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 (72) Inventor ROBERT BRADLEY JOHNSON



(54) FILM ADVANCING MECHANISM

(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 advancing mechanisms, and to motion picture projectors incorporating such mechanisms.

The conventional motion picture projector intermittently feeds film a frame at a time past the projection aperture of a gate and depends upon the presence of a loop of film in advance of the gate to isolate the intermittent film feed and gate from the supply reel to ensure steadiness of the film in the frame when the intermittent mechanism is not moving film.

In accordance with the present invention there is provided film advancing mechanism for advancing film from a supply roll to a film gate comprising drive means frictionally engageable with the film between the supply roll and the film gate to drive the film toward the film gate, the drive means being coupled to power means through a tendency drive which limits the force applied to the film by the drive means, guide means for guiding the film from the drive means to the gate with a confined length of film between the drive means and the gate, and force attenuation means frictionally engageable with the film in the guide means for resisting the movement of more film into the guide means than is withdrawn therefrom into the gate whereby force applied to the film by the drive means is partially attenuated in the guide means.

In accordance with the present invention there is also provided a motion picture projector comprising at least one high speed driven member located between a film roll and a film gate for feeding film from the

film roll through film guide means into the gate during forward film movement, wherein the driven member is driven by a power source through a tendency drive and the film guide means is provided with at least one rotatable roller around which the film is guided, which rotatable roller is locked by a brake during intermittent reverse film movement and is freely rotatable during high speed continuous rewind and film-threading movements, and comprising force attenuation means frictionally engageable with a film in the film guide means to restrain movement of the film.

In the accompanying drawings:—

Fig. 1 is a schematic view of a portion of a motion picture projector including one form of film advancing mechanism of the present invention; and

Fig. 2 is a schematic view of a portion of a motion picture projector including another form of film advancing mechanism of the present invention.

Because motion picture projector apparatus and the like are well known, the present description will be directed in particular to elements forming part of, or co-operating more directly with, apparatus in accordance with the present invention. It is to be understood that projector elements not specifically shown or described may take various forms well known to those skilled in the art.

Referring to Fig. 1, a spindle 10 supports a supply reel 12 which is keyed to the spindle to rotate therewith. The reel 12 contains a roll 14 of film F. The film F leaving the supply roll 14 is threaded into a tendency drive mechanism 15 which comprises a pressure roller 16, a driven roller 18, a constant speed motor 20 and a slip clutch 22 for frictionally interconnecting the motor 20 and roller 18. The roller 18 has a high friction surface in contact with the film F to ensure that the roller 18 will start and stop with the film F so as to avoid surface abrasion on the film F. The pressure roller

16, which is spring-biased toward the roller 18, is driven by the film F.

5 The tendency drive mechanism 15 pushes the film F into a sinuous film guide 24 formed in two sections. The first section includes a pair of walls 26 and 28 spaced sufficiently from each other to permit the film F to buckle in the guide as shown in Fig. 1. The cross-sectional width of the guide as viewed in Fig. 1 should not exceed 10 .080 inches for normal film thickness of 0.0057 inches in order to prevent the film F from doubling over on itself in the guide.

15 As the film F emerges from the guide section formed by the walls 26 and 28, it passes into a second section formed by a roller 30, which is rotatably mounted in the projector, and the wall 26. The roller 30 is normally free to rotate, but can be clamped 20 by, for instance, a brake 32 to prevent rotation. Emerging from the guide 24, the film F passes into a conventional projection film gate 34 having an aperture plate and a pressure pad which prevents movement of 25 the film F through the gate when pushed with a force below a first value. The film guide 24 formed by the surface of the roller 30, the wall 26 and the wall 28 is sufficiently wide and long to permit the accumulation of an excess of film F having a length equal 30 to or greater than the length of one film frame. An excess of film of this size permits film advance of one film frame through the film gate 34, by pulling film F from the 35 guide 24, without driving additional film into the guide by the roller 18. Intermittent advance of film is achieved by a pull down claw 36 which is part of an intermittent film advance mechanism.

40 During film threading operation, the leading end of the film F is withdrawn from the supply roll 14 either manually or by automatic means. The leading end of the film F is fed between the rollers 16 and 18, the 45 roller 18 being driven by the constant speed motor 20 through the slip clutch 22. The film F is pushed by the drive 15 along the first section of the guide 24 as defined by the walls 26 and 28 until it reaches the 50 roller 30. At this time, the brake 32 is released so that the roller 30 is free to rotate if the film F contacts its periphery. Emerging from the guide 24, the leading end of film F reaches the gate 34. At that point, the pull 55 down claw 36 engages the film F to intermittently advance the film through the gate 34 one frame at a time.

60 The tendency drive 15 threads the film F through the threading path at a very fast rate so that projection can begin soon after the operator begins to thread the machine. For example, the motor 20 may operate at 2000 rpm with the roller 18 being one-half inch 65 in diameter. Not only does this provide fast threading, but it also provides ample film

speed for projector operation at 54 fps, as well as at 18 fps and 6 fps, as will be explained hereinafter. It is important that the film F is fed into the guide 24 at a rate that exceeds the rate required for the maximum projection rate in order for the film F to assume a buckled shape.

As soon as threading is complete and the film end reaches the gate 34, operation of the pull down claw 36 shows the film at the gate 75 34 and the tendency drive 15 forces the film F into the configuration shown in Fig. 1, hugging the outside of the guide section around the roller 30 and buckling in the guide section formed by the walls 26 and 28. Film F does not buckle around the roller 30 because that portion of the guide 24 is too narrow. 80

The clutch 22 is set to slip at a torque which will in cooperation with the rollers 85 16 and 18 exert a substantial force on the film F to drive it into the guide 24. The force applied to the film F by the tendency drive 15 will be greater than can be held by the gate pressure pad, but at each contact 90 point of film with the sides of the guide, force applied to the film by the roller 18 is attenuated until it is below the force holdable by the gate. This attenuation phenomenon is greatly increased if the guide walls 95 are coated with a high friction material such as, for example, Corprene. The effect of the force attenuation means is to largely isolate from the gate 34 the forces applied to the film F at the beginning of the path. Were it 100 not for this force reduction, the film F would tend to slip through the gate 34 when the pull down claw 36 is withdrawn from the film F. Because of the reduced forces on the film F, the pressure applied thereto at 105 the gate 34 is sufficient to hold the film F steady during projection.

During forward projection, the film F assumes the configuration shown in Fig. 1, frictionally engaging the walls 26 and 28 to 110 resist the force of the tendency drive 15 and causing clutch 22 to slip. As mentioned hereinbefore, the guide 24 has the capacity to hold excess film having a length at least equal to the length of one frame of film, so 115 that when a frame is demanded by the claw 36, the guide 24 supplies it with negligible force load on the claw 36. As film is withdrawn from the guide 24 by the pull down mechanism, the tendency drive 15 acts 120 immediately to refill the guide 24 with the maximum amount of film that can be driven into the guide 24 by the tendency drive 15. The refilling action is so fast that projection rates of 54 frames per second (and greater) 125 operation can be easily obtained.

For reverse projection operation of the apparatus, the roller 30 is clamped by the brake 32 to prevent it from rotating. The direction of the tendency drive 130

15 is reversed such as by reversing the motor 20 or by appropriate gearing (not shown) to pull the film F from the guide 24. The film F hugs the surface of roller 30 so that the force applied to the film F by the tendency drive 15 is attenuated in the guide 24 and very little of that force reaches the film F in the gate 34. As the claw 36 intermittently advances the film F upwardly through the gate 34, the length of film in the guide 24 is momentarily increased to push it away from the surface of the roller 30, thereby permitting the tendency drive 15 to pull an equal amount of film out of the guide 24, restoring contact between the film F and the roller surface. Film F emerging from the guide 24 is wound upon the reel 12 which is rotated in an anticlockwise direction by a conventional tendency drive (no shown). Of course, the tendency drive for the reel 12 may be sufficient to withdraw the film F from the guide 24 without the assistance of the tendency drive 15.

It is desirable for smooth operation to eliminate as much force attenuation as possible during film rewind operation. Therefore, the brake 32 is released to unclamp the roller 30. The claw 36 is withdrawn from the film F and the roller 18, which is driven in a reverse direction by the motor 20, pulls the film F rapidly through the gate 34, around the roller 30, which is now free to rotate with the film F, and out of the guide section defined by the walls 26 and 28. At this time, the reel 12 is driven in a film take-up direction at a speed that is sufficient to wind film F on to the reel 12 as fast as it is delivered by the drive 15.

The film guide 24 can be any shape or length as long as it can hold an excess of film having a length at least as great as the length of one film frame.

Referring now to Fig. 2, there is shown a sinuous guide 48 defined by a pair of spaced walls 50 and 52. The walls form two curves 53 and 55 and are spaced sufficiently from each other to permit the formation of a compensating loop between a sprocket wheel 54 and a film gate 56. The sprocket wheel 54 has been shown as an alternative to the rollers 16 and 18 of Fig. 1 in the tendency drive mechanism 15. However, the walls 50 and 52 are sufficiently close to each other to prevent buckling of the film F therebetween. As in the form shown in Fig. 1, the inner surfaces of the walls may be coated with a high friction material. The surfaces of a pair of rollers 58 and 60 project through openings in the walls 50 and 52, respectively, and define the inner radii of the bends in the film guide 48. The rollers 58 and 60 have clamping mechanisms 62 and 64, respectively, associated therewith.

During film threading, the clamps 62 and 64 are released and the film F is rapidly advanced by the sprocket wheel 54 along the guide 48 until it reaches the film gate 56 where it is picked up by a claw 66 and advanced at a slower rate. When the leading end of film F reaches the gate 56, additional film forced into the film guide 48 by the tendency drive 15 moves the film F into engagement with the inner surface of the wall 50 in the area of the curve 53 and into engagement with the inner surface of the wall 52 in the area of the curve 55, where it contacts the high friction coating to attenuate the force applied through the slip clutch 22 by the constant speed motor 20.

As the claw 66 intermittently advances the film F through the gate 56 during forward projection operation of the apparatus, the film F is pulled away from the wall surfaces of the guide 48 to permit the tendency drive 15 to advance an equal amount of film F into the guide 48. Thus, it can be seen that the operations of the form shown in Fig. 2 in the film threading and forward projection modes are substantially the same as those of the form shown in Fig. 1. During reverse projection, the clamping mechanisms 62 and 64 are applied to prevent rotation of the rollers 58 and 60. The tendency drive 15 pulls the film F against the rollers 58 and 60, which are coated with a high friction material, to attenuate the force applied by the sprocket wheel 54 and to isolate the film F in the gate 56 from that force. As the claw 66 pushes film into the guide 48, the film F is raised from the roller surfaces, permitting the tendency drive 15 to once again pull the excess film from the guide 48 and to return the film F to the roller surfaces.

As in the form shown in Fig. 1, the rollers 58 and 60 are permitted to rotate during high speed rewind to eliminate the attenuation effect of the guide 48. The claw 66 is withdrawn from the film F, and the film F is pulled through the gate 56 by the tendency drive 15.

While the film advancing mechanism has been shown as being located between the film gate and the supply roll, it will be understood by those skilled in the art that a film snubber should be located between the gate and the take-up roll (not shown) for reversible projectors. It is pointed out that the device of the present invention is also highly suitable for use at that location as well as in the location shown in the drawings.

WHAT WE CLAIM IS:—

1. Film advancing mechanism for advancing film from a supply roll to a film gate comprising drive means frictionally engageable with the film between the supply

15 is reversed such as by reversing the motor 20 or by appropriate gearing (not shown) to pull the film F from the guide 24. The film F hugs the surface of roller 30 so that the force applied to the film F by the tendency drive 15 is attenuated in the guide 24 and very little of that force reaches the film F in the gate 34. As the claw 36 intermittently advances the film F upwardly through the gate 34, the length of film in the guide 24 is momentarily increased to push it away from the surface of the roller 30, thereby permitting the tendency drive 15 to pull an equal amount of film out of the guide 24, restoring contact between the film F and the roller surface. Film F emerging from the guide 24 is wound upon the reel 12 which is rotated in an anticlockwise direction by a conventional tendency drive (no shown). Of course, the tendency drive for the reel 12 may be sufficient to withdraw the film F from the guide 24 without the assistance of the tendency drive 15.

It is desirable for smooth operation to eliminate as much force attenuation as possible during film rewind operation. Therefore, the brake 32 is released to unclamp the roller 30. The claw 36 is withdrawn from the film F and the roller 18, which is driven in a reverse direction by the motor 20, pulls the film F rapidly through the gate 34, around the roller 30, which is now free to rotate with the film F, and out of the guide section defined by the walls 26 and 28. At this time, the reel 12 is driven in a film take-up direction at a speed that is sufficient to wind film F on to the reel 12 as fast as it is delivered by the drive 15.

The film guide 24 can be any shape or length as long as it can hold an excess of film having a length at least as great as the length of one film frame.

Referring now to Fig. 2, there is shown a sinuous guide 48 defined by a pair of spaced walls 50 and 52. The walls form two curves 53 and 55 and are spaced sufficiently from each other to permit the formation of a compensating loop between a sprocket wheel 54 and a film gate 56. The sprocket wheel 54 has been shown as an alternative to the rollers 16 and 18 of Fig. 1 in the tendency drive mechanism 15. However, the walls 50 and 52 are sufficiently close to each other to prevent buckling of the film F therebetween. As in the form shown in Fig. 1, the inner surfaces of the walls may be coated with a high friction material. The surfaces of a pair of rollers 58 and 60 project through openings in the walls 50 and 52, respectively, and define the inner radii of the bends in the film guide 48. The rollers 58 and 60 have clamping mechanisms 62 and 64, respectively, associated therewith.

During film threading, the clamps 62 and 64 are released and the film F is rapidly advanced by the sprocket wheel 54 along the guide 48 until it reaches the film gate 56 where it is picked up by a claw 66 and advanced at a slower rate. When the leading end of film F reaches the gate 56, additional film forced into the film guide 48 by the tendency drive 15 moves the film F into engagement with the inner surface of the wall 50 in the area of the curve 53 and into engagement with the inner surface of the wall 52 in the area of the curve 55, where it contacts the high friction coating to attenuate the force applied through the slip clutch 22 by the constant speed motor 20.

As the claw 66 intermittently advances the film F through the gate 56 during forward projection operation of the apparatus, the film F is pulled away from the wall surfaces of the guide 48 to permit the tendency drive 15 to advance an equal amount of film F into the guide 48. Thus, it can be seen that the operations of the form shown in Fig. 2 in the film threading and forward projection modes are substantially the same as those of the form shown in Fig. 1. During reverse projection, the clamping mechanisms 62 and 64 are applied to prevent rotation of the rollers 58 and 60. The tendency drive 15 pulls the film F against the rollers 58 and 60, which are coated with a high friction material, to attenuate the force applied by the sprocket wheel 54 and to isolate the film F in the gate 56 from that force. As the claw 66 pushes film into the guide 48, the film F is raised from the roller surfaces, permitting the tendency drive 15 to once again pull the excess film from the guide 48 and to return the film F to the roller surfaces.

As in the form shown in Fig. 1, the rollers 58 and 60 are permitted to rotate during high speed rewind to eliminate the attenuation effect of the guide 48. The claw 66 is withdrawn from the film F, and the film F is pulled through the gate 56 by the tendency drive 15.

While the film advancing mechanism has been shown as being located between the film gate and the supply roll, it will be understood by those skilled in the art that a film snubber should be located between the gate and the take-up roll (not shown) for reversible projectors. It is pointed out that the device of the present invention is also highly suitable for use at that location as well as in the location shown in the drawings.

WHAT WE CLAIM IS:—

1. Film advancing mechanism for advancing film from a supply roll to a film gate comprising drive means frictionally engageable with the film between the supply



roll and the film gate to drive the film toward the film gate, the drive means being coupled to power means through a tendency drive which limits the force applied to the film by the drive means, guide means for guiding the film from the drive means to the gate with a confined length of film between the drive means and the gate, and force attenuation means frictionally engageable with the film in the guide means for resisting the movement of more film into the guide means than is withdrawn therefrom into the gate whereby force applied to the film by the drive means is partially attenuated in the guide means.

2. Film advancing mechanism according to Claim 1 wherein the guide means comprises two opposed walls spaced sufficiently from each other to permit accumulation in the guide means of a length of film that is longer than the guide means, and the force attenuation means comprises a high friction material on the walls for contacting and frictionally restraining the film when the accumulated film length exceeds a predetermined value.

3. Film advancing mechanism according to Claim 2 wherein the two opposed walls are spaced sufficiently from each other to permit the film therein to buckle into a wavy configuration.

4. Film advancing mechanism according to Claim 2 wherein the two opposed walls form a sinuous guide and are spaced sufficiently close to each other to prevent buckling of the film into a wavy configuration.

5. Film advancing mechanism according to any one of Claims 1-4 wherein the drive means comprises a sprocket wheel.

6. Film advancing mechanism according to any one of the preceding claims wherein the film gate is provided with pressure means for preventing film from moving through the gate when pushed with a force below a first value and a film-engaging claw to move the film through the gate at a first rate, wherein the power means moves the drive means at a rate to push film toward the gate at a rate at least as great as said first rate, wherein the tendency drive limits the force applied to the film by the drive means to a second value greater than said first value, and wherein the force attenuation means attenuates the force applied to the film by the drive means to a value less than the first value.

7. Film advancing mechanism according

to Claim 1 constructed substantially as hereinbefore described with reference to, and as shown in, Fig. 1 or Fig. 2 of the accompanying drawing.

8. A motion picture projector comprising at least one high speed driven member located between a film roll and a film gate for feeding film from the film roll through film guide means into the gate during forward film movement, wherein the driven member is driven by a power source through a tendency drive and the film guide means is provided with at least one rotatable roller around which the film is guided, which rotatable roller is locked by a brake during intermittent reverse film movement and is freely rotatable during high speed continuous rewind and film-threading movements, and comprising force attenuation means frictionally engageable with a film in the film guide means to restrain movement of the film.

9. A motion picture projector according to claim 8 wherein during forward film movement the force attenuation means resists the movement of more film into the film guide means than is withdrawn therefrom into the film gate.

10. A motion picture projector according to claim 8 or 9 wherein the film guide means comprises two opposed walls defining a curved guide.

11. A motion picture projector according to claim 8, 9 or 10 further comprising a film-engaging claw for intermittently advancing film through the film gate during forward or reverse film movements and which is withdrawn from engagement with the film during rewind operation to allow continuous advance of the film through the gate.

12. A motion picture projector according to claim 11 wherein the driven member during forward film movement pushes film into the film guide means, during reverse movement pulls from the film guide a length of film corresponding to that advanced through the gate by the film engaging claw and during rewind operation draws film through and from the film guide.

13. A motion picture projector according to claim 8 constructed substantially as hereinbefore described with reference to, and as shown in, Fig. 1 or Fig. 2 of the accompanying drawing.

L. A. TRANGMAR, B.S.C., C.P.A.,
Agent for the Applicants.

