

PATENT SPECIFICATION

(11) 1415 795

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- (21) Application No. 4184/73 (22) Filed 26 Jan. 1973
 (31) Convention Application No. 778554 (32) Filed 27 Jan. 1972 in
 (33) Belgium (BE)
 (44) Complete Specification published 26 Nov. 1975
 (51) INT CL² G02B 27/00
 (52) Index at acceptance G2J 22



(54) OPTICAL ATTENUATION DEVICES

(71) We, PONDER & BEST, INC., a corporation of the State of California, United States of America, of 1630 Stewart Street, Santa Monica, California 90406, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This application is related to British Patent Applications Nos. 7937/69 (Serial No. 1,267,234), 10883/70 (Serial No. 1,309,771) and 39704/71 (Serial No. 1,374,245). These applications disclose several circuits and devices for controlling impulses generated by the discharge of a capacitor associated with a load device, such as a photoflash device, and the disclosures of the above applications are incorporated herein by reference. The device of the present application, although having other potential uses, is particularly adapted for use with electronic photoflash devices of the nature disclosed in the above mentioned applications.

The present invention relates to optical devices, and particularly to a device which, in use, provides optical attenuation of radiation entering the device and passing to a sensor disposed in the device.

The device of the present invention will be described in the environment of electronic photoflash devices, the radiation then being light and the sensor being a light sensor, although it is capable of use in other optical sensing applications. In recent years, electronic photoflash devices have incorporated various types of circuits and devices which were utilized to control flash duration. These devices represented a substantial improvement over previous non-automatic photoflash devices in which no control or minimum control of flash duration or total light output was possible. In such automatic systems, the light produced by the photoflash tube after being reflected from the subject being photographed is sensed by a light sensor and integrated. When the total quantity of the light

being sensed reaches a predetermined value or level, a signal is produced which results in termination of the light flash from the photoflash tube.

In this environment the present invention, as noted earlier, is directed to a device which enables optical attenuation of light received by the device and passing to a light sensor. Such a device, when fitted with a light sensor, is useful as the light sensor portion of an associated electronic photoflash device and in other optical applications.

The present invention, in its more general aspect, consists in an optical attenuation device comprising a body having first and second chambers and a deformable member disposed between said first and second chambers to provide an aperture the size of which depends on the degree of deformation of said member, an optically transparent member being disposed in said second chamber and being movable therein to deform said deformable member to an extent which depends on the position of said transparent member whereby, in use with an optical-to-electrical transducer disposed in said first chamber and radiation energy entering said second chamber from the exterior of the optical device, the attenuation of the radiation passing from said second chamber to the transducer in said first chamber can be adjusted by moving said optically transparent member.

Such a device, when fitted with a light sensor, constitutes a light sensor device having improved means for enabling variable optical attenuation of the light without utilizing optical focusing components. It can be so constructed that optical attenuation is accomplished continually over a relatively large range in an improved manner.

The present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a cross-sectional elevational view of a device according to the present invention wherein the same is adjusted for maximum optical attenuation;

Figure 2 is a view similar to Figure 1 but wherein the device is adjusted for minimum optical attenuation; and

Figures 3A and 3B respectively are front views of the device of Figures 1 and 2.

Turning now to the drawings, Figures 1 and 2 illustrate an optical attenuation device according to the present invention to which is fitted a light sensor which through associated leads acts as an optical-to-electrical transducer when used in conjunction with an associated electronic photoflash device to control the flash duration. Further, a structural arrangement is disclosed which enables optically the attenuation of radiation energy such as light without modification of the angle of aperture or of the axis of the field of view. The optical attenuation may be realized in a continuous manner and over a relatively large range of attenuations. The device is constructed of a body 1 formed of an opaque material, such as a plastics material. The body 1 is preferably of a black or photo-black material to avoid stray light transmission. Polyamides, Delrin (Trade Mark) and the like are suitable opaque plastics materials. The body 1 forms a first and second chamber or port 2 and 3 separated by an opaque and deformable member or wall 4. The deformable wall 4 is illustrated in its relaxed or maximum attenuation position in Figure 1 and its flexed or minimum attenuation position in Figure 2. Positions of the deformable wall 4 between that of minimum and maximum are achieved in a manner to be described subsequently. The deformable wall 4, in a preferred embodiment, is formed integrally with the body 1 to extend equidistant from the bottom and from the top of the body 1. The plurality of sections of the wall 4, although shown to be integrally molded or extruded with the body 1, may be separately manufactured and later assembled with the interior of body 1. However, the resulting wall should be flexible and deformable and return to a relaxed position when not being deformed.

Any convenient number of the sections comprising the wall 4 (whether integrally or separately assembled with the body 1) and any convenient placement of the sections comprising the wall 4 in relation to the body 1 (whether on the top, bottom sides, exterior, etc.) is meant to be encompassed herein and an exemplary embodiment is described in Figures 3A and 3B to be discussed later.

A photosensitive element 5, such as a light sensor utilized as an optical-to-electric transducer, is disposed within the first chamber 2, and centered co-axially therein for receiving light from the exterior of the device through the second chamber 3 which passes the wall when the latter is open as indicated in Figure 2.

The second chamber 3 is threaded as in-

dicated at 7 and includes a screw member 6 of a transparent filtering and/or clear material. The screw 6 is threaded into the second chamber 3, and is adjustable to deform the wall 4 into the first chamber 2. The deformation of the wall 4 and thus the amount of attenuation (between and including the maximum deformation in Figure 2 and the minimum deformation in Figure 1) is controlled by the penetration of the screw 6 within the second chamber 3. The outer surface of the screw 6 has a notch 8, similar to that of a screwhead, which enables the use of an adjustment key in threading the screw 6 axially to deform the wall 4 into the first chamber 2. The rear end of the screw 6 (the end proximate to the first chamber 2) includes a surface which facilitates even deformation of the wall 4, such as that formed by the taper 9 (which may be frusto-conical) of the screw 6.

When the screw 6 is in the position shown in Figure 1, the aperture is substantially equal to zero and the optical attenuation is at a maximum. When the screw 6 is threaded into the second chamber 3 in the manner illustrated in Figure 2, the wall 4 moves to its maximum position of deformation and consequently the aperture is large and the optical attenuation is at a minimum.

Figures 3A and 3B illustrate a front view of the wall 4 in the respective closed and opened positions corresponding to those shown in Figures 1 and 2. As can be seen in Figures 3A and 3B, the wall 4 is formed in an embodiment as four segments of a circle. When spread apart, a four pointed aperture is formed as seen in Figure 3B.

WHAT WE CLAIM IS:—

1. An optical attenuation device comprising a body having first and second chambers and a deformable member disposed between said first and second chambers to provide an aperture the size of which depends on the degree of deformation of said member, an optically transparent member being disposed in said second chamber and being movable therein to deform said deformable member to an extent which depends on the position of said transparent member whereby, in use with an optical-to-electrical transducer disposed in said first chamber and radiation energy entering said second chamber from the exterior of the optical device, the attenuation of the radiation passing from said second chamber to the transducer in said first chamber can be adjusted by moving said optically transparent member.

2. An optical attenuation device as claimed in claim 1 wherein said optically transparent member includes threads and is threaded into said second chamber, and has a surface for engaging and thereby deforming said deformable member.



Figure 2 is a view similar to Figure 1 but wherein the device is adjusted for minimum optical attenuation; and

Figures 3A and 3B respectively are front views of the device of Figures 1 and 2.

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Any convenient number of the sections comprising the wall 4 (whether integrally or separately assembled with the body 1) and any convenient placement of the sections comprising the wall 4 in relation to the body 1 (whether on the top, bottom sides, exterior, etc.) is meant to be encompassed herein and an exemplary embodiment is described in Figures 3A and 3B to be discussed later.

A photosensitive element 5, such as a light sensor utilized as an optical-to-electric transducer, is disposed within the first chamber 2, and centered co-axially therein for receiving light from the exterior of the device through the second chamber 3 which passes the wall when the latter is open as indicated in Figure 2.

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2. An optical attenuation device as claimed in claim 1 wherein said optically transparent member includes threads and is threaded into said second chamber, and has a surface for engaging and thereby deforming said deformable member.



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3. An optical attenuation device as claimed in claim 2 wherein said optically transparent member is a screw.
4. An optical attenuation device as claimed in any of claims 1—3 wherein the optical-to-electrical transducer is a light sensor and the radiation energy is light energy.
5. An optical attenuation device as claimed in any of claims 1—4 wherein said body is formed of an opaque plastics material.
6. An optical attenuation device as claimed in any of claims 1—5 wherein said deformable member is a deformable wall.
7. An optical attenuation device as claimed in claim 6 wherein said deformable wall is integrally formed with said body.
8. An optical attenuation device as claimed in any of claims 1—7 wherein said optically transparent member includes a notch which allows said optically transparent member to axially deform said deformable member.
9. An optical attenuation device as claimed in any of claims 1—8 wherein said deformable member includes symmetrical sections.
10. An optical attenuation device as claimed in claim 9 wherein said symmetrical sections form a four pointed aperture when deformed.
11. An optical attenuation device substantially as herein described with reference to the accompanying drawings.
12. An electronic photoflash device having an optical attenuation device according to any of claims 1—11 with a light sensor for controlling flash duration.
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