June 20, 1944. J. L. CLOUGH 2,352,077

COIN CONTROLLED MOTION PICTURE APPARATUS

Filed Sept. 15, 1941 6 Sheets-Sheet 1

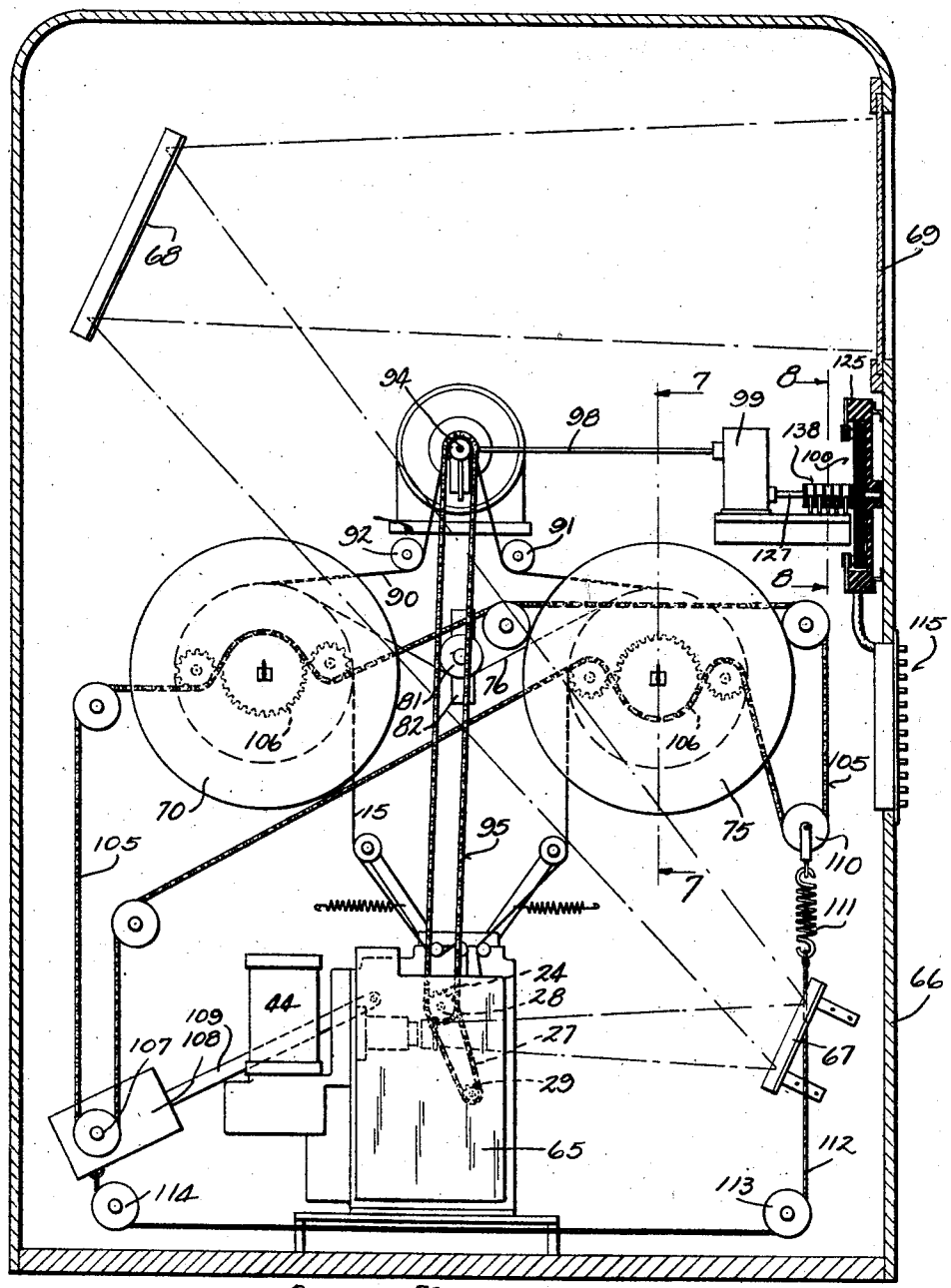


Fig. 1

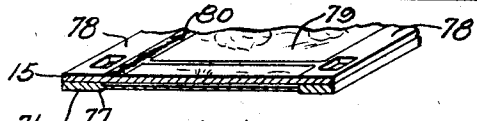


Fig. 1a.

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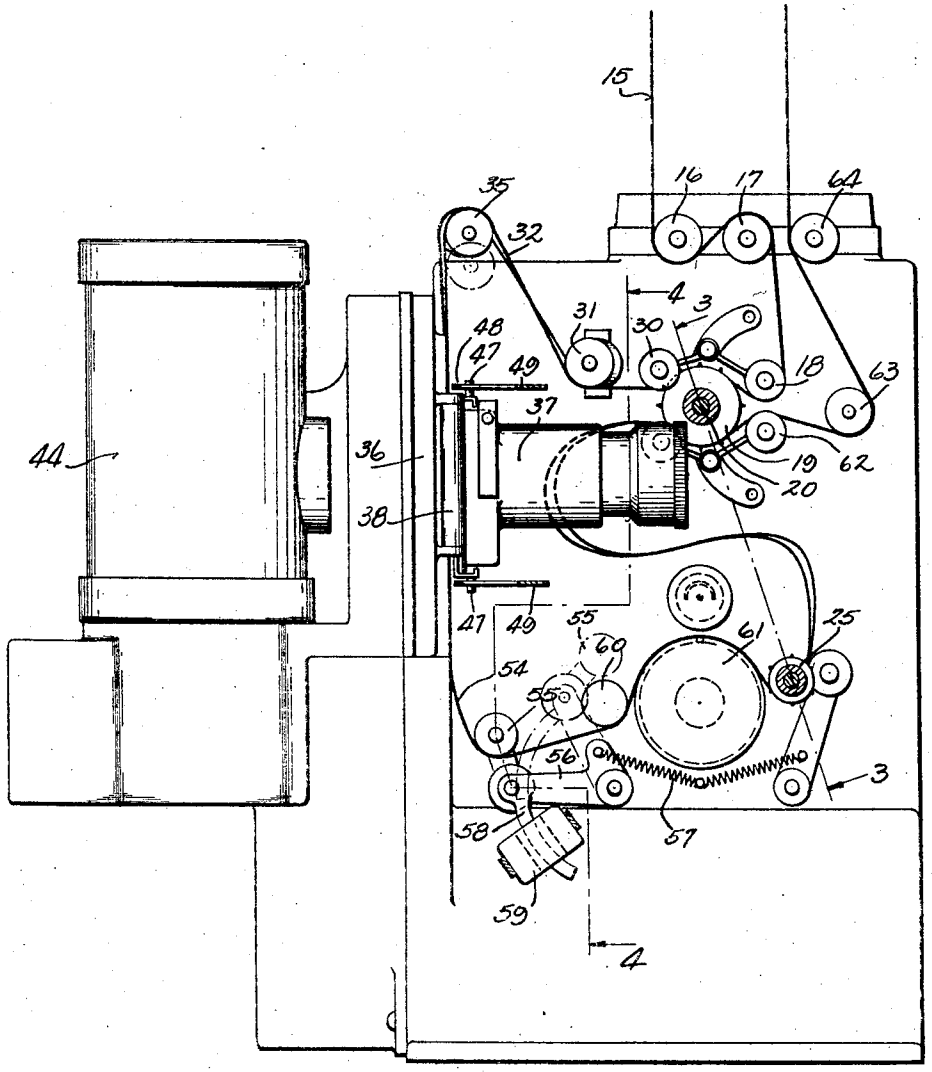


Fig. 12.

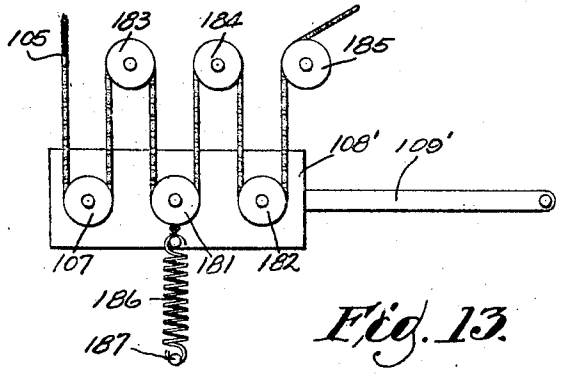


Fig. 13.

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COIN CONTROLLED MOTION PICTURE APPARATUS

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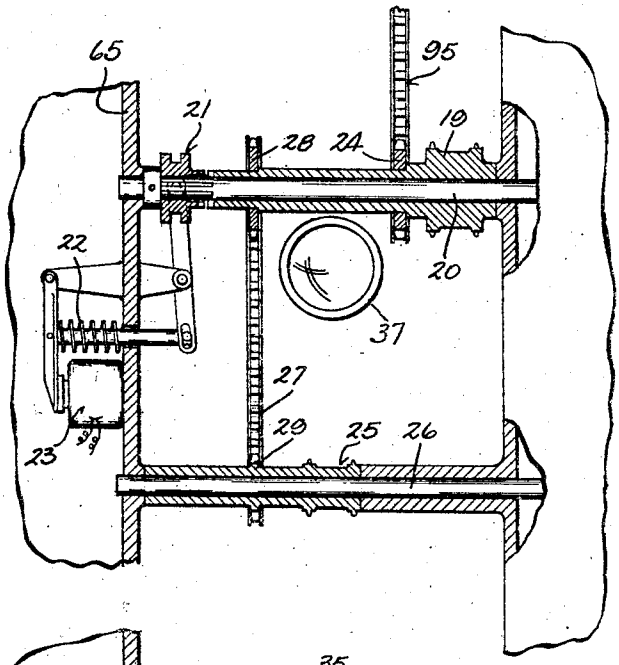


Fig. 3.

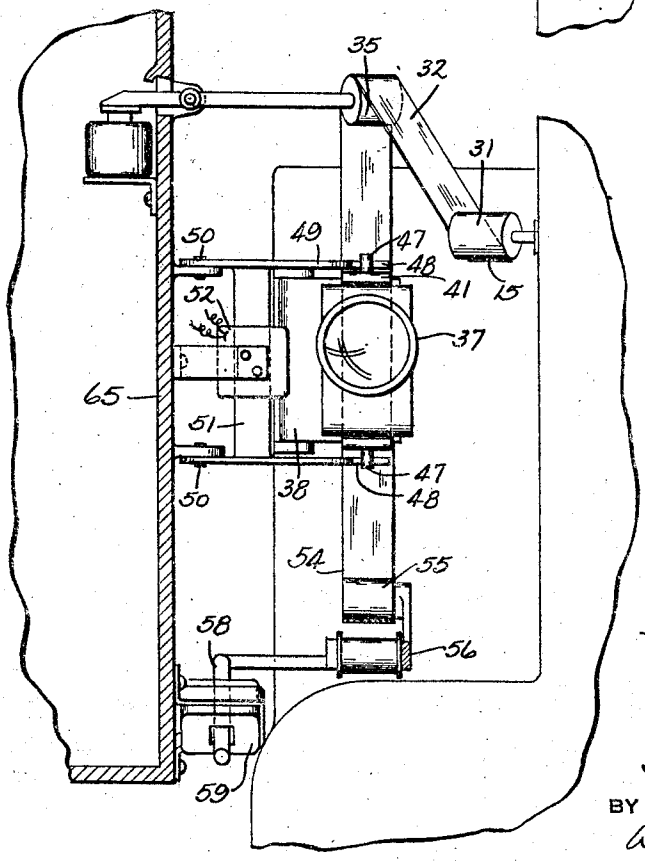


Fig. 4.

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COIN CONTROLLED MOTION PICTURE APPARATUS

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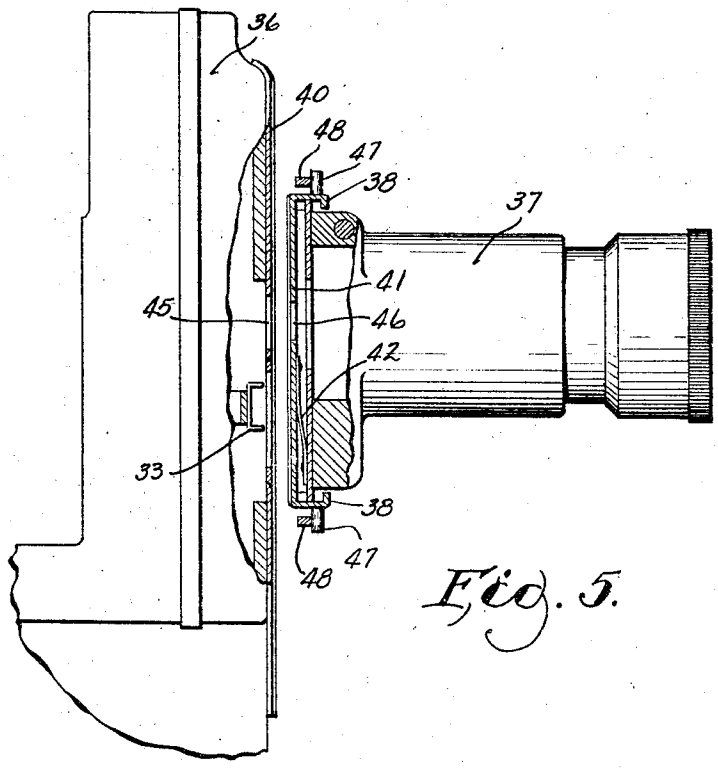


Fig. 5.

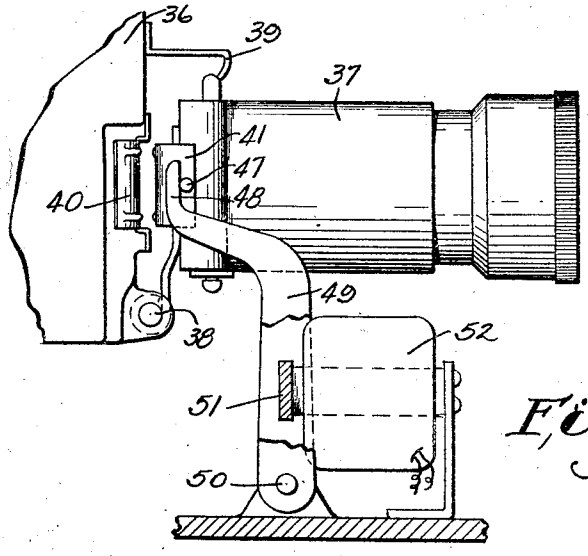


Fig. 6.

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COIN CONTROLLED MOTION PICTURE APPARATUS

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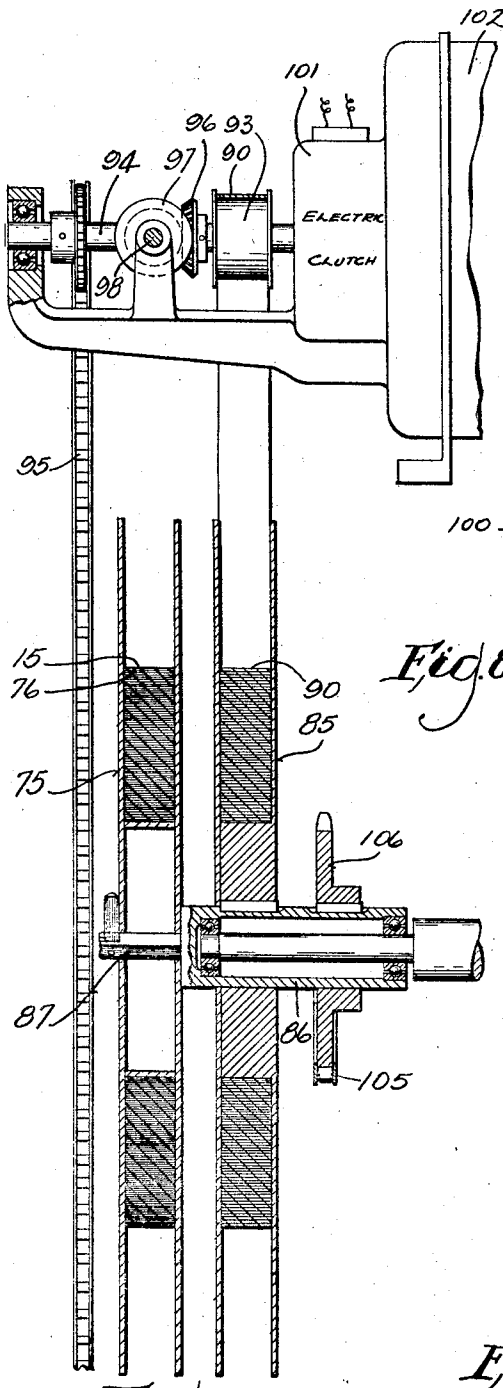


Fig. 7.

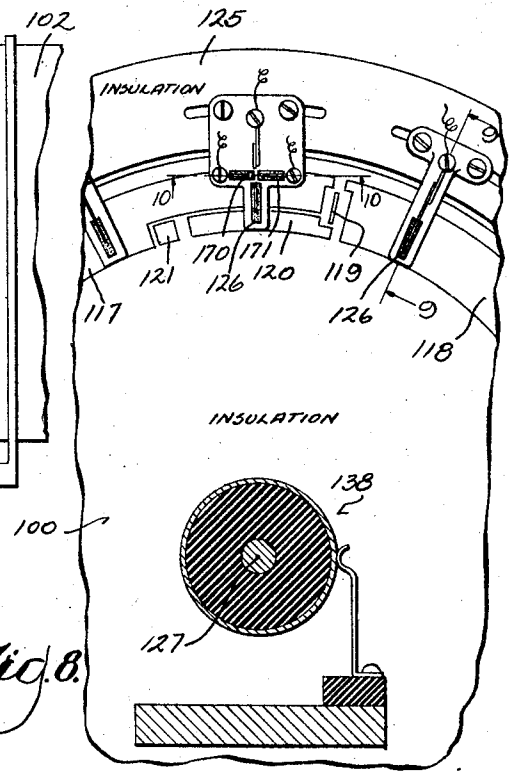


Fig. 8.

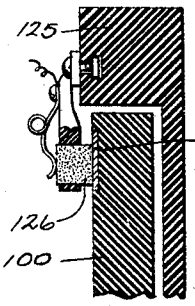


Fig. 9

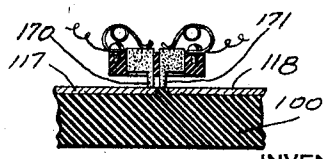


Fig. 10.

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COIN CONTROLLED MOTION PICTURE APPARATUS

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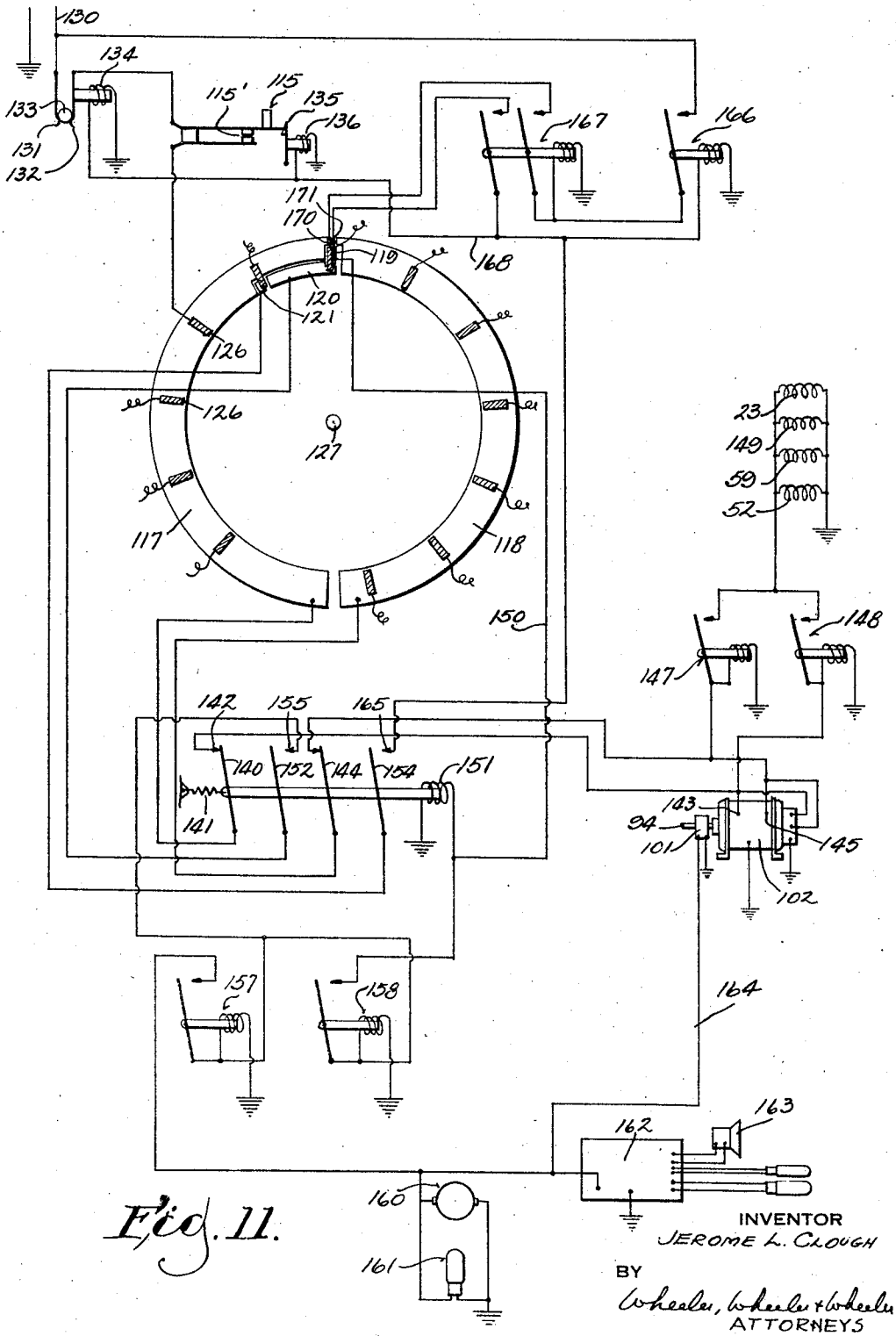


Fig. 11.

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Patented June 20, 1944 2,352,077

UNITED STATES PATENT OFFICE

2,352,077

COIN CONTROLLED MOTION PICTURE APPARATUS

Jerome L. Clough, Milwaukee, Wis.

Application September 15, 1941, Serial No. 410,828

25 Claims. (Cl. 88—24)

This invention relates to improvements in coin controlled motion picture apparatus.

The invention has many objectives, principal among which are the following:

First: The provision of means, with or without coin control, for the automatic selection at high speed of a particular feature from a strip of film which may include other features, followed automatically by the projection of the selected feature and the reproduction of sound from its sound track, if any, followed by the automatic stopping of the machine in position for a subsequent operation involving the same steps.

Secondly: The complete protection of the film from injury, particularly during its high speed traverse incident to the selection of a particular feature from a film which may contain several such features. This involves the driving of the film reels positively in both directions and at all speeds to relieve the film of tension, the film being virtually floated through the apparatus during high speed traverse, and being moved at a constant rate regardless of changes in the effective diameter of the reels consequent upon the winding and unwinding of film. Also involved is the protection of the film from friction during its traverse, the pressure of the film gate being relieved for this purpose. Also involved is the protection of the film from rubbing of successive layers upon each other, this being an important cause of injury to films, and being overcome in the present device by interposing a protective web between the successive coils of film upon the reels. Also involved is the provision of automatic loop forming means, automatically retracted during projection to leave the loops free to accommodate intermittent film movement at the projection gate while the movement of the film to and from the gate is continuous. Further involved is the provision of means for releasing the high speed selection drive when the low speed projection drive is in use, and vice versa.

Third: The provision of apparatus for the purposes stated, which may be used as an accessory to a selected and otherwise conventional motion picture projector and sound reproducer with only minor changes in the projection apparatus, the added structure being almost entirely unitary.

Fourth: The provision of novel and improved selecting means of the brush and segment type and a novel and improved electrical circuit including automatic controls, whereby the film may approach the projection point at high speed in a direction opposite to that in which it must move during projection, but may nevertheless be brought to rest and started off in projection at normal projecting speeds and finally stopped, and, if desired, returned to a predetermined starting point.

Other objects will be apparent to those skilled in the art upon analysis of the following disclosure of the invention.

In the drawings, which are largely diagrammatic:

Figure 1 is a longitudinal section through a cabinet, diagrammatically showing, largely in side elevation, but partially in section, apparatus embodying the present invention.

Figure 2 is an enlarged detail view, principally in side elevation but partially in section, showing the projector proper and indicating the parts associated therewith in accordance with the present invention.

Figure 3 and Figure 4 are detail views, respectively taken in section on the lines 3—3 and 4—4 of Figure 2.

Figure 5 is a further enlarged fragmentary detail view in side elevation of the film gate and lens barrel and associated body portions of a conventional projector, illustrating the application of cooperating parts thereto, portions of the structure being broken away to expose the interior mechanism in section.

Figure 6 is a detail plan view of the parts shown in Figure 5.

Figure 7 is an enlarged detail view in axial section on the line 7—7 of Figure 1.

Figure 8 is an enlarged detail view taken in section on the line 8—8 of Figure 1.

Figure 9 is a fragmentary detail view in section on the line 9—9 of Figure 8.

Figure 10 is a fragmentary detail view taken in section on the line 10—10 of Figure 8.

Figure 11 is a wiring diagram.

Figure 12 is a detail view, partially in perspective and partially in section through superimposed plies of film and protecting web.

Figure 13 is a fragmentary detail view, showing, diagrammatically, a slight modification of the device for taking up slack.

Like parts are identified by the same reference characters throughout the several views.

As indicated above, my improved apparatus uses, with only slight modification, an otherwise conventional motion picture projector and sound reproducer, which is shown in side elevation in Figure 2. Because this apparatus is conventional its interior structure is not included in the disclosure of the present invention, and its exterior structure will be briefly described.

The incoming web of film 15 passes about guide and tension rolls 16, 17 and 18 to a sprocket 19 normally driven for projection purposes from shaft 20, but may be disengageable, for the purposes of the present invention, from such shaft by the provision of a clutch at 21 (Figure 3) normally engaged by spring 22 but disengageable by means of a solenoid 23 when the solenoid is energized.

The purpose of disengaging the film sprocket 19 from shaft 20 is to provide for its more rapid operation for high speed traverse during feature selection, and for this purpose the film sprocket 19 is provided with a chain driven sprocket 24. In the event that the sprocket 25 over which the returning film passes is desired to be power driven, such sprocket is freed from its mounting shaft 26 and driven from film sprocket 19 by means of a chain 27 operating over sprockets 28 and 29, respectively connected with film sprockets 19 and 25, the purpose being to make the returning film sprocket 25 operable at high and low speeds with film sprocket 19 and subject to the same clutch control.

The incoming film, in leaving the drive sprocket 19, passes over guide rolls 30 and 31 and is provided at 32 with a "loop" before entering the film gate. Such loops are ordinarily formed by hand in the operation of threading the film through the projector. They accommodate a change in the movement of the film which is operated continuously in passing the film sprocket 19 but which is intermittently advanced by a claw 33 (Figure 5) in a conventional manner in traversing the film gate at the projection point. In the particular projector shown the claw is normally retracted when the reproducing mechanism of the projector is at rest, as shown in Figure 5. However, in the present apparatus, the film moves at high speed for quick traverse during selection under conditions where intermittent movement is not required. Accordingly, a retractable loop forming guide roll 35 is provided, such guide roll being shown in Figure 2 in its elevated position, although during projection it is normally retracted to a position in which it appears in dotted lines in Figure 2.

Below the loop 32 the film passes through a gate shown in detail in Figure 5 and Figure 6, between the casing 36 and the lens barrel 37. A hinge 38 normally held closed by a spring detent 39 (Figure 6) mounts the lens barrel 37 in a manner permitting the barrel to be turned aside for convenience in threading the film through the gate. The gate proper comprises a guide plate 40 carried by the casing 36 and a complementary spring pressure plate 41 carried by springs 42 (Figure 5) from the lens barrel assembly 37.

Flanges 38 on the pressure plate interact with a shoulder on the lens barrel to limit the movement of the pressure plate 41 toward the housing under compression of its leaf spring 42. The light from a suitable source of illumination within lamp housing 44 passes the shutter (not shown) to traverse the aligned openings at 45 and 46 in the plates 40 and 41, respectively, en route to the lens (not shown) which is carried by the barrel 37.

In Figure 5 and Figure 6 the pressure plate 41 which normally holds the film tightly at the gate is shown retracted to permit of the rapid transit of the film during selection without subjecting it to severe frictional wear in the gate. For this purpose the pressure plate 41 is provided with upwardly and downwardly extending pins 47 which are engaged for retraction by the fingers 48 of a bifurcated arm 49 which is pivoted at 50 and carries an armature 51 retractable by the energization of the electromagnet 52.

Below the gate the film 15 is provided with another loop at 54 which, in the quick traverse position of the parts shown in Figure 2, is maintained by a loop forming roll 55 mounted on the bell crank 56 and normally held retracted to its dotted line position by a tension spring 57. However, mounted on the bell crank is the armature 58 of a solenoid or other electromagnet 59 whereby the roller 55 may be drawn down to loop maintaining position when the solenoid 59 is energized during high speed movement of the film for selection purposes.

From the loop 54 the film passes around the fly wheel roll 60 to a scanning roller 61, which is a part of conventional soound reproducing apparatus. Beyond this the film may, if desired, be positively driven by the sprocket 25 above referred to, from which the film passes loosely to the driving sprocket 19 and thence over the guide and tension rolls 62, 63 and 64 away from the projector.

With the exception of the special clutch controlled driving connections to the film driving sprockets 19 and 25 as shown in Figure 3 and above described, and with the further exception of the pins on the film gate pressure plate as shown in Figure 5 and Figure 6, no changes are made in the projection and sound reproducing apparatus. All of the operating electromagnets and driving connections other than as above noted, are carried on the accessory standard 65 (Figure 1), or disposed conveniently in the projection cabinet 66.

The cabinet is of generally conventional design, having a first mirror at 67 and a second mirror at 68 for directing the image to the projection screen at 69. Mounted conveniently in the cabinet are the film winding, driving and controlling connections now to be described.

The film is carried upon two reels 70 and 75 (Figures 1 and 7). To protect the film from the scratching occasioned by abrasion of successive coils upon each other, I interpose a spacing web 76 between successive coils of film in the manner best shown in enlarged detail in Figure 12. As there illustrated, it will be noted that the spacing web 76 is thickened marginally at 77 so that only the perforated marginal portions 78 of the film 15 engage the spacer. The picture carrying areas 79 and the area 80 which carries the sound track on the film are entirely free of contact at all times.

The spacing web 76 passes directly from reel 70 to reel 75 about the tensioning pulley 81, which, as shown in Figure 1, is mounted for vertical movement in a guide slot 82 whereby its weight alone maintains the spacing web 76 under proper tension and takes up the slack to compensate for any slight changes in the length of this web which is exposed between the reels. Since the film is fed from one reel at the same constant rate at which it is wound upon the other, through means hereinafter to be described, it will be apparent that the spacing web 76 does not require any substantial compensation but will normally feed directly from one reel to the other.

Associated with each of the reels 70 and 75 is a companion reel 85, one of which is shown in Figure 7. The reels 85 are directly connected to turn with the film reels 70 and 75, respectively,

being mounted upon a common hub 86 having a squared end portion 87 with which the film reels 70, 75 are detachably and interchangeably connected to facilitate replacement with other films.

Wound upon the reels 85 is a flexible tension member for transmitting movement to the reels, this member preferably taking the form of a steel tape 90. This steel tape corresponds in effective thickness to the film so as to wind and unwind from its reel at the same rate at which the film is wound and unwound. The correspondence in effective thickness does not mean that the actual thickness must be the same. In the present instance, because of the fact that the separator web 76 is employed between successive coils of film, the tape 90 preferably equals the combined thickness of the film and the separator web so that the proportionate diameters of the reels 85 as the steel tape is wound and unwound therefrom will remain constant in the same ratio as the effective diameters of the film rolls 70 and 75.

Differences in thickness between the tape and the film may be compensated for by simply varying the diameter of the tape reel 85 in proportion to the diameter of the film reel 75 with which it is associated so as to maintain the desired ratio between the reels 85 in the same proportion as the ratio between reels 70 and 75 at all times.

Between the reels 85 the tape 90, which serves as a driving web, passes about the idling pulleys 91 and 92 and across the intermediate driving pulley 93. This pulley is located on the same shaft 94 from which chain 95 drives the film actuating sprocket 24 (Figure 3) as above described. From this same shaft 94 a set of bevel gears 96 and 97 operates a shaft 98, which, through a motion reducing mechanism 99, operates the selector 100 hereinafter to be described.

Shaft 94 is driven through a normally disengaged electric clutch 101 from a motor 102, the arrangement being such that the clutch is energized concurrently with the energization of the motor 102. The motor is preferably provided also with a self applying brake of the general type shown in the patent to E. C. Kiekhaefer, No. 2,059,244, dated November 3, 1936, for Automatic brakes, which brings shaft 94 and the parts driven thereby immediately to rest when the motor 102 is deenergized, the brake being disengaged to permit the free rotation of the motor armature and shaft 94 when the motor is energized. The motor 102 is of the reversible type.

It will be apparent from the foregoing that when the motor 102 is in operation to actuate shaft 94 in either direction, motion in a corresponding direction will be transmitted to the steel tape or other flexible tension element 90. This will cause the tape to be unwound from one of the reels 85, thereby driving that reel to deliver film from its associated reel 70 or 75.

However, the reels are also connected by an endless chain 105 (Figure 1) which passes about sprockets 106 on the respective reel hubs 86 (Figure 7) with intermediate provision for taking up slack under tension. As disclosed, the idler sprocket 107 (Figure 1) is mounted on a heavy weight 108 at the end of a pivoted lever 109. Another idler sprocket 110 is connected by a strong tension spring 111 and a cable 112 with the weight 108, the cable passing about pulleys 113 and 114. It is necessary to make provision for taking up slack in the chain between the respective sprockets 106 on the reel hubs for the reason that the chain has a definite unit of advance for each rotation of the reel hub and does not have the characteristic of varying its advance in proportion to the effective diameter of the reel hub, as do the film and the steel tape. The spring 111 could be provided with a fixed anchorage but for the fact that the length of the spring would have to be very great if it were not for the automatic compensation provided by connecting the spring end to the weight in such a manner that as the weight moves upwardly the anchorage of spring 111 will move downwardly to maintain the tension on the spring which would otherwise tend to be lost.

Assuming the motor driven shaft 94 to be in counter-clockwise rotation as viewed in Figure 1, the tension driving member or steel tape 90 will likewise rotate its reel 85 and the associated film reel 75 counter-clockwise to pay out film toward the projector. However, these reels cannot rotate without also rotating the sprocket 106 to transmit motion through chain 105 to the other film reel 70, causing this film reel likewise to rotate in a counter-clockwise direction to take up the film paid out from reel 75 and passed through the projector.

Correspondingly, the clockwise rotation of the driving shaft 94 as viewed in Figure 1, will transmit motion through the steel tape 90 to produce clockwise rotation of film roll 70, thus paying out film from this roll but simultaneously causing chain 105 to operate film reel 75 in a clockwise direction to take in film at the same rate at which it is paid out from reel 70.

The chain would tend to cause overrun of the winding reel as compared with the paying out reel, but such overrun is precluded by that portion of the steel tape 90 which is likewise being wound.

The combination of weight 108 and spring 111 keeps the steel tape or flexible tension transmitting element 90 constantly taut, and it is this element which at all times relieves the film of strain so that, in effect, the film floats through the winding and unwinding mechanism, being fed to the projector at the same rate at which it is wound therefrom, irrespective of the rate of film travel. It will be understood that the motor 102 is used only for the rapid transit of the film for feature selecting purposes, normal film movements being produced in the usual way by the motor (not shown) of the otherwise conventional projecting apparatus, which, through the shaft 20 (Figure 3), clutch 21 being engaged, drives sprocket 19 at projection speeds, motion being transmitted, in projection, through the chain 95 to shaft 94, which at such times is unclutched from the high speed motor 102. Thus, even at slow speeds, the several reels and the selecting mechanism are all synchronously operated through the motion transmitting connections described above.

For selection the front of the cabinet 66 is provided with a row of push buttons 115 representative of the various features which, connected together end to end, make up the film wound upon the reels. These buttons 115, preferably provided with any conventional interlock (not shown), to prevent more than one of them from being operated at a time, control the switches respectively connected with brushes in the selector mechanism 100, as more particularly shown in the wiring diagram, Figure 11.

The selector 100 comprises a dielectric disk upon which are mounted commutator segments 117, 118, 119, 120 and 121 (Figures 8, 9, 10 and 11). The adjacent mounting ring 125 supports brushes

126 with which the respective push button switches are connected. To simplify the wiring diagram, only one push button switch 115 is shown in Figure 11 connected to a single brush, the brush selected being the No. 4 brush counting clockwise from the left in Figure 11. Assuming that there are available twelve features and twelve selecting push button switches, the number 6 brush, being approximately at the middle of the series, is provided with a special auxiliary brush set, shown in detail in Figure 10 and hereinafter to be described. Otherwise it is identical with all of the other brushes 126.

The selector disk 100, upon which the several segments are mounted, is carried by a shaft 127 driven through the speed reducer 99 in synchronism with the paying out and taking up of film. Thus the position of disk 100 and a given brush thereof will at all times correspond exactly with the position of a given point on the film, which may be taken to be the commencement of a particular feature. The exact distribution of the brushes about the disk 100 and the segments 117 and 118 is immaterial so long as it is less than 360 degrees and is so correlated through the speed reducer with the driving shaft 94 that each brush is at a point representing the commencement of one of the features which can be reproduced. The several brushes may conveniently be mounted on the fixed mounting ring 125 carried by the front wall of the cabinet.

As viewed in Figure 11, segment 117 is so connected with the high speed driving motor as to operate the disk 100 and segments 117 and 118 counter-clockwise beneath the brushes, while segment 118 is so connected with the high speed driving motor as to operate the disk 100 and the segments clockwise beneath the brushes, the object being in either case to bring the short segment 119 into registry with the brush which has been energized by the closing of its push button switch 115. It is the function of segment 119 to cut off the high speed driving connections used for selection purposes and to initiate the movement of the projection apparatus under the control of segment 120, following which segment 121 functions through the circuits hereinafter described to terminate the movement of the projection apparatus and to energize the special auxiliary brushes at the sixth or other predetermined station to restore the selector disk to the predetermined intermediate position from which the operations commence in each instance. The circuit and parts through which these operations are achieved will now be described, with particular reference to the wiring diagram, in which, to minimize complication, a conventional ground symbol has been substituted for one of the wires which would normally be used.

Current supplied from wire 130 passes from contact 131 to contact 132 through a coin 133 which is held between these contacts pending retraction of contact 132 by the energization of a solenoid 134. The switch 115' controlled by push button 115 is normally open, but once the push button is depressed the switch will be held closed by the detent 135 until such detent is retracted by solenoid 136. Thus the current passing through the circuit closed by the coin 133 and by the push button switch 115' passes to the brush 126 with which this particular push button switch is connected. For purposes of illustration, as above noted, only one of the push button switches is shown, this being connected to the fourth button from the left.

Through the energization of brush 126 the segment 117 on the commutator disk of selector 100 is energized and through the appropriate ring and brush of the series shown at 138 in Figure 1, the current passes to the blade 140 of a four-pole, double-throw switch normally held in the position shown in Figure 11 by a tension spring 141. The pole 140 engages contact 142 to close a circuit to the terminal 143 of the high speed selecting motor 102 to drive such motor in a direction which is opposite to the direction in which projection occurs. The direction of motor operation is such as to rotate the disk 100 and the segments 117 and 118 counter-clockwise beneath brush 126.

Had the brush energized been on the other side of the disk to be engaged with segment 118, the operation would have been similar except that switch blade 144 would have been energized, and this would have supplied current to terminal 145 of motor 102 to drive the motor in a direction such that the rotation of the segments 117, 118 would have been clockwise instead of counter-clockwise. In either case, the movement of the film would have occurred at high speed toward the point of exhibition.

The closing of the circuit to motor terminal 143 energizes a relay at 147, and the closing of the circuit to motor terminal 145 energizes a relay at 148. In either case, the energized relay closes a circuit in shunt with the high speed motor 102 to energize a series of electromagnetic windings which condition the apparatus for high speed travel. The mechanisms for this purpose have already been described. The winding energized at 52 is the winding of the electromagnet which opens the gate, thus relieving the film of friction during its high speed movement. The winding energized at 59 is the winding which controls the lower loop forming pulley 55 into loop forming position. The winding energized at 149 is the winding which draws the upper loop forming roller 35 into loop forming position (Figure 4). The winding energized at 23 is the winding of the electromagnet which disengages the clutch 21 to release the film sprocket 19 from its normal low speed drive shaft 20. The winding energized at 101 is the winding which energizes the clutch for connecting the high speed motor 102 to the drive shaft 94, as shown in Figure 7. Thus, coincidentally with the energization of the high speed motor 102, the whole apparatus is conditioned for high speed traverse of the film to the starting point of the selected feature, and as the film moves to the predetermined starting point a corresponding motion is transmitted through the reducer 99 and shaft 127 to the selector disk 100 to rotate the segments 117, 118 beneath the energized brush 126.

Assuming segment 117 to be energized as shown in Figure 11, the energized brush, in approaching the starting point, will span the space between segment 117 and segment 120. Segment 120 is, however, disconnected at this time, and its energization from brush 126 will do no harm.

As the short segment 118 contacts the energized brush 126, the current it derives from the brush will pass through conductor 150 to energize an electromagnetic winding 151 which will throw the several switch blades 140, 144, 152, and 154. Engagement of blade 152 with contact 155 will close a circuit from the live brush 126 through segment 120 to delayed action relay 157, and also to relay 158. Relay 158, when closed,

supplies current to the winding 151 to hold the four-pole switch against the tension of spring 141 even after the short brush 119 becomes deenergized during the movement of the selector 100 at reproducing speeds.

Due to the movement of the poles 140 and 144 of the four blades of the four-pole switch, all connections between segments 117 and 118 and the forward and reverse windings of the high speed motor 102 are instantly broken. The automatic brake of this motor at once becomes effective, and, due to the deenergization of the relays 147 and 148, the several windings 52, 59, 149 and 23 are all deenergized, with the result that the loop forming rolls are retracted, the pressure plate of the gate closes, and the low speed driving clutch 21 is engaged. Thus the entire apparatus is conditioned for low speed projection, with the exception that the high speed driving clutch is not yet disengaged, its engagement being temporarily retained so that the brake will become effective upon the entire apparatus before the low speed projction motion starts.

To give time for the high speed brake to function and for the low speed connections and conditioning movements to become effective, the delayed action relay 157 does not close immediately. When it does close, it energizes the low speed projection motor 160 and the projection lamp 161, and also the sound reproducer and amplifier 162 and the speaker 163, these parts not being illustrated in detail because they are conventional. Simultaneously with the energization of the low speed motor, the conductor 164 energizes the normally engaged high speed clutch 101 in a direction to effect disengagement thereof so that, all the parts having been brought to rest through this clutch, by operation of the automatic brake with which motor 102 is equipped, the brake will no longer be effective as a brake upon the parts during their projection movement responsive to the regular projection motor 160.

The projection motor drives the selector disk 100 and associated segments 117, 118 in a clockwise direction beneath the energized brush. As soon as the brush passes from the end of segment 120 into engagement with segment 121 which occurs when the projection of the selected feature has been completed, the connection of brush 121 through switch blade 154 with contact 165 operates relay 166. This relay, when closed, receives current directly from the supply line 130 and energizes the double-pole relay 167.

Meantime, the current through conductor 168, in parallel with relay 166, has actuated solenoid 134 to release coin 133, thus opening the entire main circuit and allowing the four-bladed switch to return to its original position under tension of spring 141.

The current now supplied from source 130 through relay 166 and relay 167 energizes the auxiliary brush 170 specially provided adjacent the desired mid point. This brush 170, whether it rests on segment 117 or on segment 118, will, in any case, be able to pass current through the respective segments to its associated brush 171, whence the current will pass back through the relay 167 to hold the relay open.

Also, in parallel with relay 167, the current will pass through the energized segment 117 or 118 and through the appropriate blade of the four-pole switch 140 or 144 to the appropriate winding of the high speed motor 102 to operate the motor and at the same time to energize the several windings 52, 59, 149 and 23 to condition the entire apparatus for high speed operation. Such operation will continue until the auxiliary brush set 170, 171 reaches the gap between segments 117 and 118, this being the selected mid point. Here one or the other of the brushes will run off of its segment, thereby breaking the circuit and allowing relay 167 to open. At this point the entire apparatus comes to rest pending a further operation.

It is broadly immaterial whether the film which, for the purposes of the present disclosure, constitutes the record strip, contains features which consist solely of images for motion picture reproduction, or solely of a sound track for sound reproduction, or whether each feature includes a combination of pictures and sound track.

In any case, the apparatus as disclosed is capable of an automatic sequence of operations, including the rapid transit of the selected feature to the point for commencement of reproduction therefrom, followed by a slower movement during actual reproduction, followed, if desired, by a return of the record strip to its predetermined starting point. Such return is not essential but is desirable, partly because it saves time in reaching features at the remote ends of the strip after the coin is deposited for the sequence of operations otherwise initiated, and partly because it permits the brushes to be distributed throughout the segments of the selector instead of being concentrated within 180 degrees, as would otherwise be necessary for reasons which need not here be explained.

It is a very important feature of the invention as disclosed that the film or other record carrying web is entirely relieved of load in the operation of the machine. The reels will operate both at high speed and at reproduction speeds, subject to the fully automatic control of the selecting mechanism for the initiation, duration and termination of operation at such speeds, even though no film is loaded into the apparatus at all. Not only will the operation at predetermined speeds occur without the presence of the film, but, it is further to be noted, the control of the rate of operation will automatically be the same as if the film were present, the drums being actuated at differential speeds such as to correspond exactly to a predetermined linear rate of film travel from one reel and on to the other, such as would occur if the film or other record bearing web were present.

While it is not my intention for the purposes of the present machine to run the machine without the record bearing web, the possibility of operation in the absence of the web emphasizes the fact that the web is wholly relieved of strain and floats through the apparatus, being positively unrolled from one reel at a constant linear rate at which the web is wound upon the other reel, in either direction of operation. It is further emphasized that selection is accomplished entirely independently of the film or other record bearing web.

While these features are of particular advantage in connection with a machine handling photographic film or the like, it is desired to note the fact that the drive as herein disclosed is applicable to many other machines in which there is present the problem of operating unwinding and winding rolls at differential speeds corresponding to linear travel of the web unwound

from the one and wound upon the other at all stages of web advance.

Where the compensating counter-connection between the reels is called upon to transmit unusually heavy loads or to handle great lengths of web wound upon the reels (in which case the compensating take-up may be relatively great), or in case it is desired to provide a fixed anchorage for the spring 111 (Figure 1) and to dispense with the cable 112, in any such case it may be desirable to adopt the arrangement diagrammaticaly illustrated in Figure 13, wherein the lever 108', 109' carries not only pulley 107 but also pulleys 181 and 182 between and beyond which the chain 105 runs over fixed idler pulleys 183, 184 and 185. In such an arrangement the spring 186, having fixed anchorage at 187, will be correspondingly stronger, but, due to the functioning of the device in a manner comparable to a block and tackle, the compensating take up of slack in chain 105 in the several flights of such chain between the fixed and movable pulleys will reduce the spring travel so that the spring tension will remain more nearly constant throughout its range of movement than would be the case if some or all of the intervening take-up flights of the chain were omitted.

It is further desired to emphasize the fact that many changes may be made in the apparatus herein disclosed wtihout departing from the spirit of the invention. By way of example, and not of limitation, it is desired to note that it is by no means essential that the apparatus be coin controlled. For home use, and for other uses where the coin control is not desired, the apparatus may be substantially simplified for manual selection. Moreover, where the coin control is used, it is contemplated that in practice various refinements will be incorporated, which, because they are more or less common in the coin control art, it has not been thought necessary to show in detail here. The circuit as disclosed is operative, but no means has been shown for making it fool-proof.

Through the use of additional relays with suitable circuit connections, it is readily possible to provide protection against the contingency of a second coin being dropped into the apparatus or a second push button switch actuated before the sequence of operations herein disclosed has been completed. A showing of these arrangements would add unnecessary complications to the present disclosure, which is limited to a device which is specifically complete for performance in accordance with the objectives as hereinbefore stated. Various other additions to the apparatus disclosed, as well as modifications therein, will occur to those skilled in the art, it being recognized that this disclosure represents but one embodiment of the features to which the invention is directed.

I claim:

1. In apparatus for reproducing a selected feature from a record strip containing a plurality of features, the combination with feature reproducing mechanism and automatically operable driving connections for operating said strip in operative relation to said mechanism at reproducing speed, of high speed driving connections for said strip, a selector including manually operable means for determining the feature to be reproduced, and selector-controlled mechanism for automatically actuating the high speed driving connections to move said strip rapidly to the starting point of the selected feature and for automatically operating the selected feature substantially throughout its length through the reproducing mechanism at reproducing speeds.

2. The device of claim 1, in which the reproducing mechanism comprises a motion picture projector having automatically operable means for the intermittent advance of motion picture film during reproduction therefrom, said selector-controlled mechanism being adapted automatically to release said film from its high speed driving connections and to subject it for a predetermined projection period to intermittent advance at the point of projection by said reproduction mechanism.

3. The combination with a motion picture projector, including a film gate and automatic mechanism for the intermittent advance of film through said gate during projection, of film storage reels upon which film is wound for movement from either toward the other, means for the power operation of one of said reels and said intermittent film advancing means for film movement in a predetermined direction during projection, and means for the high speed operation of either of said reels selectively and independently of said intermittent film advancing means.

4. The structure defined in claim 3, together with means including a selector and selector-controlled mechanism for automatically operating said high speed reel driving means in a predetermined direction of film movement to a predetermined starting point, and for automatically thereafter operating said motion picture projector, including said intermittent film advancing means, for a predetermined distance in a projecting direction from said selected starting point.

5. The structure defined in claim 3, in which said film gate includes a pressure plate normally holding the film in a predetermined plane during projection and mechanism for retracting said pressure plate, said mechanism being provided with operative actuating connections for operation concurrently with the high speed actuation of either reel in either direction, whereby the film is automatically relieved of the pressure of said pressure plate at said gate during its high speed movement.

6. The combination with a motion picture projector including a film driving sprocket, means for the rotation of said sprocket at projection speeds, a film gate including a pressure plate and means for the intermittent advance of film through said gates at projection speeds and in a projection direction, of film storage reels, a source of power common to said sprocket and one of said reels for the operation of the last mentioned reel to wind film moving in a projection direction across said sprocket and through said gate, means for the high speed operation of at least one of said reels, means for disconnecting said sprocket from said source of power and connecting it with said high speed operation means for rapid film traverse independent of said intermittent film advancing means, and means for energizing said high speed means and concurrently opening said gate, whereby to relieve said film of friction during such rapid transit.

7. The combination with a motion picture projector having a film gate provided with a retractible pressure plate and means for the intermittent advance of film therethrough, said projector also including sprocket means for the continuous movement of film to and from said gate,

said film being normally provided during projection with loop portions between said gate and sprocket means, reels for film storage, means for actuating one of said reels and said sprocket means at high speed independent of said intermittent film advancing means for rapid film transit to a selected point of projection commencement, loop forming means operable to and from loop forming positions, and mechanism for concurrently controlling the retraction of the pressure plate of the gate and the advance of said loop forming means to loop forming positions concurrently with the operation of said high speed film reel actuating means, whereby to maintain film loops and to relieve film friction during high speed film transit.

8. The combination with a strip containing in sequence a plurality of features for reproduction, of reels upon which the ends of said strip are wound, reproducing mechanism through which an intermediate portion of said strip is guided between said reels, low speed driving connections for the actuation of a predetermined feature on said strip through said reproducing mechanism in a reproducing direction, high speed driving connections for the actuation of said strip in either direction through said reproducing mechanism to the starting point of a selected feature on said strip, mechanism for rendering said reproducing mechanism and low speed driving connections ineffective during the high speed movement of said strip, and a selector including a manually operable part and mechanism for controlling the sequence of high speed and low speed operations of said strip and the extent of such operation, if any, in each instance.

9. The device of claim 8, in which at least the high speed driving connections include means for positively actuating both of said reels concurrently at a rate proportioned to the linear movement of said strip irrespective of changes in effective diameter in the coils of strip wound upon said reels, whereby said strip is floated substantially free of load through said reproducing mechanism.

10. The device of claim 8, in which at least the high speed driving connections include means for positively actuating both of said reels concurrently at a rate proportioned to the linear movement of said strip irrespective of changes in effective diameter in the coils of strip wound upon said reels, whereby said strip is floated substantially free of load through said reproducing mechanism, said means including supplemental reels connected with the reels upon which the ends of said strip are wound, a flexible member wound upon said supplemental reels and proportioned in thickness to said strip, at least the high speed driving connections being applied to said member and said reels having supplemental means for communicating motion from the reel primarily driven by the tension of said member to the other of said reels for the actuation of said other reel.

11. The combination in mechanism for reproducing a record from a strip, of reels upon which the ends of said strip are wound, supplemental reels connected with said first mentioned reels, respectively, a tape having its ends wound upon the supplemental reels, said tape and supplemental reels being so proportioned dimensionally as to maintain coils upon the supplemental reels proportionate in diameter to the coils of said strip upon the reels first mentioned, supplemental driving connections between said reels for the transmission to each reel of motion from the other reel when such other reel is primarily actuated, said supplemental driving connections including slack take-up mechanism, and driving connections operable upon said tape for the actuation of said reels, together with a reproducing mechanism through which said strip passes substantially free of driving stress between the reels first mentioned.

12. The device of claim 11, in combination with a selector having a rotatable portion operatively connected with said tape and thereby movable accurately in accordance with the movement of said strip between said reels, said selector including means for controlling said actuating connections as to the extent of strip operation.

13. In a device of the character described, the combination with reels for a feature carrying strip, of supplemental reels respectively connected with the reels first mentioned for movement therewith, a flexible member wound upon the supplemental reels, the supplemental reels and said member being dimensionally proportioned so that the ratio of coils of said member upon the respective supplemental reels corresponds to the ratio of coils of said strip upon the reels first mentioned, sprockets connected with the respective pairs of reels for rotation therewith, an endless chain operable over the respective sprockets and having idler means for taking up slack in portions of said chain between said sprockets, and means operable upon said member for driving the respective pairs of reels and associated sprockets and thereby advancing said strip from one of the reels first mentioned to the other, said driving means being reversible.

14. The device of claim 13, in combination with a selector including a brush unit and a commutator unit, one of said units being connected for rotation relative to the other and connected with said flexible member to receive rotative movement therewith in operative correspondence to the movement of said strip, and means effective through said commutator and brush units for energizing said driving means whereby to produce predetermined movement of said strip to a selected point.

15. In a device of the character described, the combination with a plurality of reels for a strip bearing records for reproduction, of reproducing mechanism through which said strip passes intermediate said reels, and a protective member interwound between successive coils of said strip upon the respective reels and connected between said reels to pass from one to the other as said strip passes said mechanism.

16. A selector for the purposes described, comprising a rotor member and an adjustable stator member, brush means carried by one of said members, segments carried by the other of said members, a reversible driving motor having its reverse connections operatively engaged with the respective segments, and reproducing mechanism having means for feeding a record strip in one direction therethrough, means for operating the rotor member in accordance with the movement of the strip, and connections through said brush and segment means for the operation of said strip feeding means independently of said reproducing mechanism past said mechanism from either direction to a position predetermined by the relative locations of the brush and segment means, and guide means through which said strip moves when actuated by the feeding means concurrently with the reproducing mechanism and also when actuated independently thereof.

17. The combination of claim 16, together with supplemental segment means, and means for energizing said supplemental segment means in a predetermined postition of said rotor for the actuation of said strip feeding means of said reproducing mechanism and for the energization of said mechanism for reproduction.

18. The combination with a reproducer and means for feeding a record strip therethrough, of reversible high speed driving connections for said means, uni-directional low speed driving connections for said means, mechanism for rendering said reproducer inoperative during the actuation of said high speed driving connections, a selector including a rotor element and a stator element, the rotor element being connected for movement with said strip feeding means, whereby its position will always correspond to the position of said strip respecting said reproducer, brush means on one of said elements, a plurality of segment means on the other of said elements respectively connected with the high speed and low speed driving connections for the control of the rate and direction of operation of said strip feeding means, and mechanism for rendering said connections successively operative in a predetermined direction and speed of film feeding movement according to the successive engagement of said brush and segment means.

19. A selector, comprising a stator element and a rotor element, brushes upon one of said elements, a pair of high speed driving segments upon the other of said elements arcuately spaced and together substantially coextensive with the relative travel of said brushes during relative movement between said elements, a low speed driving segment of limited arcuate extent with which said brushes are engageable only for a limited period of relative movement between said elements, and additional control segments with which said brushes are engageable adjacent the beginning and end of the low speed segment.

20. The combination with means for reproducing selected features from a record strip containing a sequence of such features, such means including a reproducer, means independent of the reproducer for the high speed advance of the strip to a selected point for the commencement of reproduction of a particular feature, means for automatically feeding said strip through the reproducer from said selected point at reproducing speeds and for concurrently operating the reproducer, and means automatically operable following the reproduction of the selected feature for restoring said strip to a predetermined point from which all such selecting and reproducing operations commence.

21. The combination with a winding shaft and an unwinding shaft, reels upon the respective shafts, a flexible connector having its ends connected with the respective reels and adapted to be wound from one to the other, means for driving the connector intermediate the reels, and counter-connecting means between the respective shafts adapted to transmit motion from one to the other in opposition to said connector, said counter-connecting means including an endless flexible member having substantially positive driving engagement with the respective shafts, and provided in each of its flights between the respective shafts with a yieldable tensioning member, and means biasing such members to take up slack in said counter-connecting means.

22. The structure of claim 15, in which the protective member comprises a tape having increased thickness at its margins as compared with its intermediate area, whereby intermediate portions of the record bearing strip are supported free of contact.

23. The combination with a winding shaft and an unwinding shaft, reels upon the respective shafts, a flexible connector having its ends connected with the respective reels and adapted to be wound from one to the other, means for driving the connector intermediate the reels, and counter-connecting means between the respective shafts adapted to transmit motion from one to the other in opposition to said connector, said counter-connecting means including an endless flexible member having substantially positive driving engagement with the respective shafts and is provided with tension and return flights between the respective shafts, each of which flights has a yieldable guide means biased to take up slack therein, at least one of said yieldable guide means comprising a plurality of relatively fixed and movable pulleys, and means tensioning the movable pulleys, whereby a given movement thereof will have a multiplied slack absorbing action upon the flight passing over such pulleys in sequence.

24. Driving connections, comprising the combination with a winding shaft and an unwinding shaft, of reels upon the respective shafts, a flexible connector having its ends connected with the respective reels and wound upon at least one thereof, and means for driving the assembly of reels, shafts and connector, said means including a counter-connection between the respective shafts comprising rotors upon the respective shafts, an endless flexible member passing above one of said rotors and below the other and having intervening flights, each of which includes slack, together with means for taking up the slack in each of said flights.

25. The combination with a winding shaft and an unwinding shaft and reels upon the respective shafts, of a flexible connector having its ends connected with the respective reels to be wound from one to the other, and means for driving the assembly of reels, shafts and connector, said means including a counter-connection between the respective shafts comprising rotors upon the shafts, an endless flexible member passing above one of said rotors and below the other and having intervening flights, each of which includes slack, together with means for taking up the slack in each of said flights, said means for taking up the slack in at least one of said flights comprises a movable carriage biased for movement in a direction to take up slack, a series of pulleys over which said member operates to provide a plurality of flights of said member, variable in length in accordance with the movement of said carriage, at least one of said pulleys being mounted on the carriage and at least one other of said pulleys being provided with a fixed center, whereby the bias upon said carriage is transmitted equally to the plurality of flights of said member of variable length.

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