

PATENT SPECIFICATION

(11) 1246 671

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DRAWINGS ATTACHED

- (21) Application No. 40203/68 (22) Filed 14 Oct. 1968
 (31) Convention Application No. P 15 97 387.2
 (32) Filed 14 Oct. 1967 in
 (33) Germany (DT)
 (45) Complete Specification published 15 Sept. 1971
 (51) International Classification G 03 b 19/20, 9/00
 (52) Index at acceptance
 G2A 12A1 14A4B 14A4C5B 14A4C5C 14A7 14AX3 14AX6
 14B 2F



(54) A SINGLE LENS HINGED-MIRROR-REFLEX CAMERA

(71) We, FRANKE & HEIDECHE G.M.B.H., A German Body Corporate, trading as Rollei-Werke Franke & Heidecke, of 196 Salzdahlumerstrasse, Braunschweig, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a single lens hinged-mirror-reflex camera with focal-plane shutter and pre-set lens diaphragm coupled therewith.

It is desirable to provide such a camera with a between-the-lens shutter, since focal-plane shutters are not universally usable for all practical tasks, thus for example they are not usable for flash exposures in daylight with very short exposure times such as are usual for example in the "fill-in" technique.

In single lens hinged-mirror-reflex cameras with a between-the-lens shutter and pre-set diaphragm the between-the-lens shutter is ordinarily opened in cocking or in the actuation of the coupled film winding. On release the between-the-lens shutter initially closes, whereupon the drive mechanism of the camera hinges up the mirror and clears the film gate; at the same time the diaphragm is stopped down to the pre-set value or the value controlled by the exposure meter, whereupon the actual shutter release then takes place. The return of the hinged mirror to a position ready for setting is effected by the renewed cocking of the camera and of the shutter.

Focal-plane shutters *per se* permit extremely short exposures. However, in the case of flash exposures the exposure time must be adapted to the flash duration. Either the flash duration must be shorter than the duration of the shutter opening, if uniform exposure of the image field is to be achieved, or the flash duration must be adapted to the time of running-off the curtain-type shutter, for which purpose special flash bulbs are necessary. In

the former case the exposure time must not be substantially shorter than about 1/30th second; in the latter case with shorter exposure times the flash is only partially utilised, so that the focal-plane shutter is only partially suitable for the so-called "fill-in" technique, in which daylight exposures are brightened with flashlight.

According to the present invention there is provided a single lens hinged-mirror reflex camera having a focal-plane shutter, a pre-settable lens diaphragm and a between-the-lens shutter, wherein a coupling mechanism is provided connecting the focal-plane shutter to the lens diaphragm and wherein the between-the-lens shutter is connected to said coupling mechanism, whereby upon operation of the camera release the between-the-lens shutter, which is open both in the uncocked and in the cocked condition of the camera, is firstly closed, the diaphragm being closed down to its pre-set value at the same time, then after opening of the focal-plane shutter, the between-the-lens shutter opens and closes and thus effects the exposure whereupon after the closing of the focal-plane shutter, the lens diaphragm is fully opened again and likewise the between-the-lens shutter also opens up fully again.

The advantages of both kinds of shutter can be exploited according to desire. The handling of the camera takes place as usual, that is to say it is handled like a focal-plane shutter camera and only when the between-the-lens shutter is cocked does it automatically come into function. Moreover nothing is changed in the assembly of the camera by the arrangement according to the invention, so that it is even possible for focal-plane shutter cameras of the type in question to be converted by a simple attachment of the between-the-lens shutter lenses according to the invention into combined focal-plane shutter — between-the-lens shutter cameras and *vice versa*. Where interchangeable lenses are used it is possible according to choice to exchange those

with for those without a between-the-lens shutter without anything changing in the handling of the camera. It is merely to be ensured that when the between-the-lens shutter is used the opening time of the focal-plane shutter, that is the time during which the film gate is fully open, is greater than the exposure time of the between-the-lens shutter. It is sufficient if the between-the-lens shutter is designed for exposure times of 1/30th second and shorter, since in general for longer instantaneous exposure times there is no necessity for the use of the between-the-lens shutter in place of the focal-plane shutter. If the between-the-lens shutter is opened both in the cocked and in the run-off condition, it can be used in the same way both on focal-plane shutter cameras where the mirror-return into the set position is effected by the film winding or the cocking of the focal-plane shutter, and also, without particular measures of a constructive or gearing nature, in combination with mirror-reflex focal-plane shutter cameras where the mirror is transferred again or returned into the set position automatically immediately after the exposure. It is merely to be ensured that when the between-the-lens shutter is used the focal-plane shutter is set to a sufficiently long exposure time so that it is ensured that the focal-plane shutter has opened the film gate fully during the exposure time of the between-the-lens shutter. This is achieved by setting of the focal-plane shutter to a half second or a second or even to "B". If the photographer overlooks this instruction, incorrect exposures can result. However, additional safety precautions can be taken against this, which for example prevent the cocking of the between-the-lens shutter in the case of the excessively short focal-plane shutter exposure times.

The position of the between-the-lens shutter cocking handle on the lens or a corresponding signal can make it possible for the photographer to know when the between-the-lens shutter is in action. If following upon an exposure with the between-the-lens shutter an exposure is to be effected with the focal-plane shutter, then the exposure time of the focal-plane shutter must be examined and re-set. If this re-setting is omitted, admittedly errors can occur, generally over-exposures or blurred pictures.

Both manipulations, namely the setting of longer exposure times before the cocking of the between-the-lens shutter and the re-setting of a short exposure time after execution of the exposure with the between-the-lens shutter, also the special positioning of the cocking handle, become superfluous if the running-off catch of the second focal-plane shutter curtain is connected with the cocking or main drive member of the between-the-lens shutter in such manner that it is effective when the between-the-lens shutter has run-off.

When the focal-plane shutter is set to the "B" time, as is known on actuation of the release the running-off of the first curtain is liberated and at the same time the running-off catch is brought into the running-off path of the second focal-plane shutter curtain, which is effective as long as the release is actuated, so that only on liberation of the release is the second curtain released and the film gate can close again. If this existing running-off catch, or an additional one, is coupled in the stated manner with the between-the-lens shutter, then independently of the time setting of the focal-plane shutter the object is achievable and ensured that the film gate is opened during the running-off of the between-the-lens shutter and closes again after the running-off of the between-the-lens shutter.

A constructional embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

Fig. 1 shows the parts of a camera according to the present invention, for operating the diaphragm of the camera;

Fig. 2 shows, in their rest position, the parts of the camera for operating a between-the-lens shutter of the camera;

Fig. 3 shows the parts shown in Fig. 2 when the between-the-lens shutter is cocked.

Fig. 4 shows the same parts during the running-off of the between-the-lens shutter;

Fig. 5 shows the same parts after the running-off of the between-the-lens shutter and the termination of an exposure.

In a hinged-mirror reflex camera there is provided a locking member 1 which engages the hinged mirror of the camera so that the member 1 carries out a reciprocating rotation when the mirror pivots about its hinge. When the mirror pivots upwardly directly before the exposure, the member 1 moves in direction of the arrow B and when the mirror pivots downwardly to return to its position ready for setting of the camera, the member 1 moves in the direction of the arrow A.

On the between-the-lens shutter there are provided a multi-armed lever 5, a fork lever 14, and a cam disc 3 having a radial step 4, said levers and said disc being rotatably mounted on pin 2. The cam disc 3 carries projections 6 between which a radial arm 7 of the lever 5 extends so that the lever 5 has a slight peripheral play relative to the element 3. A hairpin spring 10 is arranged between a pin 8 of the lever 5 and a pin 9A of a diaphragm blade mounting ring 9 which spring seeks to rotate the lever 5 in a counter clockwise direction and thus keeps the radial step 4 in abutment with the member 1. A diaphragm blade driving ring 11 is coupled with the lever 14 by means of a pin 12 carried by the ring 11 engaging a fork 13 of the lever 14.

The ring 11 is urged in a clockwise direc-

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tion by a spring (not shown) so that by its driving pins 11A it seeks to close the diaphragm blades 11B mounted on pins 11C of the ring 11 (only one of each of the elements 11A, 11B and 11C being shown) and at the same time seeks to rotate the lever 14 due to the engagement of the pin 12 with the fork 13.

The lever 14 is provided with a projection 15 which abuts a pin 16 of the lever 5 which as hereinbefore mentioned engages the cam element 3 due to its arm 7 extending between the projections 6. Thus the lever 14 cannot rotate unless the cam element 3 rotates and therefore the ring 11 cannot close the diaphragm blades until the cam element 3 is released by the member 1.

On the between-the-lens shutter there is provided a diaphragm aperture setting ring (not shown) having a diaphragm scale and carrying a cam 17 which lies in the path of the pin 18 and prevents the closing of the diaphragm beyond a set value. When the step 4 is released by the member 1 the ring 11 rotates to close the blades 11B until the pin 18 abuts the cam 17. For fine adjustment the pin 18 is eccentrically adjustable in the lever 14.

In the case of interchangeable lenses when the lens is removed the radial step 4 is released and moves in the direction of the arrow B so that the diaphragm closes to the value determined by the cam 17. The direction of screwing-in of the interchangeable lens is therefore preferably selected so as to be in the direction of the arrow B so that on reattachment of the lens the step 4 abuts the member 1 and is therefore rotated about the axis of the cam element in the direction of the arrow A so that the diaphragm is automatically opened.

A hub 19 of the lever 5 is provided with a cut-away section extending around approximately half of the hub so that edges 20 and 21 are produced which can co-operate with two pawl recesses 23 and 24 in a pawl 22. The pawl 22 is pivotable about a pin 25 of a control ring 26 and is subjected to the tension of a hairpin spring 27 which maintains the engagement of the pawl 22 with the hub 19.

Shutter blades 28A (only one being shown) are mounted in a known manner between a blade main drive and shutter cocking ring (not shown) and a rotatable blade mounting ring 28. The blade mounting ring 28 is coupled with the control ring 26 by means of a lug 29, provided on the ring 28 engaging a recess provided in the control ring 26. When the blade main drive ring is stationary it is possible to open and close the between-the-lens shutter by rotation of the blade mounting ring 28. In the rest position the shutter blades 28A are opened and on movement of the blade mounting ring 28 or of the control ring 26 into the other limit position they are closed.

The actuation of the between-the-lens shutter by a shutter release lever 30 is effected by a lug 31 of the control ring 26 engaging the lever 30.

The control ring 26 is connected by a spring 32 with a cocking lever 33, a drive spring 34 of which is attached to a pin 35 on the camera housing. A cocking handle 36 pivotable about the shutter axis is provided with two projections 37 and 38. The projection 38 co-operates with a between-the-lens shutter cocking ring lug 39 and the projection 37 co-operates with cocking lever lug 40. A pin 42 is mounted on a lever 44 pivotable about a pin 43 mounted on the control ring 26. The lever 44 is provided with a cam 45 which lies in the path of the lug 39.

In order to cock the camera cocking handle 36 is rotated in an anti-clockwise direction so that the projection 38 moves the lug 39 whereby the between-the-lens shutter is cocked and the projection 37 then engages the lug 40 and cocks the lever 33 by rotating it in an anti-clockwise direction about an axis coaxial with the axis of the hub 19 so that the spring 34 is tensioned. At the same time, the control ring 26 moves in an anti-clockwise direction under the tension of the spring 32 until the recess 23 engages the edge 20. On continued movement of the lever 33 the pin 42 drops down behind a projection 41 of the lever 33 and the springs 32 and 34 are fully tensioned. The parts are then in the position shown in Fig. 3.

On release of the camera mechanism for making an exposure the mirror pivots upwards by the mirror drive mechanism not shown. The mirror drive mechanism actuates the locking member 1 which moves in the direction of the arrow B and causes the hub 19 to rotate in an anti-clockwise direction. The locking member 1 releases the disc 3 so that the disc is rotated by the spring 10 and the diaphragm closes to an extent determined by the pin 18 abutting on the cam 17.

The mirror drive mechanism, at the same time as it causes the locking member 1 to move, effects actuation of the focal-plane shutter via release means (not shown) coupled to move simultaneously with the locking member 1. The focal-plane shutter is of the known kind comprising a pair of curtain shutters arranged to run off in sequence under the control of the focal-plane shutter release means.

The rotation of the hub 19 causes the recess 23 to be disengaged from the edge 20. The control ring 26 is therefore free to move in a clockwise direction and is so moved by the spring 34 which rotates the cocking lever 33, moving the control ring 26 with it by engagement of the projection 41 with the pin 42. This movement closes the between-the-lens shutter. The pawl 22 travels over the hub 19 until its recess 24 engages the edge 21 whereby the

clockwise movement of the control ring 26 is arrested. During movement of the control ring 26 the lug 31 carried by the control ring 26 actuates the release lever 30 so that the blade main drive ring is free to rotate in a clockwise direction whereby the blades 28A are opened and closed for exposure by means (not shown but known *per se* see patent specification no. 991,122) causing additional relative movement between the shutter cocking ring (not shown) and the blade ring 28. The focal plane shutter, which opens during the initial running off operation of the mirror drive mechanism then closes again.

The shutter cocking ring (not shown) is held in its cocked position by means of the release lever 30 which engages means projecting from said cocking ring. Actuation of the lever 30 by the lug 31 causes the shutter cocking ring to be released to run off under the influence of its spring.

The clocking lug 39 of the blade main drive ring engages the cam 45 during operation of the between-the-lens shutter and thereby pivots the lever 44 so as to release the engagement between the projection 41 and pin 42. The spring 32 then seeks to rotate the control ring 26 in an anticlockwise direction and the control ring 26 is thus rotated when the recess 24 of the pawl 22 is released from the edge 21 which occurs when the mirror pivots downwardly and thereby rotates the hub 19. This is towards the end of the running down movement of the mirror mechanism when the latter commences its closing movement and the locking member 1 moves in the direction of the arrow A. Due to the movement of the control ring 26 in an anticlockwise direction in relation to the cocking lever 33 the shutter blades are opened again by means of the lug 29. This movement of the member 1 in the direction of the arrow A also rotates cam 3 clockwise and so causes the lever 14 to be released and the blade driving ring 11 is thereby allowed to open fully the diaphragm blades 11A. The mirror then automatically returns to the viewfinding position after exposure.

Between the between-the-lens shutter release 30 and the actual main drive running off catch in the between-the-lens shutter or at any suitable point a pre-timer mechanism is placed which allows the between-the-lens shutter exposure to be effected only when the focal-plane shutter is fully opened. For this purpose a pre-timer mechanism release delay of about 150 ms is necessary, depending upon the construction of the focal-plane shutter.

Co-operation of the pawl 22 with the hub 19 is precluded as long as the between-the-lens shutter is not cocked afresh, while in every case, that is even when the between-the-lens shutter is not cocked, the coupling of the hinged mirror with the lens diaphragm 11 remains unchanged.

If in the case of interchangeable lenses the between-the-lens shutter is cocked when the lens is taken off, it runs off immediately because the pawl 22 finds no resistance and therefore the control ring 26 cannot be held fast in the cocked position. In this case also no actuation of the focal-plane shutter takes place, so that no incorrect exposure can occur. Only if the between-the-lens shutter is deliberately cocked with the lens attached will the between-the-lens shutter operate, when the camera shutter release of the focal-plane shutter is actuated.

It is possible to provide a manual disengaging device for the pawl 22, if after cocking the between-the-lens shutter the photographer should reverse his decision and still want to carry out an exposure with the focal-plane shutter. In this case by disengaging the pawl it is possible to cause the between-the-lens shutter to run off independently without an exposure taking place.

It can also easily be seen that by an additional linkage it is possible to prevent the engagement of the pawl 22 with the edge 23 and thus the cocking of the between-the-lens shutter at all, if the focal-plane shutter is not set to the requisite adequately long exposure time or by means of the control ring 26, or by the cocking lever 33 through a linkage, to engage the existing running-off catch or an additional running-off catch for the second curtain when the between-the-lens shutter is cocked, which catch is automatically effective as long as the control ring has left its rest position. In this way on cocking of the between-the-lens shutter the focal-plane shutter is automatically switched over to the "B" setting without any change being made in the setting of the focal-plane shutter time-setting mechanism. After the execution of the exposure with the between-the-lens shutter the original exposure condition of the focal-plane shutter is thus automatically restored.

The present arrangement has the advantage that with the usual slight setting forces which are available for the setting of the lens diaphragm from the focal-plane shutter drive mechanism, the control of the between-the-lens shutter can be effected without appreciable additional loading of the springs normally used and without the need to dispense with the necessary safety devices.

WHAT WE CLAIM IS:—

1. A single lens hinged-mirror reflex camera having a focal-plane shutter, a pre-settable lens diaphragm and a between-the-lens shutter, wherein a coupling mechanism is provided connecting the focal-plane shutter to the lens diaphragm and wherein the between-the-lens shutter is connected to said coupling mechanism, whereby upon operation of the camera release the between-the-lens shutter, which is open both in the uncocked and in the cocked condition of the camera, is firstly

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clockwise movement of the control ring 26 is arrested. During movement of the control ring 26 the lug 31 carried by the control ring 26 actuates the release lever 30 so that the blade main drive ring is free to rotate in a clockwise direction whereby the blades 28A are opened and closed for exposure by means (not shown but known *per se* see patent specification no. 991,122) causing additional relative movement between the shutter cocking ring (not shown) and the blade ring 28. The focal plane shutter, which opens during the initial running off operation of the mirror drive mechanism then closes again.

The shutter cocking ring (not shown) is held in its cocked position by means of the release lever 30 which engages means projecting from said cocking ring. Actuation of the lever 30 by the lug 31 causes the shutter cocking ring to be released to run off under the influence of its spring.

The clocking lug 39 of the blade main drive ring engages the cam 45 during operation of the between-the-lens shutter and thereby pivots the lever 44 so as to release the engagement between the projection 41 and pin 42. The spring 32 then seeks to rotate the control ring 26 in an anticlockwise direction and the control ring 26 is thus rotated when the recess 24 of the pawl 22 is released from the edge 21 which occurs when the mirror pivots downwardly and thereby rotates the hub 19. This is towards the end of the running down movement of the mirror mechanism when the latter commences its closing movement and the locking member 1 moves in the direction of the arrow A. Due to the movement of the control ring 26 in an anticlockwise direction in relation to the cocking lever 33 the shutter blades are opened again by means of the lug 29. This movement of the member 1 in the direction of the arrow A also rotates cam 3 clockwise and so causes the lever 14 to be released and the blade driving ring 11 is thereby allowed to open fully the diaphragm blades 11A. The mirror then automatically returns to the viewfinding position after exposure.

Between the between-the-lens shutter release 30 and the actual main drive running off catch in the between-the-lens shutter or at any suitable point a pre-timer mechanism is placed which allows the between-the-lens shutter exposure to be effected only when the focal-plane shutter is fully opened. For this purpose a pre-timer mechanism release delay of about 150 ms is necessary, depending upon the construction of the focal-plane shutter.

Co-operation of the pawl 22 with the hub 19 is precluded as long as the between-the-lens shutter is not cocked afresh, while in every case, that is even when the between-the-lens shutter is not cocked, the coupling of the hinged mirror with the lens diaphragm 11 remains unchanged.

If in the case of interchangeable lenses the between-the-lens shutter is cocked when the lens is taken off, it runs off immediately because the pawl 22 finds no resistance and therefore the control ring 26 cannot be held fast in the cocked position. In this case also no actuation of the focal-plane shutter takes place, so that no incorrect exposure can occur. Only if the between-the-lens shutter is deliberately cocked with the lens attached will the between-the-lens shutter operate, when the camera shutter release of the focal-plane shutter is actuated.

It is possible to provide a manual disengaging device for the pawl 22, if after cocking the between-the-lens shutter the photographer should reverse his decision and still want to carry out an exposure with the focal-plane shutter. In this case by disengaging the pawl it is possible to cause the between-the-lens shutter to run off independently without an exposure taking place.

It can also easily be seen that by an additional linkage it is possible to prevent the engagement of the pawl 22 with the edge 23 and thus the cocking of the between-the-lens shutter at all, if the focal-plane shutter is not set to the requisite adequately long exposure time or by means of the control ring 26, or by the cocking lever 33 through a linkage, to engage the existing running-off catch or an additional running-off catch for the second curtain when the between-the-lens shutter is cocked, which catch is automatically effective as long as the control ring has left its rest position. In this way on cocking of the between-the-lens shutter the focal-plane shutter is automatically switched over to the "B" setting without any change being made in the setting of the focal-plane shutter time-setting mechanism. After the execution of the exposure with the between-the-lens shutter the original exposure condition of the focal-plane shutter is thus automatically restored.

The present arrangement has the advantage that with the usual slight setting forces which are available for the setting of the lens diaphragm from the focal-plane shutter drive mechanism, the control of the between-the-lens shutter can be effected without appreciable additional loading of the springs normally used and without the need to dispense with the necessary safety devices.

WHAT WE CLAIM IS:—

1. A single lens hinged-mirror reflex camera having a focal-plane shutter, a pre-settable lens diaphragm and a between-the-lens shutter, wherein a coupling mechanism is provided connecting the focal-plane shutter to the lens diaphragm and wherein the between-the-lens shutter is connected to said coupling mechanism, whereby upon operation of the camera release the between-the-lens shutter, which is open both in the uncocked and in the cocked condition of the camera, is firstly



- closed, the diaphragm being closed down to its pre-set value at the same time, then after opening of the focal-plane shutter, the between-the-lens shutter opens and closes and thus effects the exposure whereupon after the closing of the focal-plane shutter, the lens diaphragm is fully opened again and likewise the between-the-lens shutter also opens up fully again.
2. A camera as claimed in claim 1, wherein the mirror returns automatically into a view-finding position after an exposure.
3. A camera as claimed in claim 1 or 2, wherein a cocking catch of the between-the-lens shutter enables the between-the-lens shutter to be run off without exposure taking place if the exposure times are shorter than a desired amount.
4. A camera as claimed in any one of claims 1 to 3, having a pre-timer mechanism in the between-the-lens shutter for ensuring that the opening and closing of the between-the-lens shutter for exposure taken show when the focal-plane shutter is fully opened.
5. A camera as claimed in any one of claims 1 to 4, wherein a catch is provided which is coupled or couplable with a cocking member of the between-the-lens shutter and so controllable by the latter that it is inoperative when the between-the-lens shutter is uncocked or has run off.
6. A camera as claimed in any one of claims 1 to 5, wherein the between-the-lens shutter blades are arranged in between their main drive ring and a separate mounting ring, by which the shutter blades can be opened and closed independently of the condition of the shutter, and wherein this mounting ring is positively coupled with a control ring in such a way that when the latter is in its rest position the shutter blades are opened.
7. A camera as claimed in claim 6, wherein the control ring is connected with a cocking lever, which is cockable by a shutter-cocking lever, by means of a tension spring which urges the control ring into its rest position, and by a second lever which in the cocked position couples the cocking lever with the control ring in the cocked condition of the camera and during part of the running-off movement of the latter.
8. A camera as claimed in claim 7, wherein the second lever lies in the running-off path of a shutter main drive member in such a way that the coupling between the control ring and the cocking lever is disengaged during actuation of the between-the-lens shutter.
9. A camera as claimed in claim 6 or 7, having a pawl co-operating with a reciprocating diaphragm control shaft and pivotally mounted on the control ring, which pawl, upon cocking of the control ring, engages on the diaphragm control shaft and blocks the running-off of the control ring, liberation of the control ring being effected by the return of the diaphragm control shaft into its rest position.
10. A camera as claimed in any one of claims 7 to 9, wherein the shutter cocking lever is provided with projections which respectively drive the control ring and the shutter cocking mechanism in the direction of cocking the control ring.
11. A single lens mirror-reflex camera substantially as described with reference to and as illustrated in the accompanying drawings.

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