

PATENT SPECIFICATION (11)

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(21) Application No. 42742/75

(22) Filed 17 Oct. 1975

(19)

(31) Convention Application No. 516 234

(32) Filed 18 Oct. 1974 in

(33) United States of America (US)

(44) Complete Specification published 8 March 1978

(51) INT. CL.² G03B 7/08,

(52) Index at acceptance

G2A 401 403 454 464 474 488 506 602 607 641 647 663 706
711 BII.

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(54) AUTOMATIC EXPOSURE CONTROL MECHANISM



(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America, of 343 State Street, Rochester, New York 14650, 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:—

The present invention relates to an automatic exposure control mechanism for cameras.

Generally it is known in the photographic art to automatically control exposure in response to scene brightness using electronic circuitry containing a photosensor. Automatic exposure control has been achieved by determining shutter speed and/or aperture size in response to scene brightness.

It is known to use a variably masked photosensor to determine the size of an aperture for exposure control.

According to the present invention there is provided an automatic exposure control mechanism for a photographic camera, comprising a photosensor and a variable aperture therefor arranged for receiving illumination from a scene to be photographed, an impact shutter which opens on being struck by an impact member, an adjustable stop for limiting opening movement of said shutter, adjusting means for simultaneously varying the variable aperture and the position of the stop, and arresting means for arresting movement of the stop when the illumination received by the photosensor through the aperture has a predetermined value.

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

Fig. 1 is a schematic diagram of an electronic circuit for controlling the shutter speed of a photographic camera embodying the present invention, in response to the amount of light striking a photosensor.

Fig. 2 shows diagrammatically the interaction between an adjustable stop and a

shutter blade of a camera embodying the present invention; and

Fig. 3 shows a partial perspective view of an automatic exposure control mechanism of the present invention.

Because photographic cameras are well known, the present description will be directed in particular to elements forming part of, or cooperating directly with, the present invention, camera elements not specifically shown or described herein being understood to be selectable from those known in the art.

As shown in Fig. 3, an exposure control device, includes a shutter release 10 mounted for sliding movement on a support structure 12. The shutter release 10 has an extended portion 10a which engages a switch 14, and a ramp surface 10b which engages a slider 16. The shutter release 10 is urged by a spring 18 in a direction opposite to that of the arrow 'A' in Fig. 3. The slider 16 is mounted for sliding movement on the support structure 12 and is urged by a spring 20 into engagement with the shutter release 10.

A latch 22 is pivotally mounted on the support structure 12 by a pin 24. An impact member 26 is pivotally mounted on the support structure 12 by a pin 28 and is urged against the latch 22 by a spring 30.

A shutter blade 32 of an impact shutter is pivotally mounted on the support structure 12 by a pin 34. The shutter blade 32 is arranged for uncovering an exposure aperture 36 in the support structure 12 thereby allowing scene light to enter a camera lens 38. A spring 40 urges the shutter blade 32 into contact with a projecting pin 33 to cover the exposure aperture 36. The shutter blade 32 has an extension 32a in the path of the impact member 26.

A control member 44 is mounted on the support structure 12 for sliding movement in a direction parallel to the direction of movement of the slider 16 and is urged by a spring 46 (weaker than spring 20) so that a pin 47 on the control member 44 engages the slider 16. The control member 44 has a ratchet portion 44a on its upper edge and a ramp

(4)

44b on its lower edge. An adjustable stop 42 is pivoted on a pin 51 and urged into contact with the ramp 44b by a spring 43. A pawl 48 is hinged to the support structure 12 by a pin 50 and is urged toward engagement with the ratchet 44a by a spring 49 to form an arresting means. The pawl 48 may be held out of engagement with the ratchet 44a by a keeper 16a on the slider 16 and/or an electromagnet 52.

A photosensor, such as a photo-conductor 54, is arranged to receive illumination from a scene to be photographed through a variable aperture 57 defined by a pair of aperture blades 56. The size of the variable aperture 57 is controlled by a linkage 58 which is pivotally mounted to the support structure 12 on a pin 60 and is arranged to move the blades 56 relative to each other via pin and slot connections 62. The linkage is coupled to the control member 44 by a pin and slot connection 63.

The exposure control device is actuated when the shutter release 10 is depressed in the direction of the arrow A. As the shutter release 10 is depressed, the arm 10a first engages the contacts of the switch 14 closing them. Referring now to Fig. 1, an exposure control circuit 4 is shown comprising the switch 14, a source of electrical energy, such as a battery 64, a resistor 66, a threshold value switch, such as a Schmitt trigger 72 having an output 74 and a switching input 76, the electromagnet 52, the photoconductor 54, a variable resistance 68, and a normally closed switch 70.

The circuit 4 functions in the following manner. When the switch 14 is closed power is applied to the circuit 4. When the voltage at the switching input 76 exceeds a switching threshold, the voltage at the output 74 will be high. The switching threshold at which the output 74 of the Schmitt trigger 72 will change from low voltage to high voltage is determined by the value of the variable resistance 68. The value of the variable resistance 68 is selectable for different film speeds by well known notch code techniques.

The resistor 66 and the photoconductor 54 form a resistor divider network. The resistance of the photoconductor 54 is inversely proportional to the amount of light incident thereon, therefore the voltage at the centre tap of the resistor divider network is inversely proportional to the amount of light incident upon the photoconductor 54. The centre tap of the resistor divider network is connected to the switching input 76 of the Schmitt trigger 72. One terminal of the electromagnet 52 is connected to the positive side of the battery 64, the other terminal of the electromagnet 52 is connected to the output 74 of the Schmitt trigger 72. Thus if the intensity of light incident upon the photoconductor 54 is low, causing the voltage on

the switching input 76 of the Schmitt trigger 72 to be above the switching threshold, the output 74 of the Schmitt trigger 72 will be high and the electromagnet 52 will be de-energized.

If however the intensity of light incident upon the photoconductor 54 is high, thereby causing the voltage at the input 76 of the Schmitt trigger 72 to be below the switching threshold, the output 74 of the Schmitt trigger 72 will be low and the electromagnet 52 will be energized.

Returning to Fig. 3, as the shutter release 10 is further depressed in the direction of the arrow A, its ramp portion 10b engages the slider 16 urging the slider in the direction of the arrow B. As the slider is moved in the direction of the arrow B the keeper 16a releases the pawl 48 which is then controllable by the electromagnet 52.

If the intensity of the scene light incident upon the conductor 54 is high, the electromagnet 52 will be energized, holding the pawl 48 away from the ratchet 44a against the force of the spring 49.

As the slider 16 moves in the direction of the arrow B, the control member 44 urged by spring 46 follows the slider. As the control member 44 moves with the slider 16, the lever 58 which is coupled to the control member 44 is pivoted on the pin 60 thereby displacing the variable aperture blades 56 relative to each other and decreasing the aperture through which scene light is incident upon the photoconductor 54.

When the light incident upon the photoconductor 54 through the aperture 57 has a predetermined value, that is it is reduced to the level at which the voltage at the switching input 76 of the Schmitt trigger 72 exceeds the switching threshold, the output of the Schmitt trigger 72 goes high, de-energizing the electromagnet 52 and releasing the pawl 48 which is thereupon urged by the spring 49 into engagement with the ratchet section 44a on the control member 44. The control member 44 is thus restrained from further movement with the slider 16. As the control member 44 moved from left to right with the slider 16, the ramp 44b moved in slidable contact with the adjustable stop 42 thus displacing the adjustable stop 42 in a downward direction against the force of the spring 43.

As the slider 16 continues in the direction of the arrow B it encounters the latch 22 which it causes to pivot on the pin 24 thereby releasing the impact member 26. Referring now to Fig. 2, the impact member 26 moves in the direction indicated by the arrow C to strike the extension 32a of the shutter blade 32. The shutter blade 32 is pivoted in the direction indicated by the arrow D to uncover the exposure aperture 36 to initiate exposure. As the shutter blade 32 continues

in the direction indicated by the arrow D it is arrested by the adjustable stop 42. It is then returned by the spring 40 to cover the exposure aperture.

5 The shutter speed is determined by the position of the adjustable stop 42. As shown in Fig. 2 when the adjustable stop 42 is in the position shown in solid lines the shutter blade 32 will move through a short arc from the position indicated by *a* to the position indicated by *b* and return to cover the aperture 36. A long exposure time results when the adjustable stop 42 is in position 42*a* shown by dotted lines in Fig. 2. When the adjustable stop 42 is in this position the shutter blade 32 moves through a longer arc from the position indicated by *a* to the position indicated by *c* and back again.

For flash photography it is generally desirable to use the slowest shutter speed available. This is achieved by including in the shutter control circuit shown in Fig. 1 a normally closed switch 70 which may be opened by a slidably mounted pin 78 upon insertion of a flasheube (not shown). When a flasheube is in place the switch 70 is open and the electromagnet 52 cannot be energized. Referring back to Fig. 3, as the shutter release 10 is depressed and the keeper 16*a* moves away from the pawl, the pawl will immediately move, urged by the spring 49, to engage the ratchet 44*a* thereby arresting the adjustable stop 42 in the position yielding the slowest shutter speed.

35 In the embodiment just described, the variable aperture was initially in the fully open position and was progressively closed until a predetermined intensity of light incident upon the photoconductor 54 triggered the shutter control circuit 4. Alternatively a shutter control circuit 4 which responds to a photoconductor 54 that is initially covered

and is progressively uncovered until the circuit is triggered may be used.

WHAT WE CLAIM IS:—

1. An automatic exposure control mechanism for a photographic camera, comprising a photosensor and a variable aperture therefor arranged for receiving illumination from a scene to be photographed, an impact shutter which opens on being struck by an impact member, an adjustable stop for limiting opening movement of said shutter, adjusting means for simultaneously varying the variable aperture and the position of the stop, and arresting means for arresting movement of the stop when the illumination received by the photosensor through the aperture has a predetermined value.

2. An automatic exposure control mechanism as claimed in Claim 1, wherein the variable aperture is arranged to be initially in the fully open position and is progressively reduced, and the adjustable stop is initially in the position for providing the slowest shutter speed.

3. An automatic exposure control mechanism substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

4. A photographic camera including an automatic exposure control mechanism as claimed in Claim 1, 2 or 3.

5. A photographic camera as claimed in Claim 4, further including a shutter release, and a control member, whereby operation of the shutter release, causes the control member to actuate the adjusting means.

6. A photographic camera, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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- For flash photography it is generally desirable to use the slowest shutter speed available. This is achieved by including in the shutter control circuit shown in Fig. 1 a normally closed switch 70 which may be opened by a slidably mounted pin 78 upon insertion of a flashcube (not shown). When a flashcube is in place the switch 70 is open and the electromagnet 52 cannot be energized. Referring back to Fig. 3, as the shutter release 10 is depressed and the keeper 16a moves away from the pawl, the pawl will immediately move, urged by the spring 49, to engage the ratchet 44a thereby arresting the adjustable stop 42 in the position yielding the slowest shutter speed.

- 35 In the embodiment just described, the variable aperture was initially in the fully open position and was progressively closed until a predetermined intensity of light incident upon the photoconductor 54 triggered the shutter control circuit 4. Alternatively a shutter control circuit 4 which responds to a photoconductor 54 that is initially covered

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2. An automatic exposure control mechanism as claimed in Claim 1, wherein the variable aperture is arranged to be initially in the fully open position and is progressively reduced, and the adjustable stop is initially in the position for providing the slowest shutter speed.

3. An automatic exposure control mechanism substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

4. A photographic camera including an automatic exposure control mechanism as claimed in Claim 1, 2 or 3.

5. A photographic camera as claimed in Claim 4, further including a shutter release, and a control member, whereby operation of the shutter release, causes the control member to actuate the adjusting means.

6. A photographic camera, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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