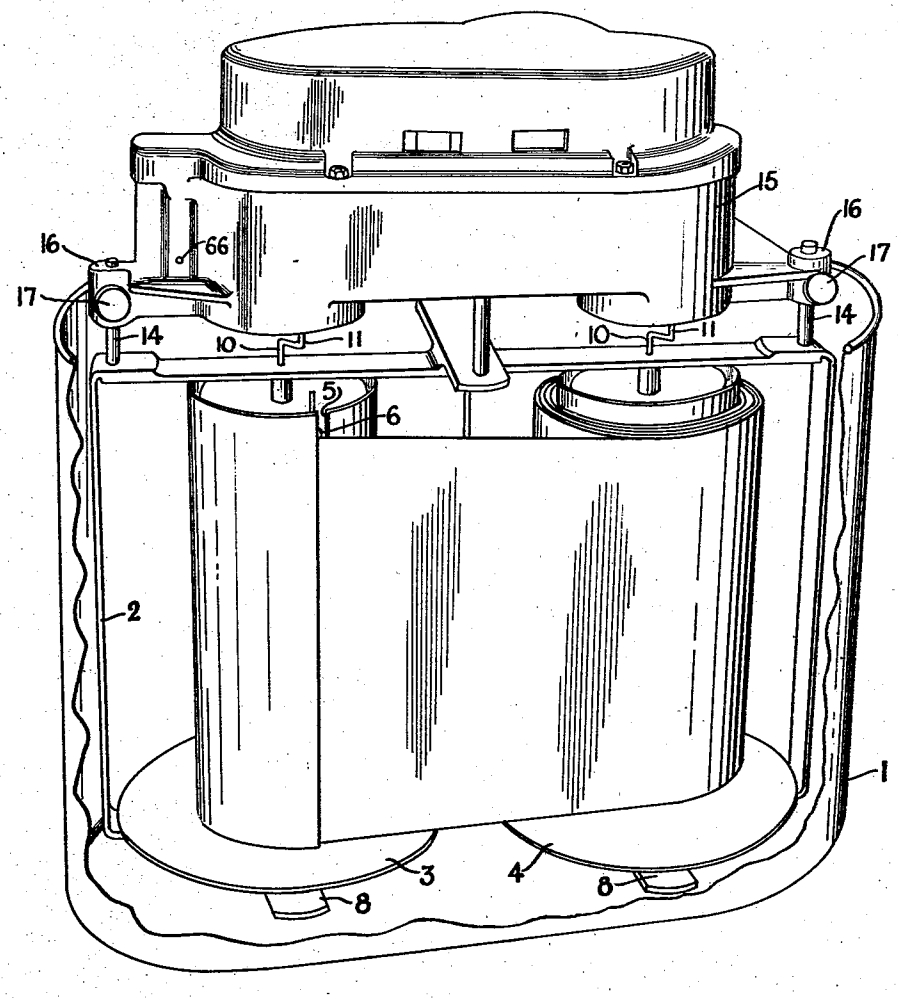
Aug. 22, 1944. J. F. MORSE 2,356,421

WEB WINDING AND REWINDING MACHINE

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Fig. 1.



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Fig. 2.

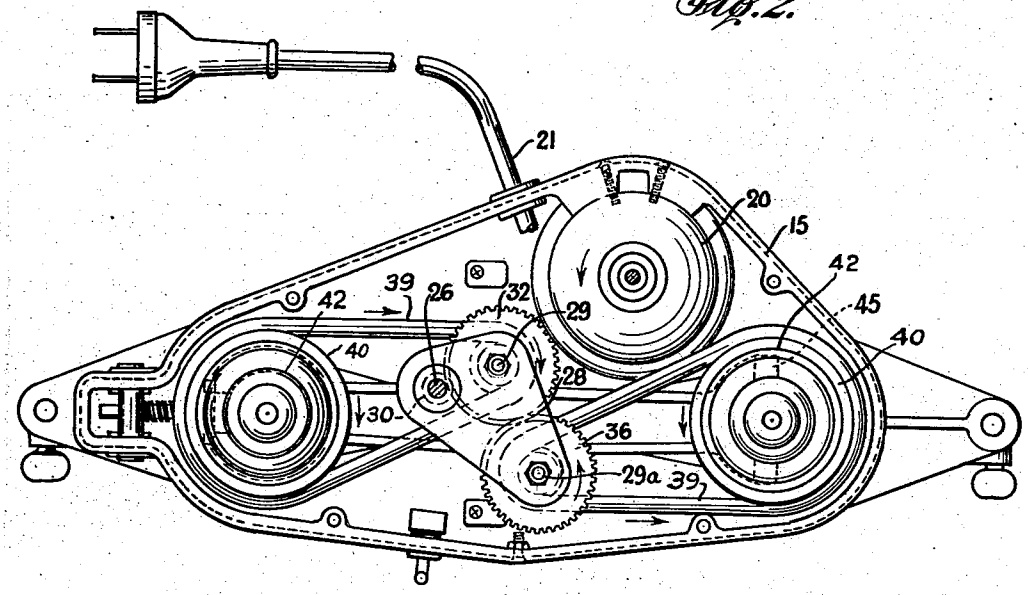
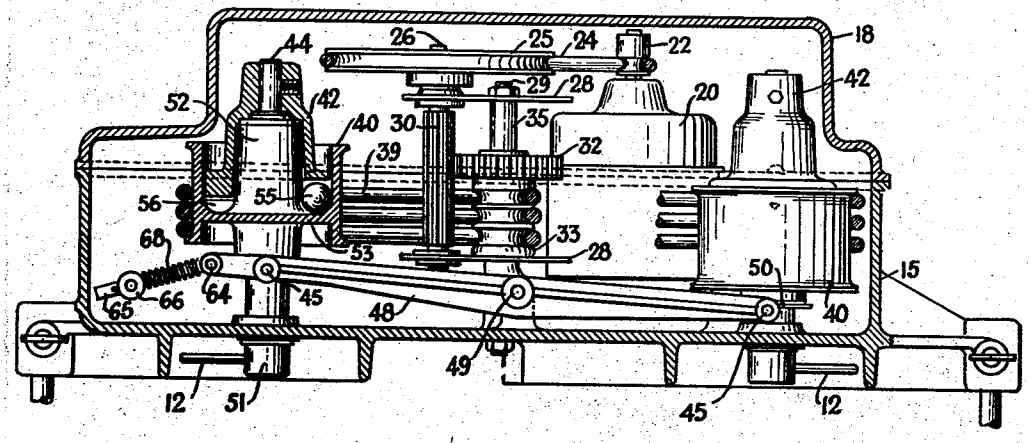


Fig. 3.



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Fig. 4.

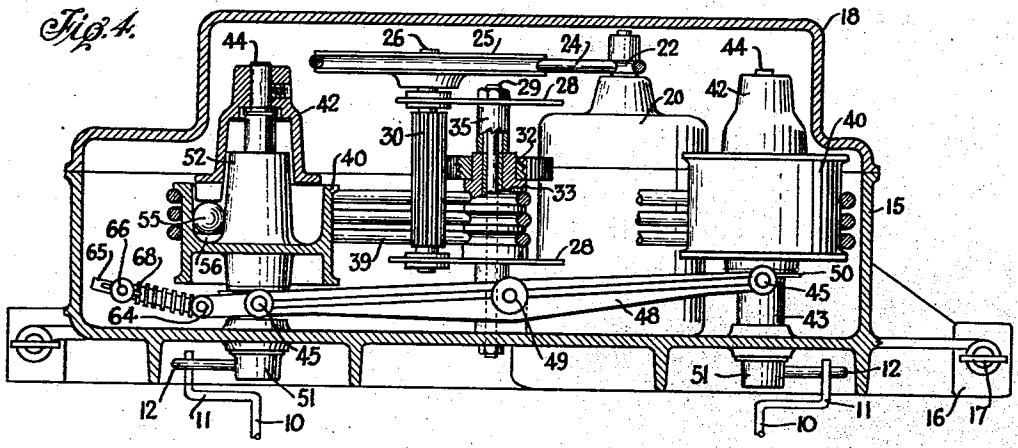


Fig. 5.

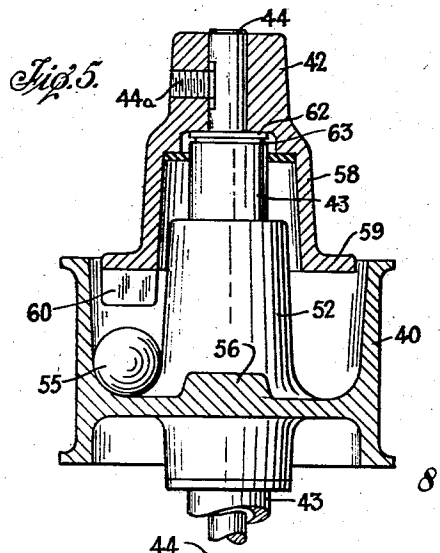


Fig. 6.

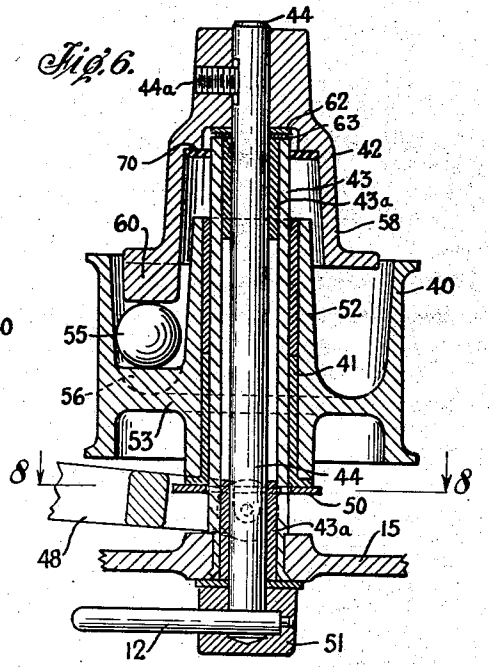


Fig. 7.

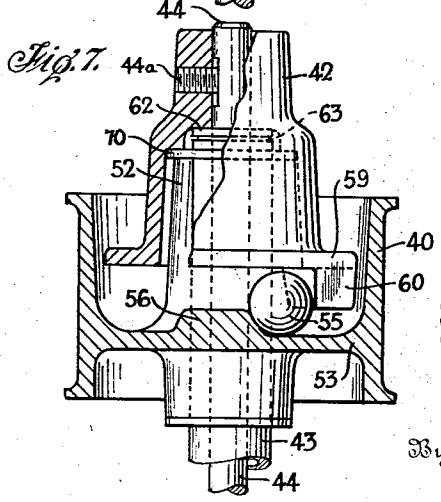
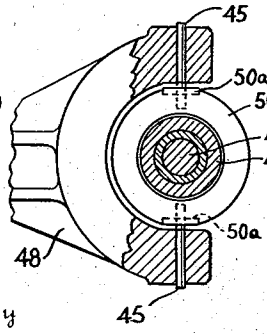


Fig. 8.



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WEB WINDING AND REWINDING MACHINE

John F. Morse, Hudson, Ohio

Application October 19, 1942, Serial No. 462,639

16 Claims. (Cl. 242—55)

The present invention relates particularly to machines for use in the development of films, and its object is to provide a mechanism by which the film will be automatically rolled and rerolled while passed through a developing solution in a tank. It may, of course, be used for fixing or washing the film.

The device is used in combination with a tank provided with two spools or sheaves to which the ends of the film are attached and between which the film is rolled back and forth until the operation is completed. The invention consists in the provision of a driving unit which will automatically reverse itself when the film is unrolled from one spool and reversing again as often as may be necessary. While the mechanism is particularly intended and adapted for the treating of photographic films, it may be equally well adapted for rolling and rerolling other materials in web, band or ribbon form.

The mechanism shown herein is so constructed that as the film, which is secured at its ends to the spools, reaches the end, the resistance of the spool to further rotation automatically actuates the mechanism by which the direction of rotation of the spools is reversed. The film is smoothly and evenly rolled on each spool alternately and the entire operation is performed without injury to the film.

Machines have been designed for this general purpose, but these prior machines have not been satisfactory, and it is the object of the invention to devise a new and improved mechanism which will operate without any attention on the part of the operator except to stop the machine when the operation is completed. The device shown herein is simple and effective and may be used indefinitely.

It will be understood that the machine shown and described herein is the best known and preferred form of the invention, but it is possible that changes and modifications may be made therein without departing from the principles of the invention as set forth in the appended claims.

In the drawings:

Fig. 1 is a perspective view of a tank showing the mechanism for driving the film attached thereto and showing the film after it has reached one end of its travel and is about to start on its reverse movement.

Fig. 2 is a plan view of the mechanism for driving the spools, the upper part of the housing and other parts of the mechanism having been removed.

Fig. 3 is a side elevation of the device with the parts in position when the left-hand spool is being driven.

Fig. 4 is a similar view showing the parts in position when the right-hand spool is being driven.

Fig. 5 is a sectional view through the automatically operated clutch, showing the position which the members of the clutch assume when the spool to which it is applied is idle.

Fig. 6 is a similar view showing the position of the clutch members during the shifting operation.

Fig. 7 is a similar view showing the parts in driving relation.

Fig. 8 is a section on the line 8—8 of Fig. 6.

Referring to the drawings in detail, an ordinary tank to hold the developing or fixing solution is indicated at 1, in which is located the removable rectangular frame 2 in which are rotatably mounted the two spools 3 and 4, the barrels of which are slotted as shown at 5 so as to receive the ends of the film 6. The frame is provided with feet 8 which rest upon the bottom of the tank and support the frame and the driving mechanism. The ends of the film are attached to the spools so that when the spool 4, for example, is filled, further rotation is prevented and the resistance offered by the film to further turning of the spool in that direction sets in motion the reversing mechanism. It will be appreciated that the reversing devices must be so designed that they will function to reverse the direction of film winding without placing too much strain upon the film. The mechanism which is shown herein is designed and operates so that it will furnish sufficient power to drive the winding spools, but the reversal of the drive is accomplished without putting sufficient strain upon the film to do it any injury.

The shaft 10 for each spool is provided at its upper end with a crank 11 which is engaged by the driving pin 12 on each driving unit as shown in Fig. 4. From opposite ends of the frame 2 extend the two vertical posts 14 to which the lower portion of the housing 15 is attached by lugs 16 and set screws 17. The upper portion or cover of the housing is indicated at 18.

Secured within the housing is the motor 20, current for which is supplied by the cable 21. The motor is provided with the pulley 22 which, through belt 24, drives the larger pulley 25 attached to the vertical main drive shaft 26. The drive shaft 26 is mounted in bearings on two spaced, parallel, triangular bearing plates 28 secured to posts 29 and 29a on the interior of the

housing 15. Between the bearing plates, the shaft 26 is formed with gear teeth 30 which engage and drive a gear 32 which is fitted tightly on the hub of a pulley 33 rotatably mounted on the shaft 29 between the plates 28 and held in position thereon by the sleeve 35. The gear 32 meshes with a similar gear 36 likewise attached to a pulley similar to the pulley 33. As shown, the gear 32 and its attached pulley drive the left-hand spool 3 while the gear 36 and its attached pulley drive the right-hand spool 4. As shown, each pulley 33 is a multiple grooved pulley and drives member 40 of the clutch through the belts 39.

As both clutch members are the same, the right-hand clutch unit will be described and is shown in detail in the drawings. The driving member of the clutch is in the form of an elongated, flanged drum 40 over which the belts 39 are trained, the length of the drum permitting it to be raised or lowered to be brought into driving relation with the driven member 42 of the clutch unit, the belts shifting over the surface of the drum. The drum 40, which is provided with bushings 41, is freely rotatable upon a bearing sleeve 43, the lower end of which is set in the horizontal portion of the housing 15 (Fig. 6). The drum 40 rests upon a ring-shaped washer 50 provided with downwardly-turned wings 50a in which are received pins 45 which are set in a yoke formed at the end of rocking lever or beam 48 pivotally mounted at 49 in the housing.

Extending through the sleeve 43 and rotatably mounted in bearings 43a is the spool driving shaft 44 to the upper end of which the member 42 is attached by set screw 44a. The lower end of the shaft 44 is extended below the casing 15 and provided with a head 51 in which the pin 12 is fixed.

The interior of the drum 40 is formed with the hub 52 and the connecting web 53 which form a channel to receive a ball 55 which acts as the connecting member for the parts 40 and 42. This is preferably a small rubber ball which runs freely in the channel. In the base of the channel is formed an upstanding lug 56 the upper surface of which is just below the center of the ball, as shown in Fig. 7, and the sides of which may be tapered slightly. The member 42 of the clutch unit is provided with a skirt 58 which extends into the channel and is provided with a flange 59 which prevents the ball from leaving the channel. On the underside of the flange is a depending lug 60 which is substantially the depth of the ball radius and the sides of which may be tapered slightly.

When the drum 40 is raised as shown in Fig. 7, the ball 55 is interposed between the lug 56 on the drum 40 and the lug 60 on the driven member 42 so that the rotation of the drum is imparted through the ball to the driven member and thence to the shaft 44 and the spool.

The member 42 is supported upon the upper end of the sleeve 43 and interposed between the sleeve and the member 42 is a bearing or thrust washer 62, usually of bronze, and a spring metal plate 63. This plate is normally arched, but, in assembling the parts as shown in Fig. 6, the plate 63 is flattened as shown, so that it exerts a spring tension on the part 42, the force of which may be adjusted in fixing the set screw 44a. The purpose of the spring tension is to exert sufficient drag upon the spool which is unwinding to prevent it from overrunning and thus causing the film to bulge out unduly. This adjustable spring tension assures smooth winding of the film.

When the film reaches the end of its travel, the member 42 cannot rotate further and the ball is forced over the top of the lug 56 and beneath the lug 60, as shown in Fig. 6, by the continued rotation of the drum which forces the drum 40 downwardly on its shaft. As long as the drum 40 is depressed, no driving action will be imparted to the member 42 and the ball will normally roll off the lug 56 and lie in the channel, as shown in Fig. 5. When the drum is raised again at the end of the reverse winding, driving connection will be re-established. Should the ball fail to roll off the lug when the clutch members are brought together, it will be thrown off the lug and assume its position in the channel, to be caught between the lugs 56 and 60 and reestablish the driving connection.

The rocker arm or beam 48 operates so that as one pulley 40 is depressed by the action of the ball 55 in the manner described, the other pulley is raised so as to start the winding of the film in the opposite direction. This is seen by comparing Figs. 3 and 4, the former showing the left-hand drive in operative position and the latter showing the right-hand drive in operative position.

In order to insure the positive movement of the clutches alternately into and out of driving position, the end of the rocking lever 48 is extended at one side, here shown at the left, and to that end is attached by the pin 64 a shaft 65 which is slidable radially in a rocker sleeve 66 pivotally mounted in the casing. An expansion spring 68 surrounds the shaft 65 between the sleeve 66 and the pin 64 so as to throw the lever 48 to one side or the other of the dead center and to hold the lever in its extreme positions. To cushion the pulley 40 at the end of its upward movement, a washer 70 of rubber or "neoprene" is inserted within the bell of the member 42.

In the operation of the device after the parts have been put together as shown in Fig. 1 with the film in position and the motor started, the drums 40 are constantly driven in reverse directions by the intermeshing gears 32 and 36 and the connecting belting. Whichever drum 40 is elevated drives its shaft 44 through the ball clutch until the spool is completely filled, whereupon the resistance of the film causes the shaft 44 and the driven member 42 to stop. When this occurs, the ball will roll up over the lug 56 whose sides are inclined at the correct angle to provide sufficient traction through the ball for driving the spool, but which will permit the ball to climb the side of the lug when the part 42 ceases to rotate. The passage of the ball between the lugs 56 and 60 will depress the drum and the lever 48 will be thrown past center, positively releasing the drive and raising the other drum 40 into driving relation. This shifting of the drive from one side of the mechanism to the other will continue indefinitely. While the element 55 is shown and described as a ball, it is evident that the spheroidal shape is not essential and that any movable piece might be employed so long as it is free to roll between the tops of the lugs 56 and 60 and thereby shift the clutch members relatively to each other. When the term "ball" is used in the claims, it is not to be considered as limited to a spherical body.

It will be seen that the clutch units are so designed and constructed that sufficient force may be transmitted to wind the film without tearing the film when it reaches the end of its travel. It will also be observed that each spool is always connected to its driving shaft so that it is not

necessary to disconnect the spools and their driving shafts whenever reversal is required.

The principles of the invention may be applied in other ways than the specific form shown within the scope of the claims. It is not necessary that the driving mechanism be employed with a tank of the character illustrated herein, nor is it essential that the web or film be in a vertical plane. The reversing mechanism is adaptable for other arts than treating films, and in applying the invention to the treatment of other webs or materials, it may be necessary to make changes and variations in the form of the apparatus without sacrificing the features of novelty shown and described herein.

What is claimed is:

1. In a web treating apparatus, the combination of two spools to which the ends of the web are fastened, a frame in which the spools are mounted, a fixed casing, a motor in the casing, spool driving shafts in the casing in alignment with the spools and driven by the motor, a clutch on each shaft, and means located in each clutch operative to disconnect the clutch when the spool driven thereby is filled.

2. In a web treating apparatus, the combination of two spools to which the ends of the web are fastened, a frame in which the spools are mounted, a fixed casing, a motor in the casing, spool driving shafts in the casing in alignment with the spools and driven by the motor, a clutch on each shaft, and means located in each clutch operative by the resistance of the web to further movement to disconnect the clutch when the spool driven thereby is filled.

3. In a web treating apparatus, the combination of two spools to which the ends of the web are fastened, a casing, spool driving shafts in the casing, a clutch on each shaft, said clutch comprising a member shiftable along the shaft, means connecting the shiftable clutch members to move them alternately into and out of driving connection, and means located in each clutch to move the shiftable member out of driving relation when the spool driven thereby is filled.

4. In a web treating apparatus, the combination of two spools to which the ends of the web are fastened, a casing, spool driving shafts in the casing, a clutch on each shaft, said clutch comprising a member shiftable along the shaft, means connecting the shiftable clutch members to move them alternately into and out of driving connection, and means located in each clutch and operated by the resistance of the web to further movement to move the shiftable member out of driving relation when the spool driven thereby is filled.

5. In a device for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, said clutch comprising a driving member and a driven member, and a shiftable element interposed between the clutch members which when in one position is operative to connect the members for driving the spool, said clutch members and shiftable element being so constructed and designed that the said element is shifted to another position by the resistance of the web to further movement and the clutch members thereby separated and disconnected.

6. In a device for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, each said clutch consisting of a driving member rotatable and shiftable on the shaft and a driven member attached to the shaft, and an element interposed between the members of each clutch to connect them for driving the spool, said element and the clutch members being so constructed and designed as to move the driving member of the clutch along the shaft and disconnect the clutch by the resistance of the web to further movement.

7. In a device for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, each said clutch consisting of a driving member rotatable and shiftable on the shaft and a driven member attached to the shaft, an element interposed between the members of each clutch to connect them for driving the spool, said element and the clutch members being so constructed and designed as to move the driving member of the clutch along the shaft and disconnect the clutch by the resistance of the web to further movement, and connections between the shiftable clutch members to move them alternately into driving relation.

8. In a machine for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, each clutch consisting of a driving member and a driven member, said clutch members being axially movable with respect to each other, a channel between the clutch members, a ball in the channel, and a lug on each clutch member projecting into the channel and affording a driving connection through the ball when the clutch members are together, the ball being movable between the tops of the lugs to force the clutch members apart when the rotation of the spools is stopped by the resistance of the web to further movement.

9. In a machine for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, each clutch consisting of a driving member and a driven member, a channel between the clutch members, a ball in the channel, a lug on each clutch member projecting into the channel and affording a driving connection through the ball when the clutch members are together, the ball being movable between the tops of the lugs to force the clutch members apart when the rotation of the spools is stopped by the resistance of the web to further movement, and connections between the clutches on the driving shafts to bring the clutches into driving relation alternately as the web reaches the ends of its winding movement in either direction.

10. In a machine for winding a web back and forth between two spools, a driving shaft for each spool, a clutch on each driving shaft, each clutch consisting of a pulley freely rotatable on the shaft and a second clutch member non-rotatably mounted on the shaft, means for driving the pulleys in opposite directions, a lug on each pulley, a lug on each second clutch member and a freely rolling element interposed between the sides of the lugs to furnish a driving connection between the clutch members, said element being movable between the ends of the lugs when the web offers sufficient resistance to further movement whereby the clutch elements are axially separated and disconnected, and connections between the clutches to bring one clutch in driving relation when the other clutch is disconnected.

11. A machine such as described in claim 10 in which the connections between the clutches in-

clude yielding means to maintain the members of each clutch in driving relation.

12. A machine for winding a web in opposite directions between two spools, said machine including two axially shiftable pulleys driven in opposite directions, a rocking beam connected to the pulleys to raise and lower the pulleys alternately, a spool driving shaft for each spool, each shaft having a member thereon with which each pulley is brought into driving relation by the movement of the beam, and means interposed between each pulley and member to connect them for rotation when they are moved toward each other and operative to force them apart by the resistance of the web to further travel.

13. A machine for winding a web in opposite directions between two spools, said machine including two axially shiftable pulleys driven in opposite directions, a rocking beam connected to the pulleys to raise and lower the pulleys alternately, a spool driving shaft for each spool, each shaft having a member thereon with which each pulley is brought into driving relation by the movement of the beam, a lug on each pulley and member, and a rolling element located between the pulley and the said member which when interposed between the sides of the lugs will form a driving connection but which may roll over the ends of the lugs to separate the pulley from the member when the web resists further movement.

14. A machine such as set forth in claim 12 including yielding means acting on the beam to hold it at the limits of its rocking movement.

15. A machine such as set forth in claim 13 in which the rocking beam is provided with yielding means to throw it to either extremity of its rocking movement.

16. In a web treating apparatus, the combination of spools to which the ends of the web are attached and between which the web passes in a straight line, a spool shaft on each spool, means to drive each spool alternately in the direction to wind the web thereon comprising a motor, two oppositely rotating driving shafts connected to the spool shafts at all times during winding and rewinding, a clutch associated with each driving shaft, one member of each clutch being constantly driven by the motor, and means interposed between the clutch members and operative by the resistance of the web to further movement when it is taut and completely unwound from one spool to disconnect its clutch and connect the clutch to the other spool driving shaft so as to reverse the direction of spool rotation without breaking the driving connection between the spool shafts and their respective driving shafts.

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