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(54) FILM DRIVE MECHANISM WITH AUTOMATIC STOPPING DEVICE

(71) We, NIPPON KOGAKU K.K., a Japanese Company of 2-3 Marunouchi 3-chome, Chiyoda-ku, Tokyo, 100 Japan, 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 a film drive mechanism for a camera, comprising an output member for driving a film transport device and a stopping device for switching off the drive to the output member when a retarding force, for example at the end of a film, is applied. The mechanism may be mounted at the bottom of a camera.

In some of the automatic stopping devices of this type, the tension produced in the film when it has been wound up to its end is utilized to cause the output member to stop. However, the motor drive still continues to act for a predetermined time after the film has been tensioned, thus breakiing or otherwise injuring the film.

According to the present invention we provide a film drive mechanism for a camera, comprising an output member for driving a film transporting device, and an automatic stopping device comprising a transmission for transmitting drive from a motor to the output member the transmission including at least a portion carrying a switch contact of a power supply switch for the motor, the portion being movable to open and close the switch, said portion being biased to a switch-closing position when the motor is running and the transmission being arranged such that said portion is moved to a switch-opening position when a retarding force is applied to the output member sufficient to overcome said bias, whereby to open the power supply switch and thereby switch off the motor.

Preferably, restoring means are provided for displacing said portion from its opening position to its closing position. The transmission preferably comprises a portion operatively associated with the output member and a portion operatively connected to the motor.

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

Figures 1 to 3 show a first embodiment of the present invention, Figure 1 illustrating the essential portions of the device during operation of the motor drive, Figure 2 illustrating the essential portions of the device at the termination of film supply, and Figure 3 illustrating the restoring means for the mechanism; and

Figures 4 and 5 show a second embodiment of the present invention, Figure 4 illustrating the essential portions of the device during operation of the motor drive and Figure 5 illustrating the essential portions of the device at the termination of film supply.

Referring to Figures 1 to 3, there is shown a first embodiment of the present invention. In the film drive mechaism of Figure 1, a motor 1 is electrically energized and de-energized through an externally operable main switch SW1 and a subswitch SW2 which will hereinafter be described. A drive gear 2 is mounted coaxially with the motor 1 and in meshing engagement with a displaceable gear 4 mounted on a displaceable lever 3 rotatable about a shaft 3a. The movable contact of the subswitch SW2 is provided on one end of the lever 3 and a toggle spring 5 which is snap action bias means is secured to the other end of the lever 3, which is thus biased clockwise when in the position shown in Figure 1. A limit pin 6 is provided to limit the clockwise rotation of the lever 3 to a closing position for closing the subswitch SW2 and a limit pin 7 is provided to limit the counter-clockwise rotation of the lever 3 to an opening position for opening the subswitch SW2. The elements 2 to 4 together constitute part of a transmission means and the elements 3 and 4 also constitute a displaceable member.

An output gear 8, which is connected to an output member (not shown) for driving a film transport device of a camera body (not shown), is supported on the same shaft 3a on which the lever 3 is mounted, and is normally in meshing engagement with the gear 4. A rewind member 9 operable by means of an

externally operable rewind knob (not shown) is slidably mounted on the main body 11 of the motor driven device, and has a pin 9a studded therein. A restoring lever 10 engageable with the lever 3 is rotatably mounted to the body 11 of the device and in meshing engagement with the pin 9a. The rewind lever 9 and the restoring lever 10 together constitute a restoring mechanism (see Figure 3).

In Figure 1 the motor is running and drive is taking place. The switches SW1 and SW2 are both closed so that the clockwise rotation of the motor 1 is transmitted through the drive gear 2, the gear 4 and the output gear 8 to the film, which is thus advanced.

When a predetermined number of frames of the film has been exposed, film transport becomes impossible because the film is secured to the film magazine shaft, and therefore the output gear 8 stops rotating. Since, however, both the two switches SW1 and SW2 remain closed on the motor side, the motor 1 and the gear 2 still continue to rotate. As the result, the drive gear 2 drives the gear 4 which continues to rotate in a counter-clockwise direction. Since the gear 8 which is secured for rotation about the shaft 3a, cannot rotate, the gear 4 rotates about the gear 8 in a counter-clockwise direction. This necessarily results in counter-clockwise rotation of the lever 3 supporting the gear 4, as shown in Figure 2 so that the fulcrum of the toggle spring 5 on the lever 3 is displaced rightwardly and the biasing force of this spring 5, then acts in a counter-clockwise direction to dislace the displaceable member 3, 4 to the position of Figure 2, namely, the opening position for opening the subswitch SW2. Thus, the motor 1 stops rotating. If the amount of displacement of the displaceable member 3, 4 is so limited that it still has some degree of engagement with the gear 2 in its open position, the restoration of the displacement member 3, 4 from the opening position to the closing position which will hereinafter be described may be accomplished smoothly.

The restoration of the member 3, 4 takes place in response to operation of the rewind knob (not shown) of the film drive mechanism. Such restoration is illustrated in Figure 3, wherein solid lines indicate the position prior to the restoration and dots-and-dash lines indicate the complete restoration.

When the rewind knob is operated to its rewind position, the rewind member 9 is displaced upwardly, as viewed in Figure 3, to thereby raise a rewind button 12 at the bottom of the camera body and release a sprocket while, at the same time, the upward displacement of the pin 9a causes counter-clockwise rotation of the restoraton lever 10 (leftward direction in Figure 2), so that the lever 3 is displaced leftwardly (clockwise in Figure 2) to its closing position, thus shifting the subswitch SW2 from its open position to its closed position. Also, the gear 4 is brought back into complete meshing engagement with the gear 2.

Reference will now be had to Figures 4 and 5 to describe a second embodiment of the present invention. Reference characters identical to those in the first embodiment are identical in significance to those in the first embodiment.

In this embodiment, the displaceable gear 4 shown in the first embodiment is eliminated and the whole of the transmission means including the motor is made displaceable. In Figure 4, a motor 101 and a drive gear 102 are supported on a displaceable lever 103 for rotation about a shaft 103a.Thus, when the output gear 8 is stopped upon termination of the film supply, the drive gear 102 rotates counter-clockwise while revolving clockwise about the shaft 103a, so that a toggle spring 105 which has so far biased the lever 103 counter-clockwise is rapidly displaced to open the subswitch SW2. That is, in this embodiment, the gear 102 and lever 103 constitute a displaceable member.

By using gears, further embodiments may be provided in which the shaft 103a of the lever 103 in the second embodiment may be common to the output gear 108 as in the first embodiment or in which the shaft 3a of the lever 3 in the first embodiment may be disposed separately from the shaft of the output gear 8 as in the second embodiment.

The transmission means of the film drive mechanism may alternatively comprise friction wheels or belt, chain, rope, or connecting rod transmission mechanism may be used. However, these would sometimes require an auxiliary mechanism which would in turn lead to a more complicated construction than the arrangement using gears.

It will be apparent that the movable contact of the subswitch need not always be provided on the displaceable member as in the embodiments shown.

In some devices, the motor drive is imparted to the rewind with the rewind shaft engaged with the film magazine shaft in the camera body during rewind operation, but such engaging action may have operatively associated therewith the restoration of the displaceable member from its switch opening position to its switch closing position.

In other words, the change-over action of the member operated during the film rewind (generally called as a film rewinding member) may have operatively associated therewith the restoration of the displaceable member.

As soon as film supply is terminated, the motor driving electric circuit switch in the motor driven device is opened to stop the drive of the motor and this prevents any unreasonable force being exerted on the film or the device itself or any damage being imparted to the film.

Also, by operatively associating the restoration of the displaceable member with the change-over action of the film rewinding member, the release from the stopped condition may be accomplished with great ease and by a very simple mechanism.

WHAT WE CLAIM IS:—

1. A film drive mechanism for a camera, comprising an output member for driving a film transporting device, and an automatic stopping device comprising a transmission for transmitting drive from a motor to the output member, the transmission including at least a portion carrying a switch contact of a power supply switch for the motor, the portion being movable to open and close the switch, said portion being biased to a switch-closing position when the motor is running and the transmission being arranged such that said portion is moved to a switch-opening position when a retarding force is applied to the output member sufficient to overcome said bias, whereby to open the power supply switch and thereby switch off the motor.

2. A film drive mechanism according to claim 1, further comprising means for biasing said portion toward said switch-opening position when it is in said switch-opening position.

3. A film drive mechanism according to claim 1 or claim 2 further comprising restoring means externally operable to displace said portion from said opening position to said closing position.

4. A film drive mechanism according to claim 4, wherein said restoring means is operatively associated with change-over means for controlling the re-winding of film by the film drive mechanism.

5. A film drive mechanism according to any preceding claim, in which the said portion of the transmission includes a lever rotatable about a fixed shaft and having at one end thereof a portion associated with said switch; and a transmission member rotatably mounted on said lever so as to transmit the rotation of said motor to a further transmission member operatively associated with the output member.

6. A mechanism according to claim 5, in which one of the switch contacts is mounted on said portion of said lever.

7. A mechanism according to claim 5 or 6, in which one or both of the transmission members are gears.

8. A film drive mechanism for a camera comprising an output member, and an automatic stopping device for transmitting drive from a motor to the output member, and for automatically switching off the motor, substantially as hereinbefore described with reference to Figures 1, 2 and 3 or Figures 4 and 5 of the accompanying drawings.

9. A camera equipped wtih a film drive mechanism as claimed in any preceding claim, said output member being engaged with a film transporting device of the camera.

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Sheet 1

FIG. 1

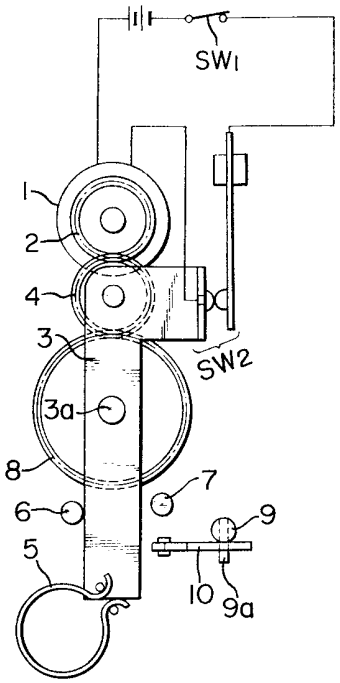


FIG. 2

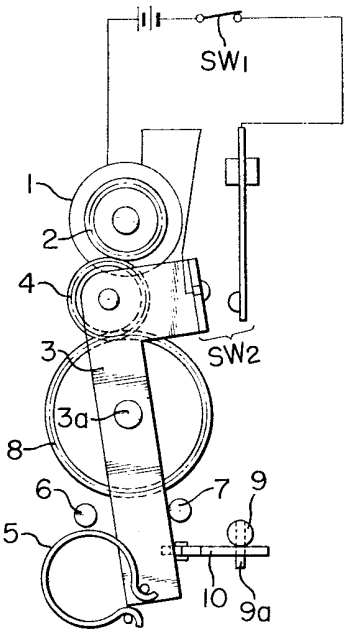
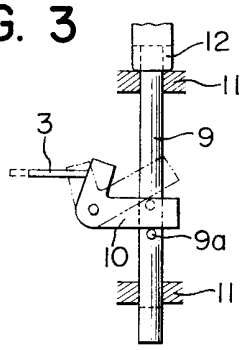


FIG. 3



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Sheet 2

FIG. 4

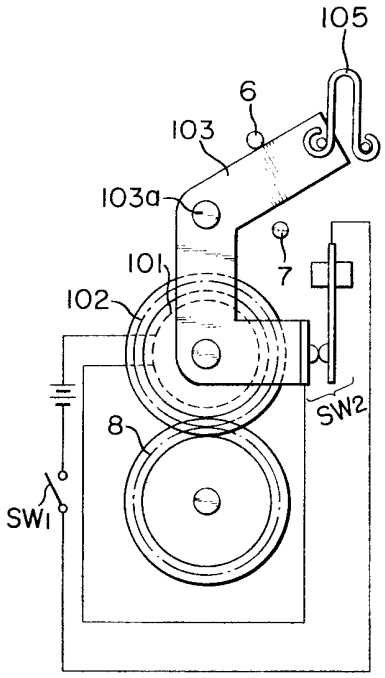

FIG. 5