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PHOTOGRAPHIC CAMERA

The present invention relates to a camera for receiving rewindable cassette loaded film, and more particularly to providing such cameras with means facilitating the removal and subsequent replacement of cassettes holding partially exposed film.

If a photographer, using a conventional 35mm camera, removes a partially exposed film cassette to replace it with another cassette containing a different type of film, he encounters a number of problems when he later wishes to expose the rest of the film in the former cassette.

After rewinding the partially exposed film, the photographer opens the camera door to remove the cassette. With most cameras, the opening of the door automatically resets the film counter in preparation for the loading of the next cassette. Alternatively, it may be reset automatically by other means associated with the changing of the cassette, such as the rewind itself. Therefore, if the photographer forgets to observe the counter before opening the door, he can no longer determine how many film frames were exposed and therefore must guess the frame number if he later re-loads the cassette to expose the remaining film.

Although some cameras have counters that must be manually reset and which thereby inherently preserve the last exposure identification, for example the camera shown in U.S. Patent No. 2,591,417, the advantage that such a counter may afford in removing and subsequently reloading partially exposed film is offset by the likelihood that the photographer will forget to reset the

counter when a new film cassette is loaded into the camera. The latter is obviously a much more common occurrence than the removal and subsequent re-loading of partially exposed film.

5 As described in U.S. Patent No.

3,511,153, the exposure counter can be reset either manually or automatically, but no provision is made for automatically preserving the counter reading when partially exposed film is removed.

10 It is the object of the invention to provide a camera with an improved counter.

 This object is accomplished according to the present invention, by the provision of a photographic camera having a frame counter and a selector means
15 having a first position in which a rewind mechanism automatically rewinds a fully exposed film and resets the frame counter on reloading the camera and a second position in which the rewind mechanism rewinds a partially exposed film and, on reloading, enables the
20 frame counter to be manually reset.

Thus with this invention, if rewind is selected after full exposure of the film, the exposure counter is automatically reset. If rewind is selected prior to full exposure of the film, the exposure counter is retained until the counter is manually reset to remind the photographer to record the counter.

When the photographer rewinds the partially exposed film, he must be certain that the exposed portion is fully received in the cassette to protect it from light, but at the same time he must be careful to leave the leader portion of the film extending out of the cassette so that he can later re-attach it to the film takeup spool in the camera. Some 35mm cameras with electrically powered rewind mechanisms leave the leader of the rewound film extending out of the cassette, but with most relatively inexpensive 35 mm cameras, the photographer must by touch or hearing sense the separation of the film from the takeup spool, which requires considerable experience and skill.

According to a preferred embodiment of the invention, the camera further includes a sensing means responsive to a characteristic of the leading portion of the film and means, responsive to the sensing means for terminating the rewind means with the leading portion of the film extending out of the cassette when the rewind means is adjusted to its second condition and for permitting the rewind means to wind the film entirely into the cassette when the rewind means is in its first condition.

If the photographer reloads the partially exposed cassette in the camera, the photographer now must return the film to the next available exposure frame. This requires him alternately to advance the film and release the shutter with the lens cap in place, until the counter indicates that the film has been advanced to its previous condition.

According to another preferred embodiment, manually operable means for decoupling the shutter from the film advancing means are provided.

The present invention will now be described, by way of example, with reference to the accompanying figure, which illustrates the mechanical and electro-mechanical components of a camera according to a preferred embodiment of the present invention.

The camera structure depicted is appropriate for use in a typical 35mm camera. Details of such a camera which are not germane to understanding the present invention have been omitted for purposes of clarity and brevity.

A 35mm cassette 10 is received in a camera film supply chamber, not shown, and the leading end 258 of its film strip 12 is attached to a take-up spool 14, permanently mounted in a corresponding take-up chamber in the camera housing, portions of which are shown at numeral 16. A camera door, partially shown at numeral 18, provides access to the film supply and take-up chambers, as is conventional in such cameras. A reversible electric motor 20 is powered by a battery 22 and is provided with a transmission mechanism represented at numeral 24, which is connected, as shown schematically by broken lines 26, to a film supply spool 28 in the film cassette and to the film take-up spool 14. The transmission mechanism 24 is responsive to the direction of rotation of the motor 20 so that whenever the motor 20

is rotating in a film advancing direction, the take-up spool 14 is driven in a film winding direction and the film supply spool 28 is disengaged from the motor 20. Similarly, whenever the motor 20 runs in the opposite direction, the take-up spool 14 is disengaged and the supply spool 28 is driven by the motor 20 to rewind film into the cassette 12. Details of the transmission mechanism 24 have been omitted because such mechanisms are known in the prior art, for example, in U.S. Patents Nos. 3,528,628 and 2,624,214. Adjacent the take-up spool 14, the camera includes a sprocket spool 42 provided with sprocket wheels 44 and 46 that mesh with the respective upper and lower rows of perforations 48 and 50 in the filmstrip. As is well known in the prior art, the number of teeth on each of the sprocket wheels 44,46 corresponds to the number of sprocket perforations 48,50 representing the film advancement necessary to bring successive exposure areas into exposure position. In other words, each successive advancement of the film to bring the next exposure area into exposure position causes the sprocket spool 42 to make a complete single rotation in a counterclockwise direction, as viewed from the top in the figure.

The sprocket spool 42 is rotatable on shaft 54, which in turn is rotatable in the camera housing 16. A spring 56 biases the sprocket spool 42 in a clockwise direction relative to shaft 54. At the lower end of the spool 42, a pin 58 thereon is aligned with a finger 60, in turn, is similarly aligned with a corresponding finger on a similar washer 64, etc. Several of these stacked washers are provided, the

lower-most one being affixed to shaft 54 and the others being freely rotatable, thus providing several rotations of lost motion between sprocket spool 42 and shaft 54. Whenever the film is removed from the camera, the spring 56 rotates the sprocket spool in a clockwise direction relative to the shaft 54 to absorb the available lost motion provided by the stack of washers. An example of the use of analogous washers to provide rotational lost motion is shown in U.S. Patent No. 3,137,457.

The top end of shaft 54 carries a clutch disk 66 provided with a spring loaded pawl 68 engageable with toothed wheel 70 on a cam shaft 72, which is coaxial with shaft 54, whereby counterclockwise rotation of shaft 54 drives cam shaft 72 in the same direction but clockwise rotation of shaft 54 does not drive the cam shaft.

A cam 74, of snail form, having a return step 75, mounted at the top of cam shaft 72 is engaged by a nose 76 of a pivotable counter lever 78, which is biased by a spring 80 to retain the nose 76 in contact with the cam 74. The cam 74 is shown in top view while the cam shaft 72 and its associated parts are shown in side view for illustrative purposes only. The end of the lever 78, opposite the nose 76 carries a pivotally mounted advancing pawl 82, a tooth 84 of which is urged by a spring 86 towards a ratchet wheel 88, mounted on a rotatable shaft 90. A spring 92 biases the shaft 90 in a clockwise direction toward the position at which a ratchet wheel ear 94 engages a stop pin 96. When advancing film causes the sprocket spool 42 to rotate the cam 74 in a counterclockwise direction from its depicted position, the pawl 82 first moves rearwardly due to the snail form, i.e.

downwardly in the figure. This movement brings a pawl notch 98 into alignment with a pin 100 and allows the tooth 84 to engage and ratchet past the ratchet wheel 88. Continuing rotation of the cam 74 allows the nose 76 to drop past the step 75 which allows the pawl to move forwardly, so that the tooth 84 advances the ratched wheel 88 in a counterclockwise direction through an angle equal to the width of one ratchet wheel tooth, whereupon the pawl tooth 84 is withdrawn from the ratchet wheel as the notch 98 moves beyond the pin 100. Each time a complete rotation of the sprocket spool 42 rotates the cam 74 counterclockwise through a complete rotation from its depicted position, the resulting reciprocation of the pawl 82 advances the ratchet wheel 88 in a counterclockwise direction through an angle corresponding to one tooth pitch. An anti-reverse pawl lever 102, pivoted at 104, has a tooth 106 that also engages the ratchet wheel 88 to prevent the latter from being rotated in a clockwise direction by the pawl 82 during the counterclockwise movement of the counter lever 78. A spring 108 biases the anti-reverse pawl lever 102 in a counterclockwise direction, to move its tooth 106 away from the ratchet wheel 88, but the spring 108 is opposed by a stronger spring 110 connecting the same end of the anti-reverse pawl lever 102 to a slide 112. This slide 112 is engageable by the camera door 18, and is held in its depicted position by the door 18 when the latter is closed, whereby the spring 110 biases the pawl tooth 106 into contact with the ratchet wheel 88. Whenever the door 18 is open, however, the spring 108 holds the tooth 106 out of contact with the ratchet wheel 88, thereby allowing the spring 92 to rotate that wheel in a clockwise direction to return the ear 94 into engagement with the stop pin 96.

At its top end, the shaft 90 carries an indicator disk 114 that is visible from the exterior

of the camera. This disk is surrounded by a numeral ring 116 that is provided with numeral indicia 118 and frictionally supported by the camera housing wall 16 so that it can be manually rotated. When the camera is loaded and the first exposure area has been moved into exposure position, as described later, the ring 116 is rotated manually to align the numeral or numeral mark corresponding to the total number of available exposures with an arrow 120 on the indicator disk, which is then advanced one tooth from the position defined by the engagement of ratchet wheel ear 94 with stop pin 96. In the figure, which depicts the ratchet wheel 88 in this position, the numeral ring 116 is shown adjusted for 36 total exposures and the arrow 120 is in the position at which it points to the numeral 36, not shown. Thereafter, each successive advancement of the film to the next exposure position causes the arrow 120 to move into alignment with the next smaller numeral indicium 118 on the ring 116, whereby the number indicated by the arrow 120 identifies the number of available exposures remaining on the filmstrip 12.

As shown partially in broken lines, the lower face of the numeral ring 116 is provided with two arcuate commutator strips 122 and 124 that are engaged by respective stationary brush contacts 126 and 128. A brush member 130 carried by an ear 132 attached to the lower face of the disk 114 is arranged to bridge strips 122 and 124 to provide a normally open switch S2 that is closed when the movement of the disk 114 has brought the arrow 120 into alignment with the mark 1 on the ring 116; i.e., when the last available exposure region has been moved into exposure position, but before that exposure region has been exposed.

A shutter 134 comprises an opening blade 136 and a closing blade 138, both

mounted on a pivot 140, and is depicted in its uncocked position in which the closing blade 138 covers a lens aperture 142. When the shutter 134 is cocked, i.e. when both blades 136, 138 are rotated about 60° in a clockwise direction from their depicted positions, the opening blade 136 is held in its cocked position against the bias of a spring 144 by a pivotable latch lever 146 engaging with a pin 148 on an ear 150 on the opening blade 136; and the closing blade 138 is held in its cocked position against the bias of a spring 125 by the engagement of an ear 154 thereon with a tongue 156 on the opening blade 136. When the blade 136 is released by the depression of a shutter release slide 158, the opening blade 136 immediately moves to its illustrated position, but the corresponding movement of the closing blade 138 is delayed by its inertia which is increased by a weight 160, thus providing a momentary exposure during the interval between the movement of the opening blade 136 out of alignment with the aperture 142 and the movement of the closing blade 138 into alignment with the aperture 142. The shutter 134 is also operated by opening the door 18, when movement of the slide 112, produced by the spring 110, causes a finger 260 thereon to strike shutter latch lever ear 262, releasing the latch lever 146. As is well known in the prior art, the movement of the closing blade can be delayed by an electro-magnet responsive to a light measuring circuit to automatically vary the shutter speed as a function of scene luminance. When the shutter 134 has completed its operation, but before it has been recocked, an ear 162 on the closing blade 138 closes normally open switches S4 and S6, for purposes described later.

During the next film advance operation a nose 164 of a pivotal cocking lever 166 engages the counter lever 78 and is thereby reciprocated by the complete rotation of cam 74, so that a finger 168 of the cocking lever 166 engages the ear pin 148 on opening blade 136 and moves both blades 136, 138, in unison, back to their