

"AUTOMATIC FOCUS/EXPOSURE OPERATING APPARATUS  
FOR A CAMERA"

The present invention relates to an automatic focus/exposure operating apparatus for a camera.

5 An automatic focus/exposure operating apparatus for a camera is disclosed in Japanese Utility Model Application No. 20793/1988, which is owned by the present applicants but was not published at the priority date of the present application.

10 This prior automatic focus/exposure operating apparatus for a camera is so arranged as to be capable of shifting speedily to an exposure operation upon completion of a focussing operation of a camera, with the result that wasted time between a lens driving operation and a blade opening/closing operation is shortened appreciably, thereby making it possible to  
15 provide an automatic focus/exposure operating apparatus for a camera which is suited for quick photography and the like.

20 However, in the case of the apparatus described above, the construction is such that reverse movement of a distance member after a focussing operation thereof is prevented by reason of a retaining pawl being engaged with a ratchet tooth of a distance member, and a blade opening/closing mechanism is adapted to operate in such a manner as to open the blades provided in a shutter  
25 aperture as a driving member moves a predetermined amount in an opposite direction on the basis of an exposure detection value after the focussing operation of the distance member. Accordingly, a phase difference unavoidably occurs between the time of completion of the

focussing operation of the distance member and the time of engagement of the ratchet tooth and the engaging pawl. Hence, there is a problem in that there is an error, which depends on the degree of the phase difference, in the exposure which causes the blade opening/closing mechanism to open the blades.

In addition, if an attempt is made to solve the problem mechanically so as to stop the distance member immediately upon completion of the focussing operation without causing any deviation in its position so as to prevent that error, there is the drawback that the apparatus becomes complicated, and higher costs result.

According to the present invention, there is therefore provided an automatic focus/exposure operation apparatus for a camera comprising a drive member driven by a motor controlled by a control circuit; a focal distance setting member for driving a lens focussing mechanism by moving together with said drive member in one direction; a retaining pawl for engaging with said focal distance setting member and preventing movement thereof in the opposite direction after a focussing operation; and a blade opening/closing mechanism which is operative so as to open said blades when said driving member drives said lens focussing mechanism in the said one direction and which moves in the said opposite direction after a focussing operation with said focal distance setting member retained by said retaining pawl, said blade opening/closing mechanism being disposed between the drive member and the focal distance setting member, and said blade opening/closing mechanism executing an exposure on the basis of a phase difference between said driving member and said focal distance setting member.

Preferably, there is a counter for counting drive pulses to the motor from the control circuit from initial operation of the apparatus to the time when the lens focussing means is so held and for comparing these pulses with known data, any said error being corrected by supplying a required number of additional drive pulses to the motor.

Preferably, the means for moving the drive member effects a correction movement of the drive member, which correction movement is based on the difference between the relative extents of operation of the drive member and the focal distance setting member when such error arises.

Both the drive member and the focal distance setting member may be a ring member.

The lens focussing means may, if desired, be arranged to move axially of the optical axis of the apparatus without rotation with respect thereto.

The invention also comprises a camera provided with the said apparatus.

The arrangement may be that a phase difference between the focal distance setting member and the retaining pawl upon completion of a focussing operation during retention by the same is detected, and that the extent of operation of the blade opening and closing means by the drive member is corrected on the basis of the phase difference. In such an arrangement, a phase difference between the time when a focussing operation of the focal distance setting member is completed and the time when the focal distance setting member is retained by the retaining pawl may be detected, and the amount of operation of the blade opening and closing means by the drive member, i.e. an exposure, is corrected on the basis of this phase difference so as to effect an exposure operation. As a result, it is

possible to prevent an error from occurring in an exposure due to the amount of the focussing operation by the focal distance setting member.

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

Figures 1 to 10 are diagrammatic views illustrating a first embodiment of an automatic focus/exposure operating apparatus for a camera in accordance with the present invention, in which:-

10 Figure 1 is a front elevational view illustrating an initial state thereof;

Figures 2 to 4 are front elevational views respectively illustrating successive operating states;

15 Figure 5 is a sequence characteristic diagram of an automatic focus/exposure operation of the embodiment of Figures 1 to 10 illustrating relationships between the amount of rotation of a drive ring, an exposure on the one hand, and time on the other hand;

20 Figure 6 is a diagram illustrating relationships between a sequence characteristic diagram and a time chart of each detection switch of the embodiment of Figures 1-10;

25 Figure 7 is a return sequence characteristic diagram during a malfunctioning of the embodiment of Figures 1-10;

30 Figure 8 is an expanded view illustrating positional relationships with respect to a pawl portion of a ratchet pawl of the embodiment of Figures 1-10; in respective cases where four drive pulses to a step motor are outputted from a control circuit during one-pitch rotation of a distance ring of the embodiment of Figures 1-10;

Figure 9 is a block diagram of a control means provided with the said control circuit;

Figure 10 is a detailed diagram illustrating the results of correction of an exposure in the sequence characteristic diagram of an automatic focus/exposure operation;

5        Figures 11-14 are diagrams illustrating a second embodiment of the present invention, in which:-

Figure 11 is a front elevational view illustrating an initial state thereof;

10        Figures 12 and 13 are front elevational views illustrating respective operating states;

Figure 14 is a sequence characteristic diagram of an automatic focus/exposure operation of the embodiment of Figures 11-14, illustrating relationships between the amount of rotation of a drive ring, an exposure, etc., on the one hand, and time on the other; and

15        Figure 15 is a detailed diagram illustrating the occurrence of an error in an exposure in the sequence characteristic diagram of the operation of a prior automatic focus/exposure operating apparatus for a camera.

20        Figures 1 to 10 relate to a first embodiment of an automatic focus/exposure operating apparatus in accordance with the present invention.

25        As shown in Figure 1, the first embodiment comprises a gear 2 which is fixed to a rotor shaft 1 of a step motor 21 (Figure 9) so as to rotate therewith, the rotation of the step motor 21 being controlled by a control circuit 23 (Figure 9) so as to be changed between forward and reverse rotation. A large diameter toothed portion 4a of an intermediate gear 4 meshes with  
30        the gear 2, and a toothed portion 6a provided around the outer periphery of a drive ring or driving member 6 meshes with a small diameter teeth portion 4b of the intermediate gear 4.

The drive ring 6 is rotated by the step motor 21 in the forward and reverse directions around an optical axis 5. Shaft members or pins 6b, 6c are mounted at diametrically spaced apart points on the peripheral portion of the drive ring 6, and two bores 6f, each of which has an abutment surface 6d, are formed radially inwardly of the shaft members 6b, 6c. A cam portion 6e is formed on the right hand side, as viewed in Figure 1, of the peripheral portion of the drive ring 6.

A distance ring 7 (focal distance setting member) is mounted for rotation about an axis adjacent to the same optical axis 5 as that of the drive ring 6. The distance ring 7, which is mounted adjacent to the drive ring 6, is movable axially of the optical axis 5 together with a lens member (not shown), e.g. of the helicoidal type, as the distance ring 7 rotates about the optical axis 5. Pins 7a, 7b projecting toward the drive ring 6 are formed on the rear side of the distance ring 7, as viewed in Figure 1. The pins 7a, 7b extend into the bores 6f of the drive ring 6.

The peripheral portion of the distance ring 7 is also provided with ratchet teeth 7e, a cam portion 7c at one end of the ratchet teeth 7e, and a switch actuating portion 7d. A spring 8 is provided on a part of the cam portion 7c of the distance ring 7 so as to extend between the cam portion 7c and the drive ring 6. The spring 8 urges the distance ring 7 to rotate clockwise relative to the drive ring 6 and urges the pins 7a, 7b to abut against the abutment surfaces 6d of the bores 6f of the drive ring 6, thereby positioning the distance ring 7 with respect to the drive ring 6.

The ends of sectors or blades 9, 10 are pivotally supported by the shaft members 6b, 6c at the two diametrically spaced apart points on the peripheral

portion of the drive ring 6 on the rear side thereof, as viewed in Figure 1. Operating bores 9a, 10a are formed in the sectors 9, 10 at positions which are closer to the optical axis 5 than to the shaft members 6b, 6c.

5 Since the pins 7a, 7b of the distance ring 7 are fitted in the operating bores 9a, 10a of the sectors 9, 10, the sectors 9, 10 are rotated as the distance ring 7 and the drive ring 6 rotate relative to each other, thereby opening or closing a shutter aperture 20.

10 Accordingly, the pins 7a, 7b of the distance ring 7, the operating bores 9a, 10a of the sectors 9, 10, and the shaft members 6b, 6c of the drive ring 6 as a whole constitute a blade opening/closing means of the sectors 9, 10, the said blade opening/closing means being disposed  
15 between the drive rings 16 and the distance ring 7.

A return detection switch 11 is provided in the vicinity of a lower left hand portion of the drive ring 6, as viewed in Figure 1. With respect to this return detection switch 11, when the distance ring 7, after  
20 having rotated counter-clockwise, rotates reversely and thus rotates clockwise to return, the switch actuating portion 7d thereof is brought into contact with the return detection switch 11, effecting an OFF operation.

A ratchet pawl 13 is pivotally mounted on a shaft  
25 12 in the vicinity of an upper right hand portion of the drive ring 6 as viewed in Figure 1. When the ratchet pawl 13 has rotated counter-clockwise, a pawl portion 13a at a tip thereof is retained by one of the ratchet teeth 7e of the distance ring 7. A rectangular retaining operation portion 13b of the ratchet pawl 13 is disposed  
30 at the rear side of a rear-end portion of the ratchet pawl 13 as viewed in Figure 1. Similarly provided at the rear-end portion of the ratchet pawl 13 is a spring 14 which extends between the ratchet pawl 13 and a stationary member 149 thereby urging the ratchet

pawl 13 counter-clockwise.

A pawl position detecting switch 15 is provided in the vicinity of the rear-end portion of the ratchet pawl 13. When the ratchet pawl 13 has rotated clockwise, the lower surface of its retaining operation portion 13b is brought into contact with the pawl position detecting switch 15, thereby effecting an OFF operation.

Similarly provided in the vicinity of the rear-end portion of the ratchet pawl 13 is a retaining pawl 17 which is pivotally mounted on a shaft 16. When the retaining pawl 17 has rotated clockwise, a pawl portion 17a at a distal end thereof is retained by the upper surface of the retaining operation portion 13b of the ratchet pawl 13. A pin portion 17b is provided at the rear end portion of the retaining pawl 17, and when this pin portion 17b is engaged by the cam portion 6e of the drive ring 6 so as to rotate it counter-clockwise, the pawl portion 17a is disengaged from the upper surface of the retaining operation portion 13b of the ratchet pawl 13. The retaining pawl 17 is urged clockwise by a spring 18 provided midway thereof.

A pin 19 is mounted on a base board (not shown) and is disposed in the vicinity of an upper portion of the drive ring 6. Excessive movement of the drive ring 6 is prevented by virtue of the fact that a step portion of the cam portion 6e of the drive ring 6 is brought into contact with the pin 19.

In operation, the rotation of the step motor 21 is transmitted from the gear 2, is decelerated by the intermediate gear 4, and is then transmitted to the tooth portion 6a of the drive ring 6, first causing the drive ring 6 to rotate counter-clockwise, as viewed in Figure 1. Subsequently, by reason of the engagement between the abutment surfaces 6d of the bores 6f in the

drive ring 6 and the pins 7a, 7b, the distance ring 7 also rotates in unison with and in the same direction as the drive ring 6, and, at this time, the ratchet teeth portion 7e of the distance ring 7 is also moved in the same direction (forward direction) (Figure 2).

Immediately after the distance ring 7 has started to rotate counter-clockwise, its switch actuating portion 7d is separated from the return detection switch 11, causing the latter to effect an ON operation and thereby causing the latter to input a rotation start signal to the control circuit 23 (Figure 10). A time chart of the operation is shown in Figure 6.

Then, as the distance ring 7 rotates about the optical axis 5, the distance ring 7 moves the said lens member (not shown) axially of the optical axis 5. As the control circuit 23 drives the step motor 21 for a predetermined duration of pulses on the basis of a focussing signal inputted to the control circuit 23, the drive ring 6 is rotated so that the said lens member moves by a predetermined amount up to the focussed position of the lens (as indicated at T0 - T1; P0 - P2 in Figure 5).

Upon completion of this focussing operation, the control circuit 23 immediately causes the step motor 21 to rotate reversely, thereby causing the drive ring 6 to rotate in the reverse direction (clockwise).

After this reversing of the drive ring 6 is started, one of the ratchet teeth 7e of the distance ring 7 is retained by the pawl portion 13a of the ratchet pawl 13, as shown in Figure 2, so that the reverse (clockwise) rotation of the distance ring 7 is prevented, thereby causing the said lens member to be held at that focussed position. For this reason, only the drive ring 6 rotates clockwise in opposition to the

spring 8, and its shaft members 6b, 6c also move in the same direction.

When the drive ring 6 has been rotated relative to the distance ring 7, the pins 7a, 7b of the distance ring 7 are stopped but the shaft member 6b, 6c of the drive ring 6 move, so that movement of the operating bores 9a, 10a of the sectors 9, 10 is stopped by the pins 7a, 7b. The ends of the sectors 9, 10, which are pivotally supported by the shaft members 6b, 6c of the drive ring 6, are angularly moved, with the result that the sectors 9, 10 rotate, thereby opening and closing the shutter aperture 20.

In other words, when the shutter aperture 20 is opened by a predetermined amount on the basis of an exposure detection signal inputted to the control circuit 23, as shown in Figure 3 (see T1 - T2; P2 - P1 in Figure 5), the drive ring 6 is immediately rotated in the reverse direction (counter-clockwise) by the step motor 21 controlled by the control circuit 23, so that the sectors 9, 10 close the shutter aperture 20 (as indicated at T2 - T3; P1 - P2 in Figure 5).

Even after the sectors 9, 10 have closed the shutter aperture 20, the drive ring 6 continues to rotate counter-clockwise, and as its abutment surfaces 6d engage the pins 7a, 7b in due course of time, the distance ring 7 is rotated again in unison with and in the same direction as the drive ring 6, while the ratchet teeth portion 7e of the distance ring 7 is also moved in the same direction.

Subsequently, after the ratchet teeth portion 7e has moved over the ratchet pawl 13, the cam portion 7c finally lifts the pawl portion 13a to a position higher than its previous level and rotates the ratchet pawl 13 clockwise to a large extent, in opposition to the spring

14. For this reason, the retaining pawl 17 becomes rotatable clockwise by means of the spring 18, and the pawl portion 17a of the retaining pawl 17 is retained by the upper surface of the retaining operation portion 13b of the ratchet pawl 13, as shown in Figure 4. Hence, with the pawl portion 13a of the ratchet pawl 13 being so spaced from the ratchet teeth 7e so as no longer to be held thereby, the ratchet pawl 13 is held in a fixed position by the retaining pawl 17 (T3 - T4; P2 - P3 in Figure 5).

Immediately before this retention of the ratchet pawl 13 by the retaining pawl 17, the lower surface of the retaining operation portion 13b of the ratchet pawl 13 is brought into contact with the pawl position detecting switch 15 to effect an OFF operation thereof. The ON and OFF operation of the pawl position detecting switch 15 with respect to time is illustrated by the graph B of the time chart of Figure 6.

For this reason, the distance ring 7 becomes rotatable clockwise together with the drive ring 6. The distance ring 7, together with the drive ring 6, is therefore rotated clockwise and is returned to its initial position by the step motor 21 which is rotated reversely under the control of the control circuit 23 to which an OFF signal from the pawl position detecting switch 15 is inputted (as indicated at T4 - T5; P3 - P0 in Figure 5).

Immediately before the distance ring 7 is returned to its initial position, the switch actuating portion 7d of the distance ring 7 is brought into contact with the return detection switch 11 to turn OFF the return detection switch 11. The ON and OFF operation of the return detection switch 11 with respect to time is illustrated by the graph A of the time chart

of Figure 6. A return signal (OFF signal) is thus inputted to the control circuit 23, thereby returning the parts to their initial state.

5 Immediately before the distance ring 7 returns to its initial position, the cam portion 6e of the drive ring 6 engages the pin portion 17b and causes the retaining pawl 17 to rotate counter-clockwise. As a result, the pawl portion 17a of the retaining pawl 17 is disengaged from the upper surface of the retaining operation portion 13b of the ratchet pawl 13, so that 10 the ratchet pawl 13 is rotated counter-clockwise by the spring 14, causing its pawl portion 13a to be retained by one of the ratchet teeth 7e of the distance ring 7 when in its initial position (Figure 1). For this reason, the lower surface of the retaining operation 15 portion 13b of the ratchet pawl 13 is separated from the pawl position detecting switch 15 so as to cause the latter to effect an ON operation (see graph B in the time chart of Figure 6), similarly inputting a pawl position detection signal to the control circuit 23. 20

As shown in Figure 6, the state of detection by the return detection switch 11 (graph A) and of the pawl position detection switch 15 (graph B) is confirmed by the control circuit 23 at the position of an arrow 33, 25 and after that confirmation the operation proceeds with an ensuing control procedure. In particular, during the returning operation of the drive ring 6 and of the distance ring 7 to their initial positions, confirmation is carried out frequently at predetermined intervals, as 30 illustrated by other arrows 34 in Figure 6.

Should the retention of the ratchet pawl 13 by the retaining pawl 17 cease during the above-described returning operation, the returning operation of the distance ring 7 would be prevented by the ratchet pawl

13, relative rotation would occur between the drive ring 6 and the distance ring 7, and the sectors 9, 10 would open. The apparatus is therefore designed to prevent this from occurring.

5        If the results of confirmation by the detection switches differ from the desired results, a determination is made that it is a case of a malfunction such as the one described above, and a sequence operation for resetting is carried out. For instance, 10 if when, even though the return detection switch 11 should be turned ON during the initial period of operation, it is impossible to obtain that signal, the drive ring 6 is continuously rotated counter-clockwise by an amount corresponding to its entire stroke, as 15 shown in Figure 7, and is moved up to its position shown in Figure 4. The distance ring 7 and the drive ring 6 are then made to effect a return operation up to their initial positions. Even during this return operation, confirmation of the state of detection by the detection 20 switches is carried out frequently at predetermined intervals.

      In Figure 7, PA denotes P-1 - P3 in Figure 6, i.e. the entire stroke of the drive ring 6, while PB denotes P3 - P0, i.e. the returning stroke of the distance ring 7 25 to its initial position.

      P-1 in Figure 6 denotes a fully open position of the drive ring 6 (reversing stop position) in a case where the distance ring 7 is retained by the pawl 17 in an initial period when the degree of operation of the 30 distance ring 7 is too small and, at this juncture, the drive ring 6 rotates reversely up to P-1 from the initial position of Figure 1. Accordingly, a difference of P-1 - P0 arises between the full stroke of the drive ring 6 and the returning stroke of the distance ring 7

up to its initial position.

A description will now be given with respect to an operation of the above-described blade opening/closing mechanism, i.e. means for correcting an exposure.

5 As shown in Figure 8, it is assumed that four drive pulses to the step motor 21 are outputted during one pitch rotation of the ratchet teeth 7e of the distance ring 7. In Figure 8, no problem exists when the focussing position is at the retaining position, but  
10 if positions D, E, F other than the retaining position respectively become focussing positions, in the prior construction referred to above a phase difference between the drive ring 6 and the distance ring 7 unavoidably occurs with respect to an actual retaining  
15 position, and an error occurs at a portion of that phase difference such that the blade opening/closing mechanism 6b, 6c, 7a, 7b, 9a, 10a opens the blades at the shutter aperture 20, i.e. an exposure error occurs.

In other words in the said prior construction, in  
20 the sequence characteristic diagram of operation shown in Figure 15, if the drive ring 6 rotates reversely at the respective focussing positions D, E, F, the amount of exposure rotation after the reverse rotation is fixed, so that an error occurs at the portion of the  
25 phase difference between the retaining position and the respective focussing positions D, E, F, with the result that actual exposures become d, e, f, respectively.

In short, if reverse rotation is effected from the focussing position D and an exposure is performed by a  
30 predetermined amount, the actual exposure d is inadequate just by a portion corresponding to one drive pulse to the step motor 21 as compared with an exposure g which is the case where an exposure is carried out from the retaining position. In addition, if reverse

rotation is effected from the focussing position E and an exposure is performed, the actual exposure e is inadequate by a portion corresponding to two drive pulses to the step motor 21, while, if reverse rotation is effected from the focussing position F and an exposure is performed, the actual exposure f is inadequate by a portion corresponding to three drive pulses to the step motor 21, with the result that the error in the exposure is at its greatest.

To solve the above-described problem, as shown in Figure 9, the control circuit 23 for driving the said lens member by controlling the step motor 21 is provided with a counter 25 for counting the drive pulses to the step motor 21 related to movement of the lens member, and an error with respect to the above-described retaining position (i.e. the position at which the distance ring 7 is retained by the retaining pawl 17) is determined by counting the said drive pulses occurring until the distance ring 7 rotates to the focussing position. In order to effect the required calculation, for instance, it may be arranged that the number of the said drive pulses occurring until the distance ring 7 rotates to the focussing position are compared with the pulse data for the retaining position, and any difference therebetween may be regarded as related to the error between the focussing position and the retaining position. Alternatively, data concerning the pulses related to each such difference may be stored in advance in a ROM (not shown).

These errors are calculated by an exposure correction circuit 27, and correction is performed for the exposure pulses by an exposure control circuit 28 on the basis of this calculated value. By virtue of this correction, when, for instance, reverse rotation is

effected from the focussing position D to effect an exposure of a predetermined amount, an actual exposure g is corrected so that a portion corresponding to one more drive pulse than in the prior construction referred to above is added, so that the amount will become absolutely identical to that in the case where the exposure is effected from the retaining position.

In addition, if the exposure is effected by effecting reverse rotation from the focussing position E, the actual exposure g is corrected so that a portion corresponding to two more pulses is added than in the said prior construction while, if the exposure is effected by effecting reverse rotation from the focussing position F, the actual exposure g is corrected so that a portion corresponding to three more pulses is added than in the said prior construction. In other words, as shown in Figure 10, in cases where the focussing position is at any of the positions D, E, F, the actual exposure uniformly becomes g as a result of correction, i.e. as a result of adding the necessary number of drive pulses to the step motor 21 so as to move the drive member 6 a required amount to compensate. It is thus possible to prevent an error in the exposure from occurring by virtue of the amount of the focussing operation of the distance ring 7.

In Figure 9, reference numeral 30 denotes a focus detection sensor for automatic focussing or the like, while reference numerals 31, 32 denote exposure detection sensors such as those used for photometry (light metering), ISO, etc.

Figures 11 to 14 illustrate a second embodiment of the present invention. Although in the above-described first embodiment a description has been given of an apparatus in which the lens member is of a helicoidal

type (a helical type which moves while undergoing helical movement), this second embodiment is a case where the lens member is a straight advancing type.

5 In Figure 11 there is shown an automatic focus/exposure operation apparatus for a camera comprising a ratchet gear 107d which is divided into three groups which are formed around a peripheral portion of a distance ring 107. The distance ring 107 has three cam portions 107a which are formed on the side thereof which is remote from the side where a drive ring 106 is provided. A lens member (not shown) is disposed on the same side of the distance ring 107 as the cam portions 107a and this lens member is of the so-called straight advancing type and is so arranged as to be 10 capable of moving in the direction of an optical axis 105 as the cam portions 107a rotate.

The mechanism and operation whereby sectors 109, 110 open and close a shutter opening 116 are identical with those of the above-described first 20 embodiment and are therefore not described further. A spring 108 for urging the distance ring 107 to rotate clockwise relative to the drive ring 106 is interposed between the drive ring 106 and the distance ring 107.

Figure 11 illustrates an initial position, and as 25 a gear 102 is rotated counter-clockwise by a step motor (not shown), that rotation is decelerated by a large-diameter toothed portion 104a and a small diameter toothed portion 104b of an intermediate gear 104 and is then transmitted to a toothed portion 106a of the drive ring 106, thereby causing the drive ring 106 to rotate 30 counter-clockwise.

At this juncture, as abutment surfaces 106d of two bores 106f provided in the drive ring 106 press against pins 107b, 107c, the distance ring 107 also moves in

unison with and in the same direction as that of the drive ring 106, and the ratchet teeth portion 107d of the distance ring 107 is also moved in the same direction (Figure 12). When the ratchet teeth portion 107d of the distance ring 107 is moved to a predetermined position on the basis of a focussing signal inputted by a control circuit, not shown, as indicated at T0 - T1; P0 - P2 in Figure 14, the gear 102 rotates reversely and starts to rotate clockwise, with the result that one of the ratchet teeth 107d is retained by a pawl portion 113a of a ratchet pawl 113.

At this juncture, the lens member is engaged by the cam portion 107a of the distance ring 107, and immediately after the lens member has been moved by a predetermined amount in the direction of the optical axis 105 to a position at which the lens is focussed by the predetermined rotation of the distance ring 107, one of the ratchet teeth 107d is retained by the pawl portion 113a of the ratchet pawl 113.

As the gear 102 continues to rotate clockwise, the drive ring 106 rotates in the same direction. At this time, since the distance ring 107 has its ratchet tooth 107d retained by the pawl portion 113a of the ratchet pawl 113, the drive ring 106 rotates in opposition to the spring 108 by leaving the distance ring 107. At this time, the pins 107b, 107c of the distance ring 107 are fixed and prevent movement of operating bores 109a, 110a provided in sectors 109, 110. Shaft portions 106b-106c of the drive ring 106, however, which pivotally support the sectors 109, 110, rotate clockwise. Accordingly, as shown in Figure 13, the sectors 109, 110 rotate clockwise, thereby opening the shutter opening 116 (as indicated at T1 - T2; P2 - P1 in Figure 14).

When an exposure operation is carried out to a

predetermined extent on the basis of an exposure detection signal inputted to the control circuit, the drive ring 106 immediately rotates in the opposite direction (counter-clockwise), and the sectors 109, 110 close the shutter aperture 116 (as indicated at T2 - T3; P1 - P2 in Figure 14).

After the sectors 109, 110 have closed the shutter aperture 116, the drive ring 106 continues to rotate counter-clockwise, and in due course of time its abutment surfaces 106d press against the pins 107b, 107c, and the distance ring 107 is moved again in unison with and in the same direction as that of the drive ring 106. As a result, the ratchet teeth 107d of the distance ring 107 are moved in the forward direction, and when the parts reach an ensuing initial position at which the pawl portion 113a of the ratchet pawl 113 is retained by a recessed portion 107e of the distance ring 107 where they are stopped, the distance ring 107 stops by means of the gear 102, thereby completing one cycle of operation (as indicated at T3 - T4; P2 - P3 in Figure 14).

In this second embodiment, when the initial position is reached at which the pawl portion 113a of the ratchet pawl 113 is retained by the recessed portion 107e, a rear end portion 113b of the ratchet pawl 113, which is on the side of the ratchet pawl 113 opposite to the pawl portion 113a, causes a return detection switch 115 to effect an OFF operation, so that a return signal is inputted to the control circuit, thereby returning the sequence cycle to its initial state.

The embodiment of Figures 11-14 is provided with means for correcting failure of the distance ring 107 to move to the correct focussing position which are comparable to those provided in the embodiment of

Figures 1-10 and which will not therefore be described further.

5 It should be noted that although, in the above-described embodiments, each member is arranged in such a way as to rotate around a shutter opening, the drive ring and the distance ring may alternatively be arranged as members that move linearly, and reciprocate.

10 In addition, although, in the above-described embodiments, ratchet teeth are formed at an outer peripheral portion of the respective distance member, it is preferred that, as disclosed in Japanese Laid-Open Patent Specification No. 200337/1987, a gear is provided around an outer peripheral portion of the distance member, and that a pinion meshing with this gear is  
15 provided together with the ratchet teeth.

In the embodiments described above, in an automatic focus/exposure operating apparatus for a camera which is capable of shifting speedily to an exposure operation upon completion of a lens focussing  
20 operation, it is possible to prevent an exposure error from occurring due to the focussing operation of a distance member.



### CLAIMS

1. An automatic focus/exposure operation apparatus for a camera comprising a drive member driven by a motor controlled by a control circuit; a focal distance setting member for driving a lens focussing mechanism by moving together with said drive member in one direction; a retaining pawl for engaging with said focal distance setting member and preventing movement thereof in the opposite direction after a focussing operation; and a blade opening/closing mechanism which is operative so as to open said blades when said driving member drives said lens focussing mechanism in the said one direction and which moves in the said opposite direction after a focussing operation with said focal distance setting member retained by said retaining pawl, said blade opening/closing mechanism being disposed between the drive member and the focal distance setting member and said blade opening/closing mechanism executing an exposure on the basis of a phase difference between said driving member and said focal distance setting member.

2. An apparatus as claimed in claim 1 comprising a counter for counting drive pulses to the motor from the control circuit from initial operation of the apparatus to the time when the lens focussing means is so held and for comparing these pulses with known data, any said error being corrected by supplying a required number of additional drive pulses to the motor.

3. An apparatus as claimed in claim 1 or 2 in which both the drive member and the focal distance setting member is a ring member.



4. An automatic focus/exposure operation apparatus for a camera substantially as hereinbefore described with reference to and as shown in Figures 1-10 or Figures 11-14 of the accompanying drawings.

5. A camera provided with apparatus as claimed in any of claims 1-4.

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