

ELECTRICAL CONTACT ARRANGEMENT FOR AN INTER-
CHANGEABLE LENS AUTOMATIC CAMERA

5 The present invention relates to an electrical contact arrangement adapted for electrical transmission of various items of information concerning a lens to a camera body, and particularly to a contact arrangement in an interchangeable-lens camera for electrical transmission of specific diaphragm values (fully opened diaphragm value, fully closed diaphragm value) and switching information such as AUTO (automatic diaphragm control) and MANUAL (manual diaphragm control) of the lens to the camera body.

10 A photographic camera of automatic exposure control type can be operated in two modes, i.e., a first mode in which the exposure time (shutter speed) is set by the photographer. Dependent upon the exposure time thus set the required lens aperture is calculated for automatically obtaining a proper exposure. This mode is generally referred to as the automatic exposure control of shutter priority type. In the second mode a desired diaphragm value is preset by the photographer and the corresponding exposure time is automatically controlled on the basis of the preset diaphragm value so that shutter operation at said exposure time gives a proper exposure. This mode is generally referred to as the automatic exposure control of diaphragm priority or aperture priority type.

25 For convenience of explanation, in this specification the first former mode will be referred to simply as AUTO (automatic diaphragm control) and the second mode will be referred to simply as MANUAL (automatic shutter control) in the following description. It should be appreciated that the term "MANUAL" is used as in a broad sense to include also the case where photography is carried out with the diaphragm and the shutter speed both being optionally determined by the photographer.

30 With a photographic camera in which one of these two modes are selectively used to perform photography by utilizing

a single camera body and various lenses interchangeably mounted on this camera body, it is necessary to transmit information concerning the respective lenses, such as the fully opened diaphragm value and the fully closed diaphragm value of the particular lens, to the associated camera body, as described in the Japanese Patent applications of the present applicant, Nos. 1980-10978 and 1980-19965 (corresponding U.K. patent applications Nos. 81 03064 and 81 05224).

For automatic exposure control and display of shutter speed or diaphragm value based thereon, it has generally been arranged for the information concerning the respective interchangeable lenses such as the fully opened diaphragm value and the fully closed diaphragm value to be mechanically transmitted to the camera body when the lens has been mounted on the camera body. However, such a mechanical solution has been disadvantageous in that the information transmission at high precision necessarily complicates the mechanism and makes it bulky, resulting in a high price for the respective interchangeable lenses.

The said prior patent applications have proposed, as a solution to this, transmitting the information concerning the lens from the lens directly to the camera body by means of electrical signals passing through electrical contacts arranged on mounts of the camera body and the lens, respectively, and projecting from the associated mounts so that the circuit is closed simultaneously when the lens is mounted on the camera body. With such arrangement, however, there arise problems concerning the information transmission to the electrical contacts on the camera body for AUTO and MANUAL, respectively. For example, reading of the specific diaphragm values is interrupted under intervention of the contact engagement for transmission of the information concerning the fully opened diaphragm value and the fully closed diaphragm value, the mount clamping screws and the lock groove. Furthermore, the power source tends to be prematurely consumed due to the circuit design. Display of control as well as arithmetic operation also involve problems to be solved.

In accordance with the invention there is provided an electrical contact arrangement in an interchangeable lens camera for transmitting diaphragm values and switching information of individual interchangeable lenses, said contact arrangement comprising

5 a plurality of pairs of electrical contacts serving for transmission of information concerning the specific diaphragm values and a pair of electrical contacts serving for transmission of switching information, the members of each pair being associated with the camera body mount and the lens mount, respectively, wherein each of

10 said mounts is made of an electrically conductive material, said plurality of pairs of electrical contacts being so arranged that, on the camera body, they are normally biased to project from the associated mount surface while, on the lens, they are fixed against projection from the associated mount surface; said one pair of

15 electrical contacts being so arranged that, on the camera body, one of the pair is fixed against projection from the associated mount surface while, on the lens, the other of the pair is normally biased to project from the associated mount surface, and wherein operation of a switching member causes said one pair of electrical

20 contacts for transmission of switching information to be closed or open.

Embodiments of the invention will be described which enable the transmission and read-out of specific diaphragm value information simultaneously when the lens has completely been mounted on

25 the camera body and thereupon the circuit is energised, in AUTO photography, without the previously mentioned problems, particularly, transmission of erroneous specific diaphragm value information due to the mounting operation of the lens.

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The preferred embodiments will be described in more detail, by way of example, with reference to the drawings in which:-

Fig. 1A is a front view partially showing a camera body;

Fig. 1B is a perspective view showing a lens barrel to be

35 coupled to said camera body;

Fig. 2 illustrates AUTO/MANUAL switching contacts during AUTO photography in a vertical section taken along the important portion thereof;

Figure 3 illustrates said switching contacts during MANUAL photography in the similar vertical section;

Figure 4 illustrates another embodiment in the similar vertical section; and

5 Figure 5 illustrates specific diaphragm value contacts in a vertical section taken along the important portion thereof.

Figure 1A is a front view showing part of a camera body 1 provided with a mount 2 comprising a brass piece plated to render it electrically conductive and integrally clamped by screws 31 on to the camera body 1. Figure 1B is a perspective view showing a lens barrel 3 to be coupled to the mount 2 of the camera body 1 shown in Figure 1A. This lens barrel 3 is also provided with a mount 4 comprising a brass piece plated to render it electrically conductive and integrally clamped by screws 22 thereon. These mounts 2, 4 are respectively provided with electrical contacts so that corresponding pairs of electrical contacts of the respective mounts are opposed to each other. These electrical contacts comprise pairs serving to transmit information depending upon the manner in which the camera is to be used, i.e. AUTO or MANUAL, from the lens to the camera body 1, and pairs serving to transmit information concerning specific diaphragm values (fully opened diaphragm value and fully closed diaphragm value) of the individual lenses in the form of electrical current or other electrical quantity determined by electrical factors such as a resistance value.

25 The lens barrel 3 shown by Figure 1B is coupled by a bayonet engagement as seen in Figures 1A and 1B in a well-known manner to the camera body 1 and, at the end of the rotation of the lens barrel 3 for such coupling, a lock pin 23 biased to project from the mount 2 is engaged into a lock groove 21 formed in the mount 4. In this condition the respective pairs of electrical contacts are brought into the relationship of mutual opposition.

30 The respective mounts and the electrical contacts arranged thereon have a unique construction as shown by Figures 2 to 5. First, the contact arrangement for AUTO/MANUAL switching will be

closely described in reference with Figures 2 and 3. Figure 2 shows the manner in which the contacts are connected as the switching member, such as a diaphragm operating ring 11, is operated for AUTO photography, and Figure 3 shows another manner of connection made when MANUAL photography is prepared by operation of said switching member.

On the camera body 1, each contact pin 6 is insulated by a collar 5 from the mount 2 of the camera body 1 and is in contact with a base plate 7 which is, in turn, connected to an electrical circuit (not shown), and said pin 6 is fixed as shown. Each contact pin 8 received in a hole formed in the mount 4 of the lens, on the other hand, is biased by a spring 9 to project from the surface of said mount 4 of the lens. A switching plate 10 has one of its ends serving to hold said contact pin 8 within a hole provided thereon and its other end is adapted to be directed by a bent portion 10a towards a relay ring 12 adapted to be rotated together with the diaphragm operating ring 11. Reference numeral 14 designates a notched groove adapted to limit rotation of the switching plate 10 around the contact pin 8. With such arrangement as mentioned above, the switching plate 10 is engaged at the other end into a recess 13 formed in the relay ring 12 and, as a result, the contact pin 8 is now influenced only by the spring 9 so that said contact pin 8 of the lens actually projects and engages the contact pin 6 on the camera body 1 to close the circuit. When the diaphragm operating ring 11 is rotated from the AUTO position (shown by Figure 2) to the MANUAL position for switching to the state preparatory for MANUAL exposure, the outer end of the bent portion 10a which has been engaged into the recess 13 is now urged out of this recess 13, and thereby the switching plate 10 is swung around the bent portion 10a so that the contact pin 8 held by said switching plate 10 is retracted below the surface of the mount 4 and thereby disengaged from the contact pin 6 of the camera body 1 to open the circuit.

Figure 4 illustrates another embodiment of AUTO/MANUAL switching contacts in a detail vertical section, in which each

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contact pin 15 insulated by a collar 16 from the mount 4 of the lens is biased by a free end of a contact spring 17 fixed to the lens barrel 3 so that said contact pin 15 is normally biased to project from the outer surface of the mount 4 of the lens. Figure 4 illustrates the arrangement as set to the MANUAL state, in which the lower end of the contact spring 17 is engaged into the recess 13 formed in the relay ring 12 and thereby said contact spring 17 is disengaged from the mount 4 of the lens to open the circuit. When the diaphragm operating ring 11 is rotated from this state to the AUTO state, a projection of the relay ring 12 continuous from said recess 13 urges the contact spring 17 and thereby brings the lower end of the contact spring 17 into contact with the mount 4 of the lens to close the circuit.

Figure 5 illustrates a contact arrangement for transmission of the specific diaphragm values in a detail vertical section of the camera body 1 and the lens barrel 3 coupled thereto. Each contact pin 18 insulated by the collar 5 from the mount 2 of the camera body is biased by a spring 19 to project from the outer surface of the mount 2 associated with the camera body 1 and electrically connected with the base plate 7. Each pin 20 stationarily arranged on the mount 4 of the lens, is made of a conductor (metal) or an insulator (plastic), to close or open the circuit respectively as the lens is coupled to the camera body and thus enable the desired switching. When this pin 20 is utilized to close the circuit, said pin 20 can be replaced by the lens mount 4, since the latter is made of electrically conductive material. It should be realised that when the specific diaphragm values are subjected to analog processing, a specific resistance is used and, when said specific diaphragm values are digitally processed, no contact for ON-signal is required.

The contact arrangement constructed as mentioned above provides the following effects. The electrical contacts on the mount 4 of the lens can be discretionarily arranged and transmission of the information concerning the mode conversion or switching between AUTO and MANUAL can be accomplished upon complete coupling

of the lens to the camera body, since the pins 20 serving for transmission of the specific diaphragm values are stationarily provided while the contacts 8 or 15 for AUTO/MANUAL switching are movably provided. Furthermore, provision of the electrical contacts on the mutually opposed surfaces of the respective mounts 2 and 4 both being conductive leads to various advantages as follows:

- a) It is possible to arrange a plurality of contacts (increase of the number of information items);
- b) the precision at which the respective pairs of electrical contacts are engaged with each other is improved;
- c) influence upon rear lens groups is eliminated;
- d) no contact for ON-signal is required if the specific diaphragm value signals are digitally processed, facilitating assembly thereof;
- e) the electrical contacts on the lens for transmission of AUTO/MANUAL switching, if the mounts are normally in engagement with each other (shown by Figures 2 and 3), are turned ON or OFF depending upon the projection or non-projection of the contact pin 8 with respect to the mount 4 of the lens and, in the embodiment of Figure 4, the contact spring 17 provided on the mount 4 of the lens enables ON/OFF switching so that neither an ordinary switch nor lead wire is required and assembly thereof is accordingly facilitated; and
- f) no electrical contact for earthing is needed.



CLAIMS:

1. An electrical contact arrangement in an interchangeable lens camera for transmitting diaphragm values and switching information of individual interchangeable lenses, said contact arrangement comprising a plurality of pairs of electrical contacts serving for transmission of information concerning the specific diaphragm values and a pair of electrical contacts serving for transmission of switching information, the members of each pair being associated with the camera body mount and the lens mount, respectively, wherein each of said mounts is made of an electrically conductive material, said plurality of pairs of electrical contacts being so arranged that, on the camera body, they are normally biased to project from the associated mount surface while, on the lens, they are fixed against projection from the associated mount surface; said one pair of electrical contacts being so arranged that, on the camera body, one of the pair is fixed against projection from the associated mount surface while, on the lens, the other of the pair is normally biased to project from the associated mount surface, and wherein operation of a switching member causes said one pair of electrical contacts for transmission of switching information to be closed or open.

2. An electrical contact arrangement according to Claim 1, wherein said one pair of electrical contacts serving for transmission of the switching information are switched by operation of the switching member between its first position in which the contacts on the lens normally under biasing effect actually project from the associated mount surface to close the circuit and its second position in which said contacts retract again into said associated mount surface to open the circuit.

3. An electrical contact arrangement according to Claim 1, wherein said one pair of electrical contacts serving for transmission of the switching information are insulated from the



mount associated with the lens and switched by a contact spring between its first position at which these contacts close the circuit and its second position at which they open the circuit.

4. An electrical contact arrangement according to Claim 1, wherein said plurality of electrical contacts on the lens mount for transmission of specific diaphragm values comprise stationary insulators with respect only to OFF-signal when said specific diaphragm values are to be digitally transmitted.
5. An electrical contact arrangement in an interchangeable-lens camera, substantially as herein described with reference to the drawings.
6. An interchangeable lens for use in a contact arrangement in accordance with any preceding claim.

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