Nov. 9, 1971 J. D. MITCHELL ET AL Re. 27,229

MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 1

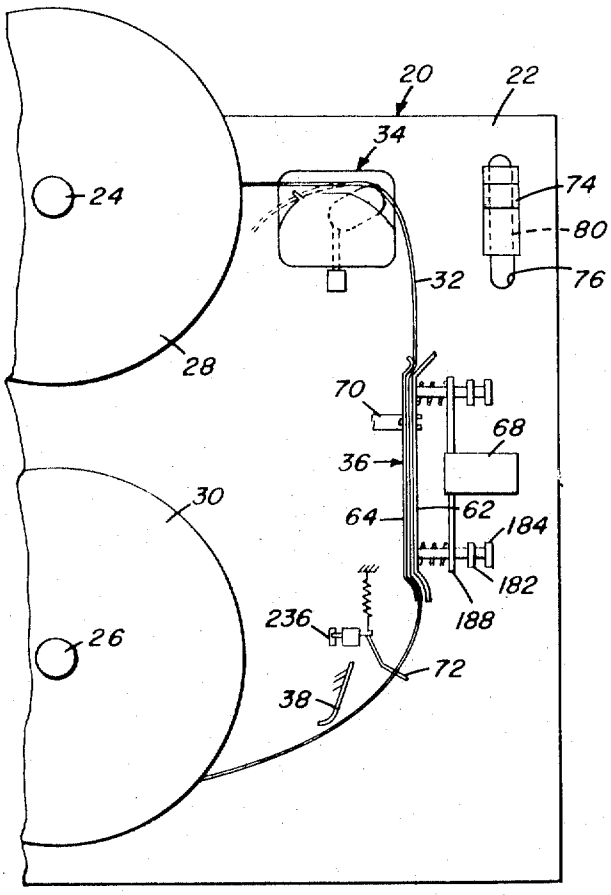

Fig. 1

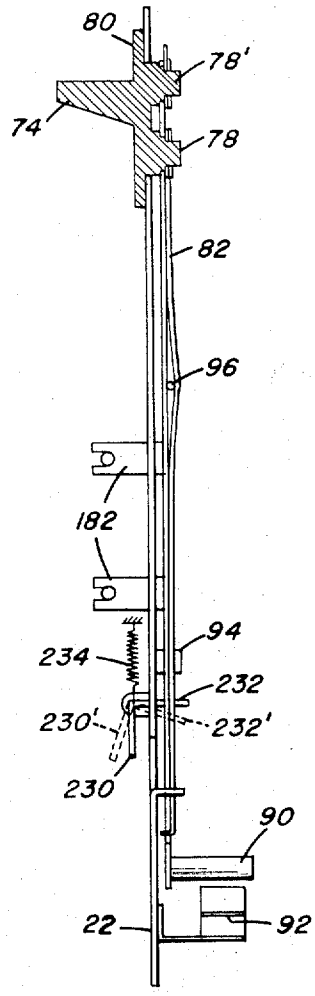

Fig. 4

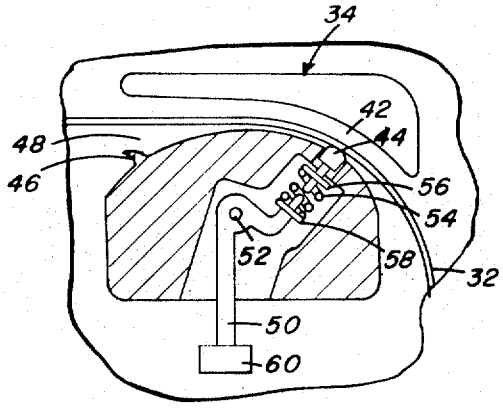

Fig. 2

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 3

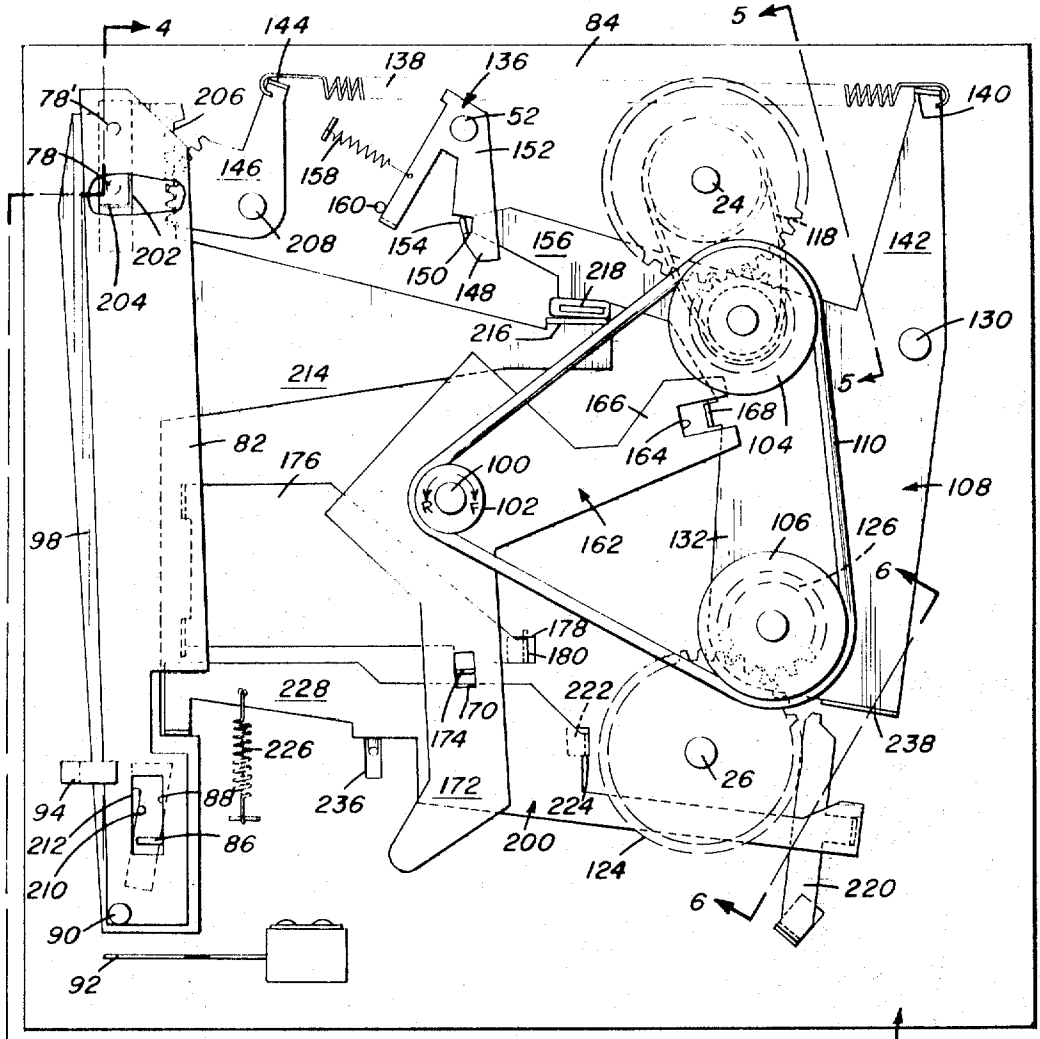

Fig. 3

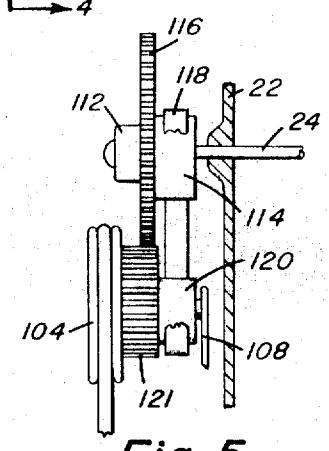

Fig. 5

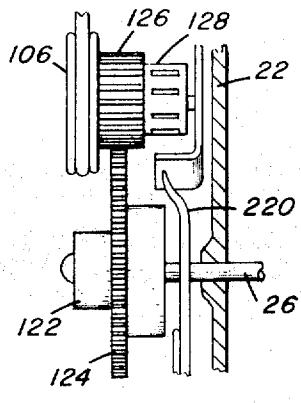

Fig. 6

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 3

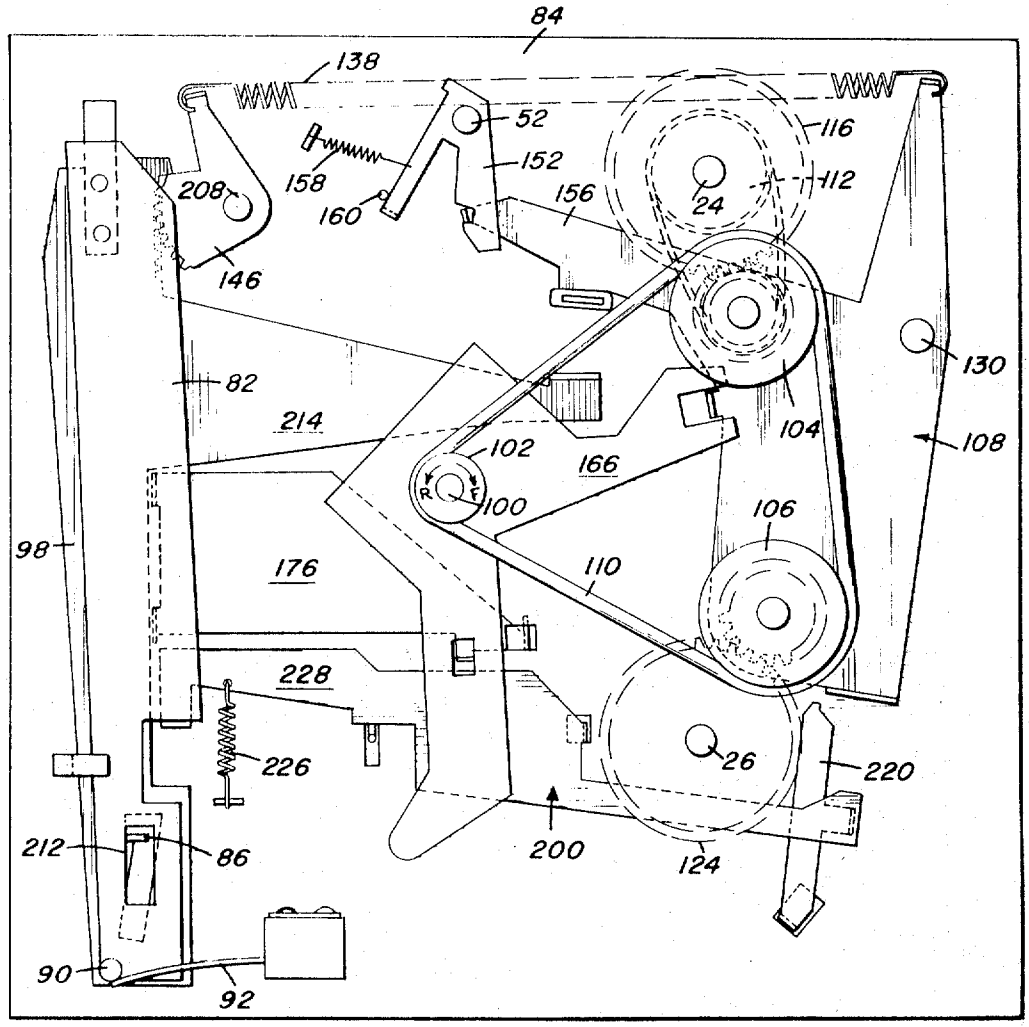

Fig. 7

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 4

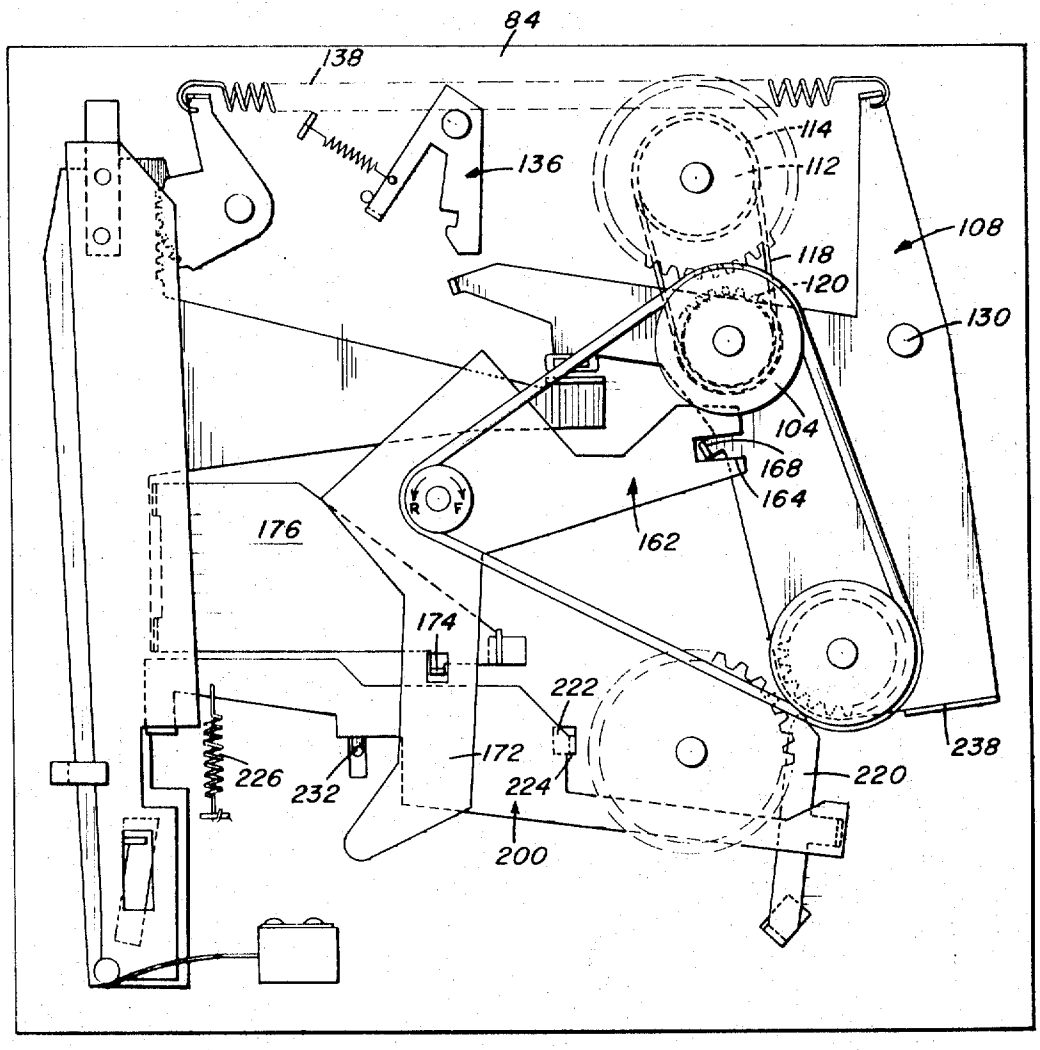

Fig. 8

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 5

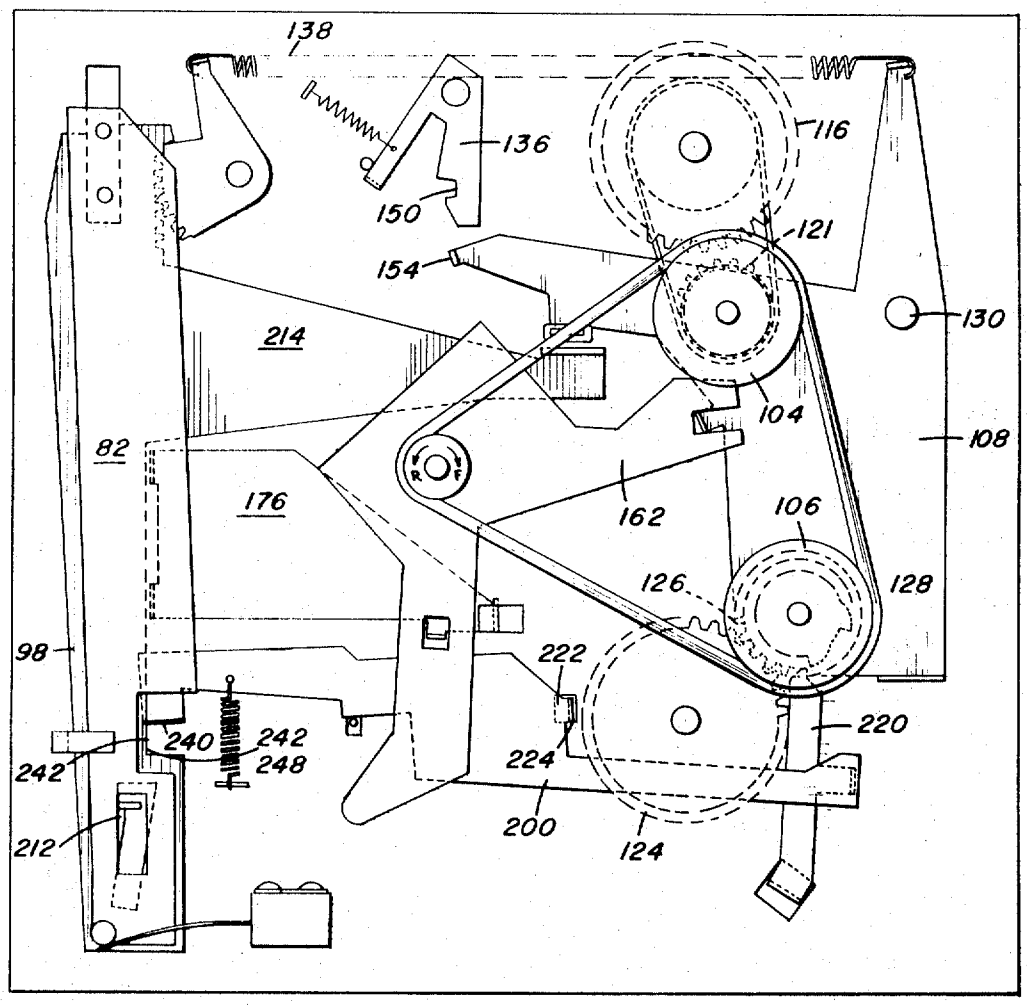

Fig. 9

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

Original Filed Aug. 20, 1962 6 Sheets-Sheet 6

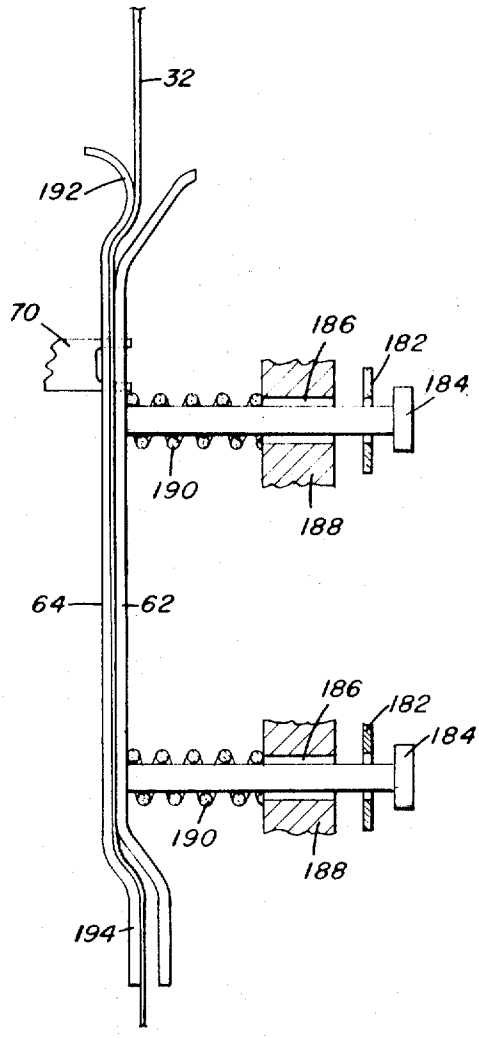

Fig. 10

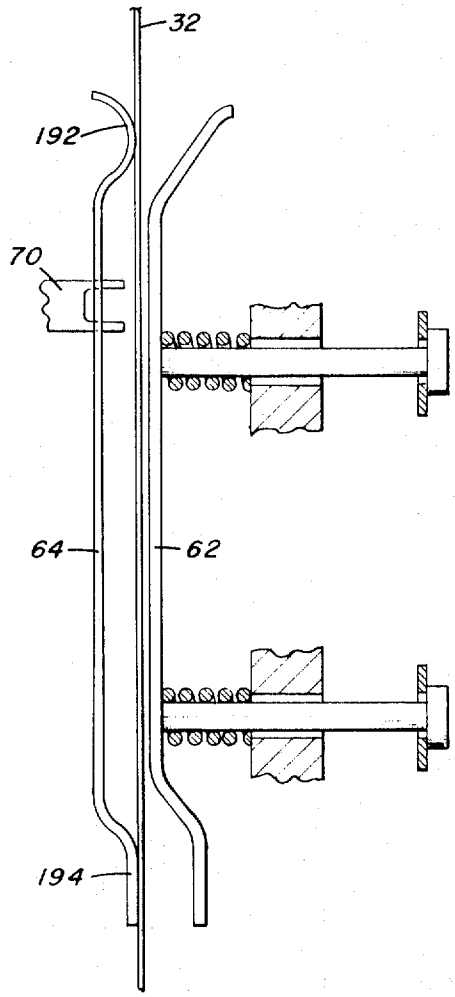

Fig. 11

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MOTION PICTURE APPARATUS WITH AUTOMATIC REWIND

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Int. Cl. G03b *23/00*

U.S. Cl. 352—124 9 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

An automatic rewind device is provided in a motion picture apparatus which includes a film-tension sensing device. The film is fed along a path from a supply reel, to which the end of the film is attached, to a take-up reel. Upon reaching the end of the film an increase in film tension causes the sensing device, through a mechanical linkage, to uncouple the take-up reel from a drive shaft and couple the supply reel thereto to effect rewind. Near the completion of the rewind operation a sensor adjacent the film path senses the passage of a leader end of the film to uncouple the drive shaft from the supply reel and couple it to the take-up reel.

The present invention relates to cinematographic apparatus and more particularly to a film feeding and automatic rewind mechanism for a motion-picture projector.

In motion-picture apparatus particularly motion-picture projectors, it is customary to provide mechanism to move the film at normal forward and reverse projection speeds as well as to hold it in a stationary position in the film gate for the projection of "stills." In addition, it is also desirable to rewind the film at high speed onto the supply reel once the entire film, or a selected portion thereof, has been projected.

It is an object of the present invention to provide cinematographic apparatus with an automatic rewinding mechanism for returning to the supply reel, at high speed, film wound on the take-up reel.

Another object of this invention is to provide cinematographic apparatus with automatic mechanism that permits film wound upon the take-up reel to be returned to the supply reel without substantially alterning the threaded path of the film from the supply reel to the take-up reel.

Still another object of the present invention is to provide a motion-picture projector with mechanism which is automatically actuated when all of the filmstrip has been projected to rewind the filmstrip onto the supply reel.

A further object of this invention is to provide cinematographic apparatus with an automatic high-speed rewind mechanism, which mechanism is driven from the same unidirectional power source that, during projection, actuates the forward drive mechanism.

Still another object of the present invention is to provide cinematographic apparatus with an automatic rewind mechanism which, upon completion of the rewind cycle, disengages the rewind mechanism and resets the operative mechanisms for another projection cycle.

Other objects and a fuller understanding of the invention can be had by referring to the following description and claims taken in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmentary, partially schematic side-elevation view of a projector incorporating our invention;

FIG. 2 is an enlarged sectional view of the filmstrip tension sensing device shown in FIG. 1;

FIG. 3 is an elevation view of the control mechanism mounted on the rear side of the sidewall of the projector shown in FIG. 1 showing the control mechanism in the OFF position;

FIG. 4 is a partial end view of the control mechanism shown in FIG. 3 taken along the line **4—4**;

FIG. 5 is a fragmentary sectional view taken on the line **5—5** of FIG. 3;

FIG. 6 is a similar view taken on the line **6—6** of FIG. 3;

FIG. 7 is a view similar to FIG. 3 but showing the control mechanism in the position it assumes in the FORWARD or REVERSE projection position;

FIG. 8 is a view similar to FIG. 7 but showing the control mechanism and operating elements in the REWIND position;

FIG. 9 is a view similar to that shown in FIG. 8 showing the control mechanism as it would appear when the filmstrip has been rewound on the supply reel but prior to the control mechanism and operating elements being returned to their OFF positions;

FIG. 10 is an enlarged side-elevation view partly in cross-section illustrating the film gate in the closed position for projection; and,

FIG. 11 is a view similar to FIG. 10 illustrating the film gate in the open position which it assumes for the REWIND operation.

In order to facilitate the understanding of the operation and construction of the apparatus, a brief summary of the device will be helpful. A perforated filmstrip, secured at its trailer end to a supply reel core, is guided and threaded in a path from the supply reel, through a gate and pulldown mechanism to a take-up reel. A filmstrip tension-sensing device, over which the filmstrip passes, is positioned adjacent the film path between the supply reel and gate. A second sensor device is positioned adjacent to the path of the filmstrip intermediate the gate and the take-up reel to sense the presence of a filmstrip in the path.

The projector is energized by suitable controls actuated by the operator to drive the filmstrip from the supply reel to the take-up reel. When the end of the filmstrip is reached, the pulldown mechanism continues to feed film past the gate; and, because the trailer end of the filmstrip is secured to the supply reel core, the filmstrip between the supply reel core and the gate is drawn taut thus tripping the tension-sensing device which unlatches a spring-loaded rewind control mechanism to automatically place the projector in the REWIND mode.

In the REWIND mode, in which the power drive is not reversed, the filmstrip is rapidly returned through the same path, including the gate, onto the supply reel. As the leader end of the filmstrip passes the second mentioned film-sensor device, the sensor actuates mechanism for returning the rewind control mechanism to its latched position and also for returning the projector control handle to the OFF position so that the projector is ready to repeat the same sequence of operation.

Referring more particularly to FIGS. 1 and 2 of the drawings, there is shown a motion picture projector housing **20** having a sidewall **22** from which a pair of spaced rotatable spindles **24** and **26** project, to carry thereon supply reel **28** and take-up reel **30** respectively. Each of spindles **24** and **26** has a one-way drive clutch mechanism for allowing free rotation of its respective spindle when the spindle is rotating in the direction for unwinding the filmstrip and coupling the spindle to a power drive when the spindle is rotating in the direction for winding

he filmstrip. A perforated filmstrip **32** which is fastened o the core of supply reel **28**, passes through a channeled ension sensing device **34** to a projection gate **36** and hence over a spring snubber **38** to take-up reel **30** on he spindle **26**.

Tension sensing device **34** shown in FIG. 2 includes a ide opening guideway **42** which directs filmstrip **32** over a predetermined spring tension snubber **44**. A single prong **46** is formed on the lower surface of the entrance of an enlarged portion **48** of guideway **42** and is adapted o project upwardly to engage a perforation of filmstrip **32** if the path of the filmstrip sags below its normal path. A pivotal bell crank lever **50** is carried by a journaled shaft **52** extending through sidewall **22**. A helical compression spring **54** extends between shoulders **56** and **58** of snubber **44** and bell crank **50**, respectively, to urge snubber **44** towards the path of filmstrip **32**. When filmstrip **32** is drawn taut between supply reel **28** and gate **36**, t will depress snubber **44** to overcome the bais of spring **54**, after which snubber **44** engages and moves bell crank **50** in a clockwise direction (as viewed in FIG. 1) about he axis of its shaft **52**, rotating the latter. Similarly, handle **60** of bell crank **50** can be moved manually to simulate the actuation of snubber **44**.

Gate **36** includes a pressure pad **62**, aperture plate **64**, and optical system **68**, and has associated therewith a conventional pulldown mechanism **70** fragmentarily shown. A film sensor **72**, for sensing the presence of the filmstrip **32** is located along that portion of the path of filmstrip **32** intermediate gate **36** and take-up reel **30**. Certain of the mechanism described hereinabove is particularly applicable to a sprocketless projector and constitutes no part of the present invention except insofar as t acts in combination with the take-up and rewind mechanism now to be described.

A start handle **74**, adapted for vertical movement in slot **76**, controls the energization of the projector. As best illustrated in FIGS. 3 and 4, a pair of vertically spaced protuberances **78** and **78'** are integrally formed with slide portion **80** of start handle **74**, and are adapted to project through slot **76** in sidewall **22**. Protuberances **78** and **78'** are fastened to an elongated control bar **82**, which is mounted for vertical, longitudinal movement adjacent one edge of the rear face **84** of sidewall **22**.

An ear **86** pressed inwardly from face **84** of sidewall **22** engages a slot **88** in control bar **82** to guide the vertical displacement of the control bar. An insulated pin **90** s mounted on the lowermost portion of control bar **82** in position to engage and actuate a motor control switch **92** when control bar **82** is moved downwardly, to thereby cause operation of the projector drive motor (not shown).

In order to provide a friction detent to hold control bar **82** in either position, control bar **82** is made of spring material and its lower end is arranged to slidably engage a guide bracket **94** which prevents it from swinging inwardly away from face **84**. A small steel ball **96** is interposed between the middle portion of control bar **82** and a reset slide **98**, which is positioned between control bar **82** and face **84** of sidewall **22** and which will be described n detail hereinafter. Thus ball **96** causes control bar **82** to be bowed slightly so as to be urged against bracket **94** and thus be frictionally retained in position.

As is best shown in FIG. 3, a journaled drive shaft **100** which is centrally disposed relative to face **84** has a driven pulley **102** secured thereto for rotation. A reversible drive, not shown, and the details of which have no bearing on the present invention but which has the characteristic of a uniform speed in the forward (F) or reverse (R) direction, applies rotational power from the projector motor to drive shaft **100** and drive pulley **102**. The pulldown mechanism, shown in FIG. 1, and a shutter (not shown) are driven from shaft **100** in a manner well known in the prior art and which likewise has no bearing on the present invention. Idler pulleys **104** and **106** carried by a shiftable gear carrier plate **108** are drivingly coupled to driven pulley **102** by a flexible extensible belt **110**.

As best illustrated in FIGS. 3 and 5, a conventional one-way circular drive clutch mechanism **112** which has a hub **114** is secured to that portion of supply spindle **24** projecting inwardly of face **84** of sidewall **22**. It should be particularly noted that drive clutch **112** whose mechanism is now shown, allows spindles **24** to freely rotate when a film strip is being unwound from the supply reel (counterclockwise direction as viewed in FIG. 3), but drivingly rotates spindle **24** when a filmstrip is being wound onto the supply reel (clockwise direction as viewed in FIG. 3). A driven gear **116** is concentrically secured to drive clutch **112** for rotation therewith while idler pulley **104** includes a coaxially mounted pinion gear **121** and a hub **120**. As is later explained in detail, driven gear **116** is adapted to be coupled to pinion gear **121** for rotation therewith to positively drive supply spindle **24** in a clockwise direction (FIG. 3) during REVERSE projection, while a belt **113** which normally rides loosely on hub **114** of drive clutch **112** and on hub **120** of pulley **104** is adapted to be selectively tensioned to drive the supply spindle in the same direction, but at higher speed, during REWIND.

Similarly, as shown in FIGS. 3 and 6, a one-way circular drive clutch mechanism **122** is secured to that portion of take-up spindle **26** projecting inwardly of face **84** of sidewall **22**. Here again it should be noted that drive clutch **122**, whose operative mechanism is not shown, allows spindle **26** to freely rotate when a filmstrip is being unwound from the take-up reel (clockwise direction as viewed in FIG. 3), but drivingly rotates spindle **26** when a filmstrip is being wound onto the take-up reel (counterclockwise direction as viewed in FIG. 3). A driven gear **124** is concentrically secured to drive clutch **122** for rotation therewith while idler pulley **106** includes a coaxially mounted pinion gear **126** and a ratchet wheel **128**. As is later explained in detail, driven gear **124** is adapted to be coupled to pinion gear **126** for rotation therewith to positively drive take-up spindle **26** during FORWARD projection while the ratchet **128** serves to power the reset operation when REWIND is complete.

Selective control of the drive system for spindles **24** and **26** is obtained by shifting gear carrier plate **108** which, as shown in FIG. 3, is pivotally mounted on pivot pin **130** projecting inwardly from face **84** of sidewall **22**. The idler pulleys **104** and **106** are rotatably mounted on substantially opposite ends of web portion **132** of gear carrier plate **108**. Hence when gear carrier plate **108** is rotated in a counterclockwise direction about pin **130**, pinion gear **121** of idler pulley **104** will be swung away and uncoupled from driven gear **116** while pinion gear **126** of idler **106** will likewise be uncoupled from driven gear **124**. Such counterclockwise movement of gear carrier plate **108** will also cause non-extensible belt **118** to be drawn taut between hub **114** of drive clutch **112** and pulley wheel **120** of idler pulley **104**, rendering the belt drive effective and limiting the movement of plate **108**. It should also be particularly noted that the ratio of the diameter of pulley wheel **120** to that of hub **114** is greater than the ratio of the diameter of pinion gear **121** to that of driven gear **116**, and hence the rotational speed of the spindle **24** when driven by belt **118** will be greater than when it is driven by gears **121** and **116**.

A latch lever **136**, controlled by the tension sensing device **34** for rotation therewith. A cam surface **148** and clockwise-shifted position shown in FIGS. 3 and 7 against the action of a tension spring **138** extending between a lug **140** on arm **142** of gear carrier plate **108** and a lug **144** on a gear sector **146** to be later described.

Latch lever **136** is secured to the inner end of the previously described journaled shaft **52** of the tension sensing device **34** for rotation therewith. A cam surface **148** and a detent **150** are located adjacent the free end of arm **152** of lever **136**, and areadapted to engage and retain

a lug **154** carried by an arm **156** of gear carrier plate **108**. A spring **158** normally urges lever **136** in a clockwise direction about shaft **52** and into engagement with a pin **160** projecting inwardly from face **84**.

Since, as will later be explained, the drive shaft **100** is neither stopped nor reversed when plate **108** is unlatched to start a REWIND operation, the film pulldown claws will continue to operate as during forward projection. It is therefore necessary to provide means for disengaging the film therefrom, to prevent damage to the film during such rewind. This result is automatically obtained by the following mechanism.

A bell crank **162** is mounted for pivotal movement about the axis of drive shaft **100**. An open ended slot **164** is located in the outermost end of arm **166** of bell crank **162** and is adapted to co-operate with a lug **168** on gear carrier plate **108**. An elongated slot **170** is provided in the other arm **172** intermediate the length thereof. This slot **170** coacts with a lug **174** projecting from a gate actuating bracket **176** mounted for lateral sliding movement on plate **22** so that rotational movement of bell crank **162** will be translated into lateral movement of gate bracket **176**.

Gate bracket **176** is mounted by an ear **178** is a slot **180** formed in plate **22** and by two spaced and slotted fingers **182** formed on the forward end of the gate bracket and which project through suitable slots in sidewall **22** and into engagement with headed pins **184** forming part of the pressure pad **62** of the gate assembly (see FIGS. 10 and 11).

As shown in FIGS. 10 and 11, the two spaced pins **184** are secured to one side of pressure pad **62** and are adapted to extend through suitable apertures **186** formed in a stationary plate **188** secured to sidewall **22** of housing **20**. Concentric helical springs **190** positioned intermediate pressure pad **62** and plate **188** urge pressure pad **62** into engagement with aperture plate **64**. When fingers **182** are displaced laterally by forward movement of the gate actuating bracket **176**, they will move the pressure pad **62** away from the aperture plate **64** and into the position shown in FIG. 11.

It will be noted that aperture plate **64** is provided at its ends with a pair of film guiding surfaces **192** and **194** which project forwardly from the plane of the main body of the plate. When the gate pressure pad **62** is open as in FIG. 11, these two guiding surfaces **192** and **194** tend to maintain the filmstrip **32** in the gate spaced slightly forwardly of the tips of the pulldown claw **70** so that the latter will be disengaged therefrom as shown in FIG. 11. This is the position assumed by the pressure pad **62** during REWIND.

On the other hand, when the apparatus is set for normal projection operation, the pad **62** will assume its closed position shown in FIG. 10, wherein it forces the film **32** rearwardly into engagement with aperture plate **64** between the surfaces **192** and **194** so that the filmstrip can be engaged by the pulldown claw **70**.

Automatic stopping of the apparatus and reset of the control mechanism for a new cycle of operation when film rewind has been completed is controlled by film sensor **72** acting in conjunction with a shutoff lever **200** and the previously mentioned reset slide **98**. As best shown in FIGS. 3 and 4, reset slide **98** is provided at its upper end with an open-ended slot **202**, the lower edge **204** of which is adapted to be engaged by lower protuberance **78** upon downward movement of the start handle **74** to start the projector. Protuberances **78** and **78'** are slightly smaller in diameter than the width of slot **202** to allow slide **98** to pivot slightly thereon for latching purposes as described hereinbelow. A rack **206** is formed on one edge of the upper portion of reset slide **98** and is adapted to co-operate with the previously mentioned gear sector **146**, which is journaled for pivotal movement on a bearing pin **208** secured to sidewall **22**. A slot **210**, which has a width sufficient to accept ear **86**, is located adjacent the lowermost end of reset slide **98** and is slanted relative to slot **88** in control bar **82**. The upper portion of slot **210** is enlarged to form a latching detent **212** in the edge of slot **210**. The arrangement is such that when control bar **82** is moved downwardly to initiate operation of the projection, reset slide **98** will likewise be forced downwardly against the tension of spring **138** and will be positively latched in its lower position by the action of latching detent **212** and ear **86**. Gear sector **146** exerts an upward force on reset slide **98**, which force tends to urge slide **98** in a counterclockwise direction about the engagement of slot **202** which protuberance **78** whereby detent **212** is urged into engagement with ear **86**.

Rest slide **98** has an arm **214** extending laterally therefrom which arm carries, adjacent its outer end, a lug **216** extending inwardly of face **84**. Lug **216** is arranged to co-operate with a mating rubber-covered lug **218** carried by an arm **156** of gear carrier plate **108**, so that upward movement of reset slide **98** at the end of the rewind operation will rotate plate **108** clockwise into its normal latched position ready for a new cycle of operation.

Again referring to FIG. 3, shutoff lever **200** having a cross arm **220** secured thereto adjacent one end is mounted on sidewall **22** for limited longitudinal sliding movement as well as limited rotational movement. The mounting therefor comprises an ear **222** on lever **200** which projects loosely through a slot **224** in sidewall **22**, with the lower edge of the slot forming a fulcrum about which the lever can pivot. A light spring member **226** secured adjacent end **228** of shutoff lever **200** tends to urge lever **200** in a counterclockwise direction about this fulcrum. Upon such pivotal movement of lever **200**, the upper end of cross bar **220** will move into engagement with ratchet wheel **128** on idler pulley **106** so that continued rotation thereof will force the lever **200** bodily to the left to unlatch the reset slide **98**.

Film sensor **72**, shown best in FIGS. 1, 3 and 4, is pivotally mounted on sidewall **22** and has a pair of arms **230** and **232**, respectively, which arms are biased clockwise by a light tension spring **234** acting on film sensor **72**. The normal position of arms **230** and **232** of sensor **72** is shown in full lines in FIGS. 3 and 4. So long as a filmstrip **32** extends from gate **36** to take-up reel **30**, an edge thereof will engage arm **230** and hold sensor **72** in this normal position. In this condition, arm **232** will extend through slot **236** in wall **22** and prevent shutoff lever **200** from rocking counterclockwise about its fulcrum **222** to an extent sufficient to permit engagement of the tips of cross bar **220** with the ratchet **128** on idler **106**. Thus lever **200** is maintained ineffective to unlatch reset slide **98** so long as film extends from the gate to the take-up reel.

An additional interlock to permit actuation of lever **200** only in the event that gear carrier plate **108** has been unlatched to initiate a rewind operation, is also provided by means of a lip **238** on the lower end of gear carrier plate **108**. As shown in FIG. 3, this lip is arranged to engage the upper end of the cross bar **220** to prevent it from swinging upwardly so long as the carrier plate **108** is in its latched position. However, when plate **108** has been released, lip **238** will swing out of the way of cross bar **220**, as shown in FIG. 8, to place lever **200** under the control of film sensor **72**.

In operation, a supply reel **28**, which contains a rolled filmstrip **32** to be projected, is mounted on the supply spindle **24** and the leader end of filmstrip **32** is inserted in guideway **42** of tension-sensing device **34** and thence is threaded into the entrance of gate **36**. The operator then moves start handle **74** downwardly to initiate operation of the projector in the FORWARD direction.

As best shown in FIGS. 1, 7, 8 and 9, when start handle **74** is depressed, control bar **82** is displaced downwardly and carries with it reset slide **98**. Gear sector **146** is thus rotated about bearing pin **208** to increase the

tension in spring **138**. The reset slide **98** is latched in the down position by ear **86** engaging detent **212** which thus prevents the biased gear sector **146** from moving the reset slide **98** upwardly to its original position. Pin **90** engages the motor control switch **92** which closes contacts for an electrical circiut, not shown, which supplies power to the electric motor and projector lamp of the projector. It should be noted, however, that the operator can at any time turn the projector off, as the start handle **74** can be returned to its OFF position independently of reset slide **98** to disengage pin **90** from the switch **92**.

During the projection sequence, rotational power in both the FORWARD (F) and REVERSE (R) direction can be applied to drive shaft **100** and pulley **102** and flexible belt **110** will transmit the rotational power to idler pulleys **104** and **106**. As previously described idler pulleys **104** and **106** will thereupon rotate driven gears **116** and **124**, respectively. However, in the FORWARD (F) direction, drive clutch **112** on supply spindle **24** does not transmit rotational movement to the supply spindle **24** and the film is actually unwound from the supply reel merely by the action of the pulldown mechanism pulling the filmstrip **32** from the supply reel. Drive clutch **122**, however, transmits rotational movement to take-up spindle **26** and hence the filmstrip **32** is positively wound upon the take-up reel. Preferably an automatic threading device (not shown) is employed to thread filmstrip **32** onto take-up reel **30**. It is apparent that if the powered drive to drive pulley **102** is reversed by the selective operation of the reversing mechanism (not shown) by the operator, the filmstrip will be wound upon the supply reel **28** and unwound from the take-up reel **30**. As the shutter and pulldown mechanisms (not shown) are operative off the drive shaft **100**, normal, forward and reverse projection actions are thus obtained.

With reference to FIGS. 1 and 8, once the end of filmstrip **32** is reached on supply reel **28**, the film intermediate the supply reel **28** and gate **36** will be drawn taut which will depress spring tensioned snubber **44** to in turn rotate bell crank **50** in a clockwise direction, as viewed in FIGS. 1 and 2. Thus, as shown in FIG. 8 latch lever **136** will be rotated counterclockwise to release the gear carrier plate **108** for counterclockwise rotation about pin **130**. Ear **238** on gear carrier plate **108** thereupon swings to the right so that it no longer blocks upward movement of cross bar **220** on shutoff lever **200**. However, arm **232** of the film sensor **72** will still be in position to block such movement of lever **200**.

The rotation of gear carrier plate **108** is limited by non-extensible belt **118** being drawn taut between hub **114** of drive clutch **112** and pulley wheel **120** of idler pulley **104**. Thus the continued forward drive of drive shaft **100** now results in reverse rotation of supply spindle **24** to rewind filmstrip **32** onto supply reel **28**.

In rotating gear carrier plate **108** in a counterclockwise direction about pin **130**, lug **168** in slot **164** of bell crank **162** will be displaced downwardly. Hence, bell crank **162** will be rotated in a clockwise direction about its axis, engaging lug **174** of gate bracket **176** to thereby displace gate bracket **176**, laterally so that, as shown in FIG. 11, the fingers **182** of gate bracket **176** will displace the pressure pad **62** away from the aperture plate **64**.

Filmstrip **32** will thus be guided by the outer surfaces of protuberances **192** and **194** so as to be displaced laterally out of engagement with pulldown mechanism **70**, which mechanism is still being actuated in the forward direction. It should be noted, that if the operator for any reason reverses the direction of rotation of the drive shaft **100** before rewind has been completed, the gate **36** will not close on the moving filmstrip **32** because, once unlatched, gear carrier plate **108** can be returned to its latched position only upon release of the reset slide **98** by shutoff lever **200** and sensor **72** will still

retain lever **200** in its blockwise position. Further, drive clutch **112** will uncouple the supply spindle **24** from the drive; and, as pinion gear **126** of idler pulley will not be coupled to gear **124**, no driving movement will be imparted to filmstrip **32** and it will merely come to rest with the gate still in the open position.

Referring again to FIG. 8, once the end of filmstrip **32** passes through that portion of the path which contains film sensor **72**, shutoff lever **200**, under the action of spring **226**, will be free to urge arm **232** of film sensor **72** downwardly against the lighter bias of spring **234** so that sensor arm **230** and **232** will take the position shown at **230'** and **232'** in FIG. 4. Shutoff lever **200** will therefore be released and will continue to swing counterclockwise to move the upper end of its cross arm **220** into engagement with ratchet wheel **128** on idler pulley **106**. As idler pulley **106** is rotating in a clockwise direction, cross arm **220** will engage one of the teeth and be displaced laterally, ear **222** of shutoff lever **200** sliding in slot **224** to permit such movement. Ear **240** of shutoff lever **200** will engage edge **242** of reset slide **98** and move it laterally so that detent **212** of reset slide **98** will no longer engage ear **86**, thereby releasing the slide. The tension of spring **138** which is urging gear sector **146** in a clockwise direction will thereupon vertically displace reset slide **98** upwardly so that lug **216** located thereon will move upwardly to engage rubber-covered lug **218** of gear carrier plate **108**, rotating the carrier plate in a clockwise direction about pin **130** until lug **154** will again be latched to detent **150** of latch lever **136**.

Simultaneously, shoulder **248** on vertically moving reset slide **98** will carry ear **240** of lever **200** upwardly to rotate lever **200** in a clockwise direction about ear **222** and back to its FIG. 3 position. Cross arm **220** will therefore be swung downwardly and out of engagement with ratchet wheel **128** while rotation of gear carrier plate **108** will again couple pinion gear **121** of idler pulley **104** to gear **116**, and pinion gear **126** of idler pulley **106** to gear **124**. Bell crank **162** will simultaneously be rotated clockwise about its axis to laterally displace gate bracket **176** to thus reposition pressure pad **62** relative to aperture plate **64** as shown in FIG. 10.

Thus, all of the mechanisms described hereinabove will be returned to their original positions as shown in FIG. 3, and the apparatus will be reset in its OFF position, ready for a new cycle of operation.

It will be seen that the invention embodied in the above described apparatus provides means for automatically rewinding an elongated web onto a supply reel when the end of the web is reached and before it pulls off said reel. The operation of this apparatus depends upon the innermost end of the web being fastened to the hub of the supply reel so that when the last convolution of the web is unwound from the supply reel, the reach of the web intermediate the supply and the web driving means will be put under tension and a tension sensing device placed intermediate the supply and the driving means will be moved to actuate the rewind mechanism to return the web to the supply reel. While the preferred embodiment of the present invention has been described as a means for feeding and rewinding a filmstrip in a cinematographic apparatus, it is to be understood that the invention could be used in any type web handling apparatus whose automatic rewind is desired, e.g. sound tape recorders and reproducers, etc.

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 as described hereinabove and as defined in the appended claims.

We claim:

1. In motion picture apparatus including a supply spindle *having a pulley wheel coaxially mounted for rotation therewith* and a take-up spindle adapted respec-

tively to carry film supply and take-up reels, a projection gate, means for guiding film from said supply reel along a predetermined path past said gate and to said take-up reel, a drive shaft, and transmission means normally [operatively] coupling said take-up spindle to said drive shaft to cause rotation of said take-up spindle in a film-winding direction upon rotation of said drive shaft in a predetermined direction, the improvement wherein:

(a) said transmission *means* includes a shiftable member *carrying a rotatably mounted idler pulley wheel coupled to said drive shaft* movable *with said shiftable member* from a first position [providing] *wherein* said [normal coupling] *take-up spindle is coupled to said drive shaft* to a second position wherein said take-up spindle is uncouple from said drive shaft and said supply spindle is [operatively] coupled to said drive shaft to cause rotation of said supply spindle in a *high-speed* film-winding direction upon continued rotation of said drive shaft in said predetermined direction; [and]

(b) said apparatus further [comprises] *comprising* means including a film-tension-sening means located adjacent said film path; *and mechanical linkage means interconnecting said film-tension-sensing means and said shiftable member* for causing movement of said shiftable member from said first *position* to said second position in response to a predetermined tension in film lying in said path *to effect high-speed rewind; and*

(c) a pulley belt embracing said idler pulley wheel and said supply spindle pulley wheel and being of such length that in said second position of said shiftable member said pulley belt frictionally and drivingly couples said idler pulley wheel and said spindle pulley wheel and in said first position of said shiftable member said pulley belt uncouples said idler pulley wheel and said spindle pulley wheel, respectively.

[2. Motion picture apparatus as in claim 1 wherein said supply spindle includes a coaxially mounted pulley wheel adapted for rotation therewith and said shiftable member carries a rotatably mounted idler pulley wheel coupled to said drive shaft and adapted for movement with said shiftable member from said first position to said second position, and further comprising:

(a) a pulley belt embracing said idler pulley wheel and said supply spindle pulley wheel and of such length that in said second position of said shiftable member said pulley belt frictionally drivingly couples said idler pulley wheel and said spindle pulley wheel and in said first position of said gear carrier plate said pulley belt uncoupled said idler pulley wheel and said spindle pulley wheel, respectively.]

[3. Motion picture apparatus as in claim 1 in which said means for sensing a predetermined tension includes:

(a) a snubber biased by a predetermined force into contact with that reach of film of said film path extending from said supply reel to said gate, said snubber being movable responsive to a given force applied thereagainst by a foreshortening of said reach of film due to its being placed under a predetermined tension to cause said shiftable member to move from said first position to said second position.]

[4. Motion picture apparatus as in claim 3 further comprising:

(a) a channeled passageway for guiding said film-strip in that portion of the path from said supply reel to said snubber; and

(b) means for halting movement of said film along said portion of said path to cause actuation of said snubber means.]

[5. In motion picture apparatus including a supply spindle and a take-up spindle adapted respectively to carry film supply and take-up reels, a projection gate, a pulldown mechanism, means for guiding film from said supply reel along a predetermined path past said gate and to said take-up reel, a drive shaft, and transmission means normally operatively coupling said take-up spindle to said drive shaft to cause rotation of said take-up spindle in a film winding direction upon rotation of said drive shaft in a predetermined direction, the improvement comprising:

(a) means for sensing a predetermined tension in that portion of said film-strip extending from said supply reel to said pulldown mechanism;

(b) means associated with said transmission means and shiftable from a first position to a second position for simultaneously uncoupling said take-up spindle from said drive shaft and drivingly coupling said supply spindle to said drive shaft;

(c) means operatively controlled by said sensing means for moving said shiftable means from said first position to said second position in response to said predetermined tension to cause said filmstrip to be rewound on said supply reel; and

(d) means responsive to movement of said shiftable means to said second position for rendering said pulldown mechanism ineffective to engage said film during said rewind operation.]

[6. In motion picture apparatus as in claim 5 in which said gate includes a pressure pad and an aperture plate positioned adjacent each other to define a portion of said path for said film, and said pulldown mechanism projects into said portion of said path to operatively engage film located therein, the further improvement wherein said means for rendering said pulldown ineffective comprises:

(a) means operatively responsive to said shiftable means for separating said pressure pad and said aperture plate when said shiftable means moves from said first position to said second position.]

[7. Motion picture apparatus as in claim 6 in which said aperture plate includes means for holding said film out of the path of movement of said pulldown mechanism when said pressure pad is separated from said aperture plate.].

8. In motion picture apparatus including a supply spindle and a take-up spindle adapted respectively to carry film supply and take-up reels, a projection gate, means for guiding film from said supply reel along a predetermined path past said gate and to said take-up reel, a drive shaft, and transmission means normally operatively coupling said take-up spindle to said drive shaft to cause rotation of said take-up spindle in a film winding direction upon rotation of said drive shaft in a predetermined direction, the improvement wherein:

(a) said transmission includes a shiftable member movable from a first position providing said normal coupling to a second position wherein said take-up spindle is uncoupled from said drive shaft and said supply spindle is operatively coupled to said drive shaft to cause rotation of said supply spindle in a film-winding direction upon continued rotation of said drive shaft in said predetermined direction;

(b) said apparatus further comprising means including a film-tension sensing means located adjacent said film path for causing movement of said shiftable member from said first to said second position in response to a predetermined tension in film lying in said path; and

(c) [means including] a sensor located adjacent the film path; *and* [for causing movement of said shiftable member from said second position to said first position in response to passage of the leader end of the film past said sensor during rotation of said supply spindle in a film-winding direction.]

(d) means movable to a latched position for exerting a force on said shiftable member to urge said shiftable member from said first position to said second position, and movable to an unlatched position in re-

sponse to passage of the leader end of the film past said sensor for returning said shiftable member from said second position to said first position.

[9. Motion picture apparatus as in claim **8** in which said means for causing movement of said shiftable member between said positions includes:

(a) means movable to a latched position for exerting a force on said shiftable member to urge said shiftable member from said first position to said second position, and movable to an unlatched position in response to passage of the leader end of the film past said sensor for returning said shiftable member from said second position to said first position.]

10. Motion picture apparatus as in claim [9] *8* wherein a spring member operatively connects said movable means to said shiftable member [for exerting] for exerting a force on both said shiftable member and said movable means when said movable means is moved to said latched position.

11. Motion picture as in claim **10** wherein said movable means includes a lug member adapted to engage and return said shiftable member from said second position to said first position when said movable means is moved from its latched position to its unlatched position by the force of said spring means.

12. Motion picture apparatus as in claim **10** in which said spring member exerts a pivotal force on said movable means for engaging said movable means to a detent in said latched position.

13. Motion picture apparatus as in claim [9] *8* in which said sensor means includes a shutoff lever for unlatching said movable means from said latched position.

14. Motion picture apparatus as in claim **13** wherein said shiftable member carries a rotating member coupled to said drive shaft, and said shutoff lever comprises means for engaging said rotating member for displacing said shutoff lever to unlatch said movable means from said latched position when said shiftable member is in said second position and the leader end of the film moves past said sensor during rotation of said supply spindle in a film winding direction.

15. In a mechanism for automatic high-speed rewinding of a web after it has been transported in one direction by intermittent film pull-down means through a motion picture projector or the like having a supply reel and a take-up reel, the combination comprising:

(a) a projection gate;

(b) drive means including a drive shaft for driving said film pull-down means for transporting said web through said projection gate in one direction and for selectively driving one of said supply and take-up reels;

(c) transmission means including shifting means between a normal forward position, in which it couples said drive shaft to said take-up reel to wind up said web thereon as said web is transported through said projection gate in said one direction, and a reverse position in which said take-up reel is uncoupled from said drive shaft and is coupled to said supply reel for high-speed rewinding of said film thereon, and

(d) control means for moving said shifting means between its forward and reverse positions, said control means including a film-tension-sensing means, a spring, and a latch for releasably holding said shifting means in its normal forward position against the bias of said spring, and in response to said film tension after it has completed its travel in said one direction for releasing said shifting means for movement by said control means to its reverse position for automatic high-speed rewinding said film onto said supply reel.

16. In a mechanism for automatic high-speed rewinding of a filmstrip after it has been transported in one direction through an image projection device by a film advancing means, said projection device having a supply reel and a take-up reel and having a film path therebetween, the combination comprising:

(a) a projection gate;

(b) drive means including a drive shaft for driving said film advancing means for transporting said film through said projection gate in one direction and for selectively driving one of said supply and take-up reels;

(c) transmission means including shifting means movable between a normal forward position, in which it couples said drive shaft to said take-up reel to wind up said film thereon as said film is transported through said projection gate in said one direction, and a reverse position, in which said take-up reel is uncoupled from said drive shaft and is coupled to said supply reel for high-speed rewinding of said film thereon;

(d) means urging said shifting means toward said reverse position;

(e) film tension sensing means along said film path between said supply reel and said projection gate; and

(f) latch means coupled to said film-tension-sensing means, said latch means being releasably engageable with said shifting means for holding said shifting means in its normal forward position against the force of said urging means, said latch releasing said shifting means in response to a predetermined tension of said film being sensed by said sensing means so that said shifting means is movable by said urging means to said reverse position.

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