
**"ELECTRICAL CONTACT SYSTEM FOR TRANSMITTING
DATA BETWEEN A CAMERA BODY AND AN INTERCHANGEABLE
LENS"**

This invention relates to a camera of the interchangeable lens type, wherein data concerning whether the camera is being operated in automatic or manual aperture control mode is transmitted electrically between the camera body and the lenses.

Two techniques for carrying out automatic exposure control in a camera are by means of a shutter speed priority (or EE) system in which the shutter speed is set manually by the photographer and the aperture is automatically adjusted in accordance with the shutter speed thus set, and by means of an aperture priority (or ES) system in which the aperture value is manually set by the photographer and the shutter speed is automatically adjusted in accordance with the aperture value thus set. A photographing lens for use in both of the above-described systems has an automatic aperture control mechanism which allows the camera body to control the diaphragm opening automatically in the EE mode, and a manual aperture control mechanism which allows the photographer to set the diaphragm opening manually in the ES mode. Conventionally, switching between the automatic and manual aperture mechanism is usually performed mechanically, with a switching signal being mechanically transmitted between the camera body and the lens. However, such mechanical transmission of the switching signal with high accuracy requires a mechanism which is intricate and large in size, which makes the lens expensive.

A technique has been proposed in which data concerning the existing and minimum aperture values of the lens and the aforementioned automatic and manual aperture control switching signal are transmitted as electrical signals between the lens and the camera body. To do this, a change-over switch is provided in a barrel of the lens for producing the automatic and manual aperture control switching

signal, and the signal produced thereby is applied to an electrical contact on the lens mount through a lead wire. However, in this case it is necessary to provide a space for the lead wire in the lens barrel. Therefore, such a change-over switch cannot be provided in a small and light photographing lens.

In view of the foregoing, an object of the present invention is to provide a camera having a data transmitting electrical switching device of simple construction which can be provided in a small space and which can transmit the automatic and manual aperture control switching signal without using lead wires.

According to the present invention, there is provided a camera operable in a first mode wherein aperture value is set manually and a second mode wherein aperture value is set automatically, the camera comprising a body, a lens which can be detachably mounted on the body, an aperture setting member provided on the lens and movable between a plurality of positions to adjust the aperture value of the lens during operation of the camera in said first mode, the aperture setting member being moved to an additional position for operation of the camera in said second mode, first and second electrical contacts which are provided respectively on the body and on the lens and which are mutually aligned when the lens is mounted on the body, the second contact being movable with respect to the lens between an extended position in which it can engage the first contact and a retracted position in which it cannot engage the first contact, the second contact being disposed in one of its extended and retracted positions when the aperture setting member is in any of said plurality of positions and being disposed in the other of its extended and retracted positions when the aperture setting member is disposed in said additional position.

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In a preferred construction, a coil spring urges the second contact into its extended position wherein it protrudes from a surface of a mounting portion of the lens, and the first contact is recessed from a surface of a mounting portion of the body and is electrically insulated from the mounting portion. An L-shaped plate supports the second contact, and has a first leg thereof fitted into a guide groove formed in a barrel of the lens around which the aperture setting member (in the form of an aperture preset ring) is rotatably mounted. The aperture preset ring has an elongate groove formed therein with a notch extending forwardly from the groove. The notch is so positioned that a pin provided at an end of the L-shaped plate abuts only against a side wall of the elongate groove to prevent protrusion of the second contact when the aperture preset ring is at any of the manual aperture control positions, but allows the pin to drop into the notch when the aperture preset ring is rotated to an automatic aperture control position in which case the second contact protrudes from said surface of the lens mounting portion and comes into contact with the first contact on the body mounting portion.

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

Figure 1A is a front view of part of a body of a camera according to the present invention;

Figure 1B is a perspective view of part of a photographing lens which is to be mounted on the camera body shown in Figure 1A;

Figure 2 is a sectional side view of an automatic switching device which forms part of the camera shown in Figures 1A and 1B, the device being shown in a manual aperture control position;

Figure 3 is a similar view to Figure 2 but showing the switching device in an automatic aperture control position;

Figure 4 is a sectional side view of an electrical contact structure which also forms part of the camera shown in Figures 1A and 1B;

Figure 5 is a perspective view of the automatic switching device shown in Figures 2 and 3;

Figure 6 is a sectional plan view of the automatic switching device when in its manual aperture control position; and

Figure 7 is a similar view to Figure 6 but showing the device in its automatic aperture control position.

Referring first to Figures 1A and 1B, the illustrated camera comprises a body 1 having a body mount 2 made of electrically conductive material integrally coupled thereto by means of screws 3, and a lens having a barrel 4 to which a lens mount 5 made of electrically conductive material is coupled by means of screws 6. The mounts 2 and 5 have electrical contacts which are located so as to connect to one another when the lens is mounted on the camera body. More specifically, the mounts 2 and 5 have switching electrical contacts 7 and 8 which are paired to transmit from the lens to the camera body data which is required to control automatically the aperture value of a diaphragm of the lens, and electrical contacts 9 and 10 which are paired to transmit to the camera body data related to inherent aperture values (aperture opening values and minimum aperture values) which differ according to the lens employed. The data may be in the form of currents or other electrical quantities which are determined by resistances or the like.

The lens barrel 4 can be mounted on the camera body 1 by means of a conventional bayonet coupling. Immediately before the lens barrel 4 is coupled to the camera body 1, a lock pin 11 elastically protruding from the body mount 2 is inserted into a lock groove 12 formed in the lens mount 5 to lock the lens barrel 4 in such a manner that the above-described pairs of electrical

contacts are engaged with one another.

An aperture preset ring 13 is rotatably mounted around the outer wall of the lens barrel 4. Manual aperture markings 14 indicating that the lens is in a manual operation mode and an automatic aperture marking 15 indicating that the lens is in an automatic operation mode are marked on the outer surface of the ring 13.

The switching electrical contacts 7 and 8 will now be described in more detail with reference to Figures 2, 3 and 5 to 7. The electrical contact 7 is electrically insulated from the body mount 2 by a collar 7a. One end face of the contact 7 is in contact with a substrate 16 connected to a circuit (not shown), while the other end face thereof is recessed from a surface 2a of the body mount 2. The electrical contact 8 on the lens to be engaged with the contact 7 is slidably fitted in a hole 8a formed in a surface 5a of the lens mount 5. One end portion of the contact 8 is supported by an end portion of an L-shaped plate 18, the plate 18 being slidably received in a guide groove 20 formed in an outer wall of the lens barrel 4. A compression spring 17 is inserted between the electrical contact 8 and the lens barrel 4 to urge the contact 8 elastically into a position wherein it protrudes from the surface 5a of the lens mount 5. A pin 19 is provided at one end of the sliding (horizontal) part of the plate 18, and engages within an elongate groove 22 formed in the radially inner surface of the aperture preset ring 13.

When any one of the manual aperture markings 14 on the aperture preset ring 13 is aligned with an index marking (not shown) on the lens barrel 4, the pin 19 abuts against the side wall of the groove 22, as shown in Figures 2 and 6, so that the electrical contact 8 is prevented from protruding from the surface 5a of the lens mount 5. On the other hand, when the automatic aperture marking 15 on the aperture preset ring 13 is aligned with the index

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marking, the pin 19 drops into a V-shaped notch 21 formed in the side wall of the groove 22, as shown in Figures 3 and 7, as a result of which the contact 8 engages the contact 7 by being extended from the mount surface 5a by the elastic force of the compression spring 17. The guide groove 20 operates to guide the movement of the plate 18 when the lens is switched from the manual aperture control mode to the automatic aperture control mode and vice versa, and to prevent rotation of the plate 18 around the contact 8 when the pin 19 is shifted from the notch 21 to the elongate groove 22.

Referring now to Figure 4, each of the electrical contacts 9 is electrically insulated from the body mount 2 by a respective collar 9a and is in electrical contact with a substrate 16 as it protrudes from the surface 2a of the body mount 2 under the action of a compression spring 17a. The corresponding electrical contact 10 on the lens is fixedly secured to the lens mount 5. When the lens is mounted on the camera body, the pairs of contacts 9 and 10 become mutually engaged to complete a circuit whereby data can be transmitted from the lens to the camera body.

The operation of the camera described above will now be described. When the photographing lens has been mounted on the camera body in the manual aperture control mode (Figures 2 and 6), the pin 19 is engaged with the side wall of the elongate groove 22 in the aperture preset ring 13 so that the contact 8 supported by the plate 18 is retracted from the surface 5a of the lens mount 5 against the elastic force of the compression spring 17. That is, the contact 8 is disengaged from the electrical contact 7. For automatic aperture control, the aperture preset ring 13 is turned to the automatic aperture control position, whereupon the pin 19 drops into the notch 21 under the

elastic force of the compression spring 17, as a result of which the plate 18 moves along the guide groove 20. That is, the switching electrical contact 8 is extended from the mount surface 5a to engage the electrical contact 7 on the camera body, as a result of which the contact 8 is connected through the contact 7 to electrical circuitry in the camera body.

If the photographing lens is mounted on the camera body when the aperture setting ring 13 is set to its automatic aperture control position, the contact 8 is brought into engagement with the body mount 2 and the electrical contacts 9. However, after the lens has been completely mounted on the body, the contact 8 engages the contact 7 on the camera body while the pairs of electrical contacts 9 and 10 are brought into contact with one another. On the other hand, if the photographing lens is removed from the camera body when the aperture setting ring 13 is set to the automatic aperture control position, the circuit is opened at the instant when the contact 8 on the lens is disconnected from the contact 7 on the camera body.

As described above, the plate 18 is moved along the guide groove 20 as the aperture preset ring 13 is turned from the manual aperture control position to the automatic aperture control position or vice versa. In this operation, the plate 18 and the electrical contact 8 are moved smoothly due to the compression spring 17. The guide groove 20 not only guides the plate 18, but also prevents deformation of the plate 18 when the pin 19 is shifted from the notch 21 to the groove 22 as the lens is switched from automatic aperture control to manual aperture control.

With this arrangement, a wide choice of material, thickness and configuration is available for the switching plate. Therefore, the number of components required is small, and the components are simple in configuration which facilitates their assembly. Moreover, only a small space is required for the installation of these components.



C L A I M S :

1. A camera operable in a first mode wherein aperture value is set manually and a second mode wherein aperture value is set automatically, the camera comprising a body, a lens which can be detachably mounted on the body, an aperture setting member provided on the lens and movable between a plurality of positions to adjust the aperture value of the lens during operation of the camera in said first mode, the aperture setting member being moved to an additional position for operation of the camera in said second mode, first and second electrical contacts which are provided respectively on the body and on the lens and which are mutually aligned when the lens is mounted on the body, the second contact being movable with respect to the lens between an extended position in which it can engage the first contact and a retracted position in which it cannot engage the first contact, the second contact being disposed in one of its extended and retracted position when the aperture setting member is in any of said plurality of positions and being disposed in the other of its extended and retracted positions when the aperture setting member is disposed in said additional position.

2. A camera as claimed in Claim 1, wherein the second contact is retracted into the lens when the aperture setting member is in any of said plurality of positions and is extended therefrom when the aperture setting member is in said additional position.



3. A camera as claimed in Claim 1 or 2, wherein the second contact is biased into its extended position.
4. A camera as claimed in Claim 1, 2 or 3, wherein the aperture setting member is movable circumferentially with respect to an optical axis of the lens, and the second contact is moved between its extended and retracted positions by means of a cam surface on the aperture setting member.
5. A camera as claimed in Claim 4, wherein the aperture setting member has an elongate groove therein on one side wall of which forms said cam surface, and the second contact is mounted on an operating member having an abutment which is biased into engagement with said one side wall of the elongate groove.
6. A camera as claimed in Claim 5, wherein the operating member is substantially L-shaped and has a first leg on which the second contact is mounted and a second leg which is slidably received in a guide groove in the lens.
7. A camera as claimed in Claim 5 or 6, wherein the abutment is in the form of a pin, and the cam surface includes a notch in which the pin engages when the second contact is in said other of its extended and retracted positions.
8. A camera as claimed in Claim 7, wherein the elongate groove extends circumferentially with respect to said optical axis, and the notch extends from the elongate groove in a direction towards the body when the lens is mounted on the body.



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9. A camera as claimed in any preceding claim, wherein the first electrical contact is recessed into the body.

10. A camera as claimed in any preceding claim, wherein the body and the lens have respective electrically conductive surfaces which are in face engagement when the lens is mounted on the body, and the first and second contacts are provided in said surfaces respectively, the first contact being insulated from said conducting surface on the body by means of an insulating collar.

11. A camera as claimed in claim 10, wherein the insulating collar is fixed relative to said conducting surface on the body, and the first contact is slidable through a central opening therein.

12. A camera substantially as hereinbefore described with reference to the accompanying drawings.

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