March 9, 1926.

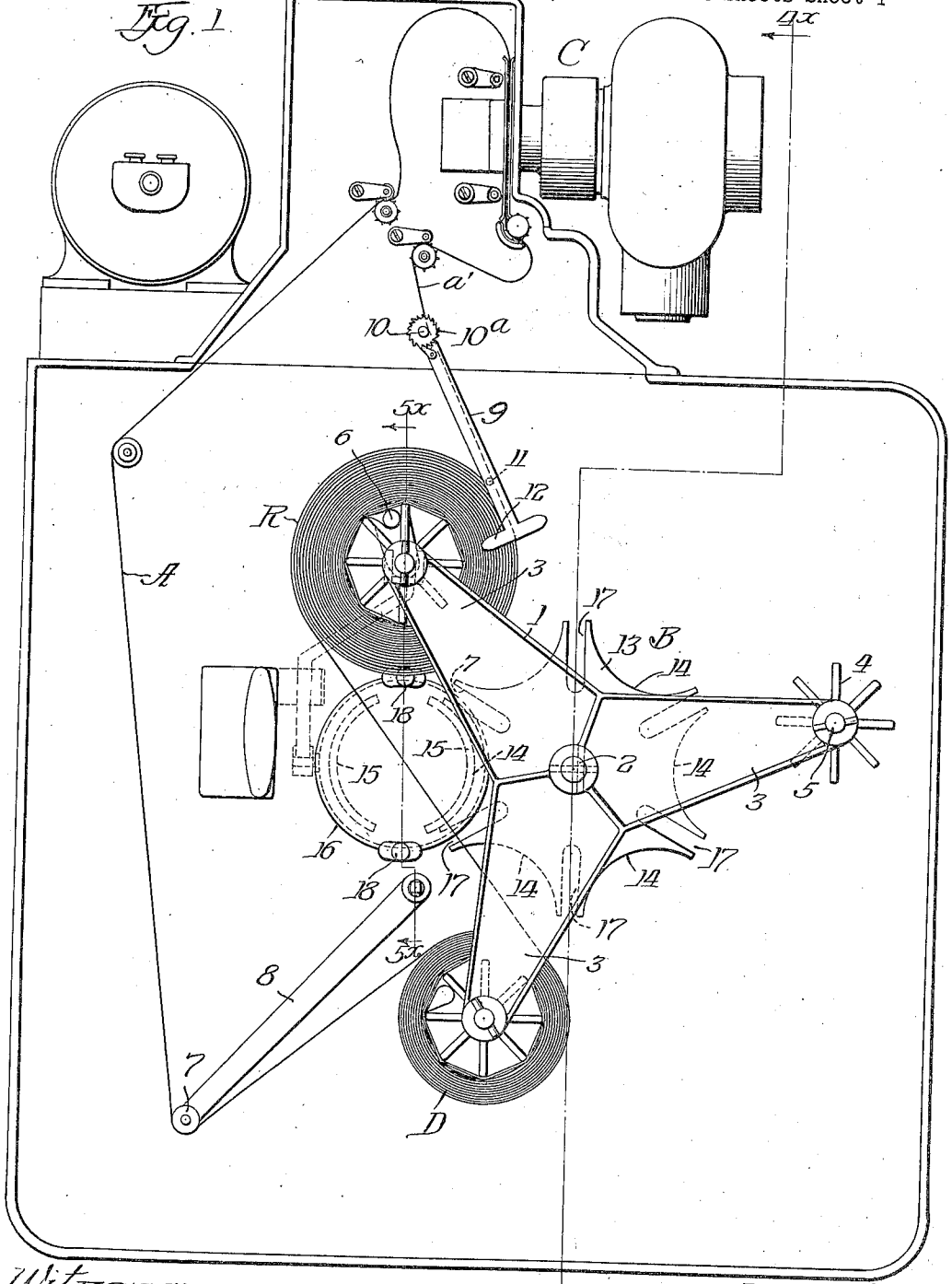
1,576,343

G. R. MACOMBER

APPARATUS FOR WINDING AND UNWINDING FILMS

Filed August 24, 1921 4 Sheets-Sheet 1

Fig. 1.



Witness:
Fred C. Dorison

4x

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March 9, 1926. 1,576,343

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APPARATUS FOR WINDING AND UNWINDING FILMS

Filed August 24, 1921 4 Sheets-Sheet 2

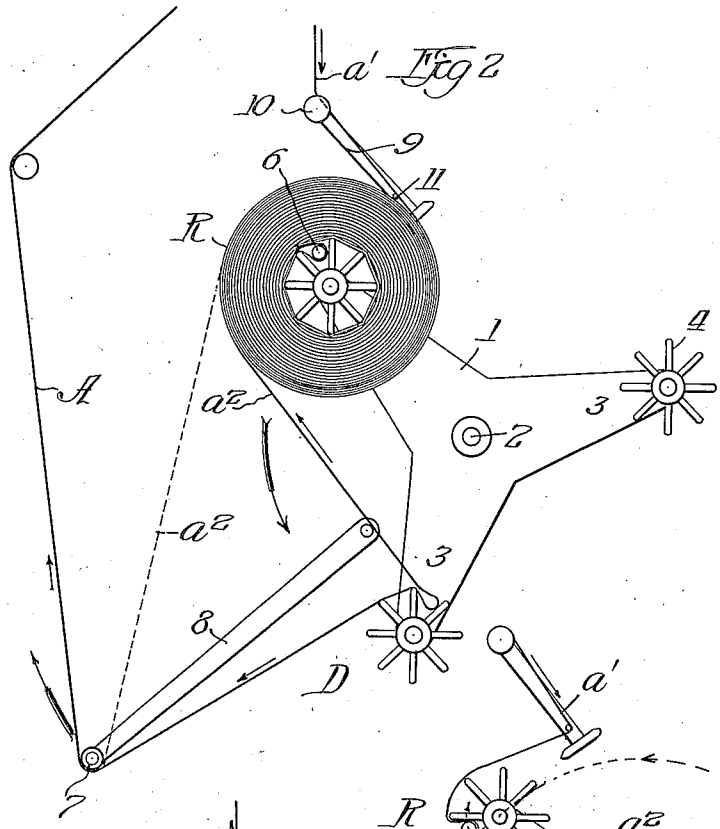


Fig 2

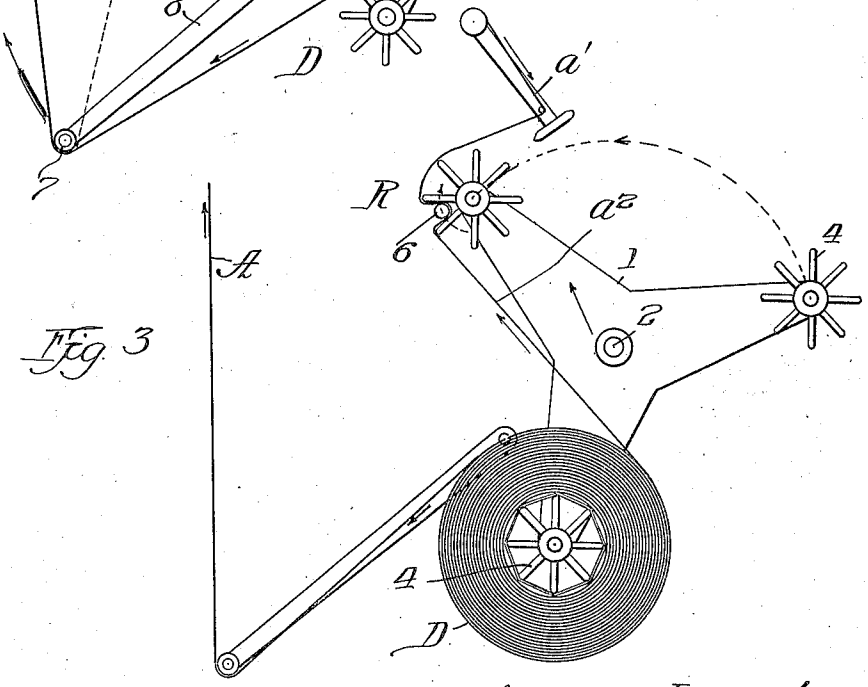


Fig 3

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APPARATUS FOR WINDING AND UNWINDING FILMS

Filed August 24, 1921 4 Sheets-Sheet 3

Fig. 4.

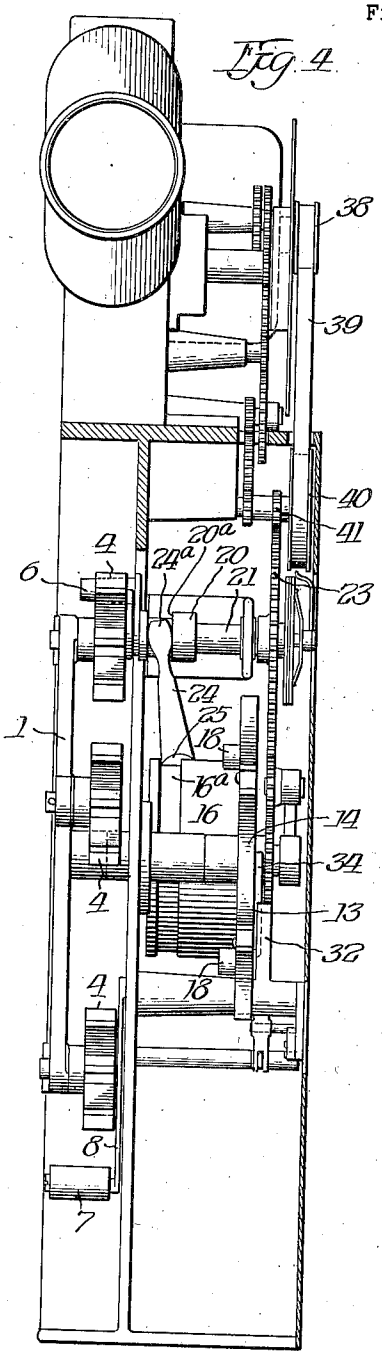
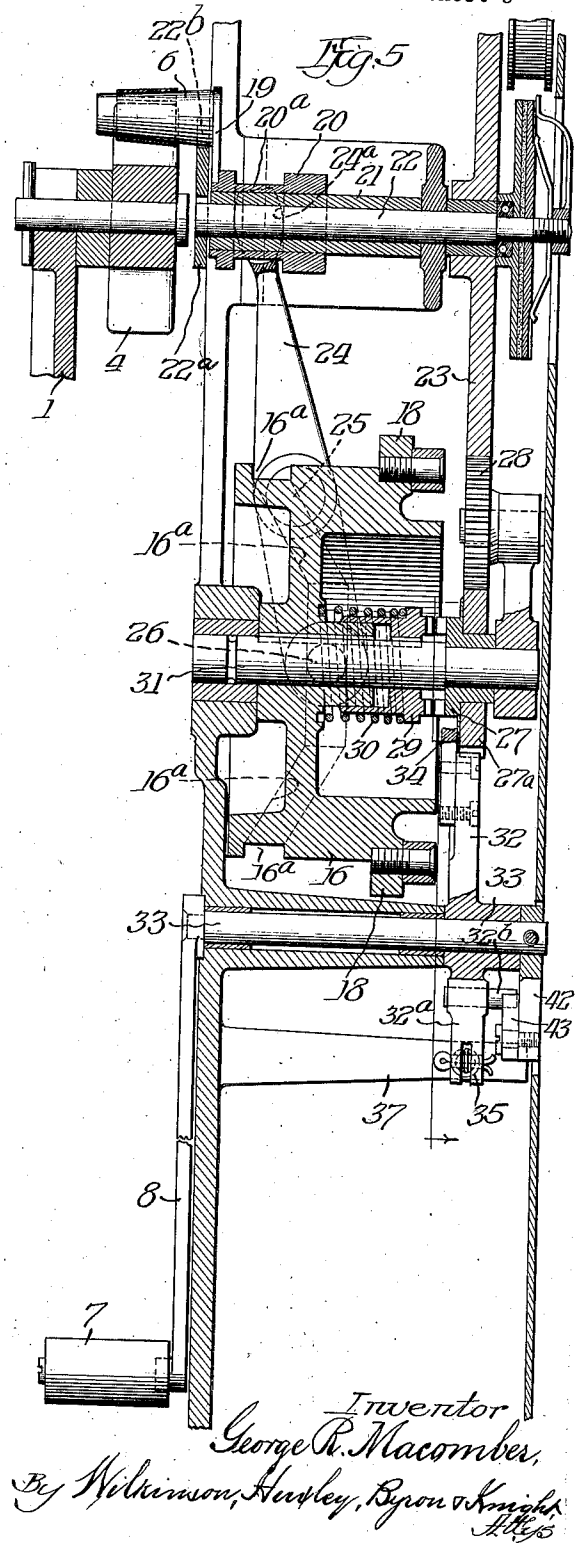


Fig. 5.



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APPARATUS FOR WINDING AND UNWINDING FILMS

Filed August 24, 1921 4 Sheets-Sheet 4

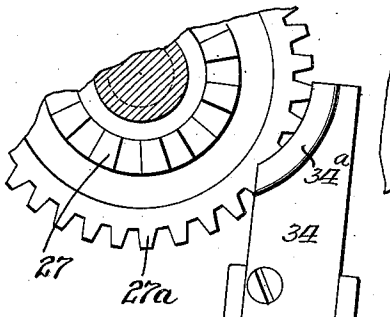


Fig. 6

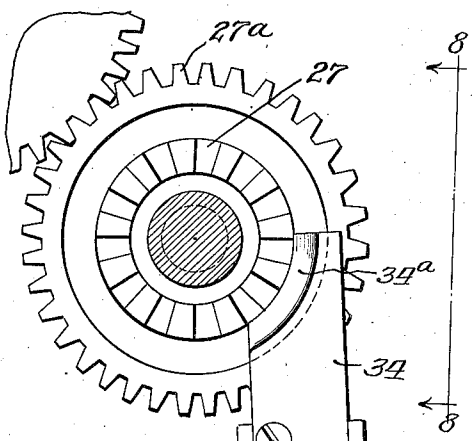


Fig. 7

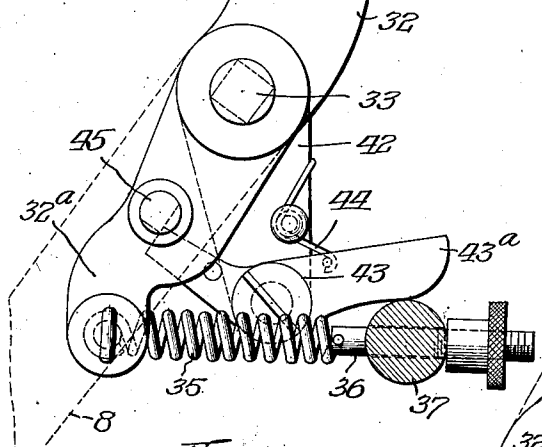
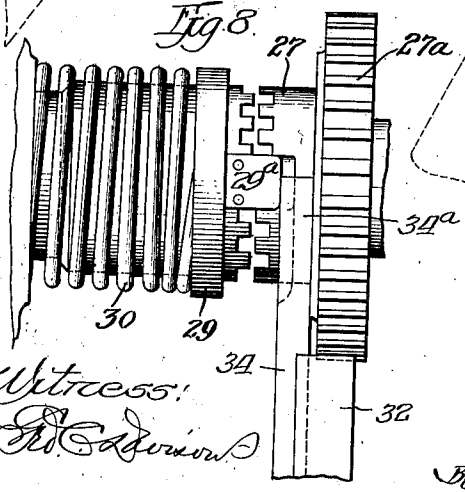
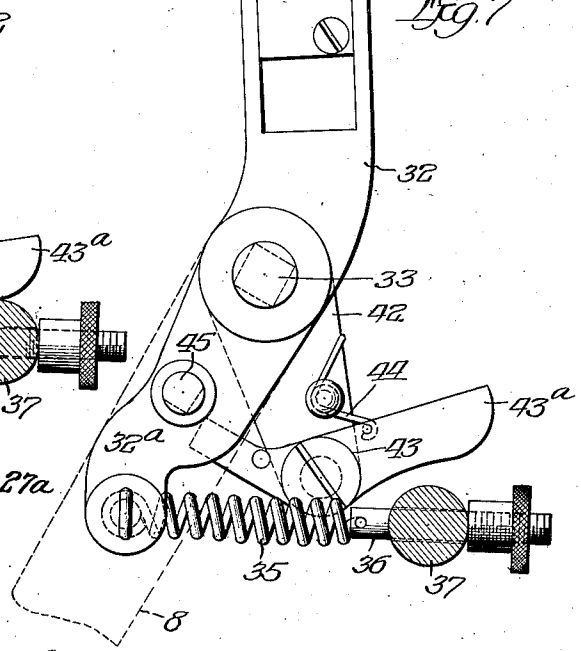


Fig. 8.





Witness:

Inventor:
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Patented Mar. 9, 1926. 1,576,343

UNITED STATES PATENT OFFICE.

GEORGE R. MACOMBER, OF CHICAGO, ILLINOIS.

APPARATUS FOR WINDING AND UNWINDING FILMS.

Application filed August 24, 1921. Serial No. 495,007.

To all whom it may concern:

Be it known that I, GEORGE R. MACOMBER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Winding and Unwinding Films, of which the following is a specification.

This invention relates to an apparatus for winding film into a coil as it is received by the apparatus, and thereafter unwinding it and paying it out from such coil to be fed from the apparatus. The invention is designed primarily for embodiment in apparatus for receiving an endless film from a picture projecting machine, storing the main bulk of the film while it is being constantly received into and delivered from the apparatus, and returning the film for reuse in the picture projecting machine. But the invention relates to the operative principle and construction of the winding and unwindging apparatus per se, which is adapted for a wide variety of uses; hence, the particular application of the invention herein shown is to be understood as merely illustrative of the invention and not definitive of its scope.

One object of the invention is to provide a plurality of film winding members hereinafter referred to as "spools" with means for mounting them which first presents a spool to the winding position in which it takes on the incoming film and coils it into a roll, and then, when the roll has been built to a suitable size and taken on the main bulk or length in the body of the film, presents it to the unwinding position where the film is paid out, the arrangement being such that as a spool passes from the winding to the unwinding position a fresh spool arrives at and enters upon the function of the winding position; the method of winding being such that film is doubled upon itself in anchoring it to the winding spool so that the film is developed into duplex or two-ply coils and draws from the incoming film as well as from the unwinding spool in winding, and pays out from the spool in unwinding position similarly in two plies, one of which goes to the subsequently formed coil, while the other passes from the apparatus to the place of use.

Further objects are to provide a means located at the winding position which will automatically enter into driving relation with each spool as it arrives thereat; to employ said driving member as the means for anchoring the film to the spool upon which it is to be wound; to provide means which will ride upon the coil of film as developed, yielding to the same radially, but non-yielding in the direction of the axis of winding, and adapted to engage the edge of the film and justify the coils as they are developed; to provide efficient means for imparting the successive advancing movements to the carrier and accurately arresting it with a spool in the winding position and in coaction with the anchoring and driving member; to provide means for withdrawing the anchoring and driving member by a motion parallel to the axis of coiling; to so connect all of the operating parts that they will be actuated from a common source of power; to provide a clutch arrangement for throwing in and out the drive to cause withdrawal of the film anchoring and spool revolving member and the shifting of the carrier to a new position; to provide means whereby the exhaustion of a film from the unwinding spool will throw the clutch into driving relation; to provide means whereby the clutch when so thrown in by the film will automatically be thrown out as soon as the train of functions have been exercised in the several parts.

In the accompanying drawings, in which the preferred embodiment of the invention is shown by way of illustration—

Figure 1 is an elevation showing the general arrangement of the carrier, its spools, and certain of the co-acting parts in their relation to a picture projector.

Figures 2 and 3 are schematic views showing parts of Figure 1, Figure 2 showing the parts at the completion of winding and unwinding, and Figure 3 showing the position of the parts at the commencement of winding and unwinding.

Figure 4 is a vertical section taken through the machine on a line corresponding to the line $4^{\times}$—$4^{\times}$ of Figure 1.

Figure 5 is a section on an enlarged scale taken through the machine in a plane corresponding to the line $5^{\times}$—$5^{\times}$ of Figure 1.

Figures 6 and 7 are enlarged detail views of the clutch controlling mechanism in positions, respectively, which permit the clutch

to move to driving position, and which throws the clutch out of driving position; and

Figure 8 is a detail view of the clutch which drives the timing cam.

Referring to Figures 1 to 3, A represents an endless film, and B portions of a film storing apparatus constituting the subject-matter of the present invention and designed to receive a film from and return it to a picture projector C. Carrier 1, pivoted at 2 and having any desired number of arms 3, is equipped with spools 4 pivoted at 5 upon the ends of the arms, and is adapted to be rotated periodically to bring its several spools successively into receiving position R and delivery position D. Spools 4 are advantageously constructed with radial spokes upon which the film is wound, as this provides recesses between the spokes through means of which to anchor the film in starting the winding operation. Located near the receiving position R is a combined anchoring and driving pin 6 which is positively driven in an orbital path about a center which coincides with the pintle 5 of the spool 4 when it reaches receiving position, and the rotation of this pin 6 is timed to present the pin in the path of a recess of the spool 4, as indicated in Figure 3, at the time the shifting movement of the carrier 1 brings the spool to receiving position. Inasmuch as the film A intersects both the orbital path of the pin 6 and the carrying path of the spool 4, coincidence of the pin with the recess of the spool depresses the film within the periphery of the spool and effectively anchors it there, so that immediately after such interengagement and anchoring the rotation, which is now imparted to the spool by the orbital movement of the pin 6, clockwise in Figures 1, 2, and 3, causes the film to be wound upon the spool in duplex coils, with one ply a' coming in from the receiving side of the apparatus and the other ply a^2 coming from the previously wound spool 4 now occupying the delivery position D. This action continues with constant building up of the spool at position R and reduction of the spool at position D until film has been exhausted from position D as shown in Figure 2, when the film, under the traction of the feeding mechanism in the projector C, draws taut beneath the guide roller 7 on a clutch actuating arm 8 to be hereinafter described, raising said arm 8 and throwing in the clutch to impart a new carrying movement to the carrier 1, transferring the now fully developed coil from position R to the position D, and starting winding of a new coil at position R, as suggested in Figure 3. This cycle of functions continues as long as the film is delivered to and drawn from the machine.

In winding the coil at the receiving position R a coil justifier 9 is employed for properly aligning the coils between the two radial planes defined by the edges of the film. This justifier consists of a swinging arm pivoted upon a shaft 10 having torsonial resiliency normally tending to swing the justifier from the coil R through the medium of pawl and ratchet 10^a. Arm 9 has a pin 11 over which the film a' travels in a manner to draw the arm toward the coil R, and said arm is further provided with a guide finger 12 which, while the arm is resting upon the periphery of a coil, engages the edge of the film and so positions the latter accurately upon the coil which is building.

To shift the carrier 1 through a definite and accurately measured arc appropriate to bring a spool 4 into coincidence with the center of revolution of the anchoring and driving pin 6, said carrier has rigidly connected with its shaft 2 a star wheel 13 having reentrant locking faces 14 which receive the arcuate locking cams 15 of a clutch driven cam wheel 16, and radial driving slots 17 which receive the circumferentially disposed pins 18 on said cam wheel. As shown in Figure 1, as the locking cam 15 revolves out of locking relation to a locking face 14 on the star wheel 13, a pin 18 on the cam wheel enters a driving slot 17 of the star wheel, and a partial revolution of the wheel 16 (say, 180 degrees) imparts a partial revolution (say, 60 degrees) to the star wheel 13, when the pin 18 goes out of the slot 17 and permits a succeeding locking cam 15 to move into locking and justifying relation to the locking face 14 of the star wheel. And since at the resumption of this relation of the parts the clutch which is driving the wheel 16, as hereinafter explained, is automatically thrown out of action, the parts remain in this new position until the previously wound coil is exhausted from the delivery position and a newly wound coil has developed in the receiving position, when the shifting action is repeated.

The described movements of the combined anchoring and driving pin 6 will be understood upon reference to Figures 4 and 5. In order to withdraw the pin from the developed coil upon the spool 4 and return it to the path of a recess of the spool 4 as the latter reaches receiving position and adapt it to drive said spool from then on until the new coil is completed, said pin is connected through means of a crank arm 19 to a wrist collar 20 which slides upon the bearing sleeve 21 surrounding shaft 22 which is constantly driven through a gear wheel 23. Collar 20 has a wrist bearing 20^a that receives the forked end 24^a of the lever 24 fulcrumed at 25 and carrying at its other end a pin 26 that works in the groove 16^a of the cam wheel 16. Cam groove 16^a is so designed that by a revolution of the

wheel 16, lever 24 will throw the collar 20 and with it the pin 6 out of the spool 4 and off the coil that is formed about said spool by a movement in the direction of the axis of coiling; and after said spool with its developed coil of film has moved on from the receiving position, said pin will move back into the path of the incoming or newly presented spool, driving connections between the carrier 1 and the cam wheel 16 being so timed as to cause this sequence in movement. To develop the orbital or driving movement of the pin 6 about the shaft 22, said shaft has a rigidly mounted driving arm 22^a, the notched outer end 22^b of which embraces the pin and causes the pin to rotate with the shaft.

The film actuated clutch as best shown in Figures 5 and 8 comprises the driving member 27, constantly driven through gear wheel 27^a and idler 28 from the gear wheel 23, and a releasable driven member 29 normally pressed by spring 30 into engagement with said driving member 27. Member 29 is keyed to the shaft 31 of the cam wheel 16 so that whenever it is permitted to mesh with the member 27, rotation will be imparted to the cam wheel.

To control the intermeshing of member 29 with member 27, a displacing lever 32 is mounted upon the shaft 33 of the film actuated lever 8 and provided with a displacing wedge 34 adapted to enter in between the clutch members 27 and 29. The general arrangement of these parts will be understood from Figures 4 and 5, but their construction is made clearer in Figures 6, 7, and 8. Wedge 34 has a bevel face 34^a which adapts it to be forced in between the clutch members, as shown in Figures 7 and 8, by the action of a spring 35 located between the lower end 32^a of lever 32 and an adjustable anchorage pin 36 mounted in post 37. Yielding to the displacing influence of the film controlled arm 8, as presently explained, the lever 32 moves the wedge to the position shown in Figure 6 and permits the clutch members to come together and establish the drive. The duration of drive is determined by the take-up in the lead a^2 of the film A acting through roller 7 on the lever 8, as already explained, and inasmuch as this take-up in the film is due to the positive feed of the film in the projecting machine, the drive of which is definitely related through pulley 38 (Figure 4) belt 39, pulley 40, and pinion 41 to the rotation of the pinion 23, the motion of which is transmitted to the clutch, the duration of drive of the cam wheel 16 which throws the pin 6 in and out and advances the carrier 1 can readily be predetermined.

In order that lever 8 may act on lever 32 during the take-up of the film lead a^2 and then automatically release said lever 32 to the action of its spring 35, shaft 33 of lever 8 carries the rock arm 42 which in turn carries pawl 43 presented by spring 44 in position to engage the stud 45 on the lower end 32^a of the lever 32, but said pawl has a tail-piece 43^a which, toward the end of movement of lever 8 and arm 42, drags over the fixed post 37 and withdraws the forward end of the pawl 43 from the stud 45, thereby releasing lever 32 and permitting the latter to disengage the clutch after the necessary revolution has been imparted to the cam wheel 16 to rotate the carrier 1 to a new position and to move the pin longitudinally away from and back to the spool 4.

I claim:

1. In a film winding apparatus, a winding spool, a spool revolving member, means for directing a film between the spool and the revolving member, and means for bringing the spool and revolving member together into spool-revolving relation, thereby clamping the film therebetween.

2. In a film winding apparatus, a winding spool, a spool revolving member, means for driving said member in an orbital path, means for directing a film between the spool and revolving member, and means for bringing the spool and revolving member together into spool-revolving relation, thereby clamping the film therebetween.

3. In a film winding apparatus, a winding spool having a recess, a spool revolving member, means for directing a film between the spool and revolving member, and means for bringing the revolving member into operative engagement with the recess in said spool, thereby clamping the film against the spool within said recess.

4. In a film winding apparatus, a spool carrier, a spool mounted on said carrier provided with a film-receiving recess, a driving pin having an orbital path intersecting the path through which said recess is moved by the carrier, means imparting movement to the carrier, and means imparting an orbital movement to the pin timed to cause the pin and recess to coincide.

5. In a film winding apparatus, a carrier, a spool mounted to revolve upon said carrier and adapted to be moved by the latter to receiving position, a driving pin for said spool having an orbital movement about an axis lying in the path of the axis of rotation of said spool, and means arresting the carrier with said axes in coincidence.

6. In a film winding apparatus, a revolving carrier, a rotary spool mounted on said carrier, a driving pin revolving about a center located in the path of the axis of said spool, means imparting a periodic rotary motion to the carrier, means for imparting orbital movement to the pin about its center of revolution, and driving connection

between the two said means to establish a timed relation between their movements.

7. In a film winding machine, a spool having a recess, a pin adapted to enter said recess and having a movement in the direction of the axis of the spool to withdraw it therefrom, a shaft coaxial with the spool upon which the pin is mounted to slide, and a radial arm on said shaft recessed to receive the pin and transmit orbital movement to the pin and cause the pin to drive the spool.

8. In a film winding machine, a winding spool, a carrier upon which said spool is mounted and by which the spool is presented in film-receiving position, a pin supported adjacent said position and in the carrying path of the spool, a lever adapted to withdraw said pin from the spool in the direction of the axis of winding, a cam imparting movement to said lever, a clutch controlling said cam, and means whereby the film controls said clutch.

9. In a film winding machine, a winding spool, a carrier upon which said spool is mounted and by which the spool is presented in film-receiving position, a pin supported adjacent said position and in the carrying path of the spool, a lever adapted to withdraw said pin from the spool in the direction of the axis of winding, a cam imparting movement to said lever and carrier, a clutch controlling said cam, and means whereby the film controls said clutch.

10. In a film winding machine, a winding spool, a carrier upon which said spool is mounted and by which the spool is presented in film-receiving position, a pin supported adjacent said position and in the carrying path of the spool, a lever adapted to withdraw said pin from the spool in the direction of the axis of winding and return it to the path of a spool approaching receiving position, a cam imparting relatively timed movements to said lever and carrier, a clutch controlling said cam, and means whereby the film controls said clutch.

11. In a film winding machine, a carrier, a spool rotatably mounted upon said carrier and presented thereby in film-receiving position, a driving pin for said spool, a shaft for revolving said pin, and means sliding the pin longitudinally of said shaft out of and into driving relation to the spool.

12. In a film winding apparatus, a rotatable spool, a carrier adapted to present the spool in film-receiving position, a shaft supported in axial alignment with the spool when the latter is in receiving position, a collar sliding longitudinally upon said shaft, a pin carried by and offset from said collar in position to coact with the spool, and means for periodically moving the collar to withdraw and return the pin.

13. In a film winding machine, a spool, a carrier which advances said spool from one position to another, a star wheel controlling said carrier, and a cam wheel controlling said star wheel locking the star wheel aginst rotation during a portion of the rotation of the cam wheel and engaging the star wheel to impart rotation thereto during another portion of the rotation of the cam wheel.

14. In a film winding machine, a winding spool, a carrier movable to present the spool in different positions, a star wheel controlling said carrier having reentrant circumferential locking recesses and propelling slots, and a cam wheel having an arcuate cam surface engaging a reentrant recess of the star wheel during a portion of the rotation of the cam wheel and having a driving stud engaging a propelling slot of the star wheel during another portion of the rotation of the cam wheel.

15. In a film winding machine, a spool, a carrier adapted to present said spool in successive positions, a spool revolving means coacting with the spool and presented by the carrier in one position, a cam wheel having a locking engagement and a propelling engagement with said carrier, and means for withdrawing the spool propelling means, coacting with said cam wheel.

16. In a film winding machine, a spool, means imparting movement to said spool, a clutch for driving the movement imparting means, a control for said clutch comprising a film actuated lever, a clutch lever actuated thereby, and a trip connection between said levers.

17. In a film winding machine, a spool, means imparting movement to said spool, a clutch for driving the movement imparting means, a control for said clutch comprising a film actuated lever, a clutch lever actuated thereby, and a trip connection between said levers; said clutch lever normally assuming displacing relation to said clutch.

18. In a film winding machine, a spool, means imparting movement to said spool, a clutch for driving the movement imparting means, a control for said clutch comprising a film actuated lever, a clutch lever actuated thereby, and a trip connection between said levers; said trip comprising a pawl carried by one of said levers, a stud carried by the other of said levers in the path of said pawl during relative movement between the levers, and a fixed member engaging said pawl upon joint movement of said levers in throwing it out of engagement with the stud.

19. In a motion picture apparatus using an endless film, a movable carrier, a plurality of reels on said carrier, means for moving said carrier to bring the reels successively into winding position, means for doubling said film and winding said dou-

bled film on the reel which is in winding position, and means engaging the film and operated by the tension thereof to actuate said carrier moving means.

20. A device for handling record strips for record controlled machinery comprising a rotatable frame, three spools thereon, one of said spools holding the portion of the strip which is being unwound, and another spool holding the portion of the strip which is being wound, the portion being wound and the portion being unwound being double, a controlling part about which the strip passes and which is moved by the strip when the wound roll becomes unwound, and mechanism controlled by said part for rotating said frame so as to move the spool which has been wound into the unwinding position.

Signed at Chicago, Illinois, this 22nd day of August, 1921.

GEORGE R. MACOMBER.