

"A MOTOR DRIVEN SHUTTER APPARATUS FOR A CAMERA"

The present invention relates to a motor-driven shutter apparatus for a camera.

Various types of camera have recently been proposed which are provided with a barrier mechanism on the front of the photographic lens of the camera for the purpose of protecting it. However, such barrier mechanisms have poor operational properties because they are operated separately from the focussing action and are moved manually before and after a photograph is taken.

It might be thought that this disadvantage could be overcome by using a motor exclusively for the purpose of driving the barrier mechanism automatically with an interlocking release mechanism therebetween. However, any such arrangement would have the disadvantage that many additional parts would be required and thus the size and cost of the camera would be increased. In addition, in a camera having a lens with two or more focal points such as a telephoto lens or a wide angle lens, the shutter is moved in the direction of the optical axis and thus any interlocking release mechanism provided between a portion of the barrier mechanism and a portion of the body of the shutter would necessarily be complicated. Furthermore, if a camera were to be provided

with separate motors used respectively for driving a lens and for driving a barrier, the driving of the barrier in the driving range of the lens would consume an excessive amount of current and would thus cause an increase in the cost of the associated power circuit or motor-driven circuit.

According, therefore, to the present invention, there provided a motor driven shutter apparatus for a camera having a motor which is operable to move a shutter part or parts to effect focussing, the shutter having lens cover means movable by said motor into and out of a closed position in which, in operation, the front surface of a lens of the camera is covered thereby.

The motor may be arranged to move the shutter part or parts and the lens cover means simultaneously.

Alternatively, the motor may be arranged to open the lens cover means before opening the shutter part or parts and to close the lens cover means after the shutter part or parts have been closed.

There may be an intermittent drive transmission between the motor and the lens cover means.

The lens cover means may comprise either a single lens cover member or a plurality of lens cover members.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a diagrammatic view of a first embodiment of a shutter apparatus according to the present invention;

5 Figure 2 is a diagrammatic view of a part of the first embodiment showing lens cover members or barriers thereof in an open state;

Figure 3 is a diagram illustrating the operation of the first embodiment; and

10 Figures 4(a) and 4(b) are diagrammatic views of a barrier driving apparatus forming part of a second embodiment of the present invention.

Terms such as "clockwise" and "counter-clockwise" are to be understood to refer to directions as seen in the drawings.

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The present invention is described in detail below with reference to the embodiments shown in the drawings.

As indicated above, Figures 1 and 2 show a first embodiment of the present invention, Figure 1 being a diagrammatic view of a stepping motor-driven shutter apparatus according to the present invention in the state before release and Figure 2 being a diagram of part of the structure of Figure 1 showing light-occluding lens cover members or barriers in an open state.

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As shown in Figure 1, a drive ring 1, which is used as a drive member, is rotatable around a lens aperture (not shown). The drive ring 1 has a sector gear 1a which meshes with a pinion 3a of an idler gear 3. The idler gear 3 meshes with a rotor gear 2a provided on the output shaft of a known stepping motor 2. A cam 1b on the drive ring 1 operates a sector driving lever 5 for driving a sector (not shown). A pin 1c on the drive ring 1 is connected to a range ring 4 described below. A sector gear 1d carried by the drive ring 1 is drivingly connected by way of a pinion 10b to a connecting gear 10 described below.

The range ring 4, which serves as a range adjustment member, is rotatable around the lens aperture in the same way as the drive ring 1. The range ring 4 has a connecting portion 4a which operates a lens (not shown); an engaging portion 4b which is engageable with the pin 1c of the drive ring 1; a sector gear 4c which is drivingly connected to a ratchet wheel 7 described below; and a spring 4d which urges the range ring 4 to rotate clockwise.

The ratchet wheel 7 is rotatably mounted by a pin 7a on a base (not shown) and has a number of teeth 7b for use in focussing and positioning. The ratchet wheel 7 has a large-diameter portion 7c for setting an engagement

lever 8, which is described below, in a retracted position.

The engagement lever 8 is rotatably mounted by a pin 8a on the base and has a claw 8b which is engageable with the teeth 7b of the ratchet wheel 7 and with the large-diameter portion 7c of the ratchet wheel 7. The engagement lever 8 also has a connecting portion 8c which connects with an armature 9a which is attracted to a solenoid 9 when the latter is energized. The engagement lever 8 also has a spring 8d which urges the engagement lever 8 to rotate clockwise.

The connecting gear 10 is rotatably mounted by a pin 10a on the base and is drivingly connected to the sector gear 1d of the drive ring 1.

An intermittent gear 11 is rotatably mounted by the pin 10a on the base in the same way as the connecting gear 10. The intermittent gear 11 is drivingly connected, as indicated by line 11c, to the connecting gear 10 so as to be rotatable in synchronism therewith. The intermittent gear 11 has a disc 11a engageable with a portion of a light-occluding first barrier 12 described below, the disc 11a having a so-called "carry" tooth or teeth 11b.

The first barrier or lens cover member 12 is pivotally mounted by a pin 12b on the base (not shown) and has a mask portion 12a for protecting the lens; thick teeth 12d

cooperable with the disc 11a and with the carry tooth 11b of the intermittent gear 11; thin teeth 12e cooperable with the carry tooth 11b of the intermittent gear 11; and a groove 12c that slidably engages with a pin 14a of a connecting ring 14 described below.

The connecting ring 14 is rotatable around the aperture of the lens in the same way as the drive ring 1 and the range ring 4. The connecting ring 14 has the pin 14a that slidably engages with the groove 12c of the first barrier 12 and a pin 14b that slidably engages with a groove 13c of a light-occluding second barrier or lens cover 13 described below. The barriers 12, 13, when closed, protect the front surface of the camera lens (not shown) from damage.

The second barrier 13 is pivotally mounted by a pin 13b on the base (not shown) and has a mask portion 13a for protecting the lens in combination with the mask portion 12a of the first barrier 12. The second barrier 13 also has the groove 13c with which the pin 14b of the connecting ring 14 is slidably engaged.

Figure 3 is a diagram of the operation of the first embodiment. The stepping motor 2 is driven forward through a lens operating range for focussing in accordance with a program previously set by a control circuit (not shown);

is driven forward and in reverse in the course of the exposure action; and is driven in reverse in a lens operating range in order to return the lens to a rest position.

The drive ring 1, which is drivingly connected to the stepping motor 2, is rotated clockwise by the forward drive of the stepping motor 2 and is rotated counter-clockwise by the reverse drive thereof.

The range ring 4 is rotated clockwise by the pin 1c, the engagement portion 4b and the spring 4d, while following the drive ring 1. The range ring 4 ceases to be rotated when the ratchet wheel 7, which is drivingly connected to the range ring 4, is engaged with the engagement lever 8. The range ring 4 is rotated counter-clockwise by the counter-clockwise rotation of the drive ring 1 while the pin 1c and the engagement portion 4b, which are in contact with each other, are charging (i.e. extending) the spring 4d.

In addition, the solenoid 9 is energized in the initial stage of a shutter operation. The solenoid 9, when energized, attracts the armature 9a so that the engagement lever 8, which is connected thereto, is held at the position of the large-diameter portion 7c of the ratchet wheel 7 which is allowed to rotate. The solenoid 9 is de-energized by an output signal from a focal point detecting circuit

(not shown) so that the engagement lever 8 is rotated clockwise and stops the ratchet wheel 7.

5 The first barrier 12 and the second barrier 13, which is operated by the first barrier 12 through the connecting ring 14, can be maintained either in a closed state (Figure 1) or in an open state (Figure 2). In the closed state, the disc 11a of the intermittent gear 11, which is rotated in unison with the connecting gear 10 which is itself drivingly connected to the drive ring 1, is brought
10 into slidable contact with the thick teeth 12d of the first barrier 12. The carry tooth 11b of the intermittent gear 11 and the thick teeth 12d and the thin teeth 12e of the first barrier 12 comprise an intermittent transmitting mechanism between the first barrier 12 and the drive ring 1 so
15 as to open or close the mask portions 12a and 13a by the gearing therebetween in the lens operating range.

The operation of the above-described shutter apparatus is described below.

20 When a release button (not shown) is operated in the state before shutter release shown in Figure 1, a main switch (not shown) is turned on and an exposure control circuit (not shown) and the focal point detecting circuit (not shown) are operated so as to set an aperture value and a focal point.

The solenoid 9 is then energized so as to hold the engagement lever 8, and the stepping motor 2 is rotated forwardly, while the ratchet wheel 7 is rotatable, so that the drive ring 1 and the range ring 4 are rotated clockwise.

At the previously set focal point, the solenoid 9 is de-energized so as to release the engagement lever 8 and allow it to engage the range ring 4 through the ratchet wheel 7, whereby the photographic lens is positioned at the focal point. The drive ring 1 continues to rotate clockwise after the focussing action and reaches the range of exposure action. When the connecting gear 10 and the intermittent gear 11 are rotated counter-clockwise by the clockwise rotation of the drive ring 1 in the lens operating range so as to start the drive connection between the carry tooth 11b of the intermittent gear 11 and the thick teeth 12d and the thin teeth 12e of the first barrier 12, the barriers 12, 13, which have been in the closed state, are opened and are then held in the open state shown in Figure 2 by the slidable contact between the disc 11a of the intermittent gear 11 and the thick teeth 12d of the first barrier 12.

The drive ring 1 is then rotated clockwise in the range of exposure action so as to cause the sector driving

cam 1b to rotate the sector driving lever 5 counter-clockwise and to cause a sector (not shown) to perform an opening action. When the previously set aperture value is obtained, the stepping motor 2 is reversed so as to rotate the drive ring 1 counter-clockwise and close the sector, and the exposure action is completed.

Although the intermittent gear 11 is continuously rotated in the range of the exposing action, the barriers 12, 13 are held in the open state because of the slidable contact between the disc 11a and the thick teeth 12d of the first barrier 12.

After the exposure action has been completed, the stepping motor 2 continues to be driven in reverse so that the intermittent gear 11, that is rotated clockwise through the drive ring 1 and the connecting gear 10, rotates the first barrier 12 counter-clockwise and the barriers 12, 13 are closed and returned to the state shown in Figure 1.

The above-described embodiment is such that the barriers 12, 13 are opened or closed in the lens operating range, but the barriers 12, 13 can alternatively be opened or closed before or after the lens operating range by changing the phase relationship between the disc 11a and the carry tooth 11b of the intermittent gear 11.

A second embodiment shown in Figure 4 using a known Geneva mechanism is described below.

Figure 4(a) is a diagrammatic view of a barrier driving apparatus in the state before shutter release, and Figure 4(b) is a diagrammatic view of the said apparatus in the state wherein a barrier is open.

An intermittent drive member 111 has a rotational shaft 111c in common with a connecting gear (not shown in Figure 4 but corresponding to the gear 10) which is drivingly connected to a drive ring (which is the same as that of the drive ring 1 of the first embodiment). The intermittent drive member 111 is thus rotatable in synchronism with the said connecting gear. The intermittent drive member 111 has a disc 111a, which cooperates with a single barrier 112 described below, and a pin 111b.

The barrier 112 is pivotally supported by a pin 112b on a base (not shown) and has a mask portion 112a for protecting a lens; a presser portion 112c which is in slidable contact with a disc portion 111a of the intermittent drive member 111; and a groove 112d which slidably engages with the pin 111b of the intermittent drive member 111.

The barrier 112 can be held either in the closed state [Figure 4(a)] or in the open state [Figure 4(b)] in which the disc portion 111a of the intermittent drive member 111,

which is rotated through the said drive ring and the said connecting gear, is in slidable contact with the presser portion 112c of the barrier. The engagement between the pin 111b of the intermittent drive member 111 and the groove 112d of the barrier 112 provides an intermittent transmitting mechanism between the barrier 112 and the said drive ring so as to open or close the mask portion 112a.

Each of the above-described first and second embodiments is such that the drive member 1 can be rotated around the lens, but it is alternatively possible to arrange that the drive member is moved linearly over the base, as described in Japanese Laid-Open Patent No. 9631/1986.

In addition, each of the first and second embodiments uses the stepping motor 2, but any motor which can be driven both forwardly and in reverse, such as an ultrasonic motor or a DC motor, can be used in either embodiment.

Furthermore, in each of the embodiments, the barrier driving action comprises a gear connection between the connecting gear 10 and the drive ring 1, but the connecting gear 10 can alternatively be drivingly connected to an idler or a rotor gear.

Since, as in the embodiments described above, a single motor 2 is employed which performs both the barrier driving

action and the lens driving action, the barrier can be automatically driven, without the need to provide a separate motor for driving the barrier, and thus the size and the cost can be reduced. In addition, since, in the said embodiments, the barrier is opened or closed by the shutter portion, a connecting mechanism between the barrier portion and the body portion need not be provided in a camera having a lens with two or more focalpoints such as a telephoto lens or a wide angle lens, and thus the number of component parts, as well as the size and cost, can be reduced. Furthermore, if the barrier is opened and closed during operation of the lens, the time from the shutter release to the start of the exposure can be reduced and one can therefore take more advantage of an opportunity to take a photograph.



C L A I M S

1. A motor-driven shutter apparatus for a camera having a motor which is operable to move a shutter part or parts to effect focussing, the shutter having lens cover means movable by said motor into and out of a closed position
5 in which, in operation, the front surface of a lens of the camera is covered thereby.
2. A shutter apparatus as claimed in claim 1 in which the motor is arranged to move the shutter part or parts and the lens cover means simultaneously.
- 10 3. A shutter apparatus as claimed in claim 1 in which the motor is arranged to open the lens cover means before opening the shutter part or parts and to close the lens cover means after the shutter part or parts have been closed.
4. A shutter apparatus as claimed in any preceding
15 claim in which there is an intermittent drive transmission between the motor and the lens cover means.
5. A shutter apparatus as claimed in any preceding claim in which the lens cover means comprise a plurality of lens cover members.
- 20 6. A motor-driven shutter apparatus for a camera substantially as hereinbefore described with reference to and as shown in the accompanying drawings.



7. A motor-driven shutter apparatus for a camera which comprises barriers for covering the front surface of a lens before and after said shutter is operated and a motor for operating said shutter for the purpose of focussing, characterized in that said barriers are driven by means of said motor.
8. A motor-driven shutter apparatus for a camera according to claim 7 which comprises a drive member movable within a lens operating range and a single motor for driving said drive member and operates said lens with interlocking said drive member, characterized in that said barriers are driven within said lens operating range.
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