

Description

Technical Field

The present invention generally relates to a photographic optical system in accordance with the generic part of claim 1 and to a camera in which such a photographic optical system is used.

This application is related to the commonly assigned application filed on even date herewith, international publication No. WO 87/07036, entitled "Zoom Lens Drive System for lens shutter type of Camera", the disclosure of which is expressly incorporated by reference herein.

EP-A-144,933 shows a lens barrel having a first barrel comprising an annular groove, and a second barrel. A member which is elastic in the radial direction is provided adjacent to the second barrel inside an annular groove in order to prevent noise from the camera inside from getting to the outside via the lens barrel.

One primary object of the present invention is to provide a photographic optical system having a rotatable cam ring with at least one groove therein and having at least one axially movable lens barrel, in this system light is prevented from entering the interior of the cam ring.

Another object is to provide a lens shutter type camera with a light intercepting assembly which minimizes light from entering a photographic optical assembly lens system.

DISCLOSURE OF INVENTION

In a photographic optical system having a cam ring rotatable in a constant axial position and at least one movable lens barrel movable along an optical axis of the photographing optical system in response to rotation of the cam ring, a light interception member is provided which is positioned in a space between a front end of a cam ring support member and a front cover having an opening through which the lens barrel is adapted to move.

In an other aspect of the present invention a camera is provided which has a photographic optical system with a rotatable cam ring and with a light blocking mechanism.

Other objects, features and advantages of the present invention will hereinafter be described.

BRIEF DESCRIPTION OF DRAWINGS

The above and other objects, features, and advantages of the present invention will be described in greater detail with respect to the accompanying drawings, in which like reference numerals represent similar elements throughout the several views, and wherein:

Fig. 1 is an exploded perspective view of a photographic optical system in accordance with the present invention;

Fig. 2 is a longitudinal sectional view of a photographic optical system in a camera formed in accordance with the present invention;

Fig. 3 is a front elevational view of a camera formed in accordance with the present invention.

Fig. 4 is a perspective view of a light intercepting ring;

Fig. 5 is a sectional view taken along line XXXVII-XXXVII of Fig. 4;

Fig. 6 is a sectional view of a second embodiment of a light intercepting ring formed in accordance with the present invention which is similar to the view of Fig. 5.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention will now be described below in greater detail, with specific reference to the accompanying drawings which illustrate a variety of embodiments and features of the present invention.

The description will be generally provided in accordance with the following general sub headings:

A. The Overall Camera Construction for a Lens Shutter Type of Camera

B. Light Interception Assembly And Mechanism.

A. Overall Camera Construction for a Lens Shutter Type of Camera

The overall construction of a lens shutter type of camera formed in accordance with the present invention is well illustrated in Figs. 1, 2 and 3. A lens shutter type of camera formed in accordance with the present invention essentially comprises a photographic optical system like a zoom lens barrel block 1. Additionally it comprises a finder and strobe block 2 (hereinafter referred to as a finder block), a light emitter and a light receiver forming a portion of a distance measuring, i.e., AF, device, and a zooming motor which is used for the zooming operation of the photographing optical system. All of these elements are secured to a base 6 which forms an immovable portion of the camera body.

Base 6 includes, as is best illustrated in Fig. 2, a lens barrel supporting plate portion 6a which lies in a plane which is perpendicular to the optical axis of the lens; and a horizontal supporting plate portion 6 is provided which extends at right angles from the lens barrel support plate portion 6a. Support plate portion 6 extends beyond the side edge of plate 6a, in order to support finder assembly 8 and strobe assembly 9. The base further comprises motor supporting plate portions 6 which are positioned perpendicularly with respect to the horizontal supporting plate portion 6 Lens

barrel block 1 is supported on lens barrel support plate portion 6a, which has a central opening (unreferenced) for receiving the lens barrel block.

Finder block 2 is secured to the right hand portion of horizontal support plate portion 6, as viewed from the front of the camera.

Lens barrel block 1 is adapted to be actuated by zooming motor, and the construction of this block will be described hereinbelow with more specific reference to Figs. 1 - 2. A rear securing plate 11 is mounted to lens barrel support plate portion 6a of base 6 by fastening screws 10, as is best illustrated in Fig. 2. Rear securing plate 11 includes four guide rods 12 which are attached to and through bores in the rear portion of the guide plate and which are located about the optical axis of the photographing optical system and parallel to this axis. A front securing plate 13 is secured to the front ends of guide rods 12; these guide rods and plates are the main securing elements for lens barrel block 1.

A rotatable cam ring 14 is positioned between front and rear securing plates 13 and 11, respectively; a sector gear 15 is provided about a substantial portion (but preferably not the entire 360°) of the outer periphery of cam ring 14; this gear can be attached to the cam ring by conventional means, e.g., via set screws 15a, as seen in Fig. 2; this gear is adapted to engage, either directly or indirectly, a pinion which is positioned between the gear train support plate and the motor support plate portion. Gear 15 can be a sector gear which will cover a predetermined range of rotational movement of cam ring 14. The cam ring is itself provided with zooming cam grooves 20 and 21 (see Fig. 1) which are used to engage the front and rear lens element groups, respectively.

A roller 17, as illustrated in both Figs. 1 and 2, is positioned within zooming cam groove 20; this roller is attached to a front lens group frame 16. A roller 19 of rear lens group frame 18 is positioned within zooming cam groove 21, again as illustrated in Figs. 1 and 2. Front lens group frame 16 and rear lens group frame 18 are movably guided by guide rods 12, and a decorative frame 22 and shutter block 23 are secured to the front lens group frame 16 via set screws 22a, as best seen in the exploded view of Fig. 1, as well as in the cross-sectional view of Fig. 2.

The front lens frame 24 which supports front lens element group L1 is engaged by shutter block 23 via helicoid 25, which is shown in Fig. 1. Front lens frame 24 includes an arm 24a which engages lens feeding lever 23a of shutter block 23 (see Fig. 2), so that when lens feeding lever 23a rotates in a circumferential direction in order to rotate front lens frame 24, the front lens frame will move along the direction of the optical axis of the photographing optical system under the guidance of helicoid 25. Rear lens element group L2 is directly attached to rear lens group frame 18, as seen in Fig. 2. One desired configuration of lens

groups L1 and L2, as illustrated in Fig. 2, are disclosed in commonly assigned U.S. Patent Application Serial No. 935,982, filed on November 28, 1986, the disclosure of which is expressly incorporated by reference herein.

The structure of shutter block 23 is known per se. This shutter block rotates lens feeding lever 23a over a predetermined angular displacement in accordance with a detection signal which is received by the shutter block from the distance measuring device, as described hereinafter, via a pulse motor which is incorporated within the camera body and which is adapted to open shutter sector 23b, which has been closed for a predetermined time, and to thereafter return lens feeding lever 23a into its original position after the shutter has again closed. This type of shutter block is disclosed, e.g., in unexamined Japanese Published Patent Application (KOKAI) No. 60-235,126, dated November 21, 1985, the disclosure of which is expressly incorporated by reference herein. The present camera utilizes such a shutter block in the fundamental way disclosed therein.

Finder block 2 includes finder assembly 8 and strobe assembly 9. The finder device and the strobe device are adapted to vary, respectively, the field of finder view and the illumination angle, i.e., the intensity of the strobe, in accordance with variance in the focal length of the lens barrel block 1. Zooming motor is used as a power source both for finder control and strobe control; only a single motor need therefore be used.

B. Light Interception Assembly and Mechanism

The light interception mechanisms are best illustrated in Figs. 2 and 4 - 6 of the present application.

In a lens shutter type of camera as described herein, the front and rear lens element groups can be independently moved along the photographing optical axis direction in order to effect a lens zooming operation. Since a gap exists between the front lens group frame 16 and the rear lens group frame 18, and since cam ring 14, which includes through cam grooves 20 and 21 for actuating movement of lens frames 16 and 18, is located about the outer peripheries of the lens frames, the possibility exists that undesirable light rays would otherwise penetrate into the photographic optical system of the camera through the gap between the front and rear lens group frames and through the cam grooves 20 and 21. Further, since front lens group frame 22 moves through opening 201 of front cover 200 (see Fig. 2), rays of light can also enter the camera via opening 201. The front cover 200 covers the front face of lens barrel block 1 and supports lenses L3 and L6 of the finder as well as strobe block 2. Opening 201 is formed along and defined by an inner flange 202 of front cover 200, so that the movable decorative frame

22, i.e., which includes the front group lens frame 16, will move through opening 201 when the camera is in its zooming operation. An annular space 203 having a relatively small width W is provided between inner flange 202 and front stationary plate 13. The front stationary plate is substantially annular in configuration.

In order to prevent rays of light from penetrating into the camera, as noted above, a light intercepting mechanism has been provided. Specifically, a light intercepting assembly 210 which comprises a plurality of sections is provided about the outer periphery of cam ring 14 and is adapted to cover through or continuous cam grooves 20 and 21 in order to intercept rays of light and prevent them from entering the interior of lens barrel block 1.

An annular light intercepting member 220 which forms an additional portion of the light intercepting assembly is provided in annular space 203, which is defined by the space between front stationary plate 13, which rotatably supports the front portion of cam ring 14, and front cover 200, as best seen in Fig.2.

Annular light intercepting member 220 which is positioned within annular space 203 comprises an elastic annular body 221, e.g., rubber, and an annular reinforcing plate 222, so that the light intercepting member 220 will have the overall configuration of a substantially flat annular ring, as best illustrated in Figs. 4 and 5. The thickness w of light intercepting member 220 is slightly less than the width W of annular space 203, so that the light intercepting member 220 can move over a small distance within space 203, along the direction of the photographing optical axis.

Elastic body 221 of light intercepting member 220 is provided, along its inner periphery, with a light intercepting lip 223 having a small width which slidably contacts the outer periphery of decorative frame 220. Reinforcing plate 222 can be secured to elastic body 221, e.g., by partially imbedding the elastic body 221 into connecting recesses, holes or apertures 224 formed in reinforcing plate 222, which plate is made, e.g., of metal or synthetic resin. The inner lip 223 is extremely flexible and is capable of moving in either direction axially of a lens barrier block about which it is positioned. The lip can thus play a minor role in reducing rebound of the barrier block after it ceases movement in a first axial direction.

Fig. 6 illustrates a second embodiment of the annular ring illustrated in Figs. 4 and 5, in which two spaced light intercepting lips 223 (rather than merely one) are formed on the inner periphery of annular light intercepting member 220 in order to increase the light interception effect of the apparatus. These lips are spaced from each other in a parallel fashion and form a generally annular U-shaped, inwardly directed annular flange for the light intercepting member. Elastic body 221 is used to cover the outer periphery of reinforcing plate 222 in such structure.

Alternately, it would be possible to replace annular light intercepting member 220 with a conventional O-ring structure, which would be the simplest manner of intercepting light and preventing it from reaching undesired areas within the camera.

With such a light intercepting mechanism, undesirable light rays will not enter the camera lens system through the circumference of the front lens group frame 16 and/or the rear lens group frame 18, nor through the front annular opening between the lens barrel and camera cover.

Claims

1. A photographic optical system (1) having a cam ring (14) with at least one cam groove (20, 21) therein, said cam ring (14) being rotatable at a constant axial position, said system (1) further having at least two movable lens barrels (22, 23, 24, 25, L1, 16; L2, 18) independently movable along the optical axis of said photographic system (1) in association with rotation of said cam ring (14) characterised by a front stationary plate (13) having a central, hole for receiving at least one movable barrel, a front cover (200) having a central hole for receiving said at least one movable barrel and positioned in front of said front stationary plate (13), and, at least one light intercepting member (220) positioned in an annular space (203) between the front stationary plate (13) and the front cover (200), said light intercepting member (220) being arranged to move over a small distance within said space (203), along the direction of the optical axis.
2. A system in accordance with claim 1, wherein said light intercepting member (220) is annular.
3. A system in accordance with one of the preceding claims, wherein the interior periphery of said light intercepting member (220) comprises at least one flexible lip (223) which slidably contacts the outer periphery of said lens barrel (22).
4. A system in accordance with claim 3, wherein said at least one flexible lip (223) comprises means for minimizing rebound of said barrel (22).
5. A system in accordance with claim 2, 3 or 4, wherein an annular reinforcing plate (222) is positioned about the outer periphery of said annular light intercepting member (220), said plate (222) comprising metal or plastic (224) which is more rigid than said annular member (220), said annular member (220) being elastic.
6. A system in accordance with one of claims 2 to 5,



22, i.e., which includes the front group lens frame 16, will move through opening 201 when the camera is in its zooming operation. An annular space 203 having a relatively small width W is provided between inner flange 202 and front stationary plate 13. The front stationary plate is substantially annular in configuration.

In order to prevent rays of light from penetrating into the camera, as noted above, a light intercepting mechanism has been provided. Specifically, a light intercepting assembly 210 which comprises a plurality of sections is provided about the outer periphery of cam ring 14 and is adapted to cover through or continuous cam grooves 20 and 21 in order to intercept rays of light and prevent them from entering the interior of lens barrel block 1.

An annular light intercepting member 220 which forms an additional portion of the light intercepting assembly is provided in annular space 203, which is defined by the space between front stationary plate 13, which rotatably supports the front portion of cam ring 14, and front cover 200, as best seen in Fig. 2.

Annular light intercepting member 220 which is positioned within annular space 203 comprises an elastic annular body 221, e.g., rubber, and an annular reinforcing plate 222, so that the light intercepting member 220 will have the overall configuration of a substantially flat annular ring, as best illustrated in Figs. 4 and 5. The thickness w of light intercepting member 220 is slightly less than the width W of annular space 203, so that the light intercepting member 220 can move over a small distance within space 203, along the direction of the photographing optical axis.

Elastic body 221 of light intercepting member 220 is provided, along its inner periphery, with a light intercepting lip 223 having a small width which slidably contacts the outer periphery of decorative frame 220. Reinforcing plate 222 can be secured to elastic body 221, e.g., by partially imbedding the elastic body 221 into connecting recesses, holes or apertures 224 formed in reinforcing plate 222, which plate is made, e.g., of metal or synthetic resin. The inner lip 223 is extremely flexible and is capable of moving in either direction axially of a lens barrier block about which it is positioned. The lip can thus play a minor role in reducing rebound of the barrier block after it ceases movement in a first axial direction.

Fig. 6 illustrates a second embodiment of the annular ring illustrated in Figs. 4 and 5, in which two spaced light intercepting lips 223 (rather than merely one) are formed on the inner periphery of annular light intercepting member 220 in order to increase the light interception effect of the apparatus. These lips are spaced from each other in a parallel fashion and form a generally annular U-shaped, inwardly directed annular flange for the light intercepting member. Elastic body 221 is used to cover the outer periphery of reinforcing plate 222 in such structure.

Alternately, it would be possible to replace annular light intercepting member 220 with a conventional O-ring structure, which would be the simplest manner of intercepting light and preventing it from reaching undesired areas within the camera.

With such a light intercepting mechanism, undesirable light rays will not enter the camera lens system through the circumference of the front lens group frame 16 and/or the rear lens group frame 18, nor through the front annular opening between the lens barrel and camera cover.

Claims

1. A photographic optical system (1) having a cam ring (14) with at least one cam groove (20, 21) therein, said cam ring (14) being rotatable at a constant axial position, said system (1) further having at least two movable lens barrels (22, 23, 24, 25, L1, 16; L2, 18) independently movable along the optical axis of said photographic system (1) in association with rotation of said cam ring (14) characterised by a front stationary plate (13) having a central hole for receiving at least one movable barrel, a front cover (200) having a central hole for receiving said at least one movable barrel and positioned in front of said front stationary plate (13), and, at least one light intercepting member (220) positioned in an annular space (203) between the front stationary plate (13) and the front cover (200), said light intercepting member (220) being arranged to move over a small distance within said space (203), along the direction of the optical axis.
2. A system in accordance with claim 1, wherein said light intercepting member (220) is annular.
3. A system in accordance with one of the preceding claims, wherein the interior periphery of said light intercepting member (220) comprises at least one flexible lip (223) which slidably contacts the outer periphery of said lens barrel (22).
4. A system in accordance with claim 3, wherein said at least one flexible lip (223) comprises means for minimizing rebound of said barrel (22).
5. A system in accordance with claim 2, 3 or 4, wherein an annular reinforcing plate (222) is positioned about the outer periphery of said annular light intercepting member (220), said plate (222) comprising metal or plastic (224) which is more rigid than said annular member (220), said annular member (220) being elastic.
6. A system in accordance with one of claims 2 to 5,



wherein said annular light interception member (220) comprises an O-ring.

7. A system in accordance with one of the preceding claims, characterised in that said system (1) is a zooming optical assembly with variable focal length.
8. A camera comprising a photographic optical system (1) as claimed in any of the preceding claims.

Patentansprüche

1. Fotografisches optisches System (1) mit einem mindestens eine Nockenrille (20, 21) aufweisenden, in einer axial konstanten Stellung drehbaren Nockenring (14) und mit mindestens zwei in Übereinstimmung mit der Drehung des Nockenrings (14) entlang der optischen Achse des fotografischen optischen Systems (1) unabhängig voneinander bewegbaren Linsentuben (22, 23, 25, L1, 16; L2, 18), gekennzeichnet durch eine stationäre Frontplatte (13) mit einer zentralen Öffnung zum Aufnehmen mindestens eines beweglichen Tubus, einer vor der stationären Frontplatte (13) angeordneten Frontabdeckung (200) mit einer zentralen Öffnung zum Aufnehmen dieses mindestens einen beweglichen Tubus und, mindestens ein in dem ringförmigen Zwischenraum (203) zwischen der stationären Frontplatte (13) und der Frontabdeckung (200) angeordnetes Lichtabfangteil (220), das entlang der Richtung der optischen Achse innerhalb dieses Zwischenraumes (203) um eine kleine Strecke bewegbar angeordnet ist.
2. System nach Anspruch 1, wobei das Lichtabfangteil (220) ringförmig ist.
3. System nach einem der vorhergehenden Ansprüche, wobei die innenliegende Oberfläche des Lichtabfangteiles (220) mindestens eine flexible Lippe (223) aufweist, die mit der äußeren Oberfläche des Objektivtubus (22) in Gleitkontakt steht.
4. System nach Anspruch 3, wobei die mindestens eine flexible Lippe (223) Mittel zum Minimieren eines Zurückprallens des Tubus (22) enthält.
5. System nach Anspruch 2, 3 oder 4, wobei eine ringförmige Verstärkungsplatte (222) am Außenrand des ringförmigen Lichtabfangteiles (220) angeordnet ist, die Metall oder Kunststoff (224) von einer höheren Steifigkeit als der des ringförmigen Lichtabfangteiles (220) enthält, und wobei das ringförmige Lichtabfangteil (220) elastisch ist.

6. System nach einem der Ansprüche 2 bis 5, wobei das ringförmige Lichtabfangteil (220) einen O-Ring beinhaltet.

7. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das System (1) eine Variooptikanordnung mit variabler Brennweite ist.

8. Kamera mit einem fotografischen optischen System (1) nach einem der vorhergehenden Ansprüche.

Revendications

1. Système optique de photographie (1) comportant une bague à cames (14) contenant au moins une rainure de came (20, 21), ladite bague à cames (14) étant mobile en rotation dans une position axiale constante, ledit système (1) comportant, en outre, au moins deux barillets d'objectif mobiles (22, 23, 24, 25, L1, 16; L2, 18), mobiles de façon indépendante suivant l'axe optique dudit système de photographie (1), en association avec la rotation de ladite bague à cames (14); caractérisé par une plaque avant fixe (13) ayant un trou central pour recevoir au moins un barillet mobile, un capot avant (200) ayant un trou central pour recevoir ledit au moins un barillet mobile et placé devant ladite plaque avant fixe (13), et au moins un élément d'interception de lumière (220) placé dans un espace annulaire (203) entre la plaque avant fixe (13) et le capot avant (200), ledit élément d'interception de lumière (220) étant agencé pour se déplacer, dans la direction de l'axe optique, sur une courte distance à l'intérieur dudit espace (203).
2. Système selon la revendication 1, dans lequel ledit élément d'interception de lumière (220) est annulaire.
3. Système selon l'une quelconque des revendications précédentes, dans lequel la surface intérieure dudit élément d'interception de lumière (220) comprend au moins une lèvre souple (223) qui contacte de manière coulissante la surface extérieure dudit barillet d'objectif (22).
4. Système selon la revendication 3, dans lequel ladite au moins une lèvre souple (223) comprend un moyen pour minimiser le rebond dudit barillet (22).
5. Système selon la revendication 2, 3 ou 4, dans lequel une plaque annulaire de renfort (222) est placée autour de la périphérie extérieure dudit



élément d'interception de lumière annulaire (220), ladite plaque (222) étant constituée de métal ou de plastique (224) qui est plus rigide que ledit élément annulaire (220), ledit élément annulaire (220) étant élastique.

5

6. Système selon l'une des revendications 2 à 5, dans lequel ledit élément d'interception de lumière annulaire (220) est constitué par un joint torique.

10

7. Système selon l'une des revendications précédentes, caractérisé en ce que ledit système (1) est un ensemble optique de changement de plan avec une distance focale variable.

15

8. Appareil photo comprenant un système optique de photographie (1) tel que revendiqué dans l'une quelconque des revendications précédentes.

20

25

30

35

40

45

50

55

6