United States Patent

Dahlgren

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[54] **CUSHIONING DEVICE FOR MECHANICAL DETAILS IN PHOTOGRAPHIC CAMERAS AND SIMILAR PRECISION APPARATUS**

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[51] **Int. Cl.**.....**F16d 63/00**

[58] **Field of Search** 74/1.5; 188/68, 85, 166

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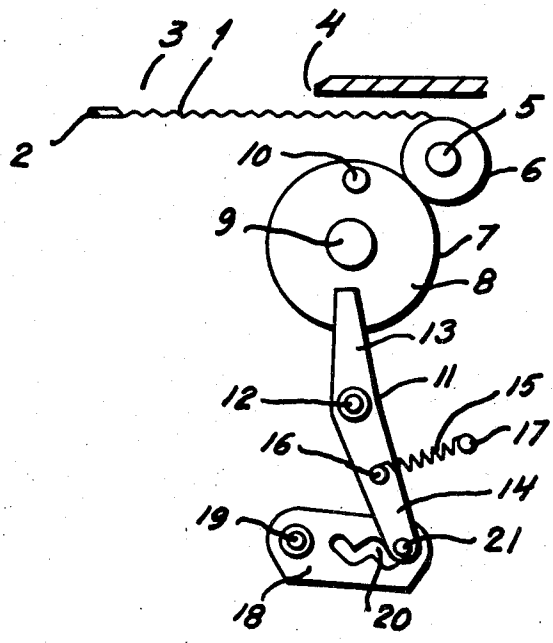
[57] **ABSTRACT**

A cushioning device for soft, reboundless braking of an intermittently operating, movable part of a mechanical mechanism of a photographic camera or like precision apparatus in which a double lever is journaled adjacent its center, one arm of the double lever is actuated to rotate the double lever about its journal by the movable part, a return spring is attached to the other arm of the double lever and is tensioned by the rotation of the double lever by the movable part, a brake link is journaled at a point offset from the first journaling point, extends toward the first journaling point and has a zigzag groove formed therein and a pin on the other arm of the double lever engages the zigzag groove and causes the brake link to oscillate with an amplitude which increases as the pin approaches the first journaling point when the double lever is rotated by the movable part.

7 Claims, 6 Drawing Figures



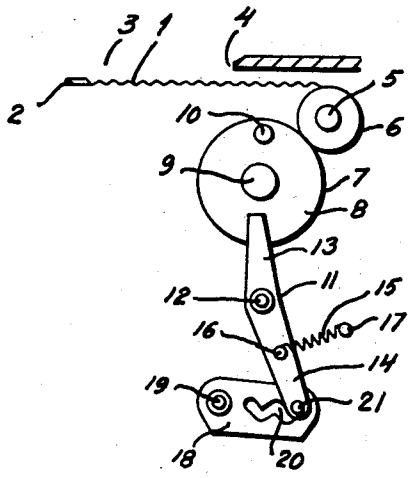


Fig.1

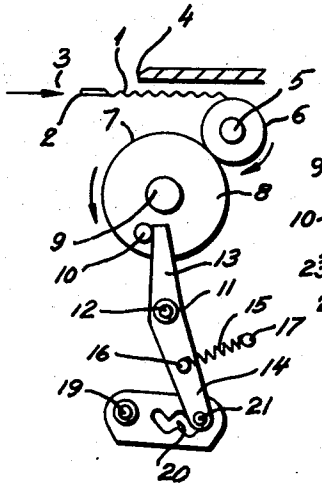


Fig.2

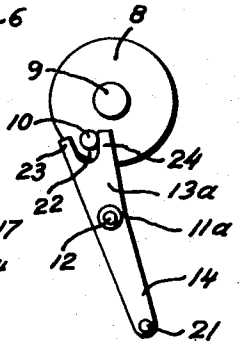


Fig.2a

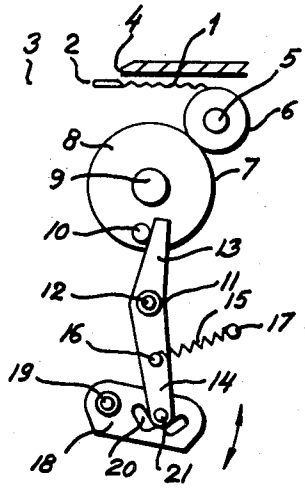


Fig.3

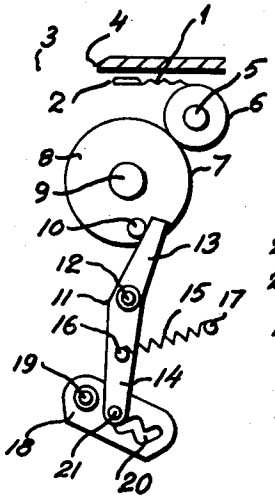


Fig.4

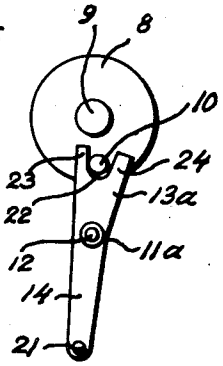


Fig.4a

CUSHIONING DEVICE FOR MECHANICAL DETAILS IN PHOTOGRAPHIC CAMERAS AND SIMILAR PRECISION APPARATUS

This invention relates to photographic cameras and similar precision apparatus with mechanisms comprising intermittently moving details in the form of, for example, shutters of roller blind type, hinged viewfinder mirrors and the like. The invention relates to a cushioning device, which in the final phase of the movement of the mechanism detail in question softly and rapidly brakes the movement and thereby prevents rebound of the detail when it arrives at an accurately defined fixed end position.

Photographic cameras and similar precision apparatus comprise intermittently and rapidly operating light-weight mechanism details such as shutters of roller blind type, flap shutters, hinged viewfinder mirrors and the like. These mechanisms have in common that their total reaction time is desired to be short so as to effect rapid operation of the apparatus, for example a camera, of which the mechanism is a part. The short total reaction time requires rapid acceleration at the release and rapid braking in the final phase. The rapid acceleration is obtained by means of a strong spring mechanism, an electro-magnet or another drive means, which is no part of the present invention. The requirement of rapid braking usually is combined with the requirement of a running as noiseless and non-vibratile as possible, an accurately defined end position of the mechanism detail and freedom from rebound. The value of a noiseless and above all non-vibratile running, for example of the viewfinders mirror and roller blind shutter mechanisms in a mirror reflex camera, need not be motivated. The definite end position of the mechanism detail is motivated by the fact that two or more mechanisms, for example viewfinder mirror and roller blind shutter mechanisms, may coact relative to one another in such a manner, that one mechanism in its end position releases the subsequent mechanism by disengaging a catch, closing a contact or the like.

A less distinct end position due to varying friction and/or caused by an adjustable speed governor can result in an interruption of the function of the apparatus in question. A rebound of one or several moving mechanism parts striking in the end position against a stationary stop may, for example, have the effect that a blind slit, which already has moved past the gate of the camera in the desired way, is recoiled so as momentarily to move again over the edge of the gate and thereby give rise to an incorrect exposure.

A plurality of means adapted to brake mechanism parts of the type here in question are already known. They involve, however, the disadvantage of being complicated and bulky, or they do not meet the aforementioned function requirements to the extent desired.

The cushioning device according to the invention renders possible a rapid and soft braking of the mechanism part at a definite end position, irrespective of possible variations in the speed, as the function of the device is self-regulating to some extent. The kinetic energy remaining when the moving parts are stopped in the end position against a stationary stop member, is small, and the construction effectively prevents a recoil movement with a resulting rebound of the mechanism part. The vibrations are reduced to an acceptable non-

detrimental level and the mechanism operates relatively noiseless. A cushioning device according to the invention further includes the advantages of simple design, small space requirements and easy assembly with the mechanism to be braked.

A preferred embodiment of the invention applied to a roller blind shutter mechanism of a photographic camera is described in greater detail in the following, with reference to the accompanying drawing in which

FIG. 1 shows in a schematic way a view from above of the cushioning device according to the invention, assembled with a roller blind shutter, the cushioning device not yet being in operation,

FIG. 2 shows the moment of commencing cushioning, FIG. 2*a* being a detail of FIG. 2 showing another variant of the cushioning device,

FIG. 3 shows the device according to FIG. 1 with ongoing braking of the mechanism, and

FIG. 4 and 4*a* show in a corresponding way the cushioning device in its end position, FIG. 4a showing the variant corresponding to FIG. 2*a*.

The mechanism for a roller blind shutter indicated in FIGS. 1–4 comprises a roller blind 1 with its edge 2, which together with a second roller blind (not shown) forms a slit, which upon exposure moves from the left to the right in the Figures where it moves past a gate 3 with one lateral edge 4 thereof. The roller blind 1 is wound on a roller blind shaft 5, carrying a stationary cogwheel 6, which coactingly engages with a toothed wheel 7 on a driving spring housing 8 supported on a shaft 9. The cogwheel 6 and toothed wheel 7 are indicated in the Figures only in a schematic way.

The cushioning device comprises a carrier pin 10 on the spring housing 8 which actuates a double lever 11 (alternatively 11*a* in FIGS. 2*a* and 4*a*) mounted on a journal 12. The double lever arm 13 (alternatively 13*a*) facing the spring housing 8 is actuated when it comes into contact with the carrier pin 10, the other arm 14 actuating the braking and cushioning details. Said details comprise a return spring 15 which tries to turn the double lever 11 (alternatively 11*a*) in counterclockwise direction and is fastened in a pin 16 on the arm 14 and in a stationary pin 17, and a brake link 18, which is designed as a single plane lever supported on a journal 19 and includes a longitudinally extending zigzag groove 20 with a guide pin 21 on the lever 14 running therein. The variant 11*a* of the lever 11 shown in FIGS. 2*a* and 4*a*, in its arm 13*a* facing the spring housing 8, is provided with a fork-shaped recess 22 having legs 23, 24 for the carrier pin 10.

In the positions occupied by the details in FIG. 1, the roller blind 1 is going to move past the gate 3, and the exposure slit still is in front of the central portion of the gate 3. The carrier pin 10 on the spring housing 8, which rotates counterclockwise, is still a long distance away from the arm 13, alternatively 13*a*, as in this position no braking is to be carried out. The double lever 11, alternatively 11*a*, by action of the return spring 15, has turned counterclockwise to its outer position, so that the guide pin 21 is farthest outwardly from the journal 19 in the groove 20. This is the starting position of the cushioning device. In a later phase (FIGS. 2 and 2*a*) the roller blind slit has come close to the edge 4 of the gate 3, and the braking commences. The carrier pin 10 has then arrived at the arm 13, alternatively 13*a*,

and starts to turn the double lever **11**, alternatively **11***a*, in clockwise direction. In the alternative embodiment according to FIG. **2***a* one can see how the carrier pin **10** can move past the lefthand leg **23** into the recess **22** where it is stopped by the righthand leg **24**. During the braking operation (FIG. **3**) the guide pin **21** runs through the zig-zag groove **20** and thereby forces the brake link **18** to oscillate about the journal **19**.

For geometrical reasons, the amplitude of the oscillation increases gradually with the approach of the guide pin **21** to the end position of the groove **20** located nearest to the journal **19**. The successively increasing work involved for oscillating the brake link **18** brings about a softly increasing braking effect. To said braking effect contributes also, to a certain smaller degree, the successive tensioning of the return spring **15**, which has as its main object to turn the double lever **11**, alternatively **11***a*, to the starting position. The driving force from the spring housing **8** considerably exceeds that from the return spring **15**. The guide pin **21** moves easily in the groove **20** as there is a small play, so that the mechanism always will reach its definite end position shown in FIGS. **4** and **4***a*, irrespective of whether the mechanism to be braked — in this case the roller blind shutter — moves fast or slowly by action of any kind of speed governor. The braking is also self-regulating to some extent in relation to the initial speed of the mechanism, because the energy braked is greater when the pin **21** is moving fast through the groove **20** than when it moves slowly therethrough. In the end position (FIG. **4**) the double lever **11** is prevented from being subject to rebound by the remaining kinetic energy, because the brake link **18** is in an outer position, and the guide pin **21** upon rebound presses against the innermost oblique surface in the groove **20** so as to cause the brake link **18** to change its direction of motion, and thereby exerts a locking effect on the double lever **11** so that the rebound is subdued to a non-detrimental value. By the variant shown in FIGS. **2a** and **4a** also the spring housing **8** and the mechanism driven thereby are prevented to rebound, because the carrier pin **10** is retained by the lefthand leg **23** in the recess **22** on the arm **13***a*. Upon retensioning of the spring housing **8**, the carrier pin **10** moves in clockwise direction and the return spring **15** turns the double lever **11**, alternatively **11***a*, counterclockwise to the starting position shown in FIG. **1**.

The details comprised in the cushioning device can be adjusted to the mechanism with which they coact and to the apparatus they are to be built in. The shape and length of groove **20**, for example, the relation between the arms **13**, **13***a* and, respectively, **14** of the double lever **11**, alternatively **11***a*, the weight and size of the brake link **18**, etc. may be varied substantially without abandoning the idea of the invention. The invention, of course, can also be applied within fields other than the photographic one, where equivalent mechanisms are applied which are to be braked and cushioned.

I claim:

1. A cushioning device for soft, reboundless braking of an intermittently operating, movable part of a mechanical mechanism of a photographic camera or like precision apparatus, comprising; double lever means mounted on a first journal means and having a first and a second arm respectively extending from the point of journaling of said double lever; said first arm of said double lever being actuatable by said movable part; return spring means attached to said second arm of said double lever and tensioned by said double lever being turned on said first journal by said movable part; brake link means mounted on a second journal means offset from said first journal, having a single arm extending from said second journal toward said first journal and having a zigzag groove formed therein; and pin means mounted on said second arm of said double lever and operatively engaged in said zigzag groove; said brake link being oscillatable with an amplitude which increases as said pin approaches said first journal when said double lever is turned on said first journal by said movable part.

2. A cushioning device for soft, reboundless braking of an intermittently operating, movable part of a mechanical mechanism of a photographic camera or like precision apparatus comprising, a pivotally mounted braking element, an intermediate element means responsive to movement of said movable part over a final portion of its movement for actuating said intermediate element, a follower element on one of said intermediate and braking elements, means on the other of said intermediate and braking elements defining a zigzag path along which said follower element is constrained to move upon actuation by said responsive means, whereby said braking element is oscillated about its pivot and thereby brakes movement of said intermediate element and thus also said movable element over the final portion of movement of said movable element.

3. The combination of claim **2** wherein said means defining said zigzag path comprises a zigzag slot in said braking element.

4. The combination of claim **3** wherein said follower element comprises a pin on said intermediate element engaging said slot in said braking element.

5. The combination of claim **2** wherein said intermediate element comprises a two-armed lever having one arm actuatable by said movable part and supporting said follower element on its other arm.

6. The combination of claim **5** which further includes a return spring urging said follower element to one end of said zigzag path.

7. The combination of claim **6** wherein said one end of said zigzag path is remote from the pivot on said braking element and the other end of said zigzag path is closer to said pivot to thereby cause the amplitude of oscillation of said braking element to increase as said movable part reaches the end of its movement.

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