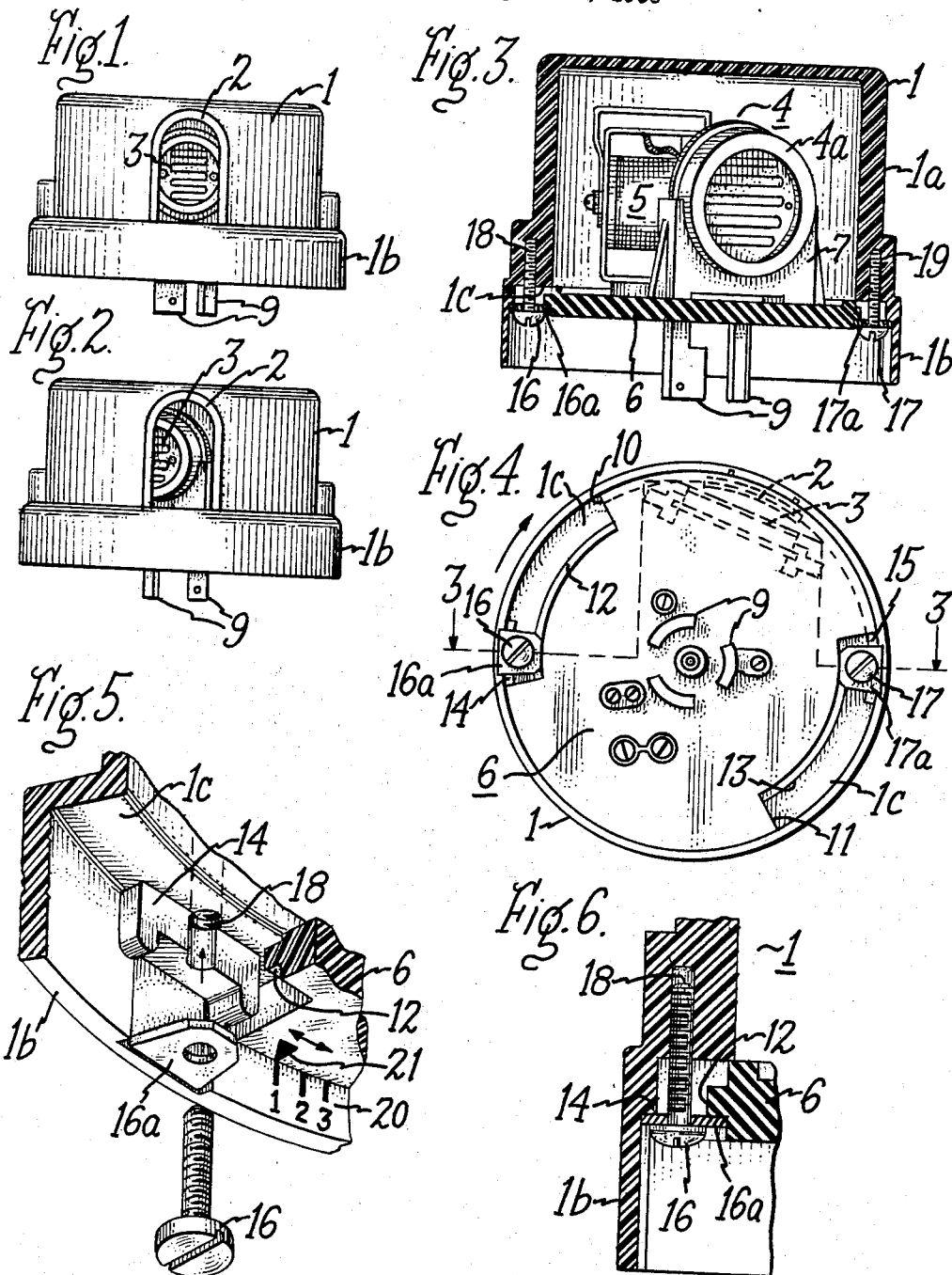


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PHOTOELECTRIC CONTROL DEVICE WITH ROTATABLE HOUSING FOR
ADJUSTABLE LIGHT CONTROL TO THE PHOTSENSITIVE ELEMENT
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PHOTOELECTRIC CONTROL DEVICE WITH ROTATABLE HOUSING FOR ADJUSTABLE LIGHT CONTROL TO THE PHOTSENSITIVE ELEMENT
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The present invention relates to photoelectric control devices, and more particularly concerns devices of this type incorporating light sensitive elements for controlling the operation of apparatus such as street lighting luminaires in accordance with the light level of ambient light. In known types of outdoor luminaires, photoelectric control units are removably attached to the exterior of the luminaire housing in electrical connection with the luminaire operating circuit, and with the light sensitive element fixed within the photoelectric control housing exposed to ambient light through a transparent opening in the housing. Certain drawbacks have been encountered in such use of known types of photoelectric control devices. For one thing, in large scale manufacture of photoelectric control devices the uniformity of the units in terms of their sensitivity to light levels cannot be readily controlled. Moreover, it well known that the sensitivity, electrical output and other characteristics of photoelectric cells tend to change over a prolonged period, and consequently the response of the cells to ambient light levels changes with time. As a result, the luminaires in a particular area may be turned on or off at widely different times, or particular luminaires may change their on or off times even at the same light level with the passage of time. In certain types of prior devices, adjustable shields have been provided to mask portions of the light sensitive element, but these have not proved entirely satisfactory since they made the masked portions inoperable and changed the size of operable portions, resulting in nonuniform operating characteristics and other undesirable results. Furthermore, the use of such shields increased the cost of the units. It is an object of the present invention to provide a photoelectric control device which overcomes the above disadvantages of known types of devices.

It is a particular object of the invention to provide a photoelectric control device which may be adjusted in its response to light levels.

It is another object of the invention to provide a photoelectric control device of the above type which is simple in construction and economically manufactured, and which may be readily and accurately adjusted and calibrated at any time to provide for its response at any particular light level.

Other objects and advantages will become apparent from the following description and the appended claims.

With the above objects in view, the present invention relates to a photoelectric control device comprising a base member having opposite sides, electrical switching means mounted on one side of the base member, electrical contact means on the opposite side of the base member electrically connected to the switching means, photoelectric means mounted on the one side of the base member in electrical connection with the switching means, the photoelectric means comprising a light sensitive element lying substantially in a plane, and an opaque housing overlying the one side of the base member and enclosing the switching means and photoelectric means thereon, the housing having a transparent window adjacent the photoelectric means arranged so that exterior light passes into the interior along the window axis and is incident on the light sensitive element, the housing being releasably secured to the base member and being rotatably

adjustable thereon for varying the angle of the plane of the light sensitive element relative to the aforementioned window axis whereby the sensitivity of the light sensitive element to the incident light may be adjusted to a predetermined level.

The invention will be better understood from the following description taken in conjunction with the accompanying drawing in which:

FIGURE 1 is a side view in elevation of a photoelectric control device embodying the invention, showing the light sensitive element in one adjusted position of the device;

FIGURE 2 is a view similar to that of FIGURE 1 showing the device adjusted to a different position;

FIGURE 3 is a partly sectional view of the photoelectric control device showing the components in the interior thereof;

FIGURE 4 is a bottom plan view of the FIGURE 3 device;

FIGURE 5 is a fragmentary detailed view in exploded form of the adjustable securing means of the FIGURE 3 device; and

FIGURE 6 is a cross-sectional view of the parts shown in FIGURE 5 in assembled form.

Referring now to the drawing, and particularly to FIGURE 1, there is shown a photoelectric control device of a type adapted for use with street lighting luminaires and comprising a generally cup-shaped opaque housing 1 formed of an upper hood portion 1a having an integral lower skirt or rim portion 1b of larger diameter. Housing 1 is provided with a window opening 2 in the side of hood portion 1a usually closed by a transparent member such as clear plastic sheet. Mounted on a base within housing 1, as more fully described below, is a disk-shaped light sensitive element 3 which, in the adjusted position shown in FIGURE 1, directly faces window 2 so that the plane of light sensitive element 3 is normal to the axis of window 2 and is exposed to ambient light which enters through the window.

FIGURE 2 shows the photoelectric control device with housing 1 rotatably adjusted relative to light sensitive element 3 so that the axis of the latter is arranged at an angle to the axis of window 2, that is, so that the plane of element 3 is no longer perpendicular to the window axis. As will be evident, such angular adjustment of element 3 relative to the incident light beam results in a reduced intensity of light striking the face of light sensitive element 3 as compared to the arrangement shown in FIGURE 1, and therefore the electrical response of the photoelectric cell and associated electrical components will occur at a lower ambient light level with the FIGURE 1 arrangement than with the FIGURE 2 arrangement.

As shown in FIGURE 3, which is a view taken along the line 3-3 of FIG. 4, the electrical components disclosed within housing 1, including photoelectric cell 4 and relay 5, are mounted on base 6 which, in accordance with the invention, is secured to housing 1 so as to be rotatably adjustable relative thereto. Photoelectric cell 4, which may be of well-known type is typically disk-shaped and comprises a light sensitive element 3 formed of a flat surface having light sensitive material such as cadmium sulfide coated thereon to which electrical leads are attached in well-known manner. Light sensitive element 3 is surrounded by an annular frame 4a holding a protective transparent disk over the face of element 3. Photoelectric cell 4 is fixedly secured to the upper, i.e., interior, side of base member 6 by means of integrally molded support 7 or other suitable mounting means. Relay 5 and other electrical components (not shown) of the photoelectric control device are also secured to the

upper side of base member 6. The electrical circuit of which photoelectric cell 4, relay 5 and the other electrical components form a part are electrically connected to plug-in contact prongs 9 projecting downwardly from the bottom side of base member 6 which are adapted to be inserted into a socket in a luminaire housing (or other apparatus) with which the photoelectric control device is to be operatively associated. Constructional details of the mounting of relay 5 and other parts on base member 6 are disclosed in co-pending application Ser. No. 542,612, filed Apr. 14, 1966 in the name of J. R. Burch and assigned to the same assignee as the present application, and do not form a part of the present invention.

As seen in the bottom view of FIGURE 4, base member 6 is generally of disk-shaped circular form and has an outer diameter slightly smaller than the inner diameter of the skirt portion 1b of housing 1 and thus readily nests within that portion and is freely rotatable therein. The photoelectric cell and other electrical parts mounted on base member 6 are all spaced inwardly from the margin of the base member a sufficient distance to clear shoulder 1c of housing 1 when base member 6 is placed in assembly within housing 1, as seen in FIGURE 3. Thus, housing 1 rests at its annular shoulder 1c on the upper marginal surface of base member 6 and is rotatable thereon.

The periphery of base member 6 is formed at opposite sides with arc-shaped cutout portions or recesses 10 and 11 into which project, respectively, ledges 12 and 13 formed in base member 6 intermediate the opposite surfaces of the latter and coextensive with length of the respective recesses 10, 11. Arranged at diametrically opposite sides of skirt portion 1b adjacent shoulder 1c are stop members 14 and 15 which lie within recesses 10 and 11, respectively, and which abut against base member 6 at opposite ends of the respective recesses when housing 1 is turned in opposite directions relative to base member 6. Stop members 14, 15, which may be integral with housing 1 or otherwise secured thereto, define the limits of a range of rotational adjustments of housing 1 on base member 6. Typically, the arrangement of stop members 14, 15 is such that when housing 1 is in the extreme position shown in FIGURE 4, light sensitive element 3 directly faces window 2 as seen in FIGURE 1, i.e., is in a plane normal to the axis of window 2; and when housing 1 is rotated relative to base member 6 in clockwise direction as viewed in FIGURE 4 until it is in the other extreme position where stop members 14, 15 reach the opposite ends of recesses 10, 11, window 2 is moved sufficiently away from light sensitive element 3 that the latter has little or no external light incident thereon. At intermediate points between such extreme positions of housing 1 relative to base member 6, the surface of light sensitive element 3 is oriented at different angles to the axis of window 2 and the light beam entering therethrough, thus providing different intensities of light on light sensitive element 3 and thereby different levels of response of the latter to entering light, depending on the particular angular position of light sensitive element 3.

To hold housing 1 in the desired adjusted position, there are provided oppositely arranged screws 16, 17 threadably received in holes 18, 19 formed in housing 1 adjacent stop members 14, 15 in which screws 16, 17 may be tightened, with washers 16a, 17a bridging ledges 12, 13 and stop members 14, 15 respectively. Such tightening of screws 16, 17 effectively clamps housing 1 to base member 6 to prevent relative rotation thereof and maintains window 2 in the desired adjusted angular position relative to light sensitive element 3.

As seen in FIGURE 6, the surface of stop member 14 is arranged to be approximately at the level of the lower surface of ledge 12 in the assembly (with corresponding arrangement of stop member 15 and ledge 13) so that washer 16a uniformly engages and clamps these surfaces when screw 16 is tightened. The surface of stop

member 14 and the adjoining portion of the inner surface of housing wall 1b are recessed as shown in FIGURE 5 to provide a retaining seat for washer 16a and to facilitate assembly of the latter in the proper position in register with hole 18.

Spaced indicator markings 20 on the inner surface of skirt portion 1b and index pointer 21 on the bottom surface of base member 6 serve to indicate the relative rotational position of base member 6 with respect to housing 1 and thereby facilitate calibration of the unit. Thus, markings 20 may be calibrated in terms of footcandles so that the particular scale line 20 with which pointer 21 is aligned indicates the footcandle level of ambient light at which the photoelectric control unit turns on the lighting apparatus which it controls. For example, assuming that with the adjustment shown in FIGURE 5 light sensitive element 3 directly faces window 2, the characteristics of the unit would be such at the particular light level that the electric current generated in the photocell is sufficient to operate the associated relay 5 and thereby switch off the lighting apparatus at the footcandle level indicated. Should it be desired to switch off the lighting apparatus at a higher level of ambient light, screws 16, 17 are loosened, housing 1 is rotated relative to base member 6 to a position where pointer 21 indicates such higher footcandle level, and screws 16, 17 are retightened. In this newly adjusted position, the axis of light sensitive element 3 is at an angle to the axis of window 2, thereby decreasing the intensity of light incident thereon at the particular time. It would thus require the ambient light to reach a higher level before the relay 5 would be actuated to turn the lighting apparatus off. Conversely, the lighting apparatus would be turned on at a higher ambient light level in the newly adjusted position, in other words, would be turned on earlier in the evening than with the original position of the photocell unit relative to the housing window.

By virtue of the features described, the photoelectric control unit of the invention may be readily calibrated at the factory using a standard illumination source so that the units produced will have uniform responses to a particular light level. Later on after prolonged use in operation the photoelectric control units may be readily readjusted in the field to compensate for any variation in response therein due to aging conditions. Users of the device are also provided thereby with means whereby they can select any desired illumination level for turn-on or turn-off of the controlled equipment.

While the present invention has been described with reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the scope of the invention. Therefore, the appended claims are intended to cover all such equivalent variations as come within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A photoelectric control device comprising, in combination, a base member having opposite sides, photoelectric means mounted on one side of said base member and having a light sensitive element extending in a plane, an opaque housing covering said one side of said base member and leaving said opposite side thereof open to the exterior of said housing, said housing having a light transmitting window through which external light may enter the interior of said housing, said housing being adjustable relative to said base member between a position wherein said light sensitive element directly faces said window so as to be substantially normal to the axis thereof, and a position wherein the plane of said light sensitive element is at a different angle to said window axis, and securing means releasably holding said housing and said base member in adjusted position, whereby

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the response of said photoelectric means to the illumination level of the entering light may be varied.

2. A device as defined in claim 1, said base member and said housing having mutually engaging circular portions arranged coaxial with one another, and being coaxially rotatable relative to one another.

3. A device as defined in claim 2, including electrical contact means electrically connected to said photoelectric means and projecting outwardly from said opposite side of said base member.

4. A device as defined in claim 2, said base member being substantially disk-shaped, said housing having an annular shoulder resting on said base member in rotatable sliding engagement therewith.

5. A device as defined in claim 4, the periphery of said base member having recess means therein, said securing means being arranged in said recess means.

6. A device as defined in claim 4, the periphery of said base member having elongated recess means therein, said housing having stop means projecting into said recess means and coacting therewith to limit the relative movement of said base member and said housing to said different positions.

7. A device as defined in claim 6, wherein said securing means comprise releasable clamping means engageable with said base member and said housing.

8. A device as defined in claim 7, said base member having ledge means projecting into said recess means along the length thereof, said clamping means being

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engageable with said stop means and said ledge means for retaining said base member and said housing in adjusted relative position.

9. A device as defined in claim 6, wherein said recess means comprise a pair of arc-shaped slots located at diametrically opposite edges of said base member.

10. A device as defined in claim 2, said housing being cup-shaped and being formed with an enlarged radially offset rim portion, said base member having an outer diameter slightly smaller than the inner diameter of said housing rim portion so as to nest therein with its periphery in slidable engagement therewith.

11. A device as defined in claim 3, said photoelectric means being adjacent a peripheral edge of said base member with its light sensitive element facing radially outwardly, and electrical switching means mounted on said one side of said base member and electrically connected to said photoelectric means and said electrical contact means.

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