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(54) RETRACTABLE CAMERA

- (71) We, W. HAKING INDUSTRIES (MECHANICS & OPTICS), LIMITED, a corporation of Hongkong, of Haking Building, 981 King's Road, Hongkong, 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:—
- This invention relates to retractable cameras.
- The invention provides a retractable camera having a main section on which is mounted substantially all of the camera mechanism including shutter operating mechanism which when released from a cocked position when a picture is taken operates the camera shutter, and which further includes a film cartridge-receiving means for receiving a film cartridge including film with film metering perforations therein spaced one frame distance apart and film moving means for engaging the film to impart movement thereto, said main section of the camera having driving means to be coupled to said film moving means in said camera, a film perforation sensing member movably urged towards the path of movement of the film metering perforations of said film, for controlling the driving means to terminate film advance, said camera further having a view finder carrying section mounted telescopically on the main camera section for movement between a retracted non-picture taking position and an extended picture taking position, film wind actuating means on said view finder carrying section of the camera and film advancing mechanism in said main section of the camera responsive to movement of said film wind actuating means on said view finder carrying section only when said view finder carrying section of the housing is moved to said extended picture taking position to operate said drive means to initiate film winding operation, and means on said main section of the camera for cocking said shutter operating mechanism and removing said sensing member from a film metering perforation to enable the sensing member to engage the film at a point behind the latter perforation before a subsequent movement of said view finder carrying section of the camera into said extended picture taking position, said film sensing member withdrawing means including means responsive only to movement of the said view finder carrying section towards said retracted non-picture taking position for effecting said sensing member withdrawing operation.
- Preferably said shutter operating mechanism cocking means includes means responsive only to the movement of said view finder carrying section towards said retracted non-picture taking position for cocking said shutter operating mechanism.
- Preferably said view finder carrying section of the camera includes ratchet teeth, said main section of the housing includes ratchet pawl means engageable with said ratchet teeth and, when engaged with said ratchet teeth, preventing the view finder carrying section from being moved in the direction of said extended position but permitting the view finder carrying section to be moved to said retracted position and means for disengaging said ratchet pawl means from said rack of said view finder carrying section of the camera when said shutter operating mechanism has been cocked by movement of said view finder carrying section to said retracted non-picture taking position, said ratchet pawl means remaining in said position where it is disengaged from said rack until said shutter operating mechanism is un-cocked.
- Said view finder carrying section of the camera may include a frame member having a portion forming said ratchet teeth, a portion forming a part of the shutter operating mechanism to cock the same when the view finder carrying section is moved from its extended to its retracted position, and a film winding rack, the main section of the camera including gear means engaged by said rack on said frame member of the view finder carrying section, said film advancing

mechanism including means responsive to the rotation of said gear means only in a direction in which it is rotated when said view finder carrying section is moved from said retracted position towards said extended position.

In any of the arrangements referred to above said shutter operating mechanism may include a cocking transmission member having a cam surface thereon, follower means riding along said surface, said follower means being connected to said film perforation sensing member to withdraw the film perforation sensing member from one film perforation to engage a point on the film behind that perforation when the cocking transmission member is moved towards said cocked position.

Again in any of the above arrangements said view finder carrying section may be operative to display a view of the scene to be photographed when said view finder carrying section is in said extended position but is disabled from showing the view of the scene to be photographed when the view finder carrying section is in said retracted position.

In a preferred construction the film advancing mechanism on said main section of the camera may be coupled between said film wind actuating means on said reciprocable section and said drive means on said main section of the camera comprises first rotatable means responsive to movement of said film wind actuating means and movable in one direction and the other respectively by reciprocation of said reciprocable section in one direction and the other between said retracted and extended positions, a slip clutch coupled for movement with said first rotatable means and being in non-slipping relationship therewith so long as there is film free to be advanced by the film moving means, an additional gear connecting the slip clutch to the film and a moving means control responsive to the position of said film perforation sensing member and the movement of said slip clutch for coupling the movement of said first rotatable means and slip clutch through said additional gear to said film moving means only when said first gear is moved in a direction resulting from the movement of said reciprocable section in one of said directions and said sensing finger has a position other than a given film wind terminating position within one of said film metering apertures.

More specifically the first rotatable means may comprise a first gear and the slip clutch includes a resilient flexible means having projecting means engaging with said teeth of said first gear, said projecting means of said resilient flexible means being in non-slipping rotation with the teeth so long as

the film is free to be advanced by said film moving means.

Further, said first gear and slip clutch may be mounted for rotation about a common axis of rotation with said first gear, said first gear having a central circular opening lined with said teeth, and said slip clutch having a recess therein in which is rotatably mounted at least one of said additional gear means.

Said film advancing means may include an annular gear rotatable in only a film winding direction and having internal teeth, a portion thereof constituting said drive means to be coupled to said film moving means on said cartridge, an eccentrically mounted gear pivoted upon and carried by said slip clutch and engaging said internal teeth of said annular gear, a centrally mounted gear meshing with said eccentrically mounted gear, said eccentrically mounted gear when said slip clutch is rotated, rotating in non-driving relationship to the internal teeth of said annular gear when said eccentrically mounted gear is free to rotate and engaging said internal teeth in driving relationship therewith to effect a film winding operation when said eccentrically mounted gear means is held against rotation, a ratchet wheel drivingly connected to said eccentrically mounted gear, a pawl engageable with said ratchet wheel so that the ratchet wheel can freely rotate in a first direction and is held against rotation in the other direction by the pawl, said pawl means normally being in engagement with said ratchet wheel so that the latter cannot rotate in said one direction when the reciprocable section is moved in a direction to effect a film winding operation and means responsive to said film perforation sensing member entering and assuming a given position with a film perforation for removing said pawl from engagement with said ratchet wheel.

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings in which:

Fig. 1 is a top perspective view of an embodiment of the retractable camera of this invention showing the viewfinder carrying section thereof in its retracted position;

Fig. 2 is a view corresponding to the view of Figure 1 showing the viewfinder carrying section in its extended, operative position;

Fig. 3 is an enlarged fragmentary sectional view taken substantially along line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view taken substantially along line 4—4 of Fig. 1;

Fig. 5 is an enlarged fragmentary sectional view taken substantially along line 5—5 of Fig. 3;

Fig. 6 is a rear view in elevation of the embodiment of the camera shown in Fig. 1;

Fig. 7 is a fragmentary view in perspective of said embodiment of the camera as viewed from below with portions of the housing removed to show the relationship of the components of the camera mechanism when the shutter release is in an uncocked position;

Fig. 8 is an enlarged fragmentary view corresponding to the view of Fig. 7;

Fig. 9 is a view corresponding to the view of Fig. 7 showing the shutter release mechanism in a cocked position;

Fig. 10 is an enlarged exploded view of the components of the gear train and clutch assembly of said embodiment of the camera;

Fig. 11 is an enlarged plan view of components of the gear train and clutch assembly as viewed from above with the top cover plate removed;

Fig. 12 is an enlarged plan view of components of the gear train and clutch assembly as viewed from below with certain components removed to show details of the hub of the clutch assembly;

Fig. 13 is an enlarged sectional view through the gear train and clutch assembly, and;

Fig. 14 is a view corresponding to the view of Fig. 13 taken at an angle of 90° thereto.

Referring, now, more particularly to Figs. 1 and 2, as there shown, the camera of the present invention, like the camera disclosed in co-pending application No. 8920/75 comprises a main-camera section 2a and a viewfinder carrying section 2b. The main camera and viewfinder carrying sections 2a and 2b, respectively include sub-assemblies 4 and 6 (see Fig. 7), and associated housings 8 and 10 which are secured by screws such as 11—11 to the associated sub-assemblies. The housing 8 for the main camera section 2a comprises relatively closely spaced top and bottom walls 8a and 8b, a front wall 8c which extends between the front margins of the top and bottom walls 8a and 8b, and an end wall 8d extending between the contiguous margins of the top, bottom and front walls 8a, 8b and 8c. The top, bottom and front walls 8a, 8b and 8c extend horizontally only a fractional part of the overall length of the camera housing. A flash cube socket 9 is exposed through an opening in the top wall 8a. The housing 8 of the main camera section includes a rear cover-forming wall 8e closing off the rear of the camera, which rear wall forms a cover pivotally mounted for movement between the vertical position shown in solid lines in Figs. 1 and 2 and the dash line position shown in Fig. 1 to expose an opening in the rear of the camera to enable the insertion of a typical 110 camera film cartridge (not shown). The rear cover-forming wall 8e extends for the

full length of the camera, unlike the other walls of the housing 8 of the main camera section 2a.

The housing 10 of the viewfinder section 2b includes a top wall 10a which is in generally the same plane as the top wall 8a of the housing 8 of the main section 2a of the camera, a bottom wall 10b which is in approximately the same plane as the bottom wall 8b of the housing of the main section 2a of the camera, a front wall 10c which is approximately in the same plane as the front wall 8c of the housing of the main section 2a of the camera and an end wall 10d which is secured by the screws 11—11 to the sub-assembly 6 of the viewfinder section. A recess 16 is formed in the front wall 8c of the housing 8 of the main section of the camera which recess extends slightly into the upper and bottom walls 8a and 8b thereof to form a laterally facing recessed edge 16a and forwardly facing edges 16b and 16b¹ (see Fig. 2) which receive in confronting relationship corresponding edges 18a, 18b and 18b¹ respectively of a projecting portion 10¹ of the housing 10 of the viewfinder section 2b, formed by the shortening of the top wall 10a of the housing 10 so that the housing sections interleave as shown in Fig. 1. The end wall 10d of the housing 10 of the viewfinder carrying section 2b is then in a position slightly within the outer margin of the pivotally mounted rear wall 8e of the housing 8 of the main section of the camera.

In the retracted position of the viewfinder carrying section 2b, the top wall 10a of the viewfinder carrying section housing covers a manually depressible shutter release button 13 exposed on a downwardly depressed extension 8a¹ of the top wall 8a of the housing of the main section of the camera. The front wall 10c of the housing 10 of the viewfinder section has a recessed cover-forming portion 14 which together with the adjacent portions of the front wall 10c covers a recess 17 in a preferably plastic molded part 24 (Figure 3) of the sub-assembly 4. The recess 17 exposes an objective lens 19 also forming part of the sub-assembly 4. The front wall 10c of the viewfinder carrying section housing 10 thus acts as a dustcover for the objective lens 19.

Laterally positioned adjacent the recessed cover-forming portion 14 of the front wall 10c of the housing 10 is a cut-out portion 15 forming a window which, when the viewfinder carrying section is in its extended position, exposes a viewfinder lens 21, and when it is in its retracted position, is in front of a cover plate 24 forming part of the main section 2a of the camera. The cover plate 24 acts as a dust cover for the front viewfinder lens 21 which passes behind the cover plate 24 when the viewfinder car-

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rying section is in its retracted position. In the retracted position of the viewfinder carrying section, the pivotally mounted rear wall 8e of the housing 8 of the main camera section covers over and acts as a dust shield for a rear viewfinder lens elements as can be seen in Figure 4.

As best shown in Figs. 7 and 9, the main camera section sub-assembly 4 includes apertured guide-forming members 25—25 in which is slidably disposed a slide rod 26 forming part of the viewfinder carrying section sub-assembly 6. The ends of the slide rod 26 are anchored in any suitable way to an actuator plate 28 formed integrally with the sub-assembly 6. The plate 28 has an engaging the teeth 28a with teeth 29 for engaging the teeth 30a of a gear 30 mounted for rotation about a vertical axis on a pin 32 secured on an extension metal base of a plate. The plate 28 has spaced notches or recesses 28b and 28c formed therein for receiving a V-shaped bend 36a in a detent spring 36. The bend 36a enters the notches 28b and 28c when the viewfinder carrying section is in its retracted and extended positions, respectively.

As shown, the actuator plate 28 is joined to a vertical end wall 6a of the sub-assembly 6. The end wall 6a has threaded apertures 38—38 as shown in Figures 3 and 4 which receive the screws 11—11 for anchoring the viewfinder carrying section housing 10 to the sub-assembly 6. The wall 6a terminates at the front of the camera in a short transversely extending front wall 6b as shown in Figures 3 and 5 in which the forward viewfinder lens 21 is mounted. In the retracted position of the viewfinder carrying section, the front wall 6b moves behind the cover plate 24 forming part of the main camera section sub-assembly 4. The rear end of the vertical wall 6a terminates in a lens holding portion 40 (see Figure 4) which holds the rear viewfinder lens 23. When the viewfinder carrying section 2b is in its retracted position, the lens holding portion 40 moves behind a portion 42 (Fig. 4) or the rear cover-forming wall 8e of the main camera section housing 8. In its retracted position, the lens holding portion 40 of the viewfinder carrying section 2b of the camera blocks the passage of the film cartridge through the rear opening of the housing 8 of the main camera section. Therefore, to insert a film cartridge within the camera, it is necessary to move the viewfinder carrying section 2b into its extended position which moves the lens holding portion 40 laterally to one side of the main camera section 2a to remove the obstruction to the passage of the film cartridge through the rear of the camera housing 8 after the rear housing wall 8e is pivoted into a horizontal position. The rear wall 8e has a releasable latch (not shown) which is

released by depression of a lever 41 on the rear wall 8e (see Fig. 6). As also shown in Fig. 6, the rear wall has a window 43 through which a number is visible on the film cartridge indicating the particular film frame which is in position for exposure.

In the extended position of the viewfinder carrying section, the front and rear lenses 21 and 23 of the viewfinder carrying section 2b are unobstructed so that the viewer can view the scene to be photographed. The view through these lens elements is obstructed by the cover plate 24 and the rear housing wall 8e when the viewfinder carrying section is in its retracted position. As previously indicated, in the retracted position of the viewfinder carrying section all light passing surfaces on which dust can accumulate are covered over by various cover elements previously described, and the shutter release button 13 is covered so that an accidental exposure is not possible.

Referring, now, in greater detail to Figs. 7—14 of the drawings, the teeth 30a of a gear 30 (Fig. 10) actuate a film advancing gear train and clutch system of the camera mechanism in response to the reciprocating movement of the viewfinder carrying section 2b by a user of the camera. As best illustrated in Figs. 10 to 14, the gear train and clutch system of the camera comprises a ratchet wheel 50 having a plurality of teeth 50a formed along its outer edge. Joined to the upper surface of the wheel 50, at the center thereof, is an extension or shaft 52 having a base portion 52a to the outer end of which is joined a reduced gear-retaining portion 52b. A base plate 54, having an opening 54a therethrough for receiving the base portion 52a of the shaft 52, is positioned on the upper surface of the ratchet wheel 50.

The plate 54 is adapted to support a clutch assembly which includes a drive disc or hub member 60. The member 60 has a centrally located opening 62 therethrough, and is formed on its lower surface 64 with an elongated, rectangularly shaped portion 64a, the ends 64a¹—64a² of which terminate inwardly of the outer edge of the member 60, and have a radius of curvature corresponding to that of the periphery of the member 60. The sides of the portion 64a each have a pair of spaced, laterally extending clutch spring seat forming portions 64b—64b for receiving clutch springs 66—66. Diametrically opposed guide portions 70—70 are formed on the lower surface 64 of the member 60, inwardly of the outer edge of the member 60, and between, but in spaced relation to, the ends of the seat forming portions 64b—64b. The springs 66—66, as shown each have a central, inwardly bent portion 66a which is adapted to be positioned between the seat forming portions 64b—

64b, and outwardly extending end portions 66b—66b, each of which is provided with a tooth-shaped bend 66c—66c.

The lower surface 64 of the member 60 also provides a seat for a ring-shaped transmission gear 72. The gear 72 has external teeth 72a formed along a portion of its outer periphery, and is provided with a plurality of evenly spaced inner teeth 72b along its inner edge. The teeth 72a of the gear 72 engage with the teeth 30a of the gear 30, while the teeth 72b of the gear 72 engage with the teeth-like bends 66c—66c in the clutch springs 66—66.

The upper surface of the hub member 60 is formed with a central recess 60a for receiving a sun gear 74 having an opening 74a therethrough in which the reduced end portion 52b of the extension 52 on the wheel 50 is secured. A second recess 60b is provided adjacent to the recess 60a for receiving a planetary gear 76. The recess 60b tangentially intersects the recess 60a to enable the teeth of the gear 76 to engage with the gear 74, and is provided with a central, circular extension 60c which is received in an opening 76a through the gear 76.

A collar 78, having a bore 78a therethrough, receives the base portion 52a of the extension 52 on the ratchet wheel 50. The base of the collar 78 abuts the gear 74, and the outer wall thereof is stepped to enable the inner end thereof to pass through the opening 54a in the plate 54 and rest against the inner surface of the ratchet wheel 50, and to enable a portion of the outer end thereof to pass through the opening 62 in the hub member 60. The stepped configuration of the outer wall of the collar 78 provides an inner shoulder 78b which abuts the plate 54, and an outer shoulder 78c which is in engagement with an annular, inwardly extending lip 60d formed in the member 60 at the opening 62 therethrough.

The member 60 is positioned within a ring-like film winding gear 80 having outer teeth 80a and inner teeth 80b. The outer teeth 80a are adapted to engage the teeth of a gear in a film cartridge or cassette (not shown) whereby film winding takes place. The inner teeth 80b of the gear 80 engage with the teeth of the planetary gear 76. The gear 80 is maintained in operative relation with respect to the hub member 60 by a cover plate 82 having countersunk bores 82a—82a therethrough for receiving screws 84—84 which are engaged in tapped bores 60e—60e formed in the hub member 60.

As best illustrated in Figs. 7, 8 and 9 of the drawings, the actuator plate 28 has an extension 28d adapted to engage a shutter cocking transmission member 90 when the viewfinder carrying section 2b is moved to

its retracted position. The shutter cocking transmission member 90 pivots on a pin 92, and is urged to its normally uncocked position by a spring 94 carried on the pin 92. The member 90, as shown, is comprised of three legs 90a, 90b and 90c which intersect with one another to impart a generally triangular configuration to the member 90. The leg 90a of the member 90 is curved slightly downwardly and has a curved inner margin 90a¹, the function of which will become clear as the description proceeds. The leg 90b intersects with the leg 90a and forms therewith a generally V-shaped recess 96, the function of which will also become clear as the description proceeds. The leg 90c of the member 90 carries a downwardly extending tab 90d which is engaged by the extension 28d on the actuator plate 28. The tab 90d has a notch at its outer end for receiving an arm of the spring 94. At the intersection of the leg 90a with the leg 90c, the end of the leg 90a forms a stop 98.

Referring to Figures 7 and 8 of the drawings, positioned above and adjacent to the shutter cocking transmission member 90 is shutter release member 100. The member 100 is mounted for pivotal movement on a pin 102, and has an extension 100a against the lower edge of which the leg 90c of the member 90 abuts as the member 90 is moved by the extension 28d of the actuator member 28. Referring to Figure 9 the member 100 also is provided with a stop-engaging tab 100b which releasably holds the stop 98 of the member 90 when the latter is in a fully cocked position.

Referring again to Figures 7 and 8, a shutter blade 104, pivotally mounted on a pin 106, is positioned in operative relation as described below to the transmission member 90. The blade 104 has a downwardly extending projection 104a which is struck by the leg 90c of the member 90, when the latter is released by depression of the shutter release button 13 (as described later), causing the shutter blade 104 to pivot out of the light path from the objective lens 19 to the film 140. The blade 104 is returned to a closed position with relation to the lens 19 by a spring 108 mounted on the pin 106. As the member 90 is moved into the cocked position, the leg 90c of the member is deflected clear of the projection 104a of the shutter blade by an extension 100a on the shutter blade to avoid an involuntary opening of the shutter.

The minimizing or prevention of overshoot, that is excess advancing of the film, is achieved with the camera mainly because the film winding operation is carried out when the viewfinder carrying section of the housing is moved to its extended position, since the user is then more likely to use less force than when moving the same to

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its retracted position. This feature also separates the shutter cocking and film winding operations, and simplifies the design of the camera operating and film winding mechanism now being described.

Film indexing a distance of one frame is achieved by the one time movement of the viewfinder section of the camera to its extended position. Film winding takes place during only a portion of this movement and film movement terminates when a film sensing finger 110 (see Figures 7 and 8) pivotally mounted on plate 54 and having a sensing and arresting pawl 112 provided thereon enters one of the film metering perforations 140a spaced one frame distance apart on the film 140. The film sensing finger 110 has a tab 110a for engaging an extension 114a formed at one end of a stroke lever 114. The lever 114 is mounted for rotation on the plate 54 by a pin 116, and is provided at its other end with a pawl 114b for engaging the teeth 50a of the ratchet wheel 50. A pair of spaced, inwardly extending hooked, spring retaining posts 114c and 54b are provided on the lever 114 and plate 54 respectively for receiving a tension spring 118 which acts to normally maintain the pawl 114b in engagement with the teeth 50a of the ratchet wheel 50. The finger 110 also has a spring retaining tab 110b which is positioned in a notch 120a formed in one side of a sensing lever 120. The lever 120 is mounted for rotation on a pin 122 secured in an extension of the plate 54. The lever 120 has an inwardly extending hooked sensing pawl 120b formed at the distal end thereof which is adapted to engage the camming edge 90a¹ of the leg 90a of the cocking transmission member 90. The lever 120 is also provided with a spring retaining post 120c which receives an end of a tension spring 124, the other end of which is anchored to a post 54b formed on the plate 54. The post 120c also receives one end of a tension spring 126, the other end of which is secured to the tab 110b of the sensing finger 110.

On the side of the extension of the plate 54 on which the lever 120 is positioned there is a lever 130 having a slot (not shown) formed in one end thereof through which extends the spring retaining tab 110b of the finger 110. The other end of the lever 130 is slidably secured in a slot 132a formed in a film cartridge or cassette sensing lever 132. The lever 132 moves against the bias of a spring 134, one end of which is retained in a hooked post 132b formed on the lever 132, and the other end of which abuts a projection 4a formed on the support frame.

Before a film cartridge or cassette is inserted into the camera, the pawl 112 on the film sensing finger 110 is in its extended or "out" position due to the force exerted by

the tension spring 124 upon the pivotal sensing lever 120. This force is transmitted to the pawl 112 through contact with the spring retaining tab 110b on the finger 110 by the innermost wall of the notch 120a in the lever 120. In addition, the pawl 112 is maintained at its extreme left (as viewed in Fig. 7), or film perforation engaging position by the force exerted by the tension spring 126 on the tab 110b. This same force moves the tab 110a away from the extension 114a of the stroke lever 114. As a result, the pawl 114b, by the action of the compression spring 118, is maintained in engagement with the teeth 50a of the ratchet wheel 50.

As indicated, a film cartridge or cassette can only be loaded into the camera when the viewfinder carrying section 2b is in its fully extended position. After a cassette has been loaded into the camera, the film 140 carried by the cassette presses against the pawl 112, if the pawl is not opposite a film perforation 140a, and forces the sensing finger 110 inward against the force of the tension spring 124 which causes lever 120 carrying the spring 124 to pivot slightly about pin 122. With the insertion of the film cassette into the main camera section 2a, the film winding gear 80 engages a gear (not shown) in the film cassette. The pawl 114b of the stroke lever 114 will movably engage with the teeth 50a of the ratchet wheel 50 to permit a film winding operation.

As just indicated, the pawl 112 of the film sensing finger does not, upon initial loading of the film cassette in the camera, generally fall into a perforation 140a in the film 140. As the viewfinder carrying section 2b of the camera is pushed to its retracted position, the extension 28d on the actuator plate 28 engages the extension 90d on the transmission member 90, causing the member 90 to pivot on the pin 92. When the stop 98 clears the tab 100b on the shutter release arm 100, the tab 100b moves down and engages the stop 98, thereby preventing the member 90 from returning to its normally uncocked position. The member 90, thus, is in a "cocked" position.

As the transmission member 90 is moved to its cocked position, the hooked sensing pawl 120b of lever 120 follows the profile of the curved camming edge 90a¹ of the leg 90a of the member 90. Normally, following the release of the shutter, the beginning of the cocking stroke of the section 2b will withdraw the film sensing pawl 112 from a perforation 140a of the film 140. As the member 90 is moved further toward its cocked position, the pawl 120b and the film sensing finger tab 110 controlled thereby are further drawn by the edge 90a¹ in a direction away from the film 140. At this stage, the film sensing finger pawl 112 does

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not make contact with the film 140. Near the end of the cocking stroke, the lever 120 pivots outwardly slightly on the pin 122 as the pawl 120b moves down a step in the camming edge 90a¹. The pawl 120b is drawn in the direction of the film 140 by the tension spring 124 which moves the film sensing finger 110 in the same direction, and the movement of the pawl 120b is sufficient to enable the film sensing pawl 112 to make contact with the film 140, at this stage this being at a location that has no perforation 140a.

At the same time that the extension 28d of the plate 28 is moving the member 90 to its cocked position, the teeth 29 on the rack 28a are rotating the gear 30 in a clockwise direction as viewed in Fig. 8. Since the teeth 30a of the gear 30 are engaged with the teeth 72a of the transmission gear 72, the gear 72 moves in a counterclockwise direction. However, this rotation of the gear 72 does not rotate film winding gear 80 because it is held against counterclockwise rotation by a spring pawl 144 (Fig. 8).

Under normal conditions of cocking the member 90 and film winding, the clutch hub 60 and gear 72 move together. The rotation of the clutch hub 60 is necessary to rotate film winding gear 80 because the gear 76 carried by the hub engages the internal teeth of the gear 80. However, rotation of gear 76 can only impart a rotating force on gear 80 if gear 74 meshing with gear 80 is held against rotation. This occurs only when ratchet wheel 50 to which gear 74 is secured is locked against clockwise rotation by pawl 114b. The clutch hub 60 will slip with regard to the gear 72 (that is, the teeth 66c—66c of the two clutch springs 66—66 will slip along the internal teeth 72b of the gear 72) when the gear 80, being driven in a clockwise direction during a film winding operation is restrained because the film in the cassette has been fully unwound. Moreover, when the viewfinder carrying section 2b is moved to a retracted position, the wheel 50 is free to move in the counterclockwise direction where it is driven by the rotation of gear 76 rotating along the internal teeth of gear 80 held against rotation by pawl 44.

To ensure full shutter cocking, film sensing pawl removal and a full one frame film winding operation to take place in a single reciprocation of the viewfinder carrying section, it is necessary to prevent outward movement of the viewfinder carrying section 2b until full completion of the cocking stroke. To this end, a stop lever 150 is provided. The lever 150 is mounted for pivotal movement on a pin 152, and has a pawl 150a at one end thereof for engaging ratchet teeth 28e integrally formed on the actuator 28 to permit, when engaged, only outward move-

ment of section 2b. A sensing tab 150b is provided at the other end of the lever 150 which is engaged by an extension 90e formed on the leg 90b of the transmission member 90. Release of the pawl 150a from the ratchet teeth 28e occurs when extension 90e on the member 90 engages the tab 150b at the end of the cocking stroke of the viewfinder carrying section 2b to permit inward movement of the latter.

Film advance occurs in the camera of the present invention when the viewfinder carrying section 2b is moved from a fully retracted position to its extended position as shown in Fig. 2. As the section 2b is being moved to its extended position, the teeth 29 on the rack 28a rotate the gear 30 in a counterclockwise direction and the gear 72 in a clockwise direction. Since the pawl 114b of the stroke lever 114 is engaged with the teeth 50a of the ratchet wheel 50, clockwise rotation of the ratchet wheel cannot occur. As a result, clockwise rotation of the gear 72, the hub member 60 and the planetary gear 76 takes place. The gear 76 then can drive the film winding gear 80 as it rotates around the locked gear 74. The film 140 is thus advanced to the next frame.

As the film 140 is advanced by the rotation of the gear 80, the pawl 112 on the film sensing finger 110 falls, due to the force of the tension spring 124, into a film perforation 140a. The pawl 112 moves with the film 140 as it is advanced by the gear 80. This movement of the pawl 112 is transmitted to the entire sensing finger 110, including the tab 110a. Movement of the tab 110a against the extension 114a of the lever 114 acts to disengage the pawl 114b from the teeth 50a of the ratchet wheel 50. As soon as this occurs, rotation of the ratchet wheel 50 can take place, and film advance ceases. With the pawl 114b in its disengaged position, any further movement of the section 2b in either direction would not cause further winding of the film. By thus causing the pawl 112 to enter a perforation 140a in film 140 near the end of the film advancing stroke of the section 2b, film movement is retarded, and precisely and positively controlled in a manner such that no overshoot occurs during winding.

When the shutter release member 100 is depressed by downward pressure exerted by the user on the shutter release button 13, the tab member 100b of the member 100 is moved inwardly, out of engagement with the stop 98 of the member 90. The member 90 thereupon is urged by the spring 94 in a direction which will place it in an uncocked position. As the member 90 moves, it strikes the projection 104a on the shutter blade 104, and exposure occurs. As soon as the stop 98 moves away from the tab 100b, a coil spring (not shown) on the release member

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100 urges the tab 100b against the leg 90a of the transmission member 90. As a result, the entire member 90 pivots slightly on pin 92. The hooked sensing pawl 120b thereupon follows the contour of the inner camming edge 90a' of the leg 90a until it reaches the generally V-shaped recess 96. With the sensing pawl 120b in this position, the pawl 112 on the film sensing finger 110 is in its extended condition, as shown in Fig. 9, due to the force exerted on the pivotal lever 120 by the compression spring 124.

It should be understood that various modifications may be made in the preferred embodiment of the invention described without deviating from the broader aspects of the invention.

WHAT WE CLAIM IS:—

1. A retractable camera having a main section on which is mounted substantially all of the camera mechanism including shutter operating mechanism which, when released from a cocked position when a picture is taken operates the camera shutter, and which further includes a film cartridge-receiving means for receiving a film cartridge including film with film metering perforations therein spaced one frame distance apart and film moving means for engaging the film to impart movement thereto, said main section of the camera having driving means to be coupled to said film moving means in said cartridge, a film perforation sensing member movably urged towards the path of movement of the film metering perforations of said film, for controlling the driving means to terminate film advance, said camera further having a view finder carrying section mounted telescopically on the main camera section for movement between a retracted non-picture taking position and an extended picture taking position, film winding actuating means on said view finder carrying section of the camera and film advancing mechanism in said main section of the camera responsive to movement of said film wind actuating means on said view finder carrying section only when said view finder carrying section of the housing is moved to said extended picture taking position to operate said drive means to initiate a film winding operation, and means on said main section of the camera for cocking said shutter operating mechanism and removing said sensing member from a film metering perforation to enable the sensing member to engage the film at a point behind the latter perforation before a subsequent movement of said view finder carrying section of the camera into said extended picture taking position, said film sensing member withdrawing means including means responsive only to movement of the said view finder carrying section towards said

retracted non-picture taking position for effecting said sensing member withdrawing operation.

2. A camera as claimed in claim 1 wherein said shutter operating mechanism cocking means includes means responsive only to movement of said view finder carrying section towards said retracted non-picture taking position for cocking said shutter operating mechanism.

3. A retractable camera as claimed in claim 1 or claim 2 wherein said view finder carrying section of the camera includes ratchet teeth, said main section of the housing includes ratchet pawl means engageable with said ratchet teeth and, when engaged with said ratchet teeth, preventing the view finder carrying section from being moved in the direction of said extended position but permitting the view finder carrying section to be moved to said retracted position and means for disengaging said ratchet pawl means from said ratchet wheel of said view finder carrying section of the camera when said shutter operating mechanism has been cocked by movement of said view finder carrying section to said retracted non-picture taking position, said ratchet pawl means remaining in said position where it is disengaged from said ratchet wheel until said shutter operating mechanism is un-cocked.

4. A camera as claimed in claim 3 wherein said view finder carrying section of the camera includes a frame member having a portion forming said ratchet teeth, a portion forming a part of the shutter operating mechanism to cock the same when the view finder carrying section is moved from its extended to its retracted position, the main section of the camera including gear means engaged by said ratchet wheel on said frame member of the view finder carrying section, said film advancing mechanism including means responsive to the rotation of said gear means only in a direction in which it is rotated when said view finder carrying section is moved from said retracted position towards said extended position.

5. A camera as claimed in any of claims 1 to 4 wherein said shutter operating mechanism includes a cocking transmission member having a cam surface thereon, follower means riding along said cam surface, said follower means being connected to said film perforation sensing member to withdraw the film perforation sensing member from one film perforation to engage a point on the film behind that perforation when the cocking transmission member is moved towards said cocked position.

6. A camera as claimed in any of the preceding claims wherein said viewfinder carrying section is operative to display a view of the scene to be photographed when said viewfinder carrying section is in said

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100 urges the tab 100b against the leg 90a of the transmission member 90. As a result, the entire member 90 pivots slightly on pin 92. The hooked sensing pawl 120b thereupon follows the contour of the inner camming edge 90a¹ of the leg 90a until it reaches the generally V-shaped recess 96. With the sensing pawl 120b in this position, the pawl 112 on the film sensing finger 110 is in its extended condition, as shown in Fig. 9, due to the force exerted on the pivotal lever 120 by the compression spring 124.

It should be understood that various modifications may be made in the preferred embodiment of the invention described without deviating from the broader aspects of the invention.

WHAT WE CLAIM IS:—

1. A retractable camera having a main section on which is mounted substantially all of the camera mechanism including shutter operating mechanism which, when released from a cocked position when a picture is taken operates the camera shutter, and which further includes a film cartridge-receiving means for receiving a film cartridge including film with film metering perforations therein spaced one frame distance apart and film moving means for engaging the film to impart movement thereto, said main section of the camera having driving means to be coupled to said film moving means in said cartridge, a film perforation sensing member movably urged towards the path of movement of the film metering perforations of said film, for controlling the driving means to terminate film advance, said camera further having a view finder carrying section mounted telescopically on the main camera section for movement between a retracted non-picture taking position and an extended picture taking position, film winding actuating means on said view finder carrying section of the camera and film advancing mechanism in said main section of the camera responsive to movement of said film wind actuating means on said view finder carrying section only when said view finder carrying section of the housing is moved to said extended picture taking position to operate said drive means to initiate a film winding operation, and means on said main section of the camera for cocking said shutter operating mechanism and removing said sensing member from a film metering perforation to enable the sensing member to engage the film at a point behind the latter perforation before a subsequent movement of said view finder carrying section of the camera into said extended picture taking position, said film sensing member withdrawing means including means responsive only to movement of the said view finder carrying section towards said

retracted non-picture taking position for effecting said sensing member withdrawing operation.

2. A camera as claimed in claim 1 wherein said shutter operating mechanism cocking means includes means responsive only to movement of said view finder carrying section towards said retracted non-picture taking position for cocking said shutter operating mechanism.

3. A retractable camera as claimed in claim 1 or claim 2 wherein said view finder carrying section of the camera includes ratchet teeth, said main section of the housing includes ratchet pawl means engageable with said ratchet teeth and, when engaged with said ratchet teeth, preventing the view finder carrying section from being moved in the direction of said extended position but permitting the view finder carrying section to be moved to said retracted position and means for disengaging said ratchet pawl means from said ratchet wheel of said view finder carrying section of the camera when said shutter operating mechanism has been cocked by movement of said view finder carrying section to said retracted non-picture taking position, said ratchet pawl means remaining in said position where it is disengaged from said ratchet wheel until said shutter operating mechanism is un-cocked.

4. A camera as claimed in claim 3 wherein said view finder carrying section of the camera includes a frame member having a portion forming said ratchet teeth, a portion forming a part of the shutter operating mechanism to cock the same when the view finder carrying section is moved from its extended to its retracted position, the main section of the camera including gear means engaged by said ratchet wheel on said frame member of the view finder carrying section, said film advancing mechanism including means responsive to the rotation of said gear means only in a direction in which it is rotated when said view finder carrying section is moved from said retracted position towards said extended position.

5. A camera as claimed in any of claims 1 to 4 wherein said shutter operating mechanism includes a cocking transmission member having a cam surface thereon, follower means riding along said cam surface, said follower means being connected to said film perforation sensing member to withdraw the film perforation sensing member from one film perforation to engage a point on the film behind that perforation when the cocking transmission member is moved towards said cocked position.

6. A camera as claimed in any of the preceding claims wherein said viewfinder carrying section is operative to display a view of the scene to be photographed when said viewfinder carrying section is in said

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(18)

extended position but is disabled from showing the view of the scene to be photographed when the viewfinder carrying section is in said retracted position.

7. A camera as claimed in any of the preceding claims wherein the film drive means has a slip clutch arranged to slip when the film is restrained against advance at the end of its travel through the film cartridge.

8. A camera as claimed in claim 7 wherein the film advancing mechanism on said main section of the camera coupled between said film wind actuating means on said reciprocable section and said drive means on said main section of the camera comprises first rotatable means responsive to movement of said film wind actuating means and movable in one direction and the other respectively by reciprocation of said reciprocable section in one direction and the other between said retracted and extended positions, a slip clutch coupled for movement with said first rotatable means and being in non-slipping relation therewith so long as there is film free to be advanced by the film moving means, an additional gear connecting the slip clutch to the film moving means and a control responsive to the position of said film perforation sensing member and the movement of said slip clutch for coupling the movement of said first rotatable means and slip clutch through said additional gear to said film moving means only when said first gear is moved in a direction resulting from the movement of said reciprocable section in one of said directions and said sensing member has a position other than a given film winding terminating position within one of said film metering apertures.

9. A camera as claimed in claim 8 wherein the first rotatable means comprise a first gear and the slip clutch include resilient flexible means having projecting means engaging with said teeth of said first gear, said projecting means of said resilient flexible means being in non-slipping rotation with the teeth so long as the film is free to be advanced by said film moving means.

10. A camera as claimed in claim 8 or claim 9 wherein said first gear and slip clutch are mounted for rotation about a

common axis of rotation with said first gear, said first gear having a central circular opening lined with said teeth, and said slip clutch having a recess therein in which is rotatably mounted at least one of said additional gear.

11. A camera as claimed in any of claims 8 to 10 wherein said film advancing mechanism includes an annular gear rotatable in only a film winding direction and having internal teeth, a portion thereof constituting said drive means to be coupled to said film moving means on said cartridge, an eccentrically mounted gear pivoted upon and carried by said slip clutch and engaging said internal teeth of said annular gear, a centrally mounted gear meshing with said eccentrically mounted gear, said eccentrically mounted gear when said slip clutch is rotated, rotating in non-driving relationship to the internal teeth of said annular gear when said eccentrically mounted gear is free to rotate and engaging said internal teeth in driving relationship therewith to effect a film winding operation when said eccentrically mounted gear is held against rotation, a ratchet wheel drivingly connected to said eccentrically mounted gear, a pawl engageable with said ratchet wheel so that the ratchet wheel can freely rotate in a first direction and is held against rotation in the other direction by the pawl, said pawl normally being in engagement with said ratchet wheel so that the latter cannot rotate in said one direction when the reciprocable section is moved in a direction to effect a film winding operation and means responsive to said film perforation sensing member entering and assuming a given position with a film perforation for removing said pawl from engagement with said ratchet wheel.

12. A retractable camera substantially as described with reference to and as illustrated in the accompanying drawings.

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