

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO A SPRING AND A PRESSURE APPLYING ASSEMBLY USING SUCH SPRING

(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:—

This invention relates generally to photographic cameras arranged to use self-processing picture units for successive exposure and processing the units by being transported through a pressure-applying assembly. The invention is particularly, but not exclusively, concerned with the provision of a spring for an improved pressure-applying assembly for such a camera.

An object of the present invention is the provision of a spring for use in a pressure-applying assembly of a photographic camera arranged to receive self-processing photographic film units.

According to the present invention, there is provided a spring comprising a pair of spaced, substantially parallel elongate first members substantially inflexible in a first direction, and having engaging members substantially inflexible in a first direction, and having means adjacent each end of each member, whereby the spring may be located, in use, in an apparatus, a second elongate member extending substantially parallel between the first members and connected thereto by transversely extending bridge means centrally of the first and second members, the second member being resiliently flexible in the first direction and being arranged, in use, to apply bias, when flexed in said direction whilst the first members are held by the engaging means.

A further object of the present invention is the provision of an improved pressure-applying assembly for use in self-processing cameras.

According to the present invention there is also provided a pressure-applying assembly comprising a pair of elongate pressure-applying members between which a self-processing photographic picture unit may be passed to initiate development thereof, means for retaining the pressure-applying members in substantially parallel relation yet permitting relative separation thereof, and a spring, for resisting the separation, in the form of three substantially parallel strips connected by bridge means extending transversely of the strips substantially centrally thereof, the two outer strips forming arms that are substantially inflexible in a direction parallel to a direction of resilient flexibility of the middle strip, and the retaining means cooperating with engaging means on the ends of the arms of the spring which cooperate with the retaining means to hold the spring in position relative to the pressure-applying members such that the end portions of the middle strip are positioned resiliently to resist separation of the pressure-applying members.

The invention will be described further, by way of example, with reference to the accompanying drawings wherein like reference numerals denote like elements and wherein:

Figure 1 is a perspective view of a photographic camera, arranged to receive selfprocessing photographic film units, having a portion thereof broken away to reveal a pressure-applying assembly according to, and embodying a spring also according to, the present invention;

Figure 2 is a perspective view of a spring according to the present invention;

Figure 3 is a sectional view of the

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pressure-applying assembly of Figure 1 taken along line III—III but not showing a film unit being processed by the assembly;

Figure 4 is a plan view of the pressure-applying assembly;

Figure 5 is a partial view of an end of the pressure-applying assembly indicated by the line V—V in Figure 4;

Figure 6 is a view of an end of the pressure-applying assembly indicated by the line VI—VI in Figure 4, partially broken away;

Figure 7 is a view similar to Figure 3 showing a cross-section of the pressure-applying assembly when a picture unit is present between rollers of the assembly;

Figure 8 is a view of the end of the pressure-applying assembly indicated by line VIII—VIII of Figure 7;

Figure 9 is an enlarged cross-sectional detail of the point contact between the spring and a bearing block of the assembly as shown in Figure 6; and

Figure 10 is an enlarged sectional detail of the point contact between the spring and bearing block in a plane at right angles to that of the cross-section shown in Figure 9.

As photographic cameras are well known, the ensuing description will be directed in particular to elements forming part of, or cooperating more directly with, the pressure-applying assembly, camera elements not specifically shown or described herein being understood to be selectable from those known in the art.

A camera 12, illustrated in Figure 1 of the drawings, is suitable for exposing and processing self-processing film units and is basically composed of a light-tight camera body 14 which is provided with a latchable, hinged loading door 16 and a forwardly projecting extension 18 supporting a camera lens 20 and a shutter assembly housing 22. The pressure-applying assembly, generally designated 24, is located within and supported by the camera body 14.

The hinged loading door 16 on the back of the camera body 14 can be opened for the camera to receive a pack of self-processing film units (not shown). After one of the film units has been exposed in the camera, it is moved by a mechanism (not shown) to the pressure-applying assembly 24 for initiation of processing. The picture unit is advanced through the pressure-applying assembly to initiate development of the latent image. A picture unit 26 which has been partially advanced through the pressure-applying assembly 24 is shown, in Figure 1, emerging through a slot (not shown) in the side of the camera. Further details of the pressure-applying assembly will be described hereinafter with reference to Figures 2 to 10. For present purposes,

however, it will be sufficient to explain that the pressure-applying assembly includes a pair of juxtaposed rotatable rollers 28 and 30 which are held in a frame 32 by a spring 34.

The self-processing film unit has a multi-layered image-receiving portion and a rupturable pod containing a fluent processing composition. After the film unit has been exposed in the camera, it is advanced into the nip formed by the rollers 28 and 30. The rollers 28 and 30 are urged towards each other by means of the spring 34 to apply pressure on the film unit. Once the exposed film unit is in the nip formed by the rollers, rotation of one or both of the rollers continues the movement of the film unit between the rollers thereby rupturing the pod and spreading the processing composition between layers of the film unit.

Rotation of the rollers 28 and 30 is accomplished either manually by means of an external crank (not shown) or by a motor (also not shown), driving a gear 38.

Reference is now made to Figures 2 to 6 which more clearly show the details of the pressure-applying assembly 24. As shown therein, the pressure assembly 24 includes a frame 32, a pair of rollers 28 and 30, a pair of bearing blocks 42, a leaf spring 34, and a pair of gears 40 and 46.

The rollers 28 and 30 are substantially identical, each having an annular groove 48 near one end. The frame 32 that holds the rollers in juxtaposed relationship has a base portion 35 slightly shorter than the length of the rollers 28 and 30 and two end portions 31 and 33, perpendicular to the base portion, having slots 49 and 51 therein for rotatably receiving the ends of the rollers. A rib 50 of the inside edge of the slot 49 engages the annular grooves 48 of the rollers to prevent longitudinal motion of the rollers in the frame 32. When so rotatably mounted in the frame, the rollers may separate by undergoing relative radial displacement.

The bearing blocks 42 are received in recesses 43 and 45 in the frame 32 and cover the open ends of the slots 49 and 51. As best shown by Figures 6 and 8, the bearing blocks 42 have a concave part-cylindrical surface 53 that is complementary to the cylindrical surface 55 of the pressure roller 28 and is engageable by the pressure roller 28. The bearing blocks 42 rest on the bottom surface 57 of the recesses 43 and 45 in the end portions of the frame and are out of contact with the roller 28 when there is no picture unit between the rollers. Thus, there is a maximum unimpeded radial displacement possible between the two rollers before the ends of the roller 28 contact the bearing blocks 42. The only critical tolerance in

manufacturing the frame 32 for maintaining this maximum unimpeded radial displacement is the distance from the bottom of the slots 49 and 51 to the bottoms 57 of the recesses 43 and 45.

Referring now to Figure 2, the spring 34, according to the present invention, may be stamped from a flat sheet of spring material to form three substantially parallel strips, the two outside strips 62 being connected to the middle strips 66 by transversely extending narrow bridges 63 of material. The bridges 63 are bent so that the two outside strips 62 form a pair of arms that are substantially parallel to the middle strip 66 and are flexible in a direction perpendicular to the direction of flexibility of the middle strip and are substantially inflexible in a direction parallel to the direction of flexibility of the middle strips 66. The end portions of the middle strip 66 are bent down slightly along lines 68 to result in a generally bow-shaped leaf spring. The ends of the arms 62 are bowed slightly away from the middle strips 66 for reasons to be explained in the following paragraph. A portion of each end portion of the arms 62 is bent at slightly less than right angles to the arm to form engaging tabs 72.

As best illustrated in Figure 4, a pair of struts 58 connect the end portions 31 and 33 of the frame 32. As shown in Figure 6, the undersides of the struts 58 slope slightly upwards away from the rollers. The spring 34 is held under tension in frame 32 by hooking the engaging tabs 72 under the struts 58, the upward slope of the underside of the struts 58 cooperating with the slightly acute angle of the tabs securely to retain the tabs under the struts. As seen in Figure 4, the slight outward bow of the arms 62 also helps to ensure that the tabs 72 remain under the struts 58 and will resist displacement when the assembly is subjected to mechanical shocks. When assembled, the ends of the bow-shaped middle strip 66 of the spring 34 exert equal forces against the bearing blocks 42. As the points where the tabs 72 hook under the struts 58 are near where the struts join the end portions 31 and 33 of the frame 32, the struts can be relatively thin and still support the forces encountered in normal use. Also, because the force of the spring 34 is equally distributed to four points of the frame, the total force that must be born by any part of the frame is relatively small thus allowing the frame to be constructed out of material such as a moulded plastics material.

When the pressure rollers 28 and 30 are mounted in the frame 32 and the bearing blocks 42 are positioned in their recesses 43 and 45, the spring 34 is easily assembled in the frame by flexing the ends of the arms 62, the arms 62 now being in the position

indicated in phantom in Figure 4. The bow-shaped strip 66 is then forced against the bearing blocks 42 until the arms 62 can be released to catch the tabs 72 under the struts 58. The total force of the spring 34 pressing against the bearing blocks 42 is thus distributed equally to the frame 32 among the four points where the tabs 72 hook under the struts 58.

As may be understood from the above description, the assembled pressure-applying assembly is held together by the spring 34 and can be handled as a unit during assembly of the camera with no danger of losing any parts from the assembly.

As shown in Figure 2, semi-cylindrical dimples 80 are embossed in the ends of the bow-shaped strip 66, the cylindrical axes of the dimples being perpendicular to the longitudinal axis of the spring. The tops of the bearing blocks 42 have part-cylindrical surfaces 81 the axes of which are perpendicular to axis of the cylindrical surfaces of the dimples 80. Thus, the ends of the strip 66 always contact the bearing blocks substantially at a point 82, shown in detail in Figures 9 and 10, so that the bearing blocks will evenly engage the surface of the roller 28 regardless of the angle at which the ends of the strip 66 encounter the bearing blocks.

As illustrated in Figure 3, if desired, a minimum clearance C (less than the thickness of a picture unit) can be maintained between one end of the rollers 28 and 30 by means of a disc-shaped projection 52 which extends radially beyond the roller 28 and engages an extension 54 of the roller 30. The minimum clearance thus established protects the surface finish of the rollers by preventing the rollers from contacting one another when the camera is jarred and in the absence of a picture unit in the nip. This minimum clearance, as shown in Figure 5, also serves to protect the teeth of the gear 46 attached to roller 28 from bottoming out against the teeth of gear 56 attached to the roller 30.

As shown in Figure 6, rollers 28 and 30 are free to move radially away from each other a certain unimpeded distance D before the roller 28 contacts the bearing blocks 43 and 45. This distance D is slightly greater than the clearance C established between one end of rollers 28 and 30 and enables a picture unit more easily to enter the nip of the rollers. As shown in Figures 7 and 8, when a picture unit 26 is between the rollers 28 and 30, the bearing blocks 43 and 45 no longer rest on the ledges 57 but transmit the force of strip 66 to roller 28. Also, disc-shaped projection 52 no longer contacts the extension 54 of the roller 30.

Equal force is maintained by the bow-shaped strip 66 on the bearing blocks 42 because the middle strip 66 of the spring 34 is able to twist slightly on the narrow bridges 63. Because the narrow bridges 63 provide relatively little resistance to slight rotations of the middle strip 66 about an axis passing through the narrow bridges, manufacturing tolerances on the parallelism of arms 62 and middle strip 66 are not critical.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A spring comprising a pair of spaced, substantially parallel elongate first members substantially inflexible in a first direction and having engaging means adjacent each end of each member whereby the spring may be loaded, in use, in an apparatus, a second elongate member extending substantially parallel between the first members and connected thereto by transversely extending bridge means centrally of the first and the second members, the second member being resiliently flexible in the first direction and being arranged, in use, to apply bias, when flexed in said direction whilst the first members are held by the engaging means.

2. A spring as claimed in Claim 1 wherein the first members are elongate in the direction parallel to the second member and are resiliently flexible in a second direction perpendicular to said first direction.

3. A spring as claimed in Claim 1 or 2 in the form of a unitary metal stamping.

4. A spring substantially as hereinbefore described with reference to and as illustrated in Figure 2 of the accompanying drawings.

5. A pressure-applying assembly comprising a pair of elongate pressure-applying members between which a self-processing photographic picture unit may be passed to initiate development thereof, means for retaining the pressure-applying members in substantially parallel relation yet permitting relatively separation thereof, and a spring, for resisting the separation, in the form of three substantially parallel strips connected by bridge means extending transversely of the strips substantially centrally thereof, the two outer strips forming arms that are substantially inflexible in a direction parallel to the direction of resilient flexibility of the middle strip, and the retaining means cooperating with engaging means on the

ends of the arms of the spring which cooperate with the retaining means to hold the spring in position relative to the pressure-applying members such that the end portions of the middle strip are positioned resiliently to resist separation of the pressure-applying members.

6. An assembly as claimed in Claim 5, wherein at least one of said pair of elongate pressure-applying members comprises a cylindrical roller.

7. An assembly as claimed in Claim 5 or 6 wherein the retaining means includes an elongate base member, a pair of end portions connected to the base member and having openings therein for receiving the ends of the elongate pressure-applying members, and a pair of struts extending between the end portions of the retaining means, one strut being disposed on each of two opposite sides of the openings therein, the engaging means comprising an outwardly extending tab on each end portion of each of the arms adapted to engage the underside of the struts to hold the spring in position relative to the pressure-applying members and the retaining means.

8. An assembly as claimed in Claim 7 wherein the arms are resiliently flexible in a direction perpendicular to the direction of flexibility of the middle strip whereby the spring may be installed in the retaining means by flexing the arms of the spring inwardly towards the middle strip until the tabs clear the struts, placing the spring in position relative to the pressure-applying members and the retaining means, and releasing the arms so that the tabs engage the underside of the struts.

9. An assembly as claimed in Claim 7 or 8 wherein the pair of elongate pressure-applying members comprises a pair of cylindrical rollers and the openings in the end portions of the retaining means comprise slots for rotatably receiving the ends of the cylindrical rollers.

10. An assembly as claimed in Claim 9, wherein a pair of bearing blocks is provided, each block covering the open end of a respective one of the slots and being disposed between one end of the middle strip of the spring and the corresponding end of one of the rollers, the bearing blocks being engageable by one of the rollers when a predetermined separation of the rollers has been achieved the ends of the middle strip of the spring thereafter contacting the bearing blocks to urge them toward the one roller.

11. An assembly as claimed in Claim 10, wherein the surface of each bearing block which is contacted by an end of the middle strip of the spring is a convex part-cylindrical surface, and the ends of the middle strip of

Equal force is maintained by the bow-shaped strip 66 on the bearing blocks 42 because the middle strip 66 of the spring 34 is able to twist slightly on the narrow bridges 63. Because the narrow bridges 63 provide relatively little resistance to slight rotations of the middle strip 66 about an axis passing through the narrow bridges, manufacturing tolerances on the parallelism of arms 62 and middle strip 66 are not critical.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A spring comprising a pair of spaced, substantially parallel elongate first members substantially inflexible in a first direction and having engaging means adjacent each end of each member whereby the spring may be loaded, in use, in an apparatus, a second elongate member extending substantially parallel between the first members and connected thereto by transversely extending bridge means centrally of the first and the second members, the second member being resiliently flexible in the first direction and being arranged, in use, to apply bias, when flexed in said direction whilst the first members are held by the engaging means.

2. A spring as claimed in Claim 1 wherein the first members are elongate in the direction parallel to the second member and are resiliently flexible in a second direction perpendicular to said first direction.

3. A spring as claimed in Claim 1 or 2 in the form of a unitary metal stamping.

4. A spring substantially as hereinbefore described with reference to and as illustrated in Figure 2 of the accompanying drawings.

5. A pressure-applying assembly comprising a pair of elongate pressure-applying members between which a self-processing photographic picture unit may be passed to initiate development thereof, means for retaining the pressure-applying members in substantially parallel relation yet permitting relatively separation thereof, and a spring, for resisting the separation, in the form of three substantially parallel strips connected by bridge means extending transversely of the strips substantially centrally thereof, the two outer strips forming arms that are substantially inflexible in a direction parallel to the direction of resilient flexibility of the middle strip, and the retaining means cooperating with engaging means on the

ends of the arms of the spring which cooperate with the retaining means to hold the spring in position relative to the pressure-applying members such that the end portions of the middle strip are positioned resiliently to resist separation of the pressure-applying members.

6. An assembly as claimed in Claim 5, wherein at least one of said pair of elongate pressure-applying members comprises a cylindrical roller.

7. An assembly as claimed in Claim 5 or 6 wherein the retaining means includes an elongate base member, a pair of end portions connected to the base member and having openings therein for receiving the ends of the elongate pressure-applying members, and a pair of struts extending between the end portions of the retaining means, one strut being disposed on each of two opposite sides of the openings therein, the engaging means comprising an outwardly extending tab on each end portion of each of the arms adapted to engage the underside of the struts to hold the spring in position relative to the pressure-applying members and the retaining means.

8. An assembly as claimed in Claim 7 wherein the arms are resiliently flexible in a direction perpendicular to the direction of flexibility of the middle strip whereby the spring may be installed in the retaining means by flexing the arms of the spring inwardly towards the middle strip until the tabs clear the struts, placing the spring in position relative to the pressure-applying members and the retaining means, and releasing the arms so that the tabs engage the underside of the struts.

9. An assembly as claimed in Claim 7 or 8 wherein the pair of elongate pressure-applying members comprises a pair of cylindrical rollers and the openings in the end portions of the retaining means comprise slots for rotatably receiving the ends of the cylindrical rollers.

10. An assembly as claimed in Claim 9, wherein a pair of bearing blocks is provided, each block covering the open end of a respective one of the slots and being disposed between one end of the middle strip of the spring and the corresponding end of one of the rollers, the bearing blocks being engageable by one of the rollers when a predetermined separation of the rollers has been achieved the ends of the middle strip of the spring thereafter contacting the bearing blocks to urge them toward the one roller.

11. An assembly as claimed in Claim 10, wherein the surface of each bearing block which is contacted by an end of the middle strip of the spring is a convex part-cylindrical surface, and the ends of the middle strip of



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the spring have convex part-cylindrical surfaces the axes of which are substantially perpendicular to the axes of the cylindrical surfaces on the bearing blocks so that each end of the middle strip of the spring contact its respective bearing block substantially at a point. 10

12. A pressure-applying assembly for use

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