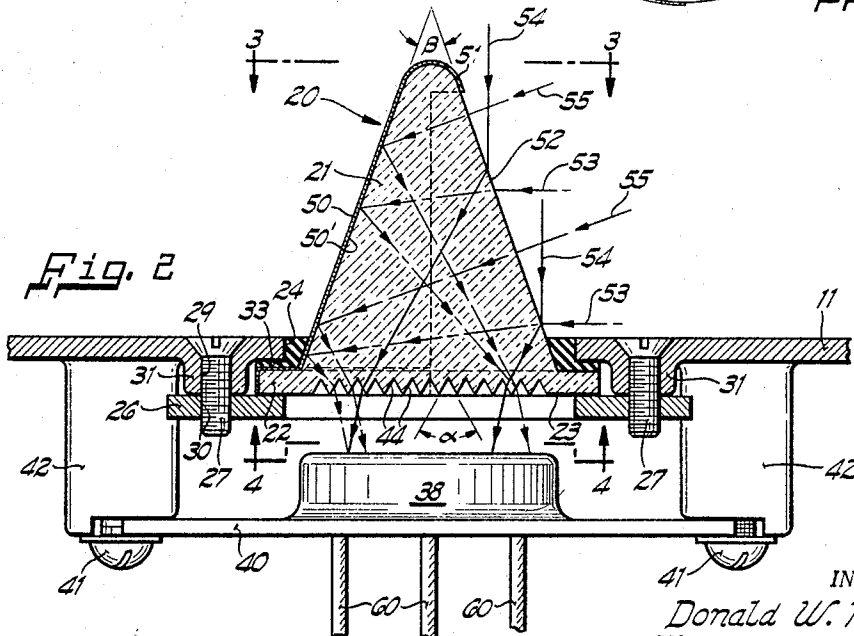


Fig. 2

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**LIGHT COLLECTOR FOR PHOTOSENSITIVE
LUMINAIRE CONTROL****Donald W. Harling, Milwaukee, Wis., assignor to
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corporation of Delaware****Filed Aug. 22, 1963, Ser. No. 303,810****6 Claims. (Cl. 250-227)**

This invention relates to luminaires and more particularly, to light collectors for the photocontrol unit of a luminaire.

Conventional photocontrol devices for outdoor luminaires generally include an outer housing which encloses a photocell and a relay and which is mounted on and connected to the luminaire by means of a plug and socket. In addition the housing is provided with a transparent window that is oriented toward the northern sky for the transmittal of indirect sunlight to the photocell. When the photocontrol becomes defective, it is removed and replaced by an entirely new unit.

It is an object of the invention to provide a light collector for the photocontrol assembly of a luminaire which permits the photocell and relay to be mounted within the luminaire housing, thus eliminating the necessity for an outer photocontrol housing and a plug-in connection.

A further object of the invention is to provide a light collector consisting of a solid conical body of transparent material having a reflecting surface on one side thereof for redirecting light rays into a photocell mounted below its base and wherein its base is provided with light modifying means for reducing the incident angle of the reflected rays. A more specific object of the invention is to provide such a light collector where the apex angle of its body portion is 39° – 41° . Another more specific object is to provide such a light collector wherein the light modifying means on its base consists of a plurality of concentric V-in-cross-section grooves whose apex angles are 59° – 61° .

These and other objects and advantages of the instant invention will become more apparent from the detailed description thereof taken with the accompanying drawings in which:

FIG. 1 is a side elevational view, with parts broken away, of a luminaire incorporating the instant invention; FIG. 2 is a fragmentary view, partly in section, of the luminaire shown in FIG. 1;

FIG. 3 is a view taken along lines 3—3 of FIG. 2; and FIG. 4 is a view taken along lines 4—4 of FIG. 2.

Referring now to the drawings in greater detail, FIG. 1 shows a luminaire 10 having a hood 11 for supporting a reflector 12 and a refractor 13 which control the light emanating from a source 14. The reflector 12 and refractor 13 are releasably mounted on the hood 11 by a latch assembly 16 which is well-known in the art. When the source 14 is of the mercury vapor type, the luminaire 10 is provided with a ballast 17 which is mounted within the hood 11 and which in turn supports a socket 18 for the source 14. The luminaire 10, the ballast 17, and the light socket 18 are all conventional and well-known in the art and will not be discussed in detail for the sake of brevity.

The light collector 20, according to the instant invention, is shown in FIG. 2 to comprise a solid, generally conical body 21 of transparent material such as glass or plastic, such as Plexiglas, and is provided with an annular mounting flange 22 at its base 23. The body 21 extends upwardly through an aperture 24 formed in the upper surface of the hood 11.

The light collector 20 is held in position by means of a ring 26 which is secured by screws 27 against an in-

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tegral, annular embossment 31 formed on the hood 11 and coaxial the aperture 24. Screws 27 extend through spaced apart apertures 29 formed in the embossment 31 and threadably engage aligned apertures 30 in the ring 26. This positions the light collector 20 with its conical body portion 21 extending vertically upward through the aperture 24 and with its base 23 disposed in a generally horizontal plane and facing inwardly of the luminaire hood 11. An annular, L-in-cross-section gasket 33 is disposed between the rim of the aperture 24 and the juncture between the upper surface of the flange 22 and the lower portion of the conical body 21 to cushion the light collector 20 and to seal the aperture 24.

A photosensitive cell 38 is suitably mounted on an insulating base plate 40 which is affixed by screws 41 to a pair of lugs 42 extending integrally downward from the cover 11 at points adjacent to a pair of opposite sides of the aperture 24 so that the photosensitive cell 38 is mounted in opposed relation to the aperture 24 and directly below the base 23 of the light collector 20.

The body portion 21 of the light collector 20 preferably has at least one-half of its outer surface covered with a reflective coating 50, such as aluminum, which may be applied in any well-known manner such as by spraying, brushing, or vacuum furnace depositing. The coating 50 is reflective in both directions so that light rays directed toward the collector 20 from its coated side will be prevented from passing to the interior thereof and a reflective surface 50', which is inclined to the axis of the body portion 21, will be presented to the opposite side of the collector. In addition a small cap portion 51 at the tip of the body 21 may also be covered by the coating 50 to prevent high angle light rays directed toward the covered side from entering the collector 20. This leaves a clear portion of window 52 at one side of the body portion 21 for the admission of light rays 53, 54 and 55 which are refracted as they enter the body 21 and then either pass directly downwardly to the base 23 or are reflected downwardly by the inclined reflective surface 50'.

The base 23 of the light collector 20 has a plurality of equally spaced, concentric, V-in-cross-section grooves 44 formed therein. The grooves 44 act to refract the downwardly directed light rays toward the photosensitive cell 38.

For reasons which will be discussed more fully hereinbelow, the preferred apex angle α of each of the grooves is approximately 60° and the preferred apex angle β of the conical body portion 21 of the light collector 20 is approximately 40° . The exact angles depend upon the refractive index of the material being employed, and for Plexiglas the apex angle of the body portion 21 should be 40° and 60° for the grooves 44. For other transparent types of plastic or glass the preferred apex angle of the body portion will vary from 39 to 41 degrees. In addition, the preferred apex angle of the grooves 44 will vary from 59 to 61 degrees for other types of plastic or glass. These angles insure that the light rays 53, 54 and 55 entering the light collector through its clear portion 52 will be directed downwardly into the photosensitive cell 38 at a relatively shallow angle.

Because the luminaire hood 11 will prevent upwardly directed light rays from falling on the light collector 20, all of the light rays can be considered as being horizontal as represented by rays 53, vertical as represented by rays 54, and intermediate light rays as represented by the numeral 55. It can be seen from FIG. 2 that substantially all of the horizontal rays 53 and the intermediate rays 55 entering the clear portion 52 at the upper end of the body 21 will be reflected by the surface 50' back toward the opposite side of the base surface 43 and at a relatively large angle to the axis of the body portion 21 so that in the absence of the grooves 44 these light rays would tend

to miss the photosensitive cell 38 or to be of relatively low effectiveness. However, the grooves 44 act as refracting prisms to redirect these light rays downwardly and into the cell 38 at a relatively smaller angle to the axis of the body portion 21. In a similar manner, vertical light rays 54 entering the upper end of the clear portion 52 are refracted toward the opposite side of the base 43 so that they also would normally miss the photosensitive cell 38, except that they are redirected by the grooves 44 downwardly into the cell 38. Thus preferred angle of 60 degrees for the apex of the grooves 44 insures that these light rays will be directed downwardly into the cell 38 at relatively shallow angles to the axis of the body portion 21 so that little of the light will be lost around the edges of said cell.

In addition, if the apex angle β of the body portion 21 exceeds the preferred range of 39°–41°, the horizontal light rays entering the clear portion 52 would tend to be redirected downwardly at too great an angle so that substantial portion would be lost around the periphery of the photosensitive cell 38. On the other hand, if the apex angle β of the body portion 21 is less than the preferred angle of 39°–41°, the light rays would be reflected at too shallow an angle from the metalized surface 51 so that a substantial portion would be redirected back out of the collector 20 through the clear portion 52.

Conductors 60 are connected to the photo-sensitive cell 38 and to relay (not shown) and a source of electrical energy (not shown) in a manner well known in the art so that when the level of illumination falling on the photosensitive device 38 is less than a predetermined level, the relay (not shown) will operate to connect the light source 14 to an energy source and so that when the level of illumination rises above the predetermined level, the light source 4 will be de-energized.

While only a single embodiment of the invention has been shown and described, and while the invention has been discussed with respect to one particular type of luminaire, it is not intended to be limited thereby, but only by the scope of the appended claims.

I claim:

1. A luminaire having an outer housing, an aperture in said housing, a photosensitive cell disposed within said housing and adjacent said aperture, a light collector consisting of a body of transparent material having a substantially conical surface and a base portion, the base portion of said light collector being disposed adjacent said opening and in an opposed relation to said photosensitive cell, said body extending away from said opening and outwardly of said housing, a substantial portion of said conical surface being reflective so that light rays may enter said collector only through the remainder thereof and so that said light rays will be reflected toward said base portion by said reflective surface, and refracting means provided on said base portion for redirecting said light rays into said photosensitive cell and at a relatively small angle to the axis of said opening.

2. A luminaire having an outer housing, an aperture in said housing, a photosensitive cell disposed within said housing and adjacent said aperture, a light collecting member consisting of a solid body of transparent material having a substantially conical surface and a base portion, the base portion of said light collector being disposed adjacent said opening and in an opposed relation to said photosensitive cell, said body extending away from said opening and outwardly of said housing, a substantial portion of said conical surface being reflective so that light rays may enter said collector only through the remainder thereof and so that said light rays will be reflected by said reflective surface toward said base portion and at a relatively large angle to the axis of said conical surface, and refracting means provided on said base portion for redirecting said light rays at a relatively small angle to the

axis of said conical portion as they pass through said base portion.

3. A luminaire having an outer housing, an aperture in said housing, a photosensitive cell disposed within said housing and adjacent said aperture, a light collector consisting of a solid body of transparent material having a substantially symmetrical conical configuration, said light collector extending through said aperture and extending outwardly of said housing, said light collector having a base portion disposed within said housing adjacent said opening and in opposed relation to said photosensitive cell, one side of the conical portion of said light collector having a reflective surface provided thereon so that light rays may enter said collector only through the opposite side thereof and so that said light rays will be reflected toward said base portion by said reflective surface, said base portion having a plurality of annular V-in-cross-section concentric grooves formed therein to provide refracting means for redirecting said light rays into said photosensitive cell at a relatively small angle relative to the axis of said aperture.

4. A luminaire having an outer housing, an aperture in said housing, a photosensitive cell within said housing and adjacent said aperture, a light collector consisting of a solid body of transparent material having a longitudinal axis, said body portion including an outer surface extending generally away from said housing and a base portion nominally normal to said axis and disposed adjacent said aperture, one side of said outer surface being inclined from said base portion toward said axis, a reflective coating on said inclined surface so that light rays enter said light collector only through the other side thereof and so that said inclined reflective coating reflects said light rays downwardly to said base at a relatively large angle to said axis, and refractor means provided on said base portion for redirecting said light rays into said photosensitive cell at a relatively small angle to said axis.

5. A luminaire having an outer housing, an aperture in said housing, a photosensitive cell disposed within said housing and adjacent said aperture, a light collecting member consisting of a solid body of transparent material having a substantially symmetrical conical configuration, said light collecting member extending through said aperture and having its base disposed within said housing and in opposed relation to said photosensitive cell, one side of the conical portion of said light collecting member having a reflective surface provided thereon so that light rays may enter said collector only through the opposite side thereof and so that said light rays will be reflected toward said base portion by said reflective surface, said base portion having a plurality of annular V-in-cross-section concentric grooves formed therein, the apex angle of said conical light collecting member being approximately 40 degrees and the apex angle of each of the grooves being approximately 60 degrees.

6. The luminaire set forth in claim 5 wherein said light collector is provided with flange means integral with its base portion for securing said light collecting member within said housing.

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