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(72) Inventors EVAN ALBERT EDWARDS
and DAVID EASTON BEACH

(54) DRIVE MECHANISM FOR PHOTOGRAPHIC FILM

(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 film cartridges and the means for transporting film loaded therein. More particularly, the invention relates to a gear driven film cartridge for effecting the transportation of film loaded in the cartridge, and to a camera for receiving such a cartridge.

It is an object of the present invention to provide a film cartridge having a gear drive take-up means of improved form.

Another object of the present invention is the provision of a camera having film advancing apparatus for cooperating with the gear-drive take-up means of the cartridge.

In accordance with the present invention there is provided a film cartridge comprising means defining a film plane for exposure of the film, a take-up means including a take-up chamber for receiving film from the plane and locating means for locating the cartridge in the camera, wherein the take-up means includes a gear co-axial with the take-up chamber and arranged, in use, to mate with and be driven by a gear of a camera's film winding mechanism, the gear being accessible to the camera's gear only over an arc remote from the film plane defining means.

The invention also provides a photographic camera arranged to receive a film cartridge as claimed in claim 1 and comprising a take-up recess wherein the take-up chamber of the cartridge is receivable, a drive gear arranged, in use, for meshing engagement with the take-up means gear, on insertion of the cartridge into the camera, and locating means

for locating the cartridge in the camera, characterised in that the camera drive gear has an axis located in that quadrant of the take-up recess remote from the optical axis and the focal plane of the camera.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a perspective view of film cartridge and camera each according to the present invention;

Fig. 2 is an axial section in a plane including the line II—II in Fig. 1, as it would appear when the cartridge is loaded in the camera;

Fig. 3 is a schematic illustration of a top view of a film cartridge loaded in a camera, with portions cut away to expose a gear train; and

Fig. 4 is a partial top view of a film cartridge loaded in a camera.

Because cameras and film cartridges are well known, the present description will be directed in particular to those camera and cartridge elements necessary to the understanding of the present invention. It is to be understood that camera and cartridge elements not specifically shown or described may take various forms well known to those skilled in the art.

A film cartridge 1 is shown in Fig. 1 in position ready for insertion into a camera 3 and comprises a film supply compartment 4, a wall 5 defining a film plane on the forward face thereof, and a film take-up compartment 2. Camera 3 includes chambers 6 and 7 for receiving the supply and take-up compartments, respectively, of film cartridge 1. Film cartridge 1 is accurately located with respect to the focal plane of the camera objective (not shown) by means of horizontal support members 8, and vertical stepped support members 40, which members engage a corresponding structure 41 in cartridge 1 (see Fig. 3). A received cartridge is urged into

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engagement with members 8 and 40 by leaf springs 9 mounted on the interior of a camera door 10, which is hinged to the rearward part of camera 3 in a conventional manner. The camera film advance mechanism comprises a manually operable knob 11 to which is attached a driving gear 12, gear 12 being engageable with a gear 13 connected to a core in take-up chamber 2 of the cartridge, in a manner and for reasons to be described hereinafter. The gear 12 is located such that its axis lies in that quadrant of the chamber 7 remote from both the optical axis and the film plane of the camera.

Fig. 2 indicates that take-up chamber 2 comprises a cylindrical casing 20, a top wall 21 including an enclosing gear cover 22, radially open, to receive the gear 12, over an arc remote from the film plane and a bottom wall 24. Enclosed in take-up chamber 2 and substantially co-axial therewith is a film core 26 having an annular recess 28 at its upper end in a mating relationship with an inwardly extending annular lip 29 to form a labyrinth light seal at the upper end of chamber 2, and another recess at its lower end by means of which core 26 is journaled on post 30. Moulded integrally and co-axially with the film spool 26 is gear 13 which, when rotated, drives core 26 to wind film 50 from supply chamber 4 onto core 26. Gear cover 22 extends over gear 13 to an extent sufficient to render gear 13 manually inaccessible, and has extending therefrom a post 34 which serves as a bearing for gear 13. The diameter of gear 13 is substantially less than the diameter of take-up chamber 2, and gear cover 22 is only large enough to fulfil its function, thereby maintaining the compactness of the cartridge. Top wall 21 and gear cover 22 define an opening 36 through which driving gear 12 in camera 3 is given access to gear 13 for engagement therewith. The end portion 37 of gear cover 22 is tapered to guide driving gear 12 through opening 36 and into engagement with gear 13. Compartment 7 of camera 3 is so structured that, upon insertion of film cartridge 2 into camera 3, gears 12 and 13 necessarily become engaged.

For purposes of economy of manufacture, the cartridge housing shown consists of only two sections. One section includes part of side wall 20, top wall 21, gear cover 22, lip 29 and bearing post 34, and the other section includes the remaining part of side wall 20, post 30, and bottom wall 24. These components are preferably made from moulded plastic, but other suitable materials and methods will readily occur to those skilled in the art.

Referring now to Fig. 3, film cartridge 2 is shown loaded in camera 3 and positioned on support members 40 of the camera. Leaf springs 9 fastened to camera door 10 urge

cartridge 2 against camera support members 40. Gear cover 22 of take-up chamber 2 is cut away in Fig. 3 in order to reveal core gear 13 and camera driving gear 12. As indicated by the directional arrow on core gear 13, that gear must be rotated in a counterclockwise direction to wind film on core 26. Accordingly, knob 11 (Fig. 1) must be rotated in a clockwise direction similarly to rotate drive gear 12 to effect the correct rotation of gear 13. As the axis of the gear 12 is in the quadrant of the chamber 7 remote from both the optical axis of the camera and the film plane of the camera, the gears 12 and 13 will mesh at an angle ϕ as seen on Fig. 3. Gears 12 and 13 have a pressure angle of 20° , but of course other gear angles could be used. By arranging the plane A—A defined by the axes of rotation of driving gear 12 and core gear 13 from a normal N—N to the film plane, at 20° so that the angle of offset ϕ equals the pressure angle of the gears, the directional force F resulting from the driving engagement of gears 12 and 13 will be parallel to the film plane. The absence of a resulting force normal to the film plane negates the necessity of providing means for offsetting such a force in order to prevent the unseating of the film cartridge from support members 40. Film cartridge 2 is contoured by the provision of seating pad 39 on the outer surface of cylindrical casing 20, so that the cartridge contacts one support member 40 in the path of the line of force F, thus obviating the creation of a moment by the force F, and accordingly obviating the need for providing a counterbalancing moment to avoid unseating of film cartridge 2 by such a moment. Of course, if the line of force F only passes near the point of contact instead of through it, a slight moment will be created, which if minimal, is easily counterbalanced by spring 9.

As an alternative to the contouring of film cartridge 2 to engage the camera along the line of force F as described above, the camera elements defining the chamber for a cartridge take-up compartment can be structured to accomplish the same end. Thus, referring to Fig. 4, a film cartridge 1¹ includes a take-up compartment 2¹ having a slightly modified profile from previously described cartridge 1. Take-up compartment 2¹ has co-axially associated therewith a gear 13¹, a gear cover 22¹, and support structure 41¹, which elements correspond in function and structure to the like-numbered elements (without the superscript) previously discussed. The camera in which cartridge 1¹ is located includes a gear 12¹, the axis of which is located in that quadrant of the chamber 7 remote from both the optical axis and the film plane of the camera which gear 12¹ engages gear 13¹ in such an offset manner,

again referring to the earlier discussion, that the directional force F^1 is parallel with the film plane. To avoid a moment tending to unseat cartridge 1^1 from the camera support members, the camera support structure is contoured so that it engages the cartridge on the line of force F^1 . Hence, camera support members 40^1 include a slightly tapered portion 43^1 which need not be in contact with the cartridge, and a section 45^1 of no taper which is in intimate contact with the similarly shaped housing of cartridge 1^1 on the line of force F^1 . This section is sufficiently large to assure the line of force F^1 will pass through it regardless of slight variation in the manner of engagement of gears 12^1 and 13^1 .

Reference is made to our copending Application No. 25919/71 (Serial No. 1,346,646) which describes and claims related subject matter.

WHAT WE CLAIM IS:—

1. A film cartridge comprising means defining a film plane for exposure of the film, a take-up means including a take-up chamber for receiving film from the film plane and locating means for locating the cartridge in the camera, wherein the take-up means includes a gear co-axial with the take-up chamber and arranged, in use, to mate with and be driven by a gear of a camera's film winding mechanism, the gear being accessible to the camera's gear only over an arc remote from the film plane defining means.

2. A cartridge as claimed in claim 1 wherein the take-up means includes a spool located in the take-up chamber of the cartridge.

3. A cartridge as claimed in claim 2 wherein the take-up means gear is integrally moulded with the spool.

4. A cartridge as claimed in any of claims 1 to 3 including a film supply chamber connected to the film plane defining means.

5. A film cartridge as claimed in claim 1 and substantially as hereinbefore described with reference to and as illustrated in Fig. 1 to 3 or Fig. 1 to 3 as modified by Fig. 4 of the accompanying drawings.

6. A photographic camera arranged to receive a film cartridge as claimed in claim 1 and comprising a take-up recess wherein the take-up chamber of the cartridge is receivable, a drive gear arranged, in use, for meshing engagement with the take-up means gear, on insertion of the cartridge in the camera, and locating means for locating the cartridge in the camera, characterised in that the camera drive gear has an axis located in that quadrant of the take-up recess remote from the optical axis and the focal plane of the camera.

7. A camera as claimed in claim 6 including a supply recess wherein a side wall of the take-up recess is located at least in part, in a plane normal to the position of the focal plane and includes the surface for contacting a reaction surface of the cartridge.

8. A photographic camera substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 3 or Figs. 1 to 3 as modified by Fig. 4 of the accompanying drawings.

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

again referring to the earlier discussion, that the directional force F^1 is parallel with the film plane. To avoid a moment tending to unseat cartridge 1¹ from the camera support members, the camera support structure is contoured so that it engages the cartridge on the line of force F^1 . Hence, camera support members 40¹ include a slightly tapered portion 43¹ which need not be in contact with the cartridge, and a section 45¹ of no taper which is in intimate contact with the similarly shaped housing of cartridge 1¹ on the line of force F^1 . This section is sufficiently large to assure the line of force F^1 will pass through it regardless of slight variation in the manner of engagement of gears 12¹ and 13¹.

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WHAT WE CLAIM IS:—

1. A film cartridge comprising means defining a film plane for exposure of the film, a take-up means including a take-up chamber for receiving film from the film plane and locating means for locating the cartridge in the camera, wherein the take-up means includes a gear co-axial with the take-up chamber and arranged, in use, to mate with and be driven by a gear of a camera's film winding mechanism, the gear being accessible to the camera's gear only over an arc remote from the film plane defining means.

2. A cartridge as claimed in claim 1 wherein the take-up means includes a spool located in the take-up chamber of the cartridge.

3. A cartridge as claimed in claim 2 wherein the take-up means gear is integrally moulded with the spool.

4. A cartridge as claimed in any of claims 1 to 3 including a film supply chamber connected to the film plane defining means.

5. A film cartridge as claimed in claim 1 and substantially as hereinbefore described with reference to and as illustrated in Fig. 1 to 3 or Fig. 1 to 3 as modified by Fig. 4 of the accompanying drawings.

6. A photographic camera arranged to receive a film cartridge as claimed in claim 1 and comprising a take-up recess wherein the take-up chamber of the cartridge is receivable, a drive gear arranged, in use, for meshing engagement with the take-up means gear, on insertion of the cartridge in the camera, and locating means for locating the cartridge in the camera, characterised in that the camera drive gear has an axis located in that quadrant of the take-up recess remote from the optical axis and the focal plane of the camera.

7. A camera as claimed in claim 6 including a supply recess wherein a side wall of the take-up recess is located at least in part, in a plane normal to the position of the focal plane and includes the surface for contacting a reaction surface of the cartridge.

8. A photographic camera substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 3 or Figs. 1 to 3 as modified by Fig. 4 of the accompanying drawings.

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

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