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 (72) Inventors: WILLIAM THOMAS HOCHREITER
 FREDRIC ALTON MINDLER



(54) PHOTOGRAPHIC CAMERA

(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America, of 343 State Street, Rochester, New York 14650, United States of America, 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 photographic camera and, more particularly, to an improved mechanism for preventing double exposure in a camera preferably having a self cocking shutter and a piezoelectric generator for flash operation.

In cameras of the type having a self cocking shutter, i.e. a shutter which is automatically cocked by the return of the shutter release member, it is known in the art to provide means for disabling the shutter to prevent a second shutter actuation prior to film advance. Generally such double exposure prevention means have taken the form of linkages that block the shutter release member of the camera and do not allow a second exposure to be made until a subsequent film advance operation has been completed. The linkage may be connected to the film metering mechanism and the blocking of the shutter release member is removed during the film advance operation.

Recently, apparatus has been developed in which a plurality of flashlamps, each ignited by means of an electric pulse generated by a piezoelectric crystal, are assembled in a multilamp array. In such an array, all of the lamps are aligned in the same direction and each lamp has its own reflector. A switching mechanism is provided, internal to the array, to ensure that the individual lamps are fired in their correct sequence. In photographic apparatus adapted to utilize such an array, a piezoelectric crystal striking mechanism is provided, including a firing spring with an

associated hammer, movable from a latched position to strike the piezoelectric crystal and thereby generate an electric pulse. In addition, a cocking mechanism is provided for moving the firing spring to its latched position subsequent to each actuation. This cocking function may be performed automatically in conjunction with some other function of the camera, such as film advance, or manually by the camera operator. However, with either mode of operation it is desirable to disable the shutter of the camera until the cocking of the firing spring has been performed to prevent an attempted flash exposure before the flash firing mechanism has been cocked. Likewise, it is desirable to disable both the shutter and the flash-firing mechanism subsequent to each actuation until the film has been advanced for exposure of the next frame.

According to the present invention there is provided a photographic camera comprising a shutter, a flash firing member having a cocked position whence it is releasable to fire a flash device, and an intermediate member, responsive to the cocking of the flash firing member for permitting the shutter to be released.

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

Fig. 1 is a front view of a photographic camera (according to the present invention) incorporating a double exposure prevention mechanism and showing a piezoelectric flash firing mechanism in a cocked position;

Fig. 2 is a rear view of the apparatus of Fig. 1 showing the relative positions of the shutter elements while the piezoelectric flash firing mechanism is in the position shown in Fig. 1;

Fig. 3 is a front view of the photographic apparatus of Figure 1 but showing the relative positions of the elements of the piezoelectric flash firing mechanism while

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the shutter is in an aperture uncovering position and the shutter release member is depressed;

Fig. 4 is a rear view of the photographic apparatus of Figure 1 but showing the relative positions of the shutter elements while the piezoelectric flash firing mechanism is in the position shown in Fig. 3;

Fig. 5 is a front view of the photographic apparatus of Figure 1 but showing the relative positions of the piezoelectric flash firing mechanism and the double exposure prevention latch after an exposure has been completed but prior to cocking of the piezoelectric flash firing mechanism; and

Fig. 6 is a rear view of the photographic apparatus of Figure 1 but showing the relative positions of the shutter elements while the piezoelectric flash firing mechanism is in the position shown in Fig. 5.

For ease of description, the present invention will be described with particular reference to elements forming part of, or cooperating more directly with, the present invention. Elements not specifically shown or described herein are understood to be selectable from those known in the art.

Referring to the accompanying drawings, there is shown a portion of a photographic camera incorporating a double exposure prevention mechanism according to a preferred embodiment of the invention. The apparatus includes a first mechanism plate 25 which defines an exposure aperture 24, a shutter 12, a second mechanism plate 26 mounted on the mechanism plate 25, a piezoelectric generator assembly generally designated 14 and an intermediate member in the form of a latch 120.

Referring to Fig. 2, the shutter 12 includes an opening shutter blade 16 and a closing shutter blade 18. The shutter blades 16 and 18 are opaque elements pivotally mounted on a stud 34 on the mechanism plate 25. When the shutter 12 is cocked, springs 39 and 40 respectively urge the shutter blades 16 and 18 to pivot in a clockwise direction about the stud 34, as viewed in Fig. 2, to respectively uncover and cover the exposure aperture 24.

A blade latch 46, urged into a latching position by a leg spring 48, retains the shutter 12 in its cocked position. In such a position, a tab 49 on the blade latch 46 engages and retains the lower leading edge of the shutter blade 16, as shown in Figs. 1 and 2. When the shutter 12 is cocked, the shutter blade 16 covers the exposure aperture 24, and, through an abutting relationship of its trailing edge with the leading edge of the shutter blade 18, the shutter blade 16 retains the shutter blade 18 in a position to one side of the exposure aperture 24, e.g. the right side in Fig. 2. When the apparatus is in the cocked position, a shutter-cocking element 51,

whose function will be described later, engages a raised portion 52 of the leading edge of the shutter blade 16, the shutter-cocking element 51 being held in that position by engagement with a trip lug 54 of a release member 56. The engagement of the shutter-cocking element 51 with shutter blade 16 is not functional in retaining the shutter 12 in the cocked position, and the engagement is removed as the release member 56 is operated.

The blade latch 46 is released by an actuating member 62 that is pivotally mounted on the mechanism plate 25 and biased in a clockwise direction by a spring 64, as viewed in Fig. 2. The actuating member 62 includes a lug 63 adapted to engage one end of the blade latch 46, an upright extension 74, and a lug 65 which extends through a hole 47 in the mechanism plate 25 and a hole 50 in the mechanism plate 26. The function of the lug 65 will be described later.

A latch 70, positioned in its latching position by a spring 72 connected between one end of the cocking element 51 and one end of the latch 70, holds the actuating member 62 in its tensioned position. When the cocking element 51 is moved to cock the shutter 12, it stretches the spring 72, creating tension therein to draw the latch 70 into its latching position. The spring 72 also pivots the cocking element 51 in a clockwise direction out of contact with the shutter blade 16 as the release member 56 positions the actuating member 62 to be latched by the latch 70. The upright extension 74 on the actuating member 62 engages and holds the contacts of a normally open switch S_2 in a closed circuit condition. The contacts of the switch S_2 , a shutter timing switch of an exposure control circuit (not shown), are opened in conjunction with movement of the actuating member 62 to release the blade latch 46. The commencement of an exposure cycle is thus synchronised with the uncovering of the exposure aperture 24 by the shutter blade 16.

As may best be seen by reference to Fig. 1, the release member 56 is pivotally mounted on the mechanism plate 25 at a post 76. An extension 77, located on a body portion 78 thereof, may be accessible from an exterior portion of the camera by a camera operator. The release member 56 is held in the position of Fig. 1 under the bias provided by a spring 79.

An electromagnet 101 and an associated armature 103 cooperate to control the shutter 12 in conjunction with the operation of the release member 56. The electromagnet 101 is controlled by the exposure control circuit (not shown). The exposure control circuit is energised during initial movement of the release member 56. A spring 104 lightly biases the armature 103 toward the electromagnet 101, and into a position in

which a pin 105 on the armature 103 extends through an opening 110 in the mechanism plate 25 to engage a lip 112 on the closing shutter blade 18. Thus the armature 103 couples the shutter blade 18 with the electromagnet 101.

Energisation of the exposure control circuit to control the electromagnet 101 is effected by a pin 58 as the release member 56 is operated. The pin 58 is located on the body portion 78 of the release member 56 and extends through a slot 113 in the mechanism plate 25 to engage an electrical contact of a switch S_1 . The pin 58 may be of an electrically non-conductive material to prevent shorting of the switch elements to ground when in contact therewith. The switches S_1 and S_2 are housed in a plastic mount 115 on the mechanism plate 25, such that travel of the pin 58 closes the switch S_1 , putting the exposure control circuit in readiness for shutter timing. The switch S_1 is normally open but is subsequently closed and held closed by engagement of the pin 58, as shown in Fig. 4. The exposure control circuit may also be encased in a plastic housing that is coupled with the mount 115.

As best shown in Fig. 1, the piezoelectric generator assembly 14 includes a piezoelectric generator 17, a flash firing member in the form of a piezoelectric firing spring 10, a firing spring cocking lever 19, and a firing spring latch 15. The cocking lever 19 is pivotally mounted on a post 20 on the mechanism plate 26 and is lightly biased in an anticlockwise direction to a rest position by means of a spring 21. The cocking lever 19 includes a firing spring engaging portion 22 and a leg 23 and is moved in a clockwise direction to cock the firing spring 10 by engagement of the leg 23 by a member 126 adapted to move in the direction of arrow A. The member 126 could, for example, be accessible to the operator for manual cocking of the piezoelectric firing spring, or alternatively it could be associated with a film advance mechanism (not shown) and adapted to move in the direction of the arrow A upon completion of, or during, film advance.

The piezoelectric firing spring 10 comprises a flat strip of spring material which may be in the form of a leaf spring and which includes a fixed end mounted on a portion of the mechanism plate 26, an intermediate portion, and a free end or striker portion on which is formed a hammer 11. The intermediate portion of the firing spring 10 lies in the path of movement of the firing spring engaging portion 22 of the cocking lever 19.

The piezoelectric generator 17 includes a piezoelectric crystal (not shown), a first anvil (not shown) and a second anvil 13, the first and second anvils being positioned at opposed ends of the piezoelectric crystal. As

is known in the art, the piezoelectric generator 17 may include one or more piezoelectric crystals with suitable electric contacts. The piezoelectric generator 17 is mounted by means of a spring clip, shown generally as 27, which is fixed within the photographic camera and engages the anvil 13. While the electrical connections to the piezoelectric generator 17 are not shown, it is understood that an electrical lead may be connected with each of the anvils and such leads may then be connected to other portions of the photographic camera, such as a socket for use with a multilamp photoflash array.

The firing spring latch 15 is pivotally mounted about pin 28, mounted on the mechanism plate 26. The firing spring latch 15 includes a latching hook 29, a biasing leg 30 and an unlatching leg 31.

As best shown in Fig. 1, double exposure prevention is provided by the latch 120. The latch 120 is pivotally mounted on the post 20 on the mechanism plate 26. The spring 21, which lightly biases the firing spring cocking lever 19 in an anticlockwise direction, also biases the latch 120 in a clockwise direction. The latch 120 includes a latching hook 32 adapted to engage the lug 65 of the actuating member 62, and a release lug 33 which cooperates with the biasing leg 30 of the piezoelectric firing spring latch 15 in a manner to be described below.

The apparatus described above operates as follows. With the piezoelectric generator assembly 14 cocked as shown in Fig. 1 and the shutter 12 in the position shown in Fig. 2, the release member 56 moves downwardly against the restoring force of the spring 79 as the extension 77 is depressed by an operator. During such movement, the pin 58, located on the body portion 78 of the release member 56, closes the switch S_1 to energize the exposure control circuit (not shown). The trip lug 54 moves downward, and the cocking element 51 is rotated in a clockwise direction under the bias of the spring 72, disengaging from the shutter blade 16 to occupy the position shown in Fig. 4. At this position in the movement of the release member 56, switches S_1 and S_2 are closed and the armature 103 is held by the electromagnet 101, thereby holding the closing shutter blade 18 in its cocked position by the engagement of the pin 105 of the armature 103 with the lip 112 on the shutter blade 18.

As the release member 56 continues its downward motion, the trip lug 54 engages the latch 70. The latch 70 pivots to release the actuating member 62. The latch 120 is held out of engagement with the lug 65 on the actuating member 62 by the engagement of the release lug 33 with the biasing leg 30 of the piezoelectric firing spring latch 15. Hence, the actuating member 62 is free to

pivot in a clockwise direction under the bias provided by the spring 64 to release the blade latch 46. The blade latch 46 releases the opening shutter blade 16, which moves, under the bias of the spring 39, to the position shown in Fig. 4 in which the raised portion 52 on its leading edge re-engages with the cocking element 51. During movement of the actuating member 62, the switch S_2 , which was held closed by engagement with the actuating member 62, is opened. When the switch S_2 is opened, the exposure control circuit (not shown) begins to compute the proper exposure time by means of a photo-sensitive element associated with the exposure control circuit, such as a photodiode 53, which is exposed to scene light.

Simultaneously with the release of the blade latch 46 and the opening of the shutter blade 16, the lug 65 on the actuating member 62 pivots into engagement with the unlatching leg 31 of the piezoelectric firing spring latch 15, thereby releasing the latch hook 29 from the firing spring 10 as shown in Fig. 3. The firing spring 10, when released, rapidly moves the hammer 11 into engagement with the anvil 13 of the piezoelectric generator 17 to produce electrical energy for flash ignition. If a flash array is present in the socket previously described, a flash will be generated to illustrate the scene to be photographed.

After a time interval related to the scene light, the exposure control circuit de-energizes the electromagnet 101 thus releasing the armature 103 to allow the closing shutter blade 18 to move under the influence of the spring 40 to cover the exposure aperture 24.

Cocking of the shutter is effected during return of the release member 56 to the position of Fig. 1, under the bias provided by the spring 79. During such return motion, the pin 58 opens the switch S_1 , and the lug 54 pivots the cocking element 51 in an anticlockwise direction to move the shutter blades 16 and 18 to the position shown in Fig. 6. The lug 73 on the lower end of the release member 56 pivots the actuating member 62 in an anticlockwise direction into a position to be latched. The anticlockwise pivotal movement of the cocking element 51 tensions the spring 72 to re-position the latch 70. The repositioning of the latch 70 latches the actuating member 62. The switch S_2 is once again held in a closed condition by the engagement of the upright extension 74 of the actuating member 62. The shutter 12 is now cocked and ready for another exposure cycle. However, as the actuating member 62 is rotated in an anticlockwise direction, the lug 65 no longer engages the unlatching leg 31 of the piezoelectric firing spring latch 15. Since the release lug 33 of the latch 120 is lightly biased into engagement with the bias-

ing leg 30 of the firing spring latch 15 by means of the spring 21, as the lug 65 disengages from the unlatching leg 31, the firing spring latch 15 and the latch 120 pivot into the positions shown in Fig. 5. In this position, the latch hook 32 of the latch 120 engages the lug 65 on the actuating member 62 to prevent movement thereof.

Thus, upon subsequent actuation of the release member 56 prior to cocking of the piezoelectric generator assembly 14, rotation of the actuating member 62 will be restricted by engagement with the latch hook 32 of latch 120 and the actuating member 62 will not move to initiate an exposure, even though it is no longer retained by the latch 70.

When the member 126 is moved in the direction of the Arrow A, for example when film is advanced if the member 126 is associated with the film advance mechanism of the photographic apparatus, to cock the piezoelectric generator assembly 14, the firing spring cocking lever 19 pivots in a clockwise direction about the post 20. The firing spring engaging portion 22 thereof engages the central portion of the firing spring 10, thereby moving the firing spring 10 away from its striking position. By means of the engagement of the free end of the firing spring 10 with a cam surface 55 on the firing spring latch 15, the firing spring latch 15 is pivoted in a clockwise direction about the pin 28 until the free end of the firing spring 10 travels past the cam surface 55 and the latch hook 29 engages the free end of the firing spring 10. As the firing spring latch 15 pivots, the biasing leg 30 of the firing spring latch 15 moves the latch 120 to disengage the latch hook 32 from the lug 65 on the actuating member 62.

When the member 126 and the cocking lever 19 return to their rest positions, as shown in Fig. 1, the piezoelectric firing spring 10 is latched in its fully energized position by the firing spring latch 15 in readiness for the generation of electrical energy during a subsequent exposure cycle. The latch 120 is disengaged from the actuating member 62 to allow the release member 56 to initiate an exposure.

WHAT WE CLAIM IS:-

1. A photographic camera comprising a shutter, a flash firing member having a cocked position whence it is releasable to fire a flash device, and an intermediate member, responsive to the cocking of the flash firing member for permitting the shutter to be released.
2. A photographic camera according to claim 1 wherein the shutter comprises a release member and an actuating member, and the intermediate member serves to latch the actuating member in an inoperative position from which it is freed on cocking the



4. pivot in a clockwise direction under the bias provided by the spring 64 to release the blade latch 46. The blade latch 46 releases the opening shutter blade 16, which moves, under the bias of the spring 39, to the position shown in Fig. 4 in which the raised portion 52 on its leading edge re-engages with the cocking element 51. During movement of the actuating member 62, the switch S_2 , which was held closed by engagement with the actuating member 62, is opened. When the switch S_2 is opened, the exposure control circuit (not shown) begins to compute the proper exposure time by means of a photosensitive element associated with the exposure control circuit, such as a photodiode 53, which is exposed to scene light.

Simultaneously with the release of the blade latch 46 and the opening of the shutter blade 16, the lug 65 on the actuating member 62 pivots into engagement with the unlatching leg 31 of the piezoelectric firing spring latch 15, thereby releasing the latch hook 29 from the firing spring 10 as shown in Fig. 3. The firing spring 10, when released, rapidly moves the hammer 11 into engagement with the anvil 13 of the piezoelectric generator 17 to produce electrical energy for flash ignition. If a flash array is present in the socket previously described, a flash will be generated to illustrate the scene to be photographed.

After a time interval related to the scene light, the exposure control circuit de-energizes the electromagnet 101 thus releasing the armature 103 to allow the closing shutter blade 18 to move under the influence of the spring 40 to cover the exposure aperture 24.

Cocking of the shutter is effected during return of the release member 56 to the position of Fig. 1, under the bias provided by the spring 79. During such return motion, the pin 58 opens the switch S_1 , and the lug 54 pivots the cocking element 51 in an anticlockwise direction to move the shutter blades 16 and 18 to the position shown in Fig. 6. The lug 73 on the lower end of the release member 56 pivots the actuating member 62 in an anticlockwise direction into a position to be latched. The anticlockwise pivotal movement of the cocking element 51 tensions the spring 72 to re-position the latch 70. The repositioning of the latch 70 latches the actuating member 62. The switch S_2 is once again held in a closed condition by the engagement of the upright extension 74 of the actuating member 62. The shutter 12 is now cocked and ready for another exposure cycle. However, as the actuating member 62 is rotated in an anticlockwise direction, the lug 65 no longer engages the unlatching leg 31 of the piezoelectric firing spring latch 15. Since the release lug 33 of the latch 120 is lightly biased into engagement with the bias-

ing leg 30 of the firing spring latch 15 by means of the spring 21, as the lug 65 disengages from the unlatching leg 31, the firing spring latch 15 and the latch 120 pivot into the positions shown in Fig. 5. In this position, the latch hook 32 of the latch 120 engages the lug 65 on the actuating member 62 to prevent movement thereof.

Thus, upon subsequent actuation of the release member 56 prior to cocking of the piezoelectric generator assembly 14, rotation of the actuating member 62 will be restricted by engagement with the latch hook 32 of latch 120 and the actuating member 62 will not move to initiate an exposure, even though it is no longer retained by the latch 70.

When the member 126 is moved in the direction of the Arrow A, for example when film is advanced if the member 126 is associated with the film advance mechanism of the photographic apparatus, to cock the piezoelectric generator assembly 14, the firing spring cocking lever 19 pivots in a clockwise direction about the post 20. The firing spring engaging portion 22 thereof engages the central portion of the firing spring 10, thereby moving the firing spring 10 away from its striking position. By means of the engagement of the free end of the firing spring 10 with a cam surface 55 on the firing spring latch 15, the firing spring latch 15 is pivoted in a clockwise direction about the pin 28 until the free end of the firing spring 10 travels past the cam surface 55 and the latch hook 29 engages the free end of the firing spring 10. As the firing spring latch 15 pivots, the biasing leg 30 of the firing spring latch 15 moves the latch 120 to disengage the latch hook 32 from the lug 65 on the actuating member 62.

When the member 126 and the cocking lever 19 return to their rest positions, as shown in Fig. 1, the piezoelectric firing spring 10 is latched in its fully energized position by the firing spring latch 15 in readiness for the generation of electrical energy during a subsequent exposure cycle. The latch 120 is disengaged from the actuating member 62 to allow the release member 56 to initiate an exposure.

WHAT WE CLAIM IS:-

1. A photographic camera comprising a shutter, a flash firing member having a cocked position whence it is releasable to fire a flash device, and an intermediate member, responsive to the cocking of the flash firing member for permitting the shutter to be released.

2. A photographic camera according to claim 1 wherein the shutter comprises a release member and an actuating member, and the intermediate member serves to latch the actuating member in an inoperative position from which it is freed on cocking the



flash firing member.

3. A photographic camera according to claim 1 or claim 2 wherein the flash firing member has a latch pivotable to a latching position on movement of the flash firing member to the cocked position and arranged, in so doing, to move the intermediate member to permit the shutter to be released.
4. A photographic camera according to claim 1, 2 or 3 wherein the flash firing member is moved towards its cocked position on operation of a film advance mechanism of the camera.
5. A photographic camera according to any one of the preceding claims wherein the flash firing member comprises a hammer, arranged on release to engage a piezoelectric generator to generate an electrical pulse and so fire a flash device.
6. A photographic camera according to any one of the preceding claims wherein the flash firing member is a leaf spring member.
7. A photographic camera substantially as hereinbefore described with reference to the accompanying drawings.

L.A. TRANGMAR, B.Sc., C.P.A.
Agent for the Applicants