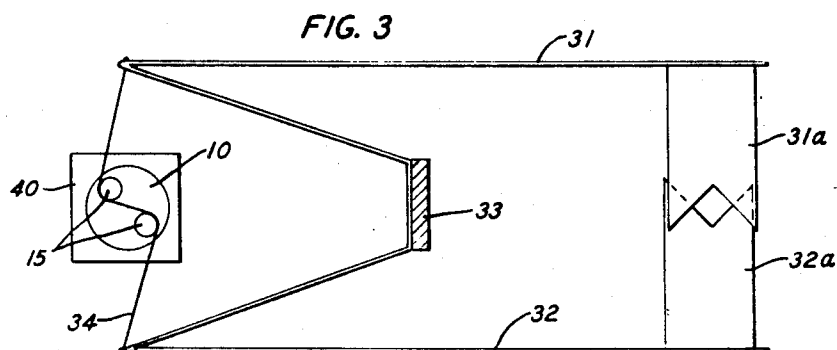
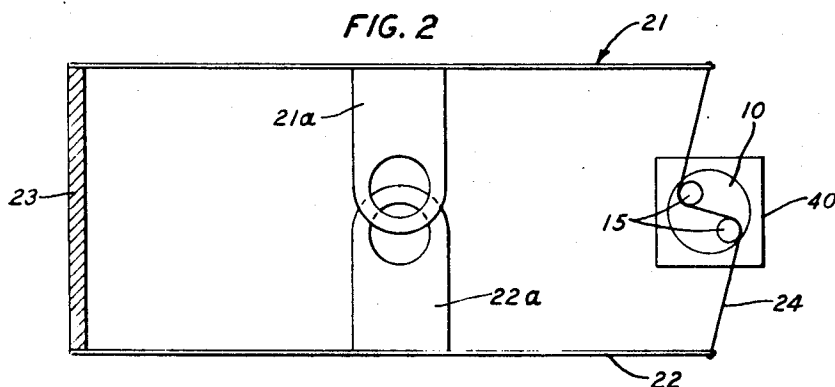
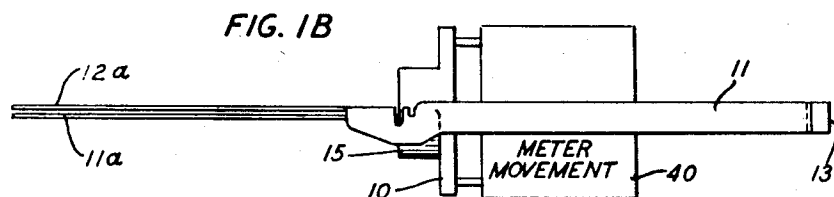
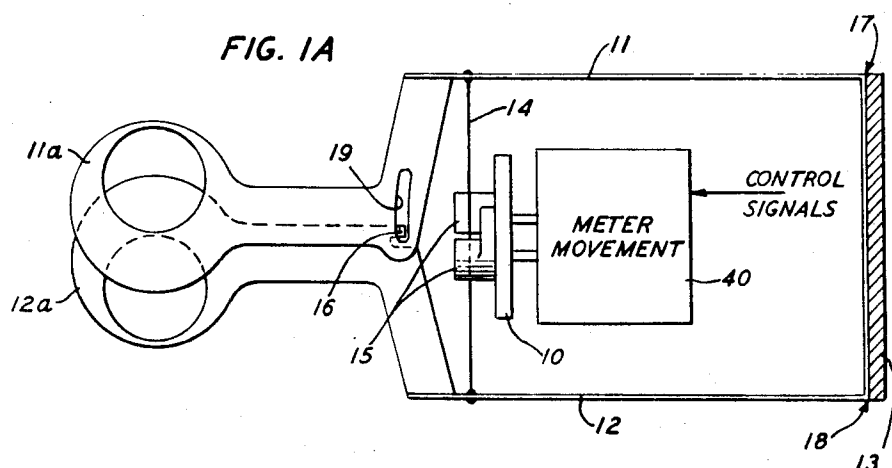


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 AUTOMATIC ELECTRORESPONSIVE LIGHT REGULATOR
 UTILIZING TAUT BAND METER MOVEMENT
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AUTOMATIC ELECTRORESPONSIVE LIGHT REGULATOR UTILIZING TAUT BAND METER MOVEMENT

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5 Claims

ABSTRACT OF THE DISCLOSURE

An electroresponsive light regulating device is constructed with a pair of light controlling elements such as filters or iris blades mounted on a pair of cantilever spring members. The cantilever springs are connected together by a taut band and a meter movement is positioned to engage and displace the taut band and thus alter the relation of the light controlling elements.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to electroresponsive regulators and more specifically relates to electroresponsive iris or filter devices.

In television and in still or motion picture photography an iris or variable density filter is commonly employed in conjunction with a lens system to regulate the intensity of light focused on a section of photographic film or other photosensitive surface. In many cameras the iris or filter is manually adjusted to the desired light conductivity or aperture size; but in others the mechanism should preferably be electrically controlled. For example, automatic light sensitive cameras for home use frequently include an electrical iris under control of a photosensitive element. Such systems have become extremely popular and important.

(2) Prior art

Electrically adjusted filters and irises are often controlled by motor operated gear or crank drive systems. Such systems are undesirable because they require considerable power and because the friction inherent in their operation generates minute free particles which tend to alter the iris' responsiveness. Other iris or filter mechanisms are driven by electrical meter movements which consume less power and operate with reduced mechanical friction. However, such meter systems still require substantial power and are susceptible to vibration. In addition, some systems employ one fixed and one movable iris blade so that the iris center is not always coincident with the optical center of the associated lens structure.

Thus, it is a primary object of the present invention to eliminate the effects of friction and vibration in a reliable low power electroresponsive iris or variable density filter.

SUMMARY OF THE INVENTION

In attaining these and other objects and in accordance with the invention, a frictionless electroresponsive iris or filter is constructed with a meter movement and a pair of selectively mounted light controlling elements. The light controlling elements, which may be iris blades or filter elements, are affixed to each of two cantilever spring members each of which is rigidly mounted to a chassis in standard cantilever fashion. The spring members are connected together at a selected point along their lengths by a taut band. A meter movement equipped with band en-

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gaging means is positioned to engage the taut band at about its center. When the meter movement is energized, the engaging means engage the taut band and displace it. This action reduces the effective length of the band and in turn equally displaces the two cantilever spring members and hence the iris blades or filter elements.

In a preferred embodiment of the invention one cantilever member is provided with a protruding pin and the other with a selectively arced channel which engages the pin so as to inhibit unwanted oscillation. The filter or iris blades may be located at any convenient point between the fulcrum and the free end of the cantilever member. The taut wire band may be located to provide the most desirable mechanical advantage for the particular application contemplated.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more fully apprehended from the following description of several illustrative embodiments thereof taken in conjunction with the appended drawings wherein:

FIGS. 1A and 1B are respectively front and top views of an electroresponsive iris constructed in accordance with the invention;

FIG. 2 shows an alternate electroresponsive iris constructed in accordance with the invention which is suitable for small sensitive iris variations; and

FIG. 3 shows a third electroresponsive iris in accordance with the invention suitable for large coarse iris variations.

DETAILED DESCRIPTION

The iris shown in FIGS. 1A and 1B consists of two elastic cantilever beam or spring members, 11 and 12, which are fixed to a rigid frame, 13, and are connected together by a wire band, 14, at a selected point along their lengths. Both spring members are preferably formed of a single piece of material that may be shaped into iris blades by selective dimensioning and appropriate folding. Iris blades 11 and 12 are so formed. A length of each cantilever member from the rigid support 13 to approximately the point at which band 14 attaches to each member is constructed so that its larger dimension faces in the direction of motion of the blades. Beyond this point, the beam member is folded so that its larger dimension is perpendicular to the direction of motion. Thus the length of each member between the fixed mounting 13 and the taut band 14 is easily flexed in the direction of motion of the iris blades while the length between the taut band and the iris blades is rigid. This permits the taut band accurately to control the iris blades while providing the spring action required to keep band 14 taut. In addition, it permits both elastic cantilever members and both iris blades to be formed from a single sheet of material by a stamping or photoetching process. It is to be understood that the iris blade design shown in FIG. 1 (11a and 12a) is merely an example of many possible blade configurations that could be employed in accordance with the invention and that band 14 need not be a wire band but could be a length of thread or other flexible material.

To control the iris setting, a meter movement 40 is located adjacent to the taut band 14 and may include a base plate 10, and two extended drive pins 15 which engage the taut band. These pins are preferably cylindrical.

Meter 40, which is preferably a taut band type meter well known in the art, may be located as shown in FIG. 1, between the cantilever members, or may be located at any convenient angle with those members. For example, meter 40 may be perpendicular to the plane of the iris blades as shown in FIGS. 2 and 3. In an alternative em-

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bodiment of the invention, meter movement 40 may employ a bearing type movement.

When meter 40 is energized by a source of power, not shown, the plate 10 carrying pins 15 is rotated. This action causes the pins to engage band 14 and displace it. This displacement reduces the effective length of the taut band which in turn displaces the cantilever members and hence the iris blades. The meter 40 should preferably exercise maximum rotation in driving the iris to the open position to minimize aperture hysteresis due to drive oversensitivity.

The two cantilever springs and the taut band type meter movement have low mechanical friction since they have no mated moving parts. In the case of the taut band and drive pin combination, the tension on each end of the taut band is equal and opposite. Further, with drive pins equispaced from the meter movement axis, the developed torque is delivered to the taut band through matched couples. With symmetrical loads and drives there is no differential force to cause the taut band to move relative to the drive pins. And with no relative motion between members, there is no sliding friction. The taut band simply wraps around the drive pins without slipping as the pins rotate. Consequently, the entire iris operates with negligible mechanical friction.

Without affecting the low friction properties of the iris, unwanted vibration can be eliminated by preventing the cantilever beams from moving together in the same direction at the same time (in phase) as will be explained below.

Vibration is introduced into the iris primarily because of external jarring. Since the beams are rigidly fastened at one end and are initially angled apart sufficiently to provide spring tension to maintain band 14 taut, the distance between the cantilever members along band 14 is held constant. Thus, if the beams vibrate they must vibrate together. They can move in opposite directions only if the effective length of band 14 is changed by meter movement 40. In addition, the locus of any motion of beam 11 must be in the form of an arc centered at approximately point 17 where beam 11 is rigidly fastened to support 13. Similarly the motion of beam 12 is constrained in an arc approximately about point 18. Since the beams must rotate about different points any vibration must be accompanied by a slippage between the beams.

To prevent this sort of slippage and hence in phase vibration, one of the cantilever beams, 12, is equipped with a pin, 16, extending perpendicular to the plane of spring motion. The other beam, 11, includes an arced aperture, 19, dimensioned to accommodate pin 16 without friction and to permit the iris blades to move in opposite directions and thus adjust the aperture size without pin 16 making contact with the walls of slot 19. If the beams attempt to move in phase, as when unwanted vibration occurs, pin 16 engages the side of slot 19. This engagement dissipates the energy tending to vibrate the beams in the same direction, but does not affect the opposing motion of the beams caused by the foreshortening of band 14. Thus, without adding friction in normal operation, pin 16 and slot 19 dissipate forces tending to generate unwanted oscillation.

FIGS. 2 and 3 show alternate embodiments of the invention wherein the relative position of the meter, iris blades, and fixed support on the cantilever spring beams is varied; in FIG. 2 to provide more sensitive iris variations; in FIG. 3, to provide coarse variations.

Thus, FIG. 2 shows an iris which operates on principles similar to those described in conjunction with FIGS. 1A and 1B except that meter movement 40 and wire band 24 are located at the free end of beams 21 and 22 while iris blades 21a and 22a are located near the center of beams 21 and 22. The beams are fixed at one end to rigid mounting 23. Variations in the effective length of band 24 thus provide smaller variations in iris size than

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would be produced in the iris of FIG. 1. This allows finer adjustment of iris aperture.

In the iris shown in FIG. 3 spring members 31 and 32 are folded so that iris blades 31a and 32a are effectively further from the rigid support 33 than in the embodiments discussed above. Meter movement 40 engages wire band 34 in accordance with the principles of the invention. However, the effective foreshortening of band 34 now produces more severe changes in the size of the aperture between iris blades 31a and 32a at the cost of reduced sensitivity.

It is to be understood that spring members 21 and 22 in FIG. 2 and 31 and 32 in FIG. 3 may be provided with a pin and slot similar to that shown in FIG. 1 to prevent unwanted vibration. Further, as should be apparent, the iris blades shown in FIGS. 1, 2 and 3 may be replaced with other appropriate light controlling means. Thus variable density filters or selectively polarized sheets may replace the blades to provide light control. Similarly, graded color filters may be employed to provide color exclusion.

It is to be further understood that the above described arrangements are merely illustrative of application of the principles of the invention. Other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An automatic electroresponsive iris which comprises,
 - a rigid member,
 - a first elastic cantilever member rigidly affixed to and protruding from said rigid member,
 - a second elastic cantilever member rigidly affixed to and protruding from said rigid member,
 - said first and second elastic members being in a predetermined spatial relationship,
 - a first iris blade having an opening therein and connected to said first elastic cantilever member,
 - a second iris blade having an opening therein and connected to said second elastic cantilever member,
 - said first and second iris blades being in a predetermined spatial relationship so that said openings form an iris which is initially closed,
 - a flexible band connecting said first elastic cantilever member and said second elastic cantilever member,
 - a meter movement for providing rotational motion in response to electrical signals, and
 - means for coupling said meter movement to said flexible band, said coupling means including
 - a plate connected to a rotational member of said meter movement, and
 - first and second elongate pins extending outward from said plate, said pins being mounted on said plate in a predetermined spatial relationship so that the rotational motion of said meter movement is translated to said flexible band through matched couples thereby to foreshorten said band and to control the relative spatial position of said iris blades causing the iris opening to vary in size.
2. An electroresponsive iris as defined in claim 1 wherein said meter movement is of the taut band type and is arranged to exert maximum rotation in a direction causing said band to foreshorten and drive the iris to its open position.
3. An electroresponsive iris as defined in claim 1 wherein said first and second iris blades are located in close relation to the free ends of said elastic cantilever members, and wherein said flexible band is connected to each of said elastic cantilever members at a point substantially at the center of each of said elastic members.
4. An electroresponsive iris as defined in claim 1 wherein said flexible band is attached to each of said elastic cantilever members at a point substantially at the free end of said members and said first and second iris blades are located substantially at the center of said first and second elastic cantilever members, respectively.

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5. An electroresponsive iris as defined in claim 1 wherein said first elastic cantilever member is provided with a pin extending perpendicular to the plane of motion of said first elastic cantilever member and said second elastic cantilever member is formed with an arced apertured slot, said slot being arranged to engage said pin so that said elastic cantilever members are free to move in opposite directions but are restrained from moving together in the same direction.

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