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(72) Inventors GEOFFREY MORTON TONGE,
WOLFGANG ORT and
CLEMENS HOPFNER



(54) SHUTTER-MECHANISM

(71) We, KODAK LIMITED, a Company registered under the Law of England of Kodak House, Station Road, Hemel Hempstead, Hertfordshire, 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 invention concerns shutters for photographic cameras, particularly electronically controlled shutters, of the kind comprising two blades, an opening blade and a closing blade which run down consecutively, in the same direction.

Such shutters are well known and co-operate with an aperture on the optical path of the camera. If the time interval between the opening blade uncovering the aperture and the closing blade covering the aperture is relatively long any errors due to the shape or size of the aperture and the shape of the opening edge of the opening blade and/or the closing edge of the closing blade, are proportionally small and generally can be ignored. However, if the aperture is photo-electrically set to a small value and/or the opening blade is provided with a tear drop shaped opening edge, errors in exposure, especially at short duration exposures can be relatively large. This is particularly the case with so-called diaphragm shutters where an opening blade with a tear drop shaped opening not only provides an initiation of a time interval but also with a closing blade determines, with the closing blade, photographically the value of the aperture.

In such instance, it is possible for the exposure value determined photoelectrically to provide an error of the same order of magnitude.

It is an object of the present invention to provide an improved shutter wherein the aforesaid disadvantage is minimized or overcome.

According to the present invention, there is provided a shutter for photographic

camera comprising an opening and a closing blade arranged to run down consecutively in the same direction, the opening blade having a re-entrant opening edge and the closing blade having a substantially complementarily shaped closing edge.

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

Fig. 1 is an elevation of a two bladed shutter in accordance with the present invention; and

Fig. 2 is an exploded perspective view of a preferred electronically controlled two bladed shutter in accordance with the present invention.

Referring firstly to Fig. 1, there is shown a two bladed photographic shutter locatable in front of an aperture 10 on the optical path of a photographic camera. The shutter comprises an opening blade 11 biased by a spring 12 for rectilinear movement (from left to right as viewed in the drawings) to uncover the aperture 10 by means of a tear drop shaped opening 13 constituting an opening edge of the blade 11.

Release means, not shown, are provided for releasing the blade 11 for its opening movement. The release means are arranged also, after a time delay, to release a closing blade 14 biased by springs 15, 16 for rectilinear movement in the same direction as the blade 11 to cover the aperture 10. The blade 14 has a closing edge 17 which, in accordance with the present invention, has a part 18 aligned with the opening 13. The part 18 is shaped so as to be substantially complementary to the initial part of the opening 13. Thus, short interval exposures are determined by the initial portion of the relevant opening 13 of the blade 11 and the complementary part 18 of the blade 14 and errors in exposure are thereby minimized.

Fig. 2 is an exploded diagram of a photographic shutter having a closing plate shaped in accordance with the present invention. As

shown, the shutter comprises an opening plate 1 which is spring-biased for movement in the direction of the arrow A against the action of a retarding means 8b. The shutter plate 1 has a rack 1a which engages with a toothed shaft 8a of the retarding means 8b. Retarding means 8b may conventionally comprise a fly-wheel type governor. The opening plate 1 has an opening 1c, alignable with an exposure aperture 10 of the camera located on the optical axis of the camera. The opening 1c has a leading edge which is tear-drop shaped as is conventional in sliding blade shutters. An arm 1b of the opening blade 1 serves to operate a switch 3 having contacts 3a to initiate a timing cycle of a conventional electronic shutter mechanism. A second arm 1f of the opening blade 1 locates behind a latch 2a of a shutter release 2 so that on depression of the shutter release 2, the latch 2a frees the arm 1f for movement of the shutter blade 1 to the right thereby to uncover the exposure aperture 10 of the camera. The opening blade 1 has a further opening 1d arranged to uncover a photoresistor or like photoresponsive device (not shown) located behind a camera opening 7b, on movement of the shutter blade 1 to the right.

A closing shutter blade 4 of the shutter has an arm 4a which engages a lug 1c on the opening blade 1 so as to prevent movement of the closing blade to the right whilst the opening blade is still in its initial position. The engagement between the arm 4a and the lug 1c also serves for re-cocking the shutter blades to their original position. A second arm 4b of the closing blade 4 is engaged by a latch 7 of an armature 8 of an electromagnet 6. The electromagnet 6 is arranged to be energized by an electronic circuit after an interval determined by the integral against time of the increasing light passing through the opening 1d and falling on the photoresponsive cell of the camera's exposure control mechanism. Energization of the electromagnet 6 causes the armature 8 to be pivoted against the action of a spring to release the engagement between the latch 7 and the arm 4b. A spring serves then to move the closing blade 4 in the direction of the arrow A. The closing blade 4 has a closing edge 4c which is arranged to intercept the optical axis so as to terminate the exposure. The edge 4c of the closing blade 4 is shaped so as to be complementary to the opening portion of the opening 1c of the opening blade 1. In this way, errors in exposure of short duration, as described above, are overcome or minimized.

A manually operated resetting slider 5 is provided which through an arm 5a engages the arm 1b of the opening blade 1 to return the same to the initial latch position. As mentioned previously, the lug 1c on the

opening blade engages arm 4a on the closing blade simultaneously to return the closing blade in a capping relationship to the opening 1c of the opening blade 1, to the latch positions of the opening and closing blades. No details have been given of the electronic circuit including the photoresponsive device and the electromagnet 6 save for the fact that the timing cycle is initiated by opening of the switch contacts 3a. Such exposure control is conventional and energization of the exposure control circuit may be effected upon depression of the shutter release 2 by closing of an appropriate pair of switch contacts 3b of the switch 3.

The invention is not confined to the precise details of the foregoing example and variations may be made thereof. For instance as shown in the embodiment of Fig. 2, the camera exposure aperture is shaped so as to have a portion corresponding in shape to the shape of the closing edge of the blade 4. Similarly, an opening 7b behind which is located the photoresponsive device has a similar shaped projection into the opening. These openings are provided for correcting the exposure given photographically through the exposure aperture and the light received by the photoresponsive device in response to movement of the opening blade 1. The correction to exposure of the film which is given, in accordance with the present invention, by the shape of the closing edge 4c of the closing blade 4 serves to provide an additional correction to the exposure time.

WHAT WE CLAIM IS:—

1. A shutter for a photographic camera comprising an opening blade and a closing blade arranged to run down consecutively in the same direction, the opening blade having a re-entrant opening edge, and wherein the closing blade has a substantially complementarily shaped closing edge.

2. A shutter as claimed in Claim 1 wherein the opening blade has a pear-shaped opening of which the long axis extends in said direction and the narrow end leads so as to define the re-entrant opening edge and wherein the leading edge of the closing blade has a closing edge of complementary shape to the first part of said pear-shaped opening.

3. A shutter as claimed in Claim 1 or 2 wherein the blades are arranged to slide rectilinearly, the opening blade having a second opening, for progressively uncovering a photocell, of similar shape to the re-entrant opening edge.

4. A shutter for a photographic camera substantially as hereinbefore described with reference to and as illustrated in Fig. 1 or Fig. 2 of the accompanying drawing.

L. A. TRANCMAR, B.Sc., C.P.A.,
Agent for the Applicants.



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A closing shutter blade 4 of the shutter has an arm 4a which engages a lug 1e on the opening blade 1 so as to prevent movement of the closing blade to the right whilst the opening blade is still in its initial position. The engagement between the arm 4a and the lug 1e also serves for re-cocking the shutter blades to their original position. A second arm 4b of the closing blade 4 is engaged by a latch 7 of an armature 8 of an electromagnet 6. The electromagnet 6 is arranged to be energized by an electronic circuit after an interval determined by the integral against time of the increasing light passing through the opening 1d and falling on the photoresponsive cell of the camera's exposure control mechanism. Energization of the electromagnet 6 causes the armature 8 to be pivoted against the action of a spring to release the engagement between the latch 7 and the arm 4b. A spring serves then to move the closing blade 4 in the direction of the arrow A. The closing blade 4 has a closing edge 4c which is arranged to intercept the optical axis so as to terminate the exposure. The edge 4c of the closing blade 4 is shaped so as to be complementary to the opening portion of the opening 1c of the opening blade 1. In this way, errors in exposure of short duration, as described above, are overcome or minimized.

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opening blade engages arm 4a on the closing blade simultaneously to return the closing blade in a capping relationship to the opening 1c of the opening blade 1, to the latch positions of the opening and closing blades. No details have been given of the electronic circuit including the photoresponsive device and the electromagnet 6 save for the fact that the timing cycle is initiated by opening of the switch contacts 3a. Such exposure control is conventional and energization of the exposure control circuit may be effected upon depression of the shutter release 2 by closing of an appropriate pair of switch contacts 3b of the switch 3.

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L. A. TRANGMAR, B.Sc., C.P.A.,
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