

[54] **WEB TENSION REGULATING APPARATUS**

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[52] U.S. Cl. **226/36, 226/195, 242/189, 352/124**

[51] Int. Cl. **B65h 23/16**

[58] Field of Search. 226/36, 44, 49, 108, 115, 183,
 226/195; 242/189; 352/124, 159

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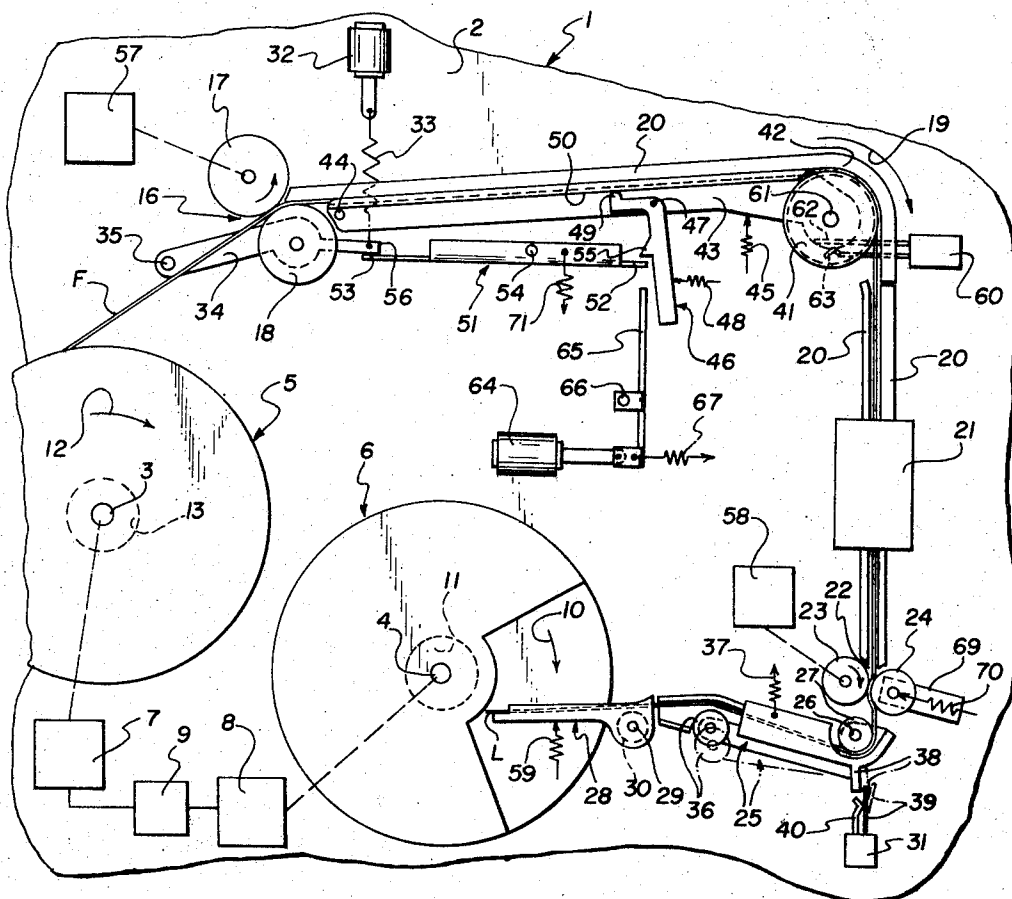
Assistant Examiner—Gene A. Church

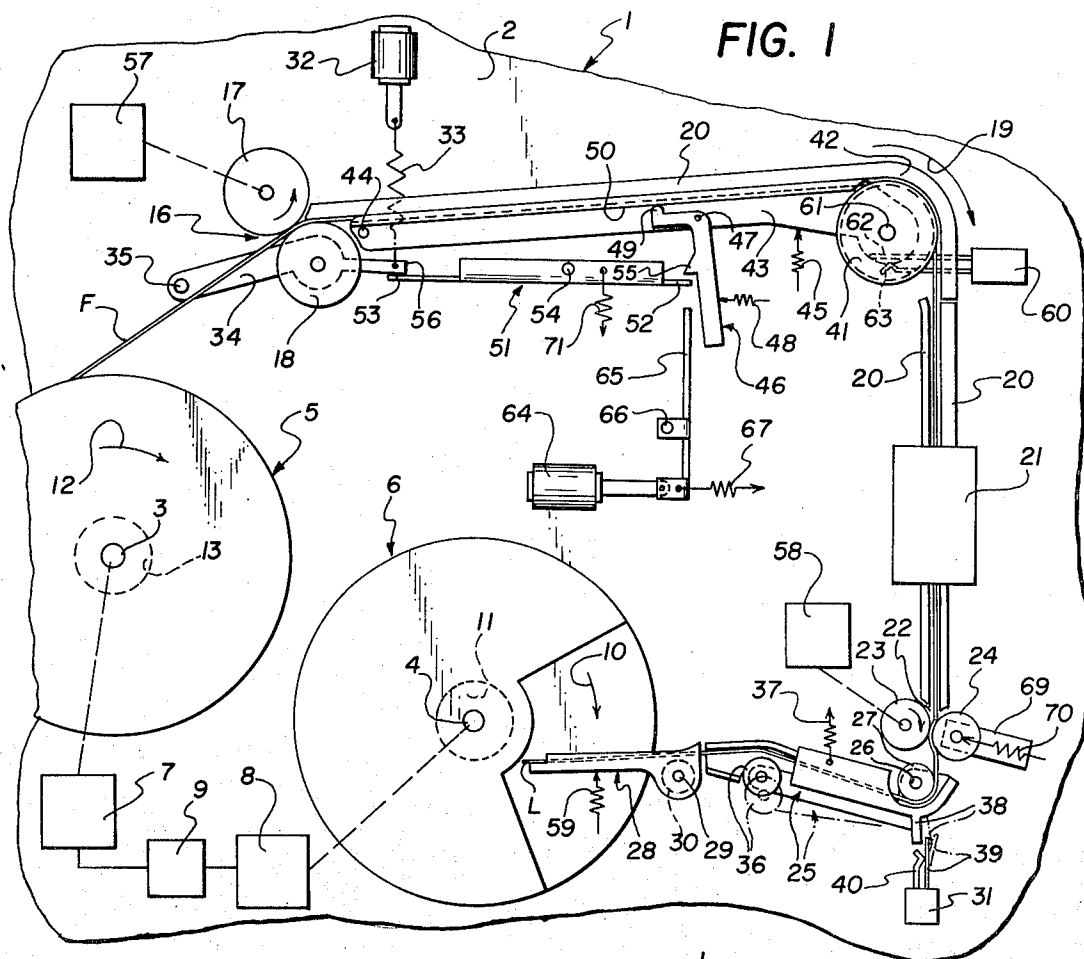
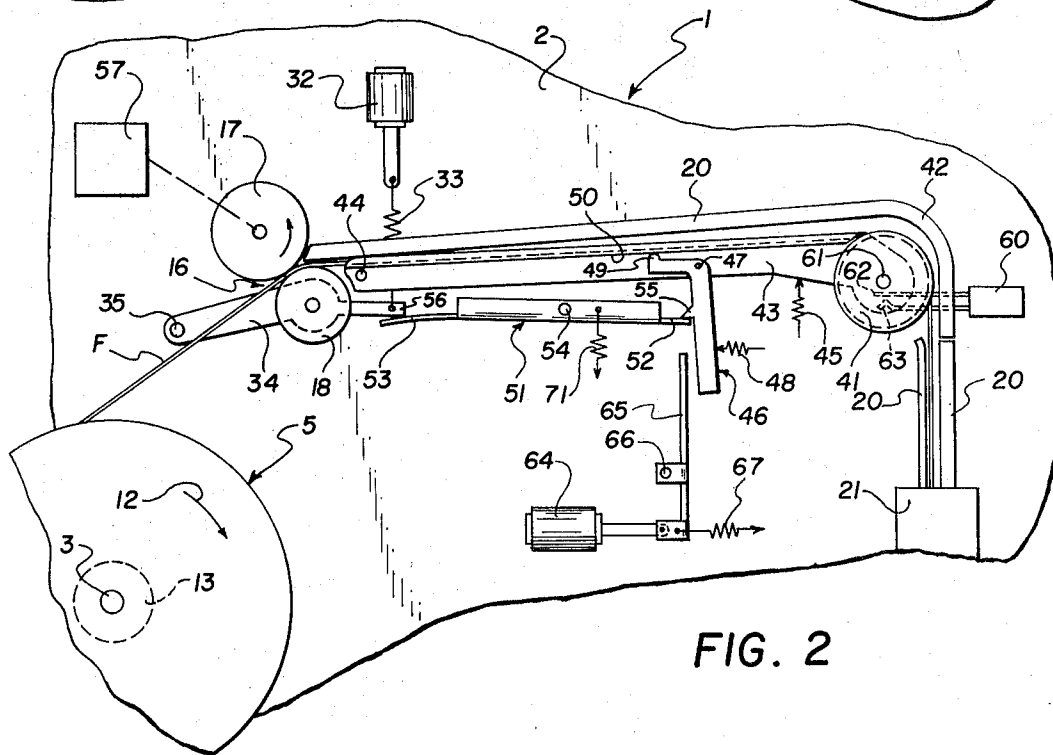
[57] **ABSTRACT**

A web handling apparatus is adapted to move web ma-

terial in forward and reverse directions and under varying degrees of web tension. In such apparatus, a web friction drive is actuatable to assume an operative mode for feeding web material, therefrom, in the forward direction toward a web drawing mechanism and at a rate in excess of that at which the drawing mechanism can draw the same material forward. The web friction drive normally assumes an idle mode in which the friction drive does not exert a web feeding affect on web material moving in the forward or reverse directions. A web tension sensing mechanism connects with the web friction drive, for actuating the friction drive to assume the operative mode in response to sensing a given tension in web material which is moving in the forward direction from the friction drive to the web drawing mechanism, and allows the friction drive to assume the idle mode after tension in the same material has eased or slackened. However, the web tension sensing mechanism and web friction drive remain disconnected as web material is moved in the reverse direction. In this way, the web tension sensing mechanism cannot actuate the web friction drive to assume the idle mode during movement of web material in the reverse direction.

19 Claims, 3 Drawing Figures





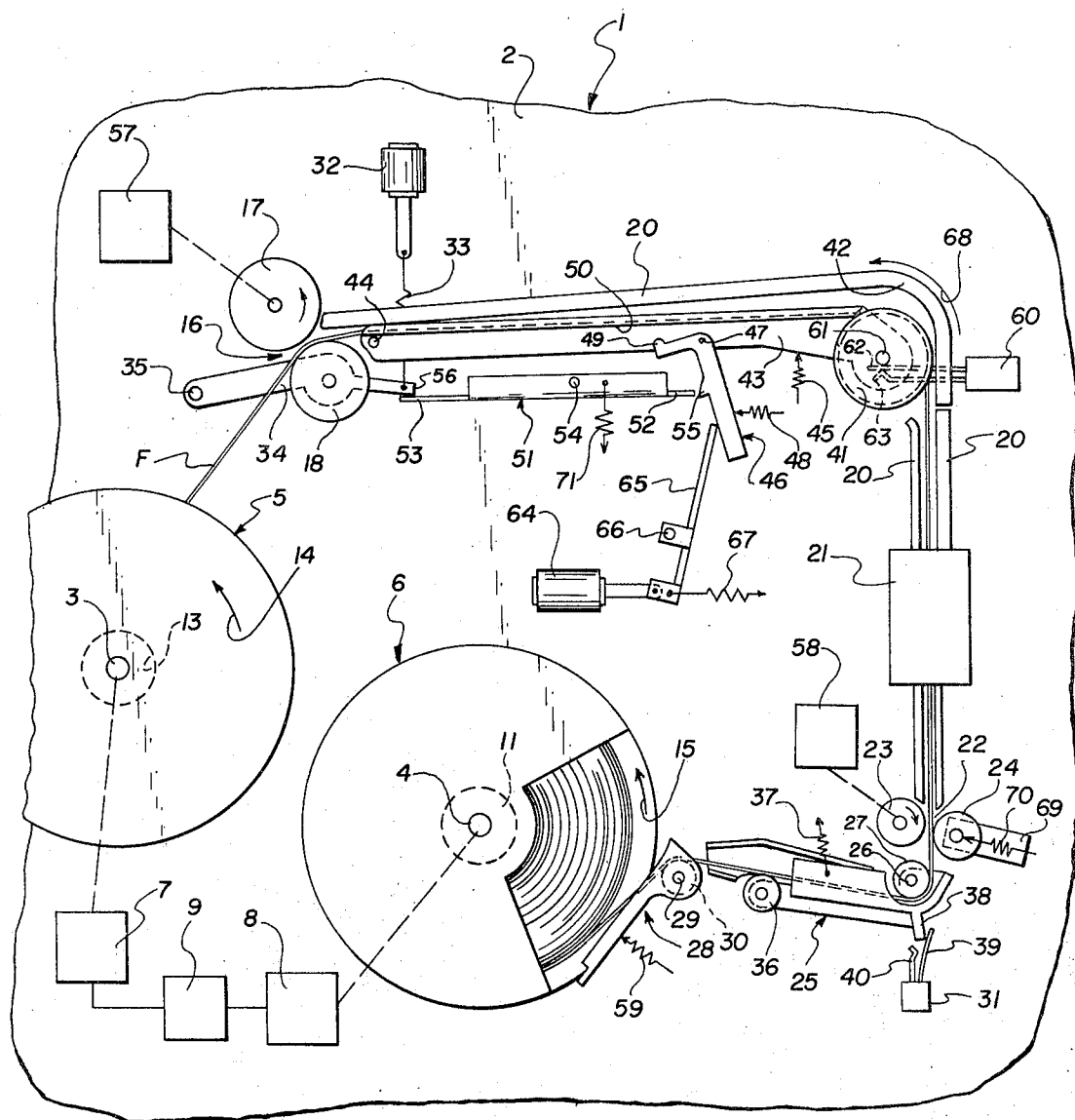


FIG. 3

WEB TENSION REGULATING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

Reference is made to commonly assigned copending U.S. patent application Ser. No. 77,959, entitled "MO-
TION PICTURE PROJECTOR APPARATUS" and
filed in the names of William A. Martin and John Q. St
Clair II on Oct. 5, 1970.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a web tension regu-
lating apparatus for regulating web tension in advance
of a web drawing mechanism, such as a web take-up de-
vice or a capstan and pressure roller assembly. More
particularly, the invention relates to a film projector in
which film tension regulating apparatus regulates ten-
sion in film moving in a forward direction to film ad-
vancing mechanism.

2. Description of the Prior Art

In many different kinds of web handling apparatus
having some mechanism for drawing a web at a known
rate, it is desirable or necessary to regulate tension in
the web in advance of such mechanism. A specific ex-
ample of this apparatus is that involving the intermit-
tent movement of the web past a given location, such
as a motion picture projector, wherein a film strip is in-
termittently moved past a projection gate.

One means for regulating web tension in advance of
the web drawing mechanism, in the foregoing apparat-
us, is a loop control arrangement for maintaining a
web loop in advance of the drawing mechanism. Such
web loop control arrangements have been devised
heretofore and, by way of example, are disclosed in
U.S. Pat. Nos. 1,958,152 and 2,735,677, patented re-
spectively May 8, 1934 and Feb. 21, 1956, and com-
monly assigned copending U.S. patent application Ser.
No. 77,959 more fully referenced hereinbefore. Gener-
ally, the known web loop control arrangements make
use of variations in the size of the web loop to cease and
resume operation of a web friction drive at the en-
trance to the loop. In one embodiment, such as dis-
closed in U.S. Pat. No. 2,735,677, successive portions
of a web are fed into the nip defined by contiguous,
driven and pressure rollers which, in turn, feed the web
into a web loop in advance of a web drawing mecha-
nism. In order to regulate the size of the web loop, and
preferably to maintain a substantially constant size
loop, the peripheral speed of the driven roller is suffi-
ciently fast to feed the web into the loop at a rate ex-
ceeding that at which the web is drawn from the loop,
and the pressure roller is movable away from the driven
roller to allow slippage between the web and the driven
roller for decreasing the loop size. A web guide lever
on which the pressure roller is rotatably mounted, rides
of floats on the web loop, permitting the pressure roller
to press the web against the driven roller during the
time that the web loop is below or at a given size, and
moves the pressure roller away from the driven roller
should the web loop exceed the given size.

It will be appreciated that the particular web loop
control arrangement, just described, relies on the stiff-
ness or rigidity of the web loop to discontinue the driv-
ing relation between the driven and pressure rollers.
Accordingly, in this instance, a web an insufficient
measure of stiffness cannot be used.

In applications where the web does not have a requi-
site measure of stiffness necessary for use with a web
loop control arrangement, other means must be found
for regulating web tension in advance of the web draw-
ing mechanism. One embodiment of such other means
appears to be disclosed in U.S. Pat. No. 2,800,832, pa-
tented July 30, 1957. In this embodiment, successive
portions of a web are fed into the nip defined by a pres-
sure roller and a driven roller which, in turn, feed the
web forward to a web drawing mechanism. Here, no in-
tervening web loop exists between the driven and pres-
sure rollers and the web drawing mechanism. Rather,
the pressure roller and a tension sensing roller are in-
terconnected by a lever for synchronous pivotal move-
ment of such rollers in the same direction about a com-
mon intermediate pivot point. Therefore, an increase in
web tension causes the tension sensing roller to actuate
the pressure roller to press the web against the driven
roller, and a decrease or lack of web tension permits
the pressure roller to move away from the driven roller
such that slippage occurs between the web and the
driven roller. While this web tension regulating means
may perform satisfactorily during forward movement
of the web from between the driven and pressure rol-
lers to the web take-up mechanism, such means ap-
pears to prohibit reverse or rewind movement of the
web, because the increased web tension normally oc-
curring in high speed web rewind will cause the tension
sensing roller to induce the pressure roller to press the
web against the driven roller so as to inhibit or defeat
web rewind.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present inven-
tion to provide a web tension regulating apparatus
which is improved over the prior art examples de-
scribed above.

It is another object of the present invention to pro-
vide a web tension regulating apparatus which regu-
lates tension in a web moving in a forward direction to
a web drawing mechanism, and which allows the web
to be moved in a reverse direction from the drawing
mechanism.

A further object of the present invention is to provide
a web tension regulating apparatus which can handle a
web not having the requisite measure of stiffness neces-
sary for use with a web loop control arrangement.

In accordance with the present invention there is dis-
closed, in detail hereinafter, a web handling apparatus
of the kind for moving web material in forward and re-
verse directions and under varying degrees of web ten-
sion. In such apparatus, a web friction drive is actu-
atable to assume an operative mode for feeding web ma-
terial, therefrom, in the forward direction to a web
drawing mechanism and at a rate in excess of that at
which the drawing mechanism can draw the same ma-
terial forward. The web friction drive normally assumes
an idle mode in which the friction drive does not exert
a web feeding affect on web material moving in the for-
ward or reverse directions. A web tension sensing
mechanism connects the web friction drive, for actu-
ating the friction drive to assume the operative mode in
response to sensing a given tension in web material
which is moving in the forward direction from the fric-
tion drive to the web drawing mechanism, and allows
the friction drive to assume the idle mode after tension
in the same material has eased or slackened. However,

the web tension sensing mechanism and the web friction drive remain disconnected as web material is moved in the reverse direction. In this way, the web tension sensing mechanism cannot actuate the web friction drive to assume the idle during movement of web material in the reverse direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of the present invention and the manner of obtaining them will become more apparent by reference to the following detailed description of a preferred embodiment of such invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a plan view of a web tension regulating apparatus in accordance with a preferred embodiment of the present invention, and shows the operation of such apparatus during the initial threading of web material from a web supply reel to a web take-up reel;

FIG. 2 is a fragmentary plan view of the web tension regulating apparatus, showing the manner in which web tension is regulated during movement of web material in the forward direction from the web supply reel to the web take-up reel; and

FIG. 3 is a plan view of the web tension regulating apparatus, showing the operation of such apparatus during reverse movement or rewinding of web material from the web take-up reel to the web supply reel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the invention will be described hereinafter for use in a motion picture projection device. However, because motion picture projection devices are well known in the art, the present description will be directed in particular only to those components of such a projection device which cooperate directly with the invention, components of the projection device not specifically shown or described are understood to be selectable from those known in the art. Moreover, it will be appreciated from the description hereinafter that the invention is suitable for use with other photographic devices, such as a camera, and, in general, can be used with various devices involving the feeding of web material.

Referring now to the drawings and in particular to FIG. 1, there is shown certain components of a motion picture projection device 1 having an enclosure 2 from which a pair of spaced spindles 3 and 4 project, to rotatably support thereon a film supply reel 5 and a film take-up reel 6. These spindles 3 and 4 operate in conjunction respectively with one-way drive clutch or other appropriate mechanisms 7 and 8 for allowing free rotation of an individual spindle during the time such spindle is rotating in a direction for unwinding or paying-out a film strip F from the reel thereon, and coupling the spindle to a power drive 9 for rotating the spindle in a direction for winding or taking-up the film strip onto the reel. Specifically, as shown in FIG. 1, the spindle 4 is driven in a winding direction 10 by means of the power drive 9 and a tendency drive clutch 8 for winding the film strip F about a core or hub member 11 of the reel 6, while the spindle 3 and the reel 5 freely rotate in the unwinding direction 12. Moreover, as shown in FIG. 3, to facilitate rewinding of the film strip F about a core or hub member 13 of the reel 5, the spindle 3 is driven in a winding direction 14, at a high

rate of speed, by means of the power drive 9 and a direct drive 7, while the spindle 4 and the reel 6 freely rotate in an unwinding direction 15. Since such direct drive 7, tendency drive 8 and power drive 9 for achieving the foregoing functions are well known in the art, further description thereof is considered unnecessary for an understanding of the invention.

Initially, as shown in FIG. 1, a film feeding or threading mechanism (not shown, but fully disclosed in commonly assigned copending U.S. patent application Ser. No. 77,959) delivers a free leading end portion L of the film strip F from the supply reel 5 into a nip 16 jointly defined by a driven roller or capstan 17 and a pressure roller 18. After passing from between the driven and pressure rollers 17 and 18, the leading film end portion L is fed by such rollers in a forward direction 19 along a stationary guide track 20, through a projection gate 21, and into a nip 22 jointly defined by a driven roller or capstan 23 and a pressure roller 24. A flying spot scanner (not shown) can be provided in the area of the projection gate 21 for scanning images on the film strip F and obtaining an electronic signal from such scanned images which may, for example, be furnished to a television receiver or to a television camera. Alternatively, a suitable rotating prism mechanism and light source (not shown) can be provided in the area of the projection gate 21 for projecting images on the film strip F in a conventional manner. From the guide track 20, the driven and pressure rollers 23 and 24 feed the leading film end portion L into a first guide shoe 25, which is pivotally mounted for movement about a shaft 26 of a guide roller 27 on such shoe. Immediately after exiting from the first guide shoe 25, the leading film end portion L enters a second guide shoe 28 which is pivotally mounted for movement about a shaft 29 of a guide roller 30 on this shoe. Finally, after exiting from the second guide shoe 28, the leading film end portion L moves onto the core member 11 of the take-up reel 6 and is snubbed thereto by any well known snubbing or self-threading mechanism (not shown). At this time, of course, the tendency drive 8 is coupled to the power drive 9 for rotating the take-up reel 6 in the winding direction 10, and the direct drive 7 is uncoupled from the power drive for allowing the supply reel 5 to rotate in the unwinding direction 12.

Previous to delivery of the leading film end portion L into the nip 16 of the driven and pressure rollers 17 and 18, and in response to the application of electrical power (source not shown) to the projection device 1, a normally closed switch 31 actuates or energizes a solenoid 32 which is connected by a helical tension spring 33 to a pressure roller support arm 34. This arm 34, on which the pressure roller 18 is rotatably mounted, normally locates such pressure roller in an idle or film guiding position in which the pressure roller is sufficiently spaced from the driven roller 17 to permit generally free movement of the film strip F therebetween. However, the arm 34 is pivotally mounted for movement about a pivot pin 35, for swinging the pressure roller 18 from the idle position to an operative or film feeding position in which such pressure roller presses successive portions of the film strip F against the driven roller 17, for feeding the film strip F in the forward direction 19 along the stationary guide track 20. Accordingly, energization of the solenoid 32 serves to move the pressure roller 18 from the idle position to the operative position; whereupon, the leading film end portion

L is fed from the driven and pressure rollers 17 and 18 to the driven and pressure rollers 23 and 24. As can be realized from FIGS. 1 and 3, since that portion of the film strip F moving between the driven and pressure rollers 17 and 18 is longitudinally tensioned and, in addition, is partially wrapped about the pressure roller, such film portion tends to urge the pressure roller away from the driven roller. Therefore, the pulling force which the spring 33 exerts on the pressure roller support arm 34, during the time that the solenoid 32 is energized, must be sufficient to overcome this urging force which the film strip F exerts on the pressure roller 18. Conversely, during the time that the solenoid 32 is not energized, the pulling force of the spring 33 must be nonexistent or insignificant so as not to interfere with the normal location of the pressure roller 18 in the idle position.

When the leading film end portion L is threaded onto the core member 11 of the take-up reel 6, the resulting increase of longitudinal tension in that reach or section of the film strip F extending from between the driven and pressure rollers 23 and 24 to such core member causes this film reach to foreshorten in length (from the guide roller 27 to the guide roller 30) and apply a lateral force against a guide roller 36 on the first guide shoe 25. This, in turn, causes the first shoe 25 to pivot counterclockwise about the shaft 26, as depicted in FIG. 1, and against the urging of a helical tension spring 37. In response to such pivotal movement of the first guide shoe 25, a finger member 38 extending therefrom, moves a flexibly movable contact 39 of the switch 31 away from a stationary contact 40 of the switch, opening the switch to deenergize the solenoid 32. When the solenoid 32 is deenergized, the pressure roller 18 returns to the idle position, since such roller is no longer held in the operative position.

As can be seen on viewing FIGS. 1-3, a guide roller 41 is located opposite and inside of a curve or bend 42 in the stationary guide track 20 such that a sufficient longitudinal tensioning of that reach of the film strip F extending along the guide track between the driven and pressure rollers 17 and 18 and the driven and pressure rollers 23 and 24, causes such film reach to foreshorten in length and apply a lateral force against this guide roller. A guide roller support arm 43, on which the guide roller 41 is rotatably mounted, serves to cooperate with the stationary guide track 20 for guiding the film strip F between such guide roller and the driven and pressure rollers 17 and 18. This arm 43 is pivotally mounted for movement with the guide roller 41 about a pivot pin 44. Accordingly, as the film force applied against the guide roller 41 increases due to increased longitudinal tensioning of the film strip F at the bend 42 in the guide track 20, the guide roller 41 is moved with the guide roller support arm 43 from a first film guiding position shown in FIG. 1, to a second film guiding position shown in FIG. 2, and to a third film guiding position shown in FIG. 3. A helical compression spring 45 urges the guide roller or (as referred to hereinafter) the tension sensing roller 41 and the arm 43 to the first guiding position, with an urging force which is less than the film force required to move such roller and arm from the first guiding position to the second and third guiding positions. Thus, the tension sensing roller 41 and the arm 43 are normally held in the first guiding position by the spring 45.

A connecting finger 46 is pivotally mounted on the tension roller support arm 43 for movement about a pivot pin 47. A helical compression spring 48 urges the connecting finger 46 to a ready position, shown in FIG. 1, and in which a stop 49 on such finger abuts against a raised edge 50 on the arm 43. A motion transmitting lever 51 has flexibly movable, opposite end portions 52 and 53 and a fulcrum or pivot point 54 located therebetween. The lever fulcrum 54 is disposed with respect to the pressure roller support arm 34 and the connecting finger 46 such that the lever end portions 52 and 53 and the finger and arm are movable respectively into motion transmitting relation, to cause the movement of the pressure roller 18 from the idle position to the operative position as the tension sensing roller 41 is moved from the first guiding position to the second guiding position. Specifically, as can be seen from a comparison of FIGS. 1 and 2, during movement of the tension sensing roller 41 with the arm 43 from the first guiding position to the second guiding position, the connecting finger 46 moves therewith, and an engageable piece 55 on the finger engages the lever end portion 52 so as to swing the lever 51 about the fulcrum 54 and force the lever end portion 53 further against an extending member 56 of the pressure roller support arm 54. When the connecting finger 46 is in this connecting position, i.e., in engagement with the lever end portion 52, continued movement of the tension sensing roller 41 from the first guiding position to the second guiding position causes the lever 51 to swing about the fulcrum 54, moving the pressure roller 18 from the idle position to the operative position. Subsequently, of course, should the tension sensing roller 41 return from the second guiding position to the first guiding position, the connecting finger 46 will separate from the lever end portion 52, allowing the pressure roller 18 to return from the operative position to the idle position.

It is apparent from the foregoing description that should the longitudinal tension fluctuate, i.e., increase and decrease, in those portions of the film strip F moving in the forward direction 19 individually about the tension sensing roller 41, then the driven and pressure rollers 17 and 18 will function as an intermittent film drive (in that such pressure roller and the tension sensing roller move to the operative and second guiding positions, respectively, in response to increase film tensioning and move to the idle and first guiding positions, respectively, in response to decreased film tensioning). This fluctuation in film tension at the tension sensing roller 41 can be caused, or example, by variations in the flange member spacing (not shown), from one film convolution to the next, on the supply reel 5 and by the resulting fluctuation in film drag as the film strip F is drawn in the forward direction 19 from the supply reel. If the driven and pressure rollers 17 and 18 were to function as a continuous (rather than an intermittent) film drive, as in the case of the driven and pressure rollers 23 and 24, then any dissimilarity in the respective diameters of such driven rollers would produce different peripheral speeds of rotation of these rollers. This variation in roller speed would produce different rates of film drive, causing excessive film tensioning or film slackening along the stationary guide track 20. Thus, in accordance with the invention, the driven roller 17 is rotated by a power drive 57 with sufficient peripheral speed such as that the pressure roller 18, in the operative position, cooperates with this driven roller to feed

the film strip F into the guide track 20 at a rate in excess of that at which the pressure and driven rollers 23 and 24 can draw or advance the film strip from the guide track. The power drive 57 for rotating the driven roller 17, as well as a power drive 58 for rotating the driven roller 23, are actuated or energized in response to the application of electrical power (source not shown) to the projection device 1.

During movement of the film strip F in the forward direction 19 along the stationary guide track 20, the tension sensing roller 41 serves as a means for sensing the demand for film at the projection gate 21 and at the driven and pressure rollers 23 and 24. This demand, of course, is measured by fluctuations in film tension at the tension sensing roller 41. Moreover, as stated above and as can be seen on viewing FIGS. 1 and 2, in response to increased film tension at the roller 41, such roller moves from the first guiding position to the second guiding position, causing the pressure roller 18 to move from the idle position to the operative position. Immediately thereafter, the film strip F is fed into the guide track 20 at a rate in excess of that at which the film strip is drawn from the guide track. As soon as film tension at the tension sensing roller 41 has decreased a given amount, such roller returns to the first guiding position and the pressure roller 18, in turn, returns to the idle position. Movement of the tension sensing roller 41 between the first and second guiding positions, and movement of the pressure roller 18 between the idle and operative positions, occurs repeatedly during the time that the film strip F is moving in the forward direction 19 along the guide track 20, with the result that the tension fluctuations in such film strip are regulated and maintained between relatively narrow limits.

As can be realized from a comparison of FIGS. 1 and 3, after the leading film end portion L is snubbed to the core member 11 of the take-up reel 6, and during the time that the film strip F is winding onto such reel, the second guide shoe 28 pivots about the shaft 29 against the urging of a helical compression spring 59, and the first guide shoe 25 remains generally stationary to hold the switch 31 open. Since a trailing end portion (not shown) of the film strip F is anchored to the core member 13 of the supply reel 5, after the last convolution of the film strip is unwound from the supply reel, the longitudinal tension in that reach of the film strip extending from the supply core to the driven and pressure rollers 23 and 24 will suddenly increase. Upon this occurrence, the film force applied against the tension sensing roller 41, at the bend 42 in the stationary guide track 20, undergoes a corresponding increase and the tension sensing roller is moved with the tension sensing roller support arm 43 from the first or second guiding positions, shown respectively in FIGS. 1 and 2, to the third guiding position, shown in FIG. 3. As shown in FIG. 3, this movement of the roller 41 and the arm 43 to the third guiding position causes the closure of a normally open switch 60. Specifically, a shaft 61 of the tension sensing roller 41 moves a flexibly movable contact 62 of the switch 60 into abutment against a stationary contact 63 of such switch. Closure of the switch 60 operates to energize or actuate a solenoid 64 which, thereupon, pivots a separating lever 65 clockwise, as viewed in FIG. 3, about a fulcrum or pivot point 66 and against the urging of a helical tension spring 67. This pivoting of the separating lever 65, from an inactive position shown in FIGS. 1 and 2 to a separating position

shown in FIG. 3, moves the connecting finger 46 against the urging of the spring 48 from the ready position shown in FIG. 1, or from the connecting position shown in FIG. 3. As is apparent from FIG. 3, in the disconnecting position, the connecting finger 46 is prevented from engaging with the end portion 52 of the motion transmitting lever 51. The connecting finger 46 is held in the disconnecting position by the separating lever 65 as long as the switch 60 remains closed. In this way, the tension sensing roller 41 cannot cause the pressure roller 18 to move to the operative position.

Closing of the switch 60 further operates, by well known electromechanical means, to uncouple the tendency drive clutch 8 and the power drive 9, allowing free rotation of the take-up reel 6, and to couple the direct drive 7 and the power drive for rotating the supply reel 5, at a high rate of speed, in the winding direction 14 shown in FIG. 3. Such winding rotation of the supply reel 5 causes the film strip F to be wound thereon, and unwound from the take-up reel 6. During this occurrence, of course, the film strip F is drawn in a reverse direction 68 along the stationary guide track 20, and is longitudinally tensioned along the guide track to retain the tension sensing roller 41 in the third guiding position and keep the switch 60 closed.

A carriage 69, on which the pressure roller 24 is rotatably mounted, enables such roller to be moved toward and away from the driven roller 23, since that portion of the film strip F moving in the forward direction 19 between the driven and pressure rollers 23 and 24 is longitudinally tensioned and, in addition, is partially wrapped about the pressure roller, this film portion tends to apply a lateral force against the pressure roller for urging such roller away from the driven roller. However, a helical compression spring 70 urges the pressure roller 24 to press the film strip F against the driven roller 23 with an urging force, which is greater than the film force applied against the pressure roller as the film strip moves in the forward direction 19, and which is less than the film force applied against the pressure roller as the film strip moves in the reverse direction 68. Accordingly, as shown in FIG. 1, the pressure roller 24 presses the film strip F against the driven roller 23 to draw or advance the film strip in the forward direction 19 along the stationary guide track 20 and to feed the film strip in the same direction to the take-up reel 6. On the other hand, as shown in FIG. 3, during the time that the film strip F moves in the reverse direction 68, the pressure roller 24 is spaced from the driven roller 23 so as not to exert any film feeding affect on such moving strip.

As can be seen in FIGS. 1 and 3, a helical tension spring 71 maintains the end portion 53 of the motion transmitting lever 51 in contact with the extended member 56 of the pressure roller support arm 34 during the time such arm and the pressure roller 18 are in the idle position. However, this spring 71 does not have a sufficient range to interfere with the arm 34 and the roller 18 normally assuming the idle position. Therefore, after the solenoid 64 is deenergized, the lever 51, the arm 34 with the roller 18, and the connecting finger 46 return from the relative locations shown in FIG. 3 to those shown in FIG. 1.

It is to be appreciated that although the driven and pressure roller 23 and 24 serve to continuously draw the film strip F, in the forward direction 19, at a uniform rate through the projection gate 21, the projec-

tion device 1 is not limited to such a continuous film feed through the projection gate and, instead, could include an intermittent film feed through this gate.

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 spirit and scope of the invention.

I claim:

1. In a web handling apparatus of the kind for moving web material in forward and reverse directions along a web path and under varying degrees of web tension, the combination comprising:

web advancing means for advancing web material in the forward direction along the web path;

web feeding means actuatable to assume a feeding mode for feeding web material in the forward direction along the web path toward said web advancing means, at a rate in excess of that at which said advancing means can advance web material, and normally assuming a non-feeding mode in which said feeding means does not feed web material;

web tension sensing means for actuating said web feeding means to assume the feeding mode in response to sensing a given tension in web material moving in the forward direction along the web path between said web advancing means and said feeding means, and for allowing said feeding means to assume the non-feeding mode after tension in the same material has eased; and

means for preventing said web tension sensing means from actuating said web feeding means to assume the feeding mode as web material is moved in the reverse direction along the web path, thereby to permit said web feeding means to remain in the non-feeding mode.

2. In a web handling apparatus of the kind for moving web material in forward and reverse directions along a web path and under varying degrees of web tension, the combination comprising:

web advancing means for advancing web material in the forward direction along the web path;

web feeding means actuatable to assume a feeding mode for feeding web material in the forward direction along the web path toward said web advancing means, at a rate in excess of that at which said advancing means can advance web material, and normally assuming a non-feeding mode in which said feeding means does not feed web material;

web tension sensing means for sensing tension in web material moving in the forward direction along the web path between said web advancing means and said web feeding means;

means for connecting said web feeding means and said web tension sensing means for actuating said feeding means to assume the feeding mode, in response to said tension sensing means sensing a given tension in web material moving in the forward direction along the web path between said feeding means and said web advancing means, and for allowing said feeding means to assume the non-feeding mode after tension in the same material has eased; and

means cooperating with said connecting means for preventing a connection between said web feeding

means and said web tension sensing means as web material is moved in the reverse direction along the web path, thereby to permit said feeding means to remain in the non-feeding mode.

3. In a web handling apparatus of the kind for moving web material in forward and reverse directions along a web path and under varying degrees of web tension, the combination comprising:

means for advancing web material in the forward direction along the web path;

a driven member against which successive portions of web material can be pressed for feeding web material in the forward direction along the web path toward said web advancing means;

a pressure member;

means supporting said pressure member for movement to an operative position in which said pressure member is disposed to cooperate with said driven member for feeding web material by pressing successive portions of web material against said driven member, and normally locating said pressure member in an idle position in which said pressure member is disposed with respect to said driven member for permitting generally free movement of web material therebetween;

means for driving said driven member with sufficient speed such that said pressure member, in the operative position, cooperates with said driven member for feeding web material at a rate in excess of that at which said web advancing means can advance web material, so as to ease tension in web material moving in the forward direction along the web path between said driven and pressure members and said advancing means;

means for sensing tension in web material moving in the forward direction along the web path between said driven and pressure members and said web advancing means;

means for connecting said pressure member and said web tension sensing means for moving said pressure member from the idle position to the operative position, in response to sensing a given tension in web material moving in the forward direction along the web path between said driven and pressure members and said web advancing means, and for allowing said pressure member to return to the idle position after tension in the same material has eased; and

means cooperating with said connecting means for preventing a connection between said pressure member and said web tension sensing means as web material is moved in the reverse direction along the web path, thereby to permit said pressure member to remain in the idle position.

4. The combination as recited in claim 3, wherein said web advancing means initially serves to advance a leading end portion of web material in the forward direction onto a rotatably supported core member to which the leading web end portion can be snubbed and about which web material can be wound, and wherein the combination further comprises:

means energizable for holding said pressure member in the operative position, and deenergizable for allowing said pressure member to return to the idle position; and

means actuatable in response to the leading web end portion snubbing to the core member for deenergizing said pressure member holding means.

5. The combination as recited in claim 3, wherein said pressure member is a pressure roller, and wherein said pressure member supporting means supports said pressure roller for movement toward and away from said driven member respectively between the operative and idle positions and locates said pressure roller in said web handling apparatus such that web material moving between said driven member and said pressure roller is partially wrapped about said pressure roller for urging said pressure roller to move away from said driven member as tension in the same material increases.

6. In a web handling apparatus of the kind for moving web material in forward and reverse directions along a web path and under varying degrees of web tension, the combination comprising:

means for drawing web material in the forward direction along the web path;

a driven member against which successive portions of web material can be pressed for feeding web material in the forward direction along the web path toward said web drawing means;

a pressure member;

means supporting said pressure member for movement to an operative position in which said pressure member is disposed to cooperate with said driven member for feeding web material by pressing successive portions of web material against said driven member, and normally locating said pressure member in an idle position in which said pressure member is disposed with respect to said driven member for permitting generally free movement of web material therebetween;

means for driving said driven member with sufficient speed such that said pressure member, in the operative position, cooperates with said driven member for feeding web material at a rate in excess of that at which said web drawing means can draw web material, so as to ease tension in web material moving in the forward direction between said driven and pressure members and said web drawing means;

a web guide member disposed with respect to said web drawing means and said driven and pressure members for guiding web material such that a sufficient tensioning of web material moving in the forward direction between said driven and pressure members and said drawing means causes the same material to foreshorten in length and apply a web force against said guide member;

means supporting said web guide member for movement from a first web guiding position to a second web guiding position in response to web material applying a given force against said guide member;

means for urging said web guide member from the second web guiding position to the first web guiding position with an urging force which is less than the given force required to move said guide member from the first web guiding position to the second web guiding position;

means for connecting said pressure member and said web guide member such that movement of said guide member from the first web guiding position to the second web guiding position causes move-

ment of said pressure member from the idle position to the operative position, and allowing said pressure member to return to the idle position after tension has eased in web material moving in the forward direction between said driven and pressure members and said web drawing means; and

means cooperating with said connecting means for preventing a connection between said pressure member and said web guide member as web material is moved in the reverse direction along the web path thereby to permit said pressure member to remain in the idle position.

7. The combination as recited in claim 6, wherein said web drawing means includes means for continuously moving web material, therepast, in the forward direction at a substantially constant rate.

8. The combination as recited in claim 7, wherein said continuous web moving means includes a driven roller against which successive portions of web material can be pressed for moving web material, therepast, in the forward direction, means for rotating said driven roller at a substantially constant speed, a pressure roller, means supporting said pressure roller for movement toward and away from said driven roller and such that web material moving between said driven and pressure rollers applies a web force against said pressure roller for urging said pressure roller to move away from said driven roller, and means for urging said pressure roller to press web material against said driven roller with an urging force which is greater than a web force applied against said pressure roller as web material is moved in the forward direction between said driven and pressure rollers and which is less than a web force applied against said pressure roller as web material is moved in the reverse direction between said driven and pressure rollers.

9. The combination as recited in claim 6, wherein said web drawing means and said driven and pressure members serve to draw web material off a rotatably supported core member about which a web supply roll is wound and to which a trailing web end portion is anchored, wherein said web guide member supporting means supports said web guide member for movement from the second web guiding position to a third web guiding position in the event that all but the trailing web end portion is drawn off the core member and web material moving in the forward direction between the core member and said web drawing means foreshortens in length and applies a greater force against said guide member than that required to move said guide member from the first web guiding position to the second web guiding position, wherein said connecting means includes motion transmitting means movable to connecting and disconnecting positions respectively in which said motion transmitting means connects and cannot connect said pressure and web guide members in motion transmitting relation, and wherein said connection preventing means includes means actuatable in response to movement of said web guide member to the third web guiding position for moving said motion transmitting means to the disconnecting position.

10. The combination as recited in claim 9, further comprising:

means actuatable in response to movement of said web guide member to the third web guiding position for initiating movement of web material in the reverse direction along the web path.

11. The combination as recited in claim 9, wherein said pressure member supporting means includes a pressure member support arm which is pivotally mounted for moving said pressure member toward and away from said driven member respectively between the operative and idle positions, wherein said web guide member supporting means includes a web guide member support arm which is pivotally mounted for moving said web guide member between the first, second and third web guiding positions, wherein said motion transmitting means includes a lever having opposite end portions and a fulcrum located therebetween such that said lever end portions and said pressure and web guide member support arms are movable respectively into motion transmitting relation to cause movement of said pressure member from the idle position to the operative position as said web guide member is moved from the first web guiding position to the second web guiding position, and wherein said means for moving said motion transmitting means to the disconnecting position includes means for separating one of said lever end portions and one of said pressure and web guide member support arms for preventing movement of said end portions and said support arms into motion transmitting relation.

12. The combination as recited in claim 6, wherein said pressure member supporting means includes a pressure member support arm which is pivotally mounted for moving said pressure member toward and away from said driven member respectively between the operative and idle positions, wherein said web guide member supporting means includes a web guide member support arm which is pivotally mounted for moving said web guide member between the first and second web guiding positions, wherein said connecting means includes a lever having opposite end portions and a fulcrum located therebetween such that said lever end portions and said pressure and web guide member support arms are movable respectively into motion transmitting relation to cause movement of said pressure member from the idle position to the operative position as said web guide member is moved from the first web guiding position to the second web guiding position, and wherein said connecting preventing means includes means for separating one of said lever end portions and one of said pressure and web guide member support arms for preventing movement of said end portions and said support arms into motion transmitting relation.

13. An improved web handling apparatus of the kind (a) wherein there is provided a driven member against which successive portions of web material can be pressed for feeding web material, (b) wherein there is provided a pressure member normally located in an idle position in which said pressure member is disposed with respect to said driven member for permitting generally free movement of web material therebetween, and movable from the idle position to an operative position in which said pressure member is disposed to cooperate with said driven member for feeding web material by pressing successive portions of web material against said driven member, (c) wherein there is provided a web guide member disposed with respect to said driven member and said pressure member such that a sufficient tensioning of web material extending between said driven and pressure members and said guide member causes the same material to foreshorten

in length and apply a web force against said guide member, and movable from a first web guiding position to a second web guiding position in response to web material applying a given force against said guide member, (d) wherein there is provided means for connecting said pressure member and said web guide member such that movement of said guide member from the first web guiding position to the second web guiding position causes movement of said pressure member from the idle position to the operative position, and wherein the improvement comprises:

said connecting means including a lever having opposite end portions and a fulcrum located therebetween, said lever fulcrum disposed with respect to said pressure member and said web guide member such that said lever end portions and said pressure and web guide members are movable respectively into motion transmitting relation to cause movement of said pressure member from the idle position to the operative position as said web guide member is moved from the first web guiding position to the second web guiding position; and means for separating one of said lever end portions and one of said pressure and web guide members for preventing movement of said lever end portions and said pressure and web guide members into motion transmitting relation.

14. The improvement as recited in claim 13, wherein said connecting means further includes a connecting member coupled to said web guide member for synchronous movement therewith from the first web guiding position to the second web guiding position, said connecting member engageable with a particular one of said lever end portions as said web guide member is moved from the first web guiding position to the second web guiding position and movable relative to said guide member for disengaging from the particular one of said lever end portions, and wherein said separating means includes means for disengaging said connecting member from the particular one of said lever end portions and for holding said connecting member separated therefrom.

15. The improvement as recited in claim 14, wherein another one of said lever end portions is flexibly movable.

16. Film projection apparatus for moving film in forward and reverse directions, said apparatus comprising: means for supporting a film supply;

a film take-up;

a film gate;

means defining a path for film from said film supply supporting means through said film gate to said film take-up;

means located with respect to the film path between said film gate and said film take-up for advancing film in the forward direction through said gate and along the path at a first rate;

actuatable film feeding means located with respect to the film path between said film supply and said film gate, said film feeding means, when actuated, being effective for feeding film in the forward direction along the path toward said gate at a second rate greater than the first rate, and said film feeding means, when not actuated, being ineffective for feeding film along the path;

film tension sensing means located with respect to a portion of the film path between said film feeding

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means and said film gate for sensing tension in film in such portion of the path;

means for actuating said film feeding means in response to said film tension sensing detecting a particular magnitude of tension in film in such portion of the film path;

means for moving film in the reverse direction along the film path; and

means for preventing said actuating means from actuating said film feeding means during movement of film in the reverse direction along the film path.

17. Film projection apparatus as recited in claim 16, wherein the film path includes a plurality of bends between said film supply supporting means and said film take-up, and wherein:

said film feeding means includes a driven roller located at one side of the film path and a pressure roller located at the other side of the path, and a support arm mounting said pressure roller for movement toward and away from said driven roller;

said film tension sensing means includes a guide roller support arm, means mounting said guide roller support arm for pivotal movement between first and second positions, a guide roller mounted on said guide roller support arm and movable with said guide roller support arm between first and second film guiding positions, said guide roller being located along the film path at the one bend in the path and the film being contactable with said guide roller as the film travels along the path so that said guide roller is urged from its first guiding position toward its second guiding position in response to an increase in tension in film contacting said guide roller, thereby urging said guide roller support arm from its first position toward its second position; and

said actuating means includes a motion transmitting lever, means mounting said lever for pivotal movement into contact with said pressure roller support arm of said film feeding means for effecting movement of said pressure roller carried by said pressure roller support arm toward said driven roller, a connecting finger pivotally mounted on said guide roller support arm for movement between (1) a first position wherein a portion of said finger is positioned for engagement with said motion transmitting lever in response to movement of said guide roller support arm from its first position toward its second position under the influence of tension in film as sensed by said guide roller so that such movement of the guide roller support arm can effect movement of said motion transmitting lever to cause said pressure roller carried by said pressure roller support arm to be moved toward said driven roller in response to an increase in film tension, and (2) a second position wherein said portion of said connecting finger is located with respect to said motion transmitting lever so that said finger is ineffective to move said motion transmitting lever or said pressure roller support arm in response to movement of said guide roller support arm from its first position toward its second position in response to an increase in film tension as sensed by said guide roller.

18. Film projection apparatus as recited in claim 17, wherein said actuating means further includes means

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urging said guide roller support arm and said finger toward their respective first positions, and said film projection apparatus further comprises a separating lever, means mounting said separating lever for movement between (1) a first position wherein said separating lever is located with respect to said finger for permitting movement of said finger to its first position and (2) a second position wherein said separating lever holds said finger in its second position against said urging means, and means for moving said separating lever between its first and second positions.

19. Film projection apparatus as recited in claim 18, wherein said means for moving said separating lever includes a spring connected to said separating lever for urging said separating lever to its first position, a solenoid coupled to said separating lever and effective when energized to move said separating lever to its second position, and means for energizing said solenoid.

20. Film projection apparatus comprising:

means for supporting a film supply;

a film take-up;

a film gate located between said film supply supporting means and said film take-up;

means defining a path for film from said film supply supporting means through said film gate to said film take-up, the film path including at least one bend;

means located along the film path between said film gate and said film take-up for advancing film through said gate and along the path;

actuatable film feeding means located along the film path between said film supply and said film gate, said film feeding means including a driven roller located at one side of the film path and a pressure roller located at the other side of the path, a support arm mounting said pressure roller for movement toward said driven roller when said film feeding means is actuated, and away from said driven roller when said feeding means is not actuated, whereby said film feeding means, when actuated, is effective for feeding film along the film path toward said film gate, and said film feeding means, when not actuated, being ineffective for feeding film along the path;

film tension sensing means located along a portion of the film path between said film feeding means and said film gate for sensing tension in film in such portion of the path, said film tension sensing means including a guide roller support arm, means mounting said guide roller support arm for pivotal movement between first and second positions, a guide roller mounted on said guide roller support arm and movable with said guide roller support arm between first and second film guiding positions, said guide roller being located along the film path at the one bend in the path and the film being contactable with said guide roller as the film travels along the path so that said guide roller is urged from its first guiding position toward its second guiding position in response to an increase in tension in film contacting said guide roller, thereby urging said guide roller support arm from its first position toward its second position; and

means for actuating said film feeding means in response to said film tension sensing means sensing a particular magnitude of tension in film in such portion of the film path, said actuating means in-

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cluding a motion transmitting lever, means mounting said lever for pivotal movement into contact with said pressure roller support arm of said film feeding means for effecting movement of said pressure roller carried by said pressure roller support arm toward said driven roller, a connecting finger carried by said guide roller support arm for movement therewith to a position wherein a portion of said finger is engageable with said motion transmitting lever in response to movement of said guide 10

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roller support arm from its first position toward its second position under the influence of tension in film as sensed by said guide roller so that such movement of said guide roller support arm can effect movement of said motion transmitting lever to cause said pressure roller carried by said pressure roller support arm to be moved toward said driven roller in response to an increase film tension.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,794,231 Dated February 26, 1974

Inventor(s) William A. Martin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 9, lines 10 thru 37 - Cancel Claim 1 in its entirety.

Col. 13, line 11 - change "opposite" to --opposite--.

Col. 14, line 61 - delete "being" and insert --assuming a feeding mode in which said feeding means is--;

line 65 - delete "being" and insert --assuming a non-feeding mode in which said feeding means is--;

Col. 15, line 3 - after "means" insert --,for connecting said film feeding means and said film tension sensing means--;

delete "film", after "feeding means" insert --to assume the feeding mode--;

line 4 - delete "film"

line 6 - after "path" insert --, and for allowing said feeding means to assume the non-feeding mode after tension in the same film has eased--;

line 9 - after "means" (first occurrence) insert --cooperating with said connecting means--; delete "said actuating means from actuating" and insert --a connection between--;

line 10 - before "during" insert --and said film tension sensing means--;

line 11 - after "path" insert --, thereby to permit said feeding means to remain in the non-feeding mode--;

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Col. 15, line 38 - delete "actuating" and insert --connecting--;
line 65 - delete "ss" and insert --as--;
line 68 - delete "actuating" and insert --connecting--.

Signed and sealed this 29th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

PO-1050
(5/69)

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