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(54) IMPROVEMENTS RELATING TO PHOTOGRAPHIC CAMERAS

(71) We, POLAROID CORPORATION, a corporation organised under the laws of the State of Delaware, United States of America, of 730 Main Street, Cambridge, Massachusetts, 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 is concerned with photographic cameras and particularly with cameras of the reflex type.

In accordance with the present invention the optical path between the focusing lens of a camera and its focal plane includes specular reflecting means for establishing the focal plane either at an exposure plane containing photosensitive material when in an exposure mode or at a viewing surface overlying the exposure plane when in a focusing mode.

In a preferred embodiment of the invention the specular reflecting means comprises a first specular reflecting surface which establishes the focal plane at the exposure plane, and a second specular reflecting surface positioned closely behind the first specular reflecting surface in the exposure mode. The first reflecting surface is then moved out of the optical path in the focusing mode to expose the second reflecting surface which is oriented to establish the focal plane at the viewing surface. This viewing surface is preferably formed on the reverse side of the first reflecting surface and may include an echelon lens surface to improve the visibility of the image focused at the viewing surface.

If the spacing between the two reflecting surfaces in the exposure mode is made equal to the spacing between the viewing surface and the exposure plane in the focusing mode, then the optical path length will be independent of the particular mode in which the camera is operating.

One example of the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a sectional view of a photo-

graphic camera embodying the present invention showing the orientation of certain of its components during a focusing mode of operation;

Figure 2 is a sectional view of the camera illustrated in Fig. 1 showing certain of its components during an exposure mode of operation;

Figure 3 is a perspective view of the camera shown in Figs. 1 and 2;

Figure 4 is a top view of the camera having portions broken away to reveal internal structure;

Figure 5 is a fragmentary view of a shutter mechanism operative in conjunction with the viewing system of the illustrated camera;

Figure 6 is a plan view of a shutter arrangement which may be used with the illustrated camera; and

Figure 7 is a plan view of the shutter arrangement of Figure 6 showing the orientation of its components in an aperture unblocking configuration.

In Figures 1 to 3, a photographic camera is illustrated generally at 10. Camera 10 is formed having a forwardly disposed exposure control system housing 12 within which are mounted all of the components required to regulate light passing into the camera. These components include, but are not limited to, an objective lens system shown generally at 14, a shutter mechanism shown generally at 16, a shutter release button 18, electronic control circuitry and the film unit processing rolls 20 and 22. The camera 10 is of a reflex variety having a bottom support portion 24 which serves as a receiving and retaining chamber for a film laden cassette structure as at 26. The uppermost surfaces of the camera 10 include a relatively elongated top wall section 28 which will be seen to support reflecting surfaces of a reflex optical system. Elongated top wall 28 is joined with a shorter forward wall portion 30 which serves to support a viewing arrangement shown generally at 32.

Film retaining cassette 26, positioned within the bottom support housing 24 of the camera, is formed as a generally thin paral-

lelepipiped having a top open portion, the rectangular periphery of which is defined by an integrally formed ridge 40. The forward-most facing side of cassette 26 is formed incorporating an opening or slot 42 aligned with the line of tangency between rolls 20 and 22. Cassette 26 is removably insertable within a cassette receiving chamber within bottom support portion 24 so as to consistently and accurately orient an exposure plane 44 established at the lowermost periphery of the film frame opening defined by ridge 40. A more detailed disclosure of mechanisms for supporting the cassettes within the camera 10 will be found in our British Patent 1,240,531.

Coincidentally situated at the exposure plane 44 is an uppermost one of a plurality of the film units 46. Each film unit includes all of the materials necessary to produce a positive photographic print. Each unit 46 is physically structured to include a photosensitive element 48 positioned adjacent and in laminar relationship with an image-receiving element 50. Image-receiving element 50 is located upwardly from element 48 and is urged by spring means (not shown) into the exposure plane 44. A rupturable container 52 of processing fluid is secured to one end of the laminar assembly of elements 48 and 50 and is located forwardly within the cassette structure 26. Containers 52 dispense their processing fluid between elements 48 and 50 when subjected to appropriate compressive pressure. Each film unit as at 46 is adapted to be processed when advanced, rupturable container 52 foremost, through slot 42 and between pressure applying processing rolls 20 and 22. The latter manipulation causes container 52 to dispense its fluid contents between elements 48 and 50 and to spread the fluid between and in contact with these two elements. The image-forming process is now well-known in the art and involves the formation of transverse image-forming substances in the exposed photosensitive element accompanied by their diffusion in a manner forming a visible, positive image. The processing fluid also includes an opacifying agent which is spread as a layer between the photosensitive element 48 and transparent element 50. The opacifying agent is opaque to actinic light and provides a background for the photosensitive transfer image evolved in the process. The film units are described in more detail in United States Patent 3,415,646.

The components of camera 10 normally assume a configuration for operation in a focusing mode. During a photographic cycle, however, these components are pre-oriented to assume an exposure mode configuration. Looking to Figure 1, the components of camera 10 are shown as they assume a focusing mode of configuration. In this configura-

tion, the lens system as shown only generally at 14 may be considered to define a mean optical path which, for illustrative purposes, is designated by path line 60. The optical path as designated at 60, passes from the lens system 14 and across the exposure chamber of the camera until it impinges upon and is reflected from a specular reflecting surface shown as a mirror 62. Mirror 62 is stationary and fixed to the elongated top wall section 28 of camera 10. Upon reflection from mirror 62, the optical path courses to a viewing surface depicted generally at 64. As shown additionally in Figure 4, reflective surface 64 is formed as an echelon or Fresnel mirror with its incremental sections angularly oriented to re-direct the image formed by the rays reflecting from mirror 62 toward the eye piece lens 66 of viewing arrangement 32.

Light rays re-directed from viewing surface 64 are illustrated by a path line 72. From lens 66, path 72 passes through an Amici element roof prism 68 mounted within an eye piece housing 70. Housing 70 is attached to forward wall section 30 at a position suitable for viewing from a station as at 74. The presence of this roof prism 68 provides a right-left reversal correction for facilitating operator viewing from the eye station 74.

With the arrangement above described, camera 10 may be focused by adjusting lens system 14 while simultaneously viewing the image projected to viewing surface 64 from viewing arrangement 32. With this focusing mode of operation, optical path 60 may be considered to have a predetermined length and lens system 14 may be considered to establish a focal plane which, when the camera is focused, lies in coincidence with the viewing surface 64.

Viewing surface 64 is mounted upon or formed as an integral component of an operator unit shown generally at 76. Formed of a material opaque to light, unit 76 is of generally flat configuration and includes a peripheral rib portion or frame 78. Frame 78 is rectangular in shape and dimensioned to nest over the rib 40 of film cassette 26. As a consequence of this configuration, the operator unit 76 serves to light seal or cap the exposure plane 44 at which a film unit 46 is positioned. As seen in Figure 4, peripheral frame 78 of operator unit 76 is formed integrally with hinge portions 80 which are fixed to an axle 82. Axle 82 is journaled for rotation within sections 84 of the housing of camera 10. Extending through a section 84 at one side of the camera housing, axle 82 is fixed to a hand-manipulated knob 86.

The viewing surface 64 of operator unit 76 is biased into the focusing mode orientation shown in Figure 1 by a centrally dis-

posed helical spring 88. Spring 88 has a stationary side 90 positioned in abutment against the top side 28 of the camera housing and a movable side 92 tensioned against a central portion 94 of the operator unit 76 assembly. A magnetizable metal insert 96 is fixed to portion 94 of the operator unit 76. Insert 96 forms part of a magnetic latching assembly including a permanent magnet 98 fixed to the inward side of top wall section 28.

Turning to Figure 2, the components of camera 10 are shown as they assume an exposure mode configuration, as opposed to the focusing mode illustration described in connection with Figures 1 through 4. To convert the camera 10 to the exposure mode configuration, knob 82 of operator unit 76 is rotated against the bias of spring 88 until metallic insert 96 contacts and is attached to magnet 98. When so magnetically latched, mirror 62 is isolated from the earlier derived optical path 60; viewing surface 64 is removed from the exposure plane 44; and a second, specularly reflecting surface 104 is introduced in operative position within the exposure chamber. With the resulting configuration, lens system 14 may be considered to define a mean optical path which, for illustrative purposes, is designated by a path line 110. Optical path 110 passes from the lens system 14 and across the exposure chamber of the camera until it impinges upon and is reflected from second specularly reflective surface 104. Upon reflection from reflecting surface 104, the optical path courses to the exposure plane earlier described at 44. In this orientation, therefore, the uppermost of the film units 46 may be exposed and thereafter drawn through slot 42, into processing rolls 20 and 22 to exit therefrom at a slot 36 formed in the front portion of the camera, (see Figure 3).

With the arrangement of components as shown in Figure 2, the optical path 110 is of length equivalent to that of the optical path 60 derived from a focusing mode configuration of the camera 10. This path length equalization is achieved by virtue of the removal of viewing surface 64 from its position closely proximate but a finite distance displaced from exposure plane 44, accompanied by the repositioning of a specularly reflecting surface 104 along wall section 28 of the camera. Note in this regard that specular reflecting surface 104 is displaced an equivalent finite distance from the reflecting surface mirror 62. In the exposure mode depicted, the focal plane evolved from lens system 14 now coincides with the exposure plane 44.

The mechanisms which support the exposure and focusing mode operation of the camera 10 components thus far described are depicted in detail in Figure 5 through 7.

Referring to Figure 5 in addition to Figures 1 and 2, a subsidiary shutter mechanism is illustrated at 116. Shutter 116 functions to block the opening defined by eye lens 66 of viewing arrangement 32 throughout the operation of the camera when the latter is in an exposure mode. Shutter 116 is formed having a simple capping blade 118 which is movable into a blocking position as shown in phantom at 118¹. Blade 118 is rotatably mounted upon a stud 120 extending into forward top wall 30. The blade 118 is biased for rotation into blocking position 118¹ by a wire spring 122. Spring 122 is formed having a movable side 124 coupled with blade 118 and a stationary side 126 located in abutment against a stud 128. Stud 128 extends from top wall portion 30. Blade 118 is also fashioned having an extending arm portion 130 which is pivotably attached at 132 to the movable center core or rod 134 of a solenoid 136. Once energized, solenoid 136 causes rod 134 to move outwardly from its internal position, thereby rotating blade 118 from its blocking position at 118¹ to its open position 118.

Turning to Figures 6 and 7, the shutter mechanism described earlier at 16 is depicted in detail. Mechanism 16 is mounted upon a lens board or supporting panel situated within housing 12 of the camera. The mechanism 16 is formed of three basic blade elements, namely, a capping blade 140, a shutter opening blade 142 and a shutter closing blade 144. Blades 140, 142 and 144 are mounted for rotation co-axially about a stud 146 extending from the supporting panel. An extension 148 of capping blade 140 extends outwardly from its axis of rotation at 146 to abut against an internal push rod 150 extending from shutter release button 18. Release button 18 is biased upwardly by an internally disposed helical spring 152.

Shutter mechanism 16 is illustrated in a pre-exposure or rest position in Figure 6. In this orientation, both shutter opening blade 142 and capping blade 140 cover or block an exposure aperture at 154 and all of the blades are biased toward an electromagnet 156 by a helical spring 158 attached between the extension 148 of the capping blade 140 and a stationary mount 160 attached to the shutter supporting panel. Additionally in this configuration, opening blade 142 is latched in its shutter blocking position by an arm member 162 pivotally mounted upon a stud at 164. A wire spring 166 is coupled between the arm member 162 and a stud 168 extending from the shutter supporting panel to bias the member 162 into engagement with opening blade 142.

Closing blade 144 is powered by a wire spring 170 slidably wound about stud 146. One side of spring 170 is attached to shutter closing blade 144 at 172 and the other side

of the spring is attached to capping blade 140 at 174. A similar powering arrangement is provided for the opening blade 142. A portion of a spring 176 supplying such power is revealed in Figure 7.

To unblock the aperture 154, shutter release button 18 is depressed, thereby causing capping blade 140 to rotate against the bias of spring 158. As the blade 140 is rotated, springs 170 and 176 are wound or "loaded"; shutter opening blade 142 is retained in the aperture blocking position shown in Figure 6 by arm member 162; and shutter closing blade 144 is retained in the unblocking position shown by virtue of its engagement with electromagnet 156, now energized along leads 178 from an exposure control circuit 180.

As capping blade 142 is rotated to the fully extended position shown in Figure 7, it functions to cam against arm member 162, thereby permitting the release of shutter opening blade 142. In its fully opened position, an annular opening 182 within capping blade 140 lie in registry with aperture opening 154. Under the bias of spring 176, shutter opening blade 142 moves to the uncovering position shown in Figure 7, at which point it abuts against a flange 184 formed in capping blade 140.

Following an interval determined by exposure control circuit 180, electromagnet 156 will be de-energized, thereby releasing shutter closing blade 144 for movement under the bias of spring 170 into a blocking position. When in such blocking position, blade 144 will abut against shutter opening blade 142. A release of shutter release button 18 permits the entire assembly to re-assume the configuration of Figure 6 under the bias of spring 158. A more detailed description of the foregoing shutter mechanism and exposure control circuit 180 will be found in our British Patent 1,213,747.

Shutter release button 18 is also configured for manual rotation between two positions designated "E" and "F" and shown in Figure 3. These positions, respectively, represent an exposure mode of operation and a focusing mode of operation. A small vertical groove 19 formed within shutter release button 18 promotes proper rotational orientation of the shutter release button. When detent 19 is aligned with focusing mode position "F", a double pull switch 190 (Figures 6 and 7) is thrown into a focusing mode configuration. This configuration overrides exposure control circuit 180 to cause a continued energization of electromagnet 156. A power and override line 191 is generally depicted extending from switch 190 to the exposure control circuit 180. The basic battery power supply of circuit 180 is used not only for powering electromagnet 156, but also solenoid 136. When shutter release but-

ton 18 is depressed and switch 150 is in a focusing mode, shutter closing blade 144 will be held in an unblocking position, thereby permitting a continuous imaging at viewing surface 64.

Switch 190 also serves to energize solenoid 136 (Figure 5) from circuit 180, thereby causing rod 134 to be extended. The latter extension causes auxiliary shutter blade 118 to move from its blocking position at 118¹ to an unblocking position 118. As a consequence, viewing surface 64 may be observed through the viewing arrangement 32.

Following appropriate focusing procedures, shutter release button 18 is rotated until groove or index 19 is oriented with exposure mode position "E". In this orientation, switch 190 is opened and exposure control circuit 180 is permitted to operate conventionally. During the latter operation, a light sensitive network functions to measure the intensity of scene brightness and to regulate the duration of energization of electromagnet 156.

OPERATION

A photographic sequence is initiated with the manual rotation of knob 82 in a direction causing operator unit 76 to move into a focusing mode orientation. This orientation, depicted in Figure 1, provides for the light scaled covering of exposure plane 44 and the simultaneous operative positioning of viewing surface 64 a finite and closely proximate distance therefrom. Following this maneuver, the operator moves indexing groove 19 of shutter release button 18 to a position for focusing mode operation as designated on the control system housing 12 at "F". Switch 190 is actuated, thereby energizing electromagnet 156 and solenoid 136. The energization of solenoid 136 causes auxiliary shutter blade 118 to move to an open position unblocking the optical path from surface 64 through viewing arrangement 32. The energization of electromagnet 156 will cause the retention of shutter closing blade 144 in an aperture unblocking position.

The shutter release button is then depressed as the operator looks through viewing arrangement 32 from station 74. Following any necessary focusing adjustment to lens system 14, shutter release button 18 is released and rotated until index groove 19 is opposite exposure position "E". This secures the exposure chamber for an exposure sequence by causing the de-energization of solenoid 136 and cancelling an override of electromagnet 156. As a consequence of the de-energization of solenoid 136, shutter blade 118 is returned under the bias of spring 122 to a blocking position shown at 118¹.

Shutter release button is again depressed to cause a conventional exposure of film units 46 through the shutter mechanism 16.

Knob 82 is rotated to cause operator unit 76 to move into an exposure configuration as shown in Figure 2. In this configuration, the operator unit 76 is magnetically latched by virtue of the union of metallic member 92 with permanent magnet 98. Thus positioned, operator unit 76 provides a reflecting surface 104 while uncovering the exposure plane 44.

10 WHAT WE CLAIM IS:—

1. A photographic camera in which the optical path between a focusing lens and its focal plane includes specular reflecting means for establishing the focal plane either at an exposure plane when in an exposure mode or at a viewing surface overlying the exposure plane when in a focusing mode.

2. A camera according to claim 1 in which the specular reflecting means reflects from one position in the exposure mode and from another position in the focusing mode.

3. A camera according to claim 1 or claim 2 in which the specular reflecting means comprises a first specular reflecting surface for establishing the focal plane at the exposure plane in the exposure mode and a second specular reflecting surface positioned closely behind the first specular reflecting surface in the exposure mode.

4. A camera according to claim 3 in which the first specular reflecting surface is positioned out of the said optical path in the focusing mode.

5. A camera according to claim 4 in which the first specular reflecting surface is movable and the second specular reflecting surface is fixed.

6. A camera according to any one of the claims 3 to 5 in which the second specular

reflecting surface is oriented to establish a focal plane at the viewing surface in the focusing mode.

7. A camera according to claim 6 in which the viewing surface and the first specular reflecting surface are mounted back to back for joint movement between an exposure mode position in which the first specular reflecting surface establishes the focal plane at the exposure plane and a focusing mode position in which the viewing surface is brought to the focal plane established by the second specular reflecting surface while the first specular reflecting surface is coincidentally moved out of the optical path.

8. A camera according to claim 1 in which the said movement into the focusing mode position further serves to isolate the exposure plane from actinic radiation.

9. A camera according to any one of the preceding claims in which the viewing surface includes an echelon lens surface.

10. A camera according to claim 4 in which the spacing between the two reflecting surfaces in the exposure mode is selected such that the optical path length from the focusing lens to the viewing surface in the focusing mode is substantially equal to the optical path length from the focusing lens to the exposure plane in the exposure mode.

11. A camera according to claim 1 substantially as herein described with reference to the accompanying drawings.

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