

1054,106



PATENT SPECIFICATION

DRAWINGS ATTACHED

1054,106

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COMPLETE SPECIFICATION

Photographic Apparatus

We, EASTMAN KODAK COMPANY, a Company organised under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, Unites States of America (Assignees of ROBERT JUSTIN ROMAN and VICTOR JOSEPH WITKOWSKI) 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 an intermittent pulldown system for motion picture apparatus, and particularly to an intermittent claw pulldown mechanism for motion picture projectors by the use of which reverse projection of any rate of motion, as well as still projection can be achieved without stopping the shutter.

Whilst some known projectors provide means for reversing the intermittent film advancing mechanism to obtain reverse projection, such reversing generally requires that the prime mover for the pulldown claw be stopped and then reversed in its direction of operation. All of this requires time during which the shutter stops and reverses so that there is a period when the screen is dark and undesirable flicker results.

An object of the present invention is to provide a pulldown system which can be reversed almost instantly without changing the direction of, or stopping, the drive means therefor.

According to the present invention, there is provided a motion picture projector comprising a film claw for intermittently transporting a film through a gate having a projection aperture, drive means connected to a first cam means serving to reciprocate the film claw and wherein the connection between the drive means and the first cam means permits rotation of the first cam means relative to the drive means through 180°.

In the accompanying drawings:

Figure 1 is a perspective view showing an

intermittent pulldown system for a motion picture projector of the kind to which the present invention is particularly applicable;

Figure 2 is a partial front elevational view of a face cam of the mechanism which provides in and out movements of a film pulldown claw;

Figure 3 is an enlarged sectional detail showing the manner in which in and out motion is transmitted to the pulldown claw by the in and out face cam;

Figure 4 is an enlarged sectional detail view taken through a shutter shaft, just ahead of the shutter, and showing how the up and down cam of the projector of Figures 1 to 3 is, in accordance with the present invention, connected to a drive shaft so that it can be rotated 180° thereon to reverse the direction of film advance without stopping or changing the direction of rotation of the drive shaft, and

Figure 5 is a sectional view taken substantially on line 5—5 of Figure 4.

Referring now to the drawings, for purposes of clarity and simplification, only those parts of a motion picture projector which are essential to an understanding of the operation of the same have been shown. These parts include an apertured film gate 10, the aperture 12 of which is illuminated by a lamp 14 located behind the gate. A motion picture film F is adapted to be intermittently moved through this gate by an improved pulldown claw mechanism to be described hereinafter, and, as each frame of the film is moved into alignment with the aperture in the gate and is illuminated by the lamp 14, it is projected by a lens 16 onto a screen not shown.

A prime mover of the projector comprises an electric motor M, a drive shaft 18 of which extends to one side of, and substantially parallel to, the optical axis of the projector. Under normal load conditions, the drive shaft 18 will rotate at approximately 3250 rpm or 54 cycles/sec. which is the normal operating speed of certain commercially available small

[Price 4s. 6d.]

electric motors. The light beam is repeatedly cut off from the projection aperture of the gate by a rotating sector shutter 20 fixed to the drive shaft 18. Since this shutter has but a single cut-off blade it will intercept the light beam at 54 cycles per second and is arranged to do this only during the interval of time in which the film is being advanced through the gate, as is well known in the art.

Coming now to the intermittent film feeding mechanism, this includes a rigid claw arm 22 extending laterally of the film to be fed and having turned-over perforated ears slidably and pivotally engaging a fixed rod 23 which extends substantially parallel to the film gate and to one side thereof. One end of the claw arm is turned at right angles to the body of the arm and is provided with one or more claws or teeth 24 which are adapted to engage the perforations of the film F to advance the same. As is well known, the claw will reciprocate up and down the rod 23 to effect the film advance and will pivot about said rod to move the claws or teeth 24 into and out of engagement with the film, the gate being provided with an elongated slot 25 to accommodate the pulldown claws and allow the up and down movement of the claw arm whilst the claws are in engagement with the film.

In the arrangement shown, the up and down reciprocal movement of the claw arm for feeding the film is under the control of an up and down cam 26 fixed to the drive shaft. This cam is embraced by a pair of followers 28 fixed to the claw arm and extending substantially at right angles to the rod 23 to an extent sufficient always to embrace the cam 26 during pivotal movement of the claw arm 22. Since each revolution of the up and down cam produces one complete reciprocal stroke of the film claw, and the drive shaft is rotating at 54 rps., it follows that the claw will be reciprocated vertically at a rate of 54 strokes per second.

The in and out movement of the pulldown claw relative to the film gate will now be described. A spring 30, one end 32 of which is fastened to a wall portion of the projector indicated at 31 in Figure 3, bears against one surface of the end 34 of the claw arm remote from the film engaging claws, causing the claw arm normally to be pivoted about the rod 23 in a direction to withdraw the claw from engagement with the film in the gate. At the same time the spring 30 urges the other surface of the end 34 of the claw arm against a follower pin 36 which is free to slide in a bushing 38, see Figure 3. Also secured to the drive shaft 18 is a worm gear 40 which engages complementary gear teeth on the periphery of a wheel or face cam 42 rotating about an axis 44 which is parallel to the drive shaft.

The inner face of the face cam or wheel 42 has a series of cam lobes 47 arranged in three concentric circles. The outer circle has

nine evenly spaced cam lobes; the next inner circle has three evenly spaced cam lobes; and the next circle has one cam lobe. Finally, within the innermost circle containing a single cam lobe there is a circle which contains no lobe.

The bushing 38 is fixed to a lever 50 which pivots about a stud shaft 52 fixed to the projector housing, not shown, and said lever includes a shaft handle 54 which will extend through the top of the projector housing to be accessible to the operator. When the lever 50 is rotated by means of the shaft handle 54, the follower pin 36 can be moved radially of the face cam 42 and along the end 34 of the claw arm 22 to be positioned in alignment with any of the aforementioned circles on the face cam. The flat surface of the face cam is so disposed that, when the follower pin 36 engages it, the spring 30 can pivot the claw arm by a sufficient amount to swing the claw out of engagement with the film in the gate. All of the cam lobes 47 have the same rise or throw end which is of such dimension that when the follower pin engages the top thereof the claw arm is pivoted about the rod 23 against the action of the spring 30 by an amount which will move the film claw into engagement with the film to advance the same. Obviously each of the cam lobes is of sufficient length as to hold the claw in engagement with the film long enough to produce the advancing stroke of the film. Accordingly, each circular series of the lobes 47, in combination with the face of the wheel 42, will constitute a circular in and out face cam for controlling the in and out movement of the claw with respect to the film path at the gate. Whilst the innermost circle described has no lobes 47, the face of the wheel allows the claw to be spring held out of engagement with the film for the projection of 'stills' and, in reality, constitutes an in and out cam despite the fact that it possesses no lobes.

The reduction ratio between worm gear 40 and wheel or face cam 42 is nine to one (9:1). Since there are nine lobes 47 on the outer circular series of lobes, when the follower pin 36 is positioned to engage this series of lobes, it will produce an in and out stroke per revolution of the up and down cam 26. This means that the film F will be pulled down one frame per revolution of the cam 26 i.e., at a rate of 54 frames per second. When the follower pin 36 is moved inwardly of the face cam to the next circular series of the lobes 47, i.e., that circle containing three lobes, it produces one in and out stroke of the claw for every three revolutions of the up and down cam 26, i.e., 18 frames per second. When the follower pin 36 is moved inwardly to the circle containing one lobe it produces one in and out stroke of the claw for every nine revolutions of the up and down cam 26 i.e., six frames per second.

If the follower pin 36 is moved in on the

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95

100

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110

115

120

125

130

face cam to a portion where there are no lobes, there will be no in and out stroke of the claw but the claw teeth will be held out of engagement with the film by the spring 30. This will produce a desirable condition of still projection in which the shutter continues to run. It is also pointed out that, for all three film speeds described, as well as during still projection, the light beam interruption rate by the shutter, and hence the flicker, has remained constant at 54 frames per second. Furthermore, the amount of light transmitted remains constant and independent of the rate of projection.

As will be noted in Figure 3, the cam lobes 47 as well as the end of the follower pin 36 engaging the face cam 42, are shaped to allow the shifting of the follower pin 36 from one circular face cam to the next concentric one without stopping the mechanism. As is most clearly shown in Figure 3, this involves tapering the long sides of each lob 47 as shown at 60 and rounding the end of the follower pin engaging the same. This produces an apparently instant change of frame rate which is highly desirable. In addition, there is little difference in mechanism noise from fast to slow film speeds. It goes without saying that the leading and trailing edges of each cam lobe 47 are tapered to allow the end of the follower pin 36 to move up onto and down off of each lobe as the face cam rotates relative thereto.

The variable intermittent pulldown mechanism described up to this point can feed the film at 54, 18 or 6 frames per second with instant shift from one rate to another. This means that the film is travelling through the projector at 8.1, 2.7 or 0.9 inches per second, respectively. With a sprocketless projector of the well known type i.e., where the film is pulled directly from a supply reel and fed to a takeup reel by the pulldown claw, this difference in film rate is absorbed easily by the takeup and supply reels which are generally tendency driven i.e., drive through a light friction clutch or the like. If this pulldown system were used on a conventional sprocket-type projector, however, means would have to be provided to alter the sprocket feed rate in exact synchronism with a change in rate of the pulldown mechanism in order to avoid loss of the film loop ahead of the pulldown claw. This would probably involve such a complicated and expensive sprocket driving mechanism as to take such a projector out of the price range of amateur projection equipment.

Whilst we have mentioned certain rates of projection in describing the above projector, it will be appreciated that a greater or lesser number of speed changes could be provided. Likewise, only one arrangement of parts has been shown by which the change in frequency between the up and down and in and out movements of the claw can be achieved almost instantly whilst the prime mover is operating at one speed, it is pointed out that the inven-

tion to be described hereinafter is not liked to the particular arrangement of parts disclosed to accomplish this end, but is intended to cover all arrangements wherein a claw is vertically reciprocated.

In order to achieve reverse projection with this variable rate pulldown system without having to stop or reverse the direction of drive of the motor M, an arrangement of parts has been devised in accordance with the present invention, for rotating the up and down cam 26 through 180° so that the claw teeth are pivoted into engagement with the film perforations at the end of the pulldown stroke of the claw and are moved out of engagement with the film at the end of the upward stroke of the claw instead of *vice versa* as is the case for forward projection.

To this end, referring to Figures 4 and 5, an up and down cam 26¹ constructed according to the present invention, is rotatably mounted on the drive shaft 18 and has a radial arm 70 secured thereto by a pin 71. This arm 70 is adapted to be engaged alternatively and driven by either of two drive pins 72 and 73 located 280° apart and slidably extending through holes in a hub portion of the shutter 20. One drive pin 72 is notched at 75 to allow the arm 70 to pass through it, whilst the other drive pin 73 has a length corresponding to the shortest part of the notch 75. Axially shifting both the drive pins 72 and 73 relative to the plane of movement of the arm 70 gives the choice of driving the arm 70 and the up and down cam 26¹ secured thereto by either of the pins 72 or 73. To enable the pins 72 and 73 to be shifted between their two positions, they are each fixed at one end to a disc 80 which is, in turn, secured to a bushing 82 slidably mounted on a hollow shaft 84 of a bearing 85, which is secured to the drive shaft 18 by a set screw 86 and which has a key portion 87 engaging a keyway 88 in the hub portion of the shutter 20 to connect the shutter to the drive shaft. Whilst the drive shaft and the shutter are rotating, the drive pins 72 and 73 can be slid axially between their two operating positions by means of a shift lever 90, one end of which has a yoke 91 engaging a groove in the bushing 82. The other end of the shift lever 90 extends through the top of the projector to be engaged manually by an operator. The drive pins 72 and 73 can be maintained in either position of adjustment by a detent action formed by a spring-loaded ball 93 carried by bushing 82 snapping into one or the other of two grooves 94 and 95 formed in and spaced axially of the bushing 82. A stop ring 97 is fixed to the drive shaft 18 to limit the motion of the bushing 82 in a direction away from the shutter and to prevent the drive pins 72 and 73 from being withdrawn from driving engagement with the shutter, should the shift lever 90 be moved far enough to shift the bushing 82 to a point beyond which the spring-

loaded ball 93 might tend to move out of, and beyond the groove 95.

Whilst this reversing mechanism has been shown in combination with the particular variable rate pulldown mechanism of Figures 1 to 3, it is pointed out, and it will be appreciated by those skilled in the art, that this reversing mechanism could be used in combination with any conventional pulldown mechanism capable of only one rate of projection with or without provision for still projection.

The subject matter of and the invention claimed in, the present application is fully described in application No. 29441/63 (Serial No. 1,054,105) of which the present application is a divisional.

WHAT WE CLAIM IS:—

1. A motion picture projector comprising a film claw for intermittently transporting a film through a gate having a projection aperture, drive means connected to a first cam means serving to reciprocate the film claw and wherein the connection between the drive means and the first cam means permits rotation of the first cam means relative to the drive means through 180°.

2. A projector as claimed in claim 1 wherein the first cam means reciprocates the film claw in the direction of film transport and the drive means is also connected to second cam means serving to reciprocate the film claw into engagement with the film.

3. A projector as claimed in claim 1 or 2, wherein the drive means comprises a drive shaft whereon is fixedly mounted a shutter.

4. A projector as claimed in claim 3, where-

in a bushing is axially slidably mounted on the drive shaft and has two axially projecting parallel pins which pins are disposed on opposite sides of the drive shaft and slidably locate in respective apertures in the shutter.

5. A projector as claimed in Claim 4 wherein the first cam means comprises a cam mounted on the drive shaft for rotation relative thereto and having a radially projecting arm arranged to engage either one or the other of the parallel pins, on selective axial displacement thereof.

6. A projector as claimed in claim 4 or 5, wherein a sleeve is fixedly secured to the drive shaft and keyed to the shutter, the bushing being axially slidable thereon, and wherein the bushing is axially slidable between an end stop on the sleeve and the shutter.

7. A projector as claimed in claim 6, wherein resilient detent means are provided between the bushing and the sleeve whereby to locate the bushing selectively in such position as to effect engagement between the radial arm and a particular one of the parallel pins.

8. A projector as claimed in any of claims 4 to 7, wherein a manually operable member is arranged, on operation to displace the bushing to cause relative rotation of the first cam means and the drive means by 180°.

9. A motion picture projector as claimed in claim 1 and substantially as hereinbefore described with reference to, and as illustrated in Figures 4 and 5 of the accompanying drawings.

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Patent Agent.

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