

2209403

"MOTOR DRIVEN SHUTTER MECHANISM FOR A CAMERA"

This invention relates to a motor driven shutter mechanism for an automatic focusing and automatic exposure camera.

In Japanese Patent Specification No. 26450/87,
5 there is described a motor driven shutter which employs
a single motor to effect a lens operation for the purpose
of focusing and then an exposure operation in succession,
the camera lens being locked in a position corresponding
to a focusing signal and being arranged to be reset
10 instantly by means of a spring after the exposure operation.
The camera lens is provided with an adjusting means for
focusing accurately on a film surface and fine adjustment
has to be executed during the manufacturing process. In
such a shutter, however, the focusing of the camera lens
15 can be affected by shock, there is considerable shutter
operating noise, and the durability of the parts for
setting the camera lens can be adversely affected by the
fact that the camera lens is reset in an instant by the said
spring.

20 According, therefore, to the present invention, there
is provided a motor driven shutter mechanism for an
automatic focusing and automatic exposure camera
comprising a single motor arranged to be driven both

forwardly and in reverse; a movable drive member which
is arranged to be driven by the motor in opposite
directions; a movable range member for setting the position
of a lens, the range member being movable in one direction
5 by the drive member; urging means for urging the range
member in the opposite direction towards an initial position;
an opening and closing member which is movable by the drive
member between positions in which the opening and closing
member is arranged to effect opening and closing respectively
10 of a shutter aperture; movement preventing means which,
when operative, prevent movement of the range member
in the said opposite direction after the range member has
moved in the said one direction to a focusing position
determined by a focusing detection signal; release
15 initiation means which are brought into operation after the
range member has been moved further in the said one
direction past the focusing position, the release initiation
means being brought into operation in the vicinity of the
maximum movement of the range member in the said one
20 direction and putting the movement preventing means in
an inoperative condition; release maintaining means for
maintaining the movement preventing means in the inoperative
condition during subsequent movement of the range member

in the said opposite direction towards the initial position; and cancellation means, which are brought into operation in the vicinity of the initial position of the range member, for cancelling the operation of the release maintaining means.

Thus, in the preferred form of the present invention, the above problems are overcome because when the camera lens is reset, the reset speed of the camera lens to the initial position is controlled.

Preferably, in operation, the range member undergoes a first stage of movement in which it is moved by the drive member from the initial position and in the said one direction to a locked position in which it is prevented from moving in the opposite direction by the movement preventing means; thereafter undergoes a second stage of movement in which it is released from the locked position after a predetermined time and is moved further in the said one direction to its said position of maximum movement; and finally undergoes a third stage of movement in which it is moved by the urging means back to the initial position.

Preferably also, in operation, the motor rotates in reverse during the said first stage of movement; rotates both forwardly and in reverse during the time that the range

member is in the locked position, the said second stage of movement occurring in the latter portion of the reverse movement of the motor; and rotates forwardly during the said third stage of movement.

5 The range member may be provided with a release initiation means and the latter may comprise a cam portion of the range member, the cam portion being adapted to cam the movement preventing means into an inoperative position in which it does not prevent movement of the range member.

10 The movement preventing means may have a detent portion which is engageable with teeth of a toothed portion of the range member, the cam portion being engageable with the detent portion so as to move the latter to a position in which it is spaced from the said teeth.

15 Preferably, the release maintaining means comprise portions of the movement preventing means and of a release member which can be brought into and out of locking engagement with each other.

20 The cancellation means preferably comprise a part of the release member which is engageable with a part of the drive member.

 Preferably, the drive member and range member respectively comprise concentric ring members.

25 The drive member and the range member may have engageable portions which are in engagement when the drive member is driven in the said one direction.

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

Figure 1 is a diagrammatic view of an embodiment of a motor driven shutter mechanism for a camera according to the present invention, the parts of the shutter mechanism being shown in an initial position prior to shutter release;

Figure 2 is a block diagram showing an example of a control circuit for controlling the operation of the mechanism shown in Figure 1;

Figure 3 is a time chart showing the operation of the shutter mechanism shown in Figure 1; and

Figures 4(a), 4(b) and 4(c) are views similar to Figure 1 but showing various stages in the operation of the shutter mechanism.

Terms such as "clockwise" and "counter-clockwise", as used in the description below, are to be understood to refer to directions as seen in the accompanying drawings.

In Figure 1 there is shown a motor driven shutter mechanism for a camera which comprises a drive ring 1 which is rotatably mounted on a fixed substrate or support member (not shown) so as to be concentric with the optical axis of a camera lens (not shown). The drive ring 1 is capable of being rotated in opposite angular directions.

That is to say it can be rotated counter-clockwise through a lens operating area and can be rotated clockwise through an exposure operating area. The drive ring 1 is provided with a rack portion 1a which is arranged to receive drive from a step motor M by gearing comprising a pinion 3 and an idler 4. The drive ring 1 has a pin 1b for abutment with a projection 2c of a range ring 2 which is described below.

A shutter blade, or sector, not shown, is arranged to be moved by a sector lever 5 between open and closed positions in which the shutter aperture, not shown, is respectively open and closed. The drive ring 1 has a cam portion 1c for moving the sector lever 5 to its open position at the time of clockwise rotation of the drive ring 1, viz., at the time of the exposure operation.

The drive ring 1 also has a cam portion 1d for releasing the locking effected by a focusing lock lever 6 and by a release lever 7 which will be described later. A spring 5a urges the sector lever 5 to rotate clockwise so as to maintain a pin 5b on the sector lever 5 in contact with the drive ring 1.

The range ring 2 is rotatably mounted on the fixed substrate and is always urged clockwise by means of a spring 2a, the range ring 2 being mounted concentrically

with the optical axis of the camera lens and thus is concentric with the drive ring 1. The range ring 2 is provided both with a portion 2b having a plurality of teeth and with the projection 2c which is adapted to abut against the pin 1b on the drive ring 1. The range ring 2 also has a projection 2d which is adapted to abut against a pin 8 on the fixed substrate so as to maintain the parts in the initial position of the shutter mechanism which is shown in Figure 1. The range ring 2 has a cam portion 2e which, as described below, is adapted to release the locking effected by the focusing lock lever 6 on the locking teeth portion 2b. Additionally, the range ring 2 has a lens coupling portion 2f for moving a camera lens, not shown, to a focusing position.

The focusing lock lever 6 is urged clockwise by a spring 6a and is rotatably mounted on the fixed substrate. The focusing lock lever 6 is provided at one end thereof with a detent portion 6b for locking engagement with the locking teeth portion 2b of the range ring 2 and is provided at the opposite end thereof with a locking portion 6c which is adapted to be locked by release lever 7.

The release lever 7 is urged clockwise by a spring 7a and is rotatably mounted on the fixed substrate. The release lever 7 is provided with a detent portion 7b

for locking the locking portion 6c of the focusing lock lever 6. The release lever 7 has a pin 7c which is engageable with the cam portion 1d of the drive ring 1. The arrangement is such that the detent portion 7b and locking portion 6c are not engaged with each other when the cam portion 1d and the pin 7c are engaged with each other.

The relationship of the cam portion 2e of the range ring 2, the detent portion 6b and the locking portion 6c of the focusing lock lever 6, and the detent portion 7b of the release lever is such that the detent portion 6b is disposed in an inoperative position beyond the rotary locus of the locking teeth portion 2b when the cam portion 2e and the detent portion 6b are engaged in the neighbourhood of the maximum extent of movement of the range ring 2 as shown in Figure 4(c), and when, moreover, the detent portion 7b and the locking portion 6c are locked with each other so that the operation of the focusing lock lever 6 is controlled.

Figure 2 is a block diagram of a control circuit for the shutter mechanism, the control circuit comprising an auto-focus unit 50 which performs focus detection and outputs a focusing signal; an exposure control portion 52 which determines exposure by means of brightness

information obtained from a photometry portion 51 which performs photometry of the brightness of the object, film sensitivity information and so forth and outputs an exposure signal; and a controller 54 which controls forward rotation and reverse rotation of the step motor M through a motor drive circuit 53 for performing predetermined lens position setting and exposure by the focusing signal of the auto-focus unit 50 and the exposure signal of said exposure control portion 52.

The operation of the above-mentioned embodiment will now be described.

The control circuit is operated by operating a camera release member, not shown, so that the parts can be moved from their pre-released state shown in Figure 1. A focusing signal from the auto-focus unit 50 and an exposure signal from the exposure control portion 52 are inputted to the controller 54 so as to bring the step motor M into operation. The number of pulses of forward and reverse rotation of the step motor M is determined by said signals, that is to say, the said number in the lens operating area is determined by the focusing signal and the said number in the exposure operating area is determined by the exposure control signal.

First, when the step motor M is rotated reversely,
i.e. counter-clockwise, in order to set the camera lens at a
position determined by the focusing signal, the drive
ring 1 is rotated counter-clockwise through the pinion
3 and the idler 4. The pin 1b of the drive ring 1 and the
projection 2c of the range ring 2 abut against each other,
and the range ring 2 therefore also rotates counter-
clockwise. By means of such counter-clockwise rotation, the
focusing lock lever 6 engages with and rides over the
locking teeth portion 2b of the range ring 2 as shown
in Figure 4(a), the focusing lock lever 6 being oscillated
to and fro by the ratchet shape of the locking teeth as
indicated by the double headed arrow. The engagement
between the pin 7c of the release lever 7 and the cam
portion 1d of the drive ring 1 is therefore released,
and the release lever 7 is rotated clockwise by its
spring 7a but is controlled by its engagement with the
surface of the locking portion 6c of the focusing
lock lever 6. The above-mentioned oscillation of the
focusing lock lever 6 is able to occur because the
locking portion 6c and the detent portion 7b of the
release lever 7 are not locked to each other.

After the drive ring 1 and the range ring 2 have been rotated counter-clockwise by the step motor through an angle determined by the focusing signal, the step motor M is reversed so as to perform forward, i.e. clockwise, rotation and the drive ring 1 therefore commences clockwise rotation. The range ring 2 is normally interlocked with the drive ring 1, but, at this time, the range ring 2 does not move since the locking teeth portion 2b is locked by the detent portion 6b of the focusing lock lever 6. Thus, the focusing position of the camera lens, not shown, which is connected to the range ring 2, is determined.

The step motor M rotates clockwise through a number of pulses or steps determined by the focusing signal. The drive ring 1 is therefore rotated clockwise so as to reset it to the initial position, and the step motor M continues to rotate the drive ring 1 in the exposure operating area. The number of pulses, or steps, of forward and reverse rotation of the step motor M in the exposure operating area is determined in advance by the signal of the exposure control portion 52. By means of the clockwise rotation of the drive ring 1 corresponding to this number of pulses, the cam portion 1c of the drive ring 1 and

the sector lever 5, move into the relative position shown in Figure 4(b), and the said sector, or shutter blade, not shown, performs an aperture opening operation because the sector lever 5 is rotated counter-clockwise against its spring 5a. Then, after the forward rotation of the drive ring 1 has been effected by the predetermined number of pulses or steps of the step motor M, the step motor M is reversed to rotate counter-clockwise. Therefore, the sector lever 5 is rotated clockwise along the cam portion 1c thereby to close the said sector and thus close the shutter aperture, and thus the drive ring 1 is reset to the initial position thereof.

Thereafter, the step motor M further continues its counter-clockwise rotation for a predetermined number of pulses or steps until the focusing lock lever 6 and the cam portion 2e of the range ring 2 are in contact with each other. During this operation, the projection 2c of the range ring 2, which is stationary in order to effect focusing of the camera lens, and the pin 1b of the drive ring 1 abut against each other. Therefore, the drive ring 1 and the range ring 2 rotate counter-clockwise until the parts are positioned as shown in Figure 4(c). In the Figure 4c position, the detent portion 6b of the focusing

lock lever 6 is raised by the cam portion 2e of the range ring 2 so as to be out of the rotary locus of the locking teeth portion 2b of the range ring 2. The locking portion 6c of the focusing lock lever 6 is locked by the detent portion 7b of the release lever 7 so that the focusing lock lever 6 is maintained in the position shown in Figure 4(c). While the focusing lock lever 6 is locked in this position, the step motor M is reversed so as to be reset to its initial position and it thus rotates clockwise through a predetermined number of pulses or steps. Therefore, the drive ring 1 also rotates clockwise, and the range ring 2 follows the drive ring 1 by virtue of the force of the spring 2a. Then, immediately before the drive ring 1 has rotated sufficiently clockwise to get to the initial position shown in Figure 1, the cam portion 1d of the drive ring 1 and the pin 7c of the release lever 7 are engaged and the release lever 7 is rotated counter-clockwise. Therefore, the locking of the focusing lock lever 6 is released and the focusing lock lever 6 is rotated clockwise, thus being reset to the state shown in Figure 1 to complete the operation.

This operation of the shutter mechanism is illustrated in Figure 3.

As described above, the range ring 2 is released from locking in the neighbourhood of the maximum counter-clockwise movement of the range ring 2 after the exposure operation,

and this state of release is maintained during the time that the range ring 2 is moved clockwise until the neighbourhood of the initial position of the range member. The range ring 2 which has been released from locking after the exposure operation is reset while following the drive ring 1 which is driven by the motor M from the neighbourhood of the said maximum movement to the initial position. Accordingly, the range ring 2 and the camera lens operated by the range ring are reset in accordance with the motor speed. Therefore, the shock which is the above-mentioned disadvantage of the known construction is substantially avoided. Since the construction is also simple, it is suitable for a low-cost shutter for an automatic focusing and automatic exposure camera.

C L A I M S

1. A motor driven shutter mechanism for an automatic focusing and automatic exposure camera comprising a single motor arranged to be driven both forwardly and in reverse; a movable drive member which is arranged to be driven by the motor in opposite directions; a movable range member for setting the position of a lens, the range member being movable in one direction by the drive member; urging means for urging the range member in the opposite direction towards an initial position; an opening and closing member which is movable by the drive member between positions in which the opening and closing member is arranged to effect opening and closing respectively of a shutter aperture; movement preventing means which, when operative, prevent movement of the range member in the said opposite direction after the range member has moved in the said one direction to a focusing position determined by a focusing detection signal; release initiation means which are brought into operation after the range member has been moved further in the said one direction past the focusing position, the release initiation means being brought into operation in the vicinity of the maximum movement of the range member in the said one direction and putting the movement preventing means in an inoperative condition; release maintaining means for maintaining the movement preventing



means in the inoperative condition during subsequent movement of the range member in the said opposite direction towards the initial position; and cancellation means, which are brought into operation in the vicinity of the initial position of the range member, for cancelling the operation of the release maintaining means.

2. A shutter mechanism as claimed in claim 1 in which, in operation, the range member undergoes a first stage of movement in which it is moved by the drive member from the initial position and in the said one direction to a locked position in which it is prevented from moving in the opposite direction by the movement preventing means; thereafter undergoes a second stage of movement in which it is released from the locked position after a predetermined time and is moved further in the said one direction to its said position of maximum movement; and finally undergoes a third stage of movement in which it is moved by the urging means back to the initial position.

3. A shutter mechanism as claimed in claim 2 in which, in operation, the motor rotates in reverse during the said first stage of movement; rotates both forwardly and in reverse during the time that the range member is in the locked position, the said second stage of movement occurring in the latter portion of the reverse movement of the motor; and rotates forwardly during the said third stage of movement.



4. A shutter mechanism as claimed in any preceding claim in which the range member is provided with the release initiation means.

5. A shutter mechanism as claimed in claim 4 in which the release initiation means comprises a cam portion of the range member, the cam portion being adapted to cam the movement preventing means into an inoperative position in which it does not prevent movement of the range member.

6. A shutter mechanism as claimed in claim 5 in which the movement preventing means has a detent portion which is engageable with teeth of a toothed portion of the range member, the cam portion being engageable with the detent portion so as to move the latter to a position in which it is spaced from the said teeth.

7. A shutter mechanism as claimed in any preceding claim in which the release maintaining means comprise portions of the movement preventing means and of a release member which can be brought into and out of locking engagement with each other.

8. A shutter mechanism as claimed in claim 7 in which the cancellation means comprise a part of the release member which is engageable with a part of the drive member.

9. A shutter mechanism as claimed in any preceding claim in which the drive member and range member respectively comprise concentric ring members.



10. A shutter mechanism as claimed in any preceding claim in which the drive member and range member have engageable portions which are in engagement when the drive member is driven in the said one direction.

5 11. A motor driven shutter mechanism for an automatic focusing and automatic exposure camera substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

10 ~~12. Any novel integer or step, or combination of integers or steps, hereinbefore described and/or shown in the accompanying drawings, irrespective of whether the present claim is within the scope of, or relates to the same or a different invention from that of, the preceding claims.~~

15 13. A motor driven shutter for a camera provided with a drive member moving in a lens operating area and an exposure operating area that are parted in one and the other, only one motor capable of reciprocal operation for operating said drive member, a range member for setting a lens position by interlocking with said drive member in
20 said lens operating area, an urging member for urging said range member in a direction toward an initial position, an opening and closing member which has a sector open and close by interlocking with said drive member on said exposure



operating area, locking means which locks said range member at a position corresponding to a focusing detection signal, and releasing means for releasing the locking of said range member by moving said drive member to the lens operating area again after exposure operation is completed, characterised in that:

said releasing means consist of a first releasing portion which operates in the neighbourhood of the maximum movement of said range member and releases the locking of said locking means; a maintaining portion which maintains the releasement released by said first releasing portion; and a second releasing portion which gets in touch with said drive member in the vicinity of the initial position of said range member and releases the maintaining function of said maintaining portion; and

said range member is reset so as to follow said drive member.
