

PATENT SPECIFICATION

(11)

1 309 801

DRAWINGS ATTACHED

1 309 801

- (21) Application No. 14122/70 (22) Filed 24 March 1970
 (31) Convention Application No. P 19 14 945.2
 (32) Filed 24 March 1969 in
 (33) Germany (DT)
 (44) Complete Specification published 14 March 1973
 (51) International Classification G03B 7/08
 (52) Index at acceptance

(19)



G2A 11B 11C1 11CY 11E1 11E3B 11E3Y 11EY 11F12A
 11F12C 11F12F 11F12Y 11F2 11FY 11H1 11H7
 11HY

(54) IMPROVEMENTS IN AND RELATING TO CAMERAS HAVING AUTOMATIC SHUTTER ELECTRONIC EXPOSURE CONTROL MEANS

(71) We, AGFA-GEVAERT AKTIENGESELLSCHAFT, a body corporate recognised under German Law of Leverkusen, Germany, 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 a camera having an electronic automatic shutter exposure control device. The control device is arranged to be supplied with direct current and the photographic camera includes an electronic switching device, the input of which can be connected to timing means containing a capacitor and a photo-sensitive element, and the output of which is connected with an electro-magnet arranged to terminate the exposure operation, and also with means for indicating inadequate lighting conditions, which can be connected to the output of the switching device.

An exposure control device of this type has previously been proposed in German Patent Specification No. 1,276,437. When the brightness falls below a certain value, in this previously proposed exposure control device an indicating means becomes effective which indicates to the user of the camera that hand-held exposures can no longer be made. In a previously proposed camera of this type, a larger aperture can be set, for example, by hand, in order to widen the exposure range. It is also known to set the aperture by way of a meter. However, the cost of such a diaphragm control is considerable.

It is an object of the invention to enable automatic control of the diaphragm aperture from a small aperture to a large one or vice versa to be provided with simple means and utilising the means provided for exposure control.

In accordance with the invention, this is achieved by arranging that, before the shutter

is released, a variable resistance means is switched into the timing circuit in place of the capacitor and the second electro-magnet and the indicating means are switched in parallel with the first electro-magnet, the second electro-magnet being energised if the brightness is below the first predetermined level and if the second electro-magnet is energised the variable resistance means is adjusted to take into account the change in aperture, the indicating means being operated if the brightness is below the second predetermined level.

When the brightness falls below a certain value, the second electro-magnet is excited, and, for example, alters the diaphragm aperture from a small aperture value to a larger one. The exposure range given for hand-held exposures is thereby widened correspondingly. At the same time, the value of the resistance of the variable resistor is so altered that, when the brightness falls below the increased range, the indicating means responds and indicates to the camera user that a tripod exposure must be made.

The second electro-magnet is, preferably, connected to the first electro-magnet by a changeover contact, the arrangement being such that the changeover contact is actuated by means of a release member.

Because it is possible to set two diaphragm apertures, the variable resistor preferably comprises two individual resistors, one of which is arranged to be connected and disconnected by means of a contact which is arranged to be actuated by the shutter-release member.

Advantageously, the arrangement is such that the changeover contact for the second magnet and the contact for the variable resistor are arranged to be actuated simultaneously. Both contacts are, preferably, arranged to be actuated by means of a setting member which can be influenced by means of the shutter-release member. It is

also possible, however, for the arrangement to be such that the contact for one of the two resistors in the input circuit of the switching device is actuated not by the release but by means of the second magnet.

A small lamp may be used as the indicating means, but it is also possible to provide another signal device, for example, a locking magnet, by means of which the shutter-release member, for example, can be locked.

Advantageously, the electrical switching device comprises two transistors, the input transistor of which, prior to release of the shutter, is connected by its base to a voltage divider comprising the photo-resistor and the variable resistor.

In order to take account of the diaphragm apertures in determining the exposure time, the diaphragm-setting member may have coupled to it a diaphragm arranged to cover the photo-resistor, so that, when the diaphragm aperture is small, a slower shutter speed is produced than when the diaphragm aperture is large. In the first case the photo-resistor is covered over to a great extent to correspond to the given aperture of the lens diaphragm, whilst in the second case the photo-resistor is screened off to a lesser degree. Instead of a diaphragm, a grey filter can be used, which is preferably also connected to the diaphragm-setting member.

A camera constructed in accordance with the invention will now be described with reference to the accompanying drawing, which is a cross-section of a part of the camera perpendicular to the axis of the lens with the electric circuitry shown diagrammatically.

Referring to the accompanying drawing, the camera comprises an electronic exposure control device located within the camera body 1. A direct-voltage source 2 is provided and this can be connected to a switching device by way of an operating switch 3. The switching device includes two transistors 4 and 5. The collector of the transistor 4 is connected on one side to the base of the transistor 5 and on the other side to the operating switch 3 by way of a resistor 6. The emitter of the transistor 4 is connected to a voltage divider, which comprises resistors 7 and 8, situated in the emitter circuit of the transistor 5. In the collector circuit of the transistor 5, there is an exposure-control magnet 9. Connected in parallel with the exposure-control magnet 9, by way of contacts 10 and 11 of a first changeover switch 16, is a setting magnet 12. An indicator lamp 14 arranged to be visible in the field of a viewfinder 13 can be switched in parallel with the exposure-control magnet 9 in place of the setting magnet 12 by means of the contact 15 of the first changeover switch 16.

The base of the transistor 4 is connected

by way of a dropping resistor 17 to a voltage divider which, before the exposure time is determined, is connected on the one hand to a photo-resistor 18 and on the other hand to two series-connected resistors 20 and 21 by way of a contact 19 of a second changeover switch. In the drawing, the resistor 20 is shown short-circuited by way of a contact 22.

A capacitor 24 can be connected in place of the two resistors 20 and 21 by means of a contact 23 of the second changeover switch. The capacitor 24 can be short-circuited by means of a contact 25 which is arranged to be actuated by means of an extension 26 of a shutter ring.

The contacts 3 and 10 can be actuated by means of a pin 27 on the shutter-release member 28. Similarly, the second changeover switch, with its contacts 19 and 23, can be actuated by means of a pin 30 on the member 28. Furthermore, the contact 15 of the first changeover switch 16 can be actuated by the member 28 by means of an oblique surface 31 provided at the free end of the member. The changeover switch 16 consists of a layer 33 which is pivotable about a fixed pin 32 and one end of which is in contact with a segment 34. The lever 33 is electrically connected to the collector of the transistor 5 and is subject to the effect of a spring 35, which tends to hold the lever 33 in the position shown in the drawing. The contact 22 can be actuated by means of the other end of the lever 33.

The release member 28 is held in the initial position by means of a spring 36. By means of an extension 37 provided on the release member 28, the latter is in contact with a diaphragm ring 38 by way of an extension 39. There also engages with the diaphragm ring 38 a spring 40 which tends to rotate the diaphragm ring in the direction of the arrow 41. The force exerted by the spring 36 on the member 38 is greater than the force exerted by the spring 40 on that member. On a further diaphragm ring 42, several diaphragm leaves 43 are rotatably mounted on pins 44 (only one leaf 43 and pin 44 being shown in the drawing for the sake of simplicity). The diaphragm leaf 43 has a groove, which is engaged by a pin 45 provided on the diaphragm ring 38.

The diaphragm ring 38 also has a recess 46 in which a locking pawl 48 engages under the influence of a spring 47. The pawl 48 can be moved to free the diaphragm ring 38 by excitation of the setting magnet 12.

Also connected with the diaphragm ring 38 is a lever 49 on the free end of which a grey filter 50 is fitted. The lever 49 is located in a guide 51 in such a way that the grey filter 50 executes a rectilinear movement when the diaphragm ring 38 rotates. For this purpose, the lever 49 has at the end which is

connected to the diaphragm ring 38 a longitudinal groove which is engaged by a pin 52 of the diaphragm ring 38.

5 The operation of the exposure-control device is as follows. In the position shown in the drawing, the diaphragm leaves 43 form a small diaphragm aperture. It is assumed the lighting conditions are such that a hand-held exposure can be made with this
10 small diaphragm aperture.

If the release member 28 is actuated in the direction of the arrow 29 against the action of the spring 36, the contact 3 is closed by means of the pin 27, with the result that the positive pole of the voltage source 2 is connected to the switching device. In the assumed lighting conditions, a potential is applied to the base of the transistor 4 which is positive in relation to the emitter of the transistor 4. The transistor 4 is therefore
15 triggered on, with the result that the transistor 5 is blocked. The setting magnet 12 cannot therefore be excited, and so the diaphragm ring 38 remains locked. Furthermore, the grey filter 50 remains in front of the photo-resistor 18.

When the release 28 is actuated further in the direction of the arrow 29, the contact 10 is opened and the contact 23 is closed. Accordingly, the capacitor 24 is switched in series with the photo-resistor 18, whilst the two resistors 20 and 21 are switched out of the circuit.

35 The shutter ring is moved into its tensioning position with the extension 26 in a manner which is not shown. The contact 25 is thereby closed and thus the capacitor 24 is short-circuited. The actuation of the first changeover switch 16 by means of the release 28 does not result in any switching operations, since the contact 10 is already in the open position. The tensioning of the shutter ring may also be arranged to take place during the film transport operation.

45 In a manner which is not shown or described herein, the shutter ring runs down under the influence of a spring counter to the direction of the arrow 41 and, by means of the extension 26, opens the contact 25. Consequently the charging of the capacitor 24 of the timing circuit commences. After a delay, of which the period is determined by the time constant of the photo-resistor 18 and the capacitor 24, the transistor 4, which was previously conducting, is blocked and the exposure control magnet 9 is excited. In a manner which is not shown, this allows the closing of the shutter blades.

60 It is now assumed that the lighting conditions will not suffice to allow hand-held exposures to be made when using the small diaphragm aperture, but that the brightness is great enough for a hand-held exposure to be made using the large diaphragm aperture.

65 When the release 28 is actuated in the

direction of the arrow 29, the contact 3 is again closed and the switching device connected to the voltage source 2. With the lighting conditions now assumed, however, the resistance value of the photo-resistor 18 is so great that the transistor 4 is blocked. The base of the transistor 5 is therefore positive with respect to its emitter. The transistor 5 is therefore triggered on and the setting magnet 12 is excited. The exposure-control magnet 9 is also excited, but this does not lead to any switching operation. The locking pawl 48 is moved by means of the setting magnet and the diaphragm ring 38 is thereby freed.

When the release member 28 is pushed further, one end of the lever 33 is moved over the segment 34 and, after leaving the segment 34, the contact 11 is opened. The setting magnet 12 is consequently de-energised. Previously, the diaphragm ring 38 could move in the direction of the arrow 41 under the influence of the spring 40. When the lever 33 is pivoted, the contact 22 is also opened and the resistor 20 is connected to the resistor 21. Consequently, the potential at the base of the transistor 4 is made sufficiently positive that the transistor 4 is triggered on and the transistor 5 is blocked.

After the contact 15 of the changeover switch 16 is closed, the lamp 14 is switched into the collector circuit of the transistor 5. However, the lamp 14 does not light up, because the transistor 5 is non-conductive. When the release member 28 is moved further in the direction of the arrow 29, the contact 10 is opened, and the setting magnet 12 and the indicator lamp 14 are switched off. In addition, the diaphragm ring 38 can move further in the direction of the arrow 41 so that the large diaphragm aperture is set.

As in the first assumed case, the capacitor 24 is then switched in and the resistors 20 and 21 are switched out. On rotation of the diaphragm ring 38, furthermore, the grey filter 50 is moved away from the photo-resistor 18.

115 It is now assumed that the lighting conditions are not adequate for a hand-held exposure even when using the large diaphragm aperture. The operations take place as in the second of the two cases previously described, but with the difference that, when the resistor 20 is switched in, the resistance value of the photo-resistor 18 is so great that the base of the transistor 4 is negative with respect to the emitter, for which reason the transistor 4 remains non-conducting. Consequently the transistor 5 is rendered conductive, so that, when the contact 15 is closed, the indicator lamp 14 lights up, and indicates to the camera user that a hand-held exposure is no longer possible. After the
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release member 28 has returned to the initial position shown in the drawing, all movable parts assume the positions shown in the drawing again. When the contact 3 is opened, the electrical switching device is switched off.

WHAT WE CLAIM IS:—

1. A camera having automatic shutter electronic exposure control means arranged to be operated by direct current, which exposure control means comprises electronic switch means, timing means connected in operation to the input of the switch means and comprising a capacitor and a photo-sensitive element, a first electro-magnet connected to the output of the switch means for terminating exposure, a second electro-magnet arranged to be actuated when the brightness of the prevailing illumination is below a first predetermined level to alter the diaphragm aperture and means for indicating when the brightness of the prevailing illumination is below a second predetermined level, the arrangement being such that, before the shutter is released, a variable resistance means is switched into the timing circuit in place of the capacitor and the second electro-magnet and the indicating means are switched in parallel with the first electro-magnet, the second electro-magnet being energised if the brightness is below the first predetermined level and if the second electromagnet is energised the variable resistance means is adjusted to take into account the change in aperture, the indicating means being operated if the brightness is below the second predetermined level.

2. A camera as claimed in claim 1, wherein the second electro-magnet is connected to the first electro-magnet by a changeover contact which is arranged to be actuated by a shutter-release member.

3. A camera as claimed in claim 1 or claim 2, wherein the variable-resistance means comprises two resistors, one of which

is arranged to be connected or disconnected by a contact which is actuated by the shutter-release member before the shutter is released.

4. A camera as claimed in claim 2 or claim 3, wherein the changeover contact for the second electro-magnet and the contact for the variable-resistance means are arranged to be actuated simultaneously.

5. A camera as claimed in claim 3, wherein the arrangement is such that the contact for one of the two resistors is actuated by the second electro-magnet.

6. A camera as claimed in any one of claims 1 to 5, wherein the indicator device is a lamp.

7. A camera as claimed in any one of claims 1 to 6, wherein the electronic switching device comprises two transistors, the input transistor of which is arranged to be connected by its base to a voltage divider comprising the photo-sensitive element and the variable-resistance means before the shutter is released.

8. A camera as claimed in any one of claims 1 to 7, wherein there is provided a diaphragm which is arranged to cover the photo-sensitive element and is coupled to means for setting the diaphragm aperture.

9. A camera as claimed in any one of claims 1 to 8, wherein there is provided a grey filter which is arranged to cover the photo-sensitive element and is coupled to means for setting the diaphragm aperture.

10. A camera having automatic shutter electronic exposure control means substantially as hereinbefore described with reference to, and as shown in the accompanying drawing.

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2. A camera as claimed in claim 1, wherein the second electro-magnet is connected to the first electro-magnet by a changeover contact which is arranged to be actuated by a shutter-release member.

3. A camera as claimed in claim 1 or claim 2, wherein the variable-resistance means comprises two resistors, one of which

is arranged to be connected or disconnected by a contact which is actuated by the shutter-release member before the shutter is released.

4. A camera as claimed in claim 2 or claim 3, wherein the changeover contact for the second electro-magnet and the contact for the variable-resistance means are arranged to be actuated simultaneously.

5. A camera as claimed in claim 3, wherein the arrangement is such that the contact for one of the two resistors is actuated by the second electro-magnet.

6. A camera as claimed in any one of claims 1 to 5, wherein the indicator device is a lamp.

7. A camera as claimed in any one of claims 1 to 6, wherein the electronic switching device comprises two transistors, the input transistor of which is arranged to be connected by its base to a voltage divider comprising the photo-sensitive element and the variable-resistance means before the shutter is released.

8. A camera as claimed in any one of claims 1 to 7, wherein there is provided a diaphragm which is arranged to cover the photo-sensitive element and is coupled to means for setting the diaphragm aperture.

9. A camera as claimed in any one of claims 1 to 8, wherein there is provided a grey filter which is arranged to cover the photo-sensitive element and is coupled to means for setting the diaphragm aperture.

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