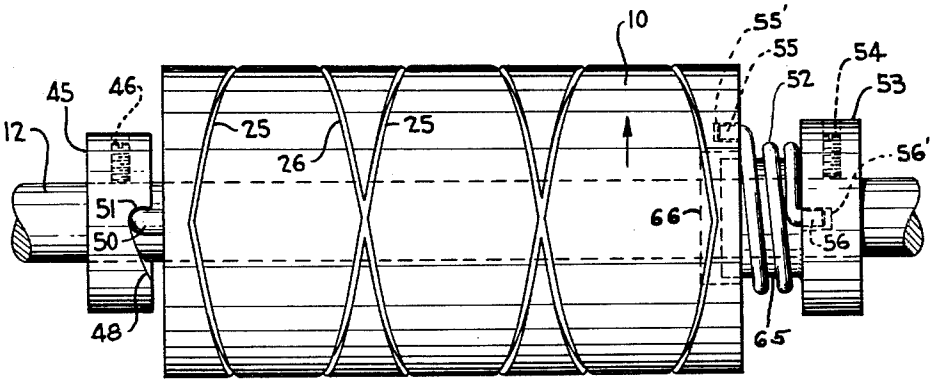
July 24, 1962 W. H. O'BRIEN 3,045,935

WINDING MACHINE

Filed June 22, 1961

FIG. 1



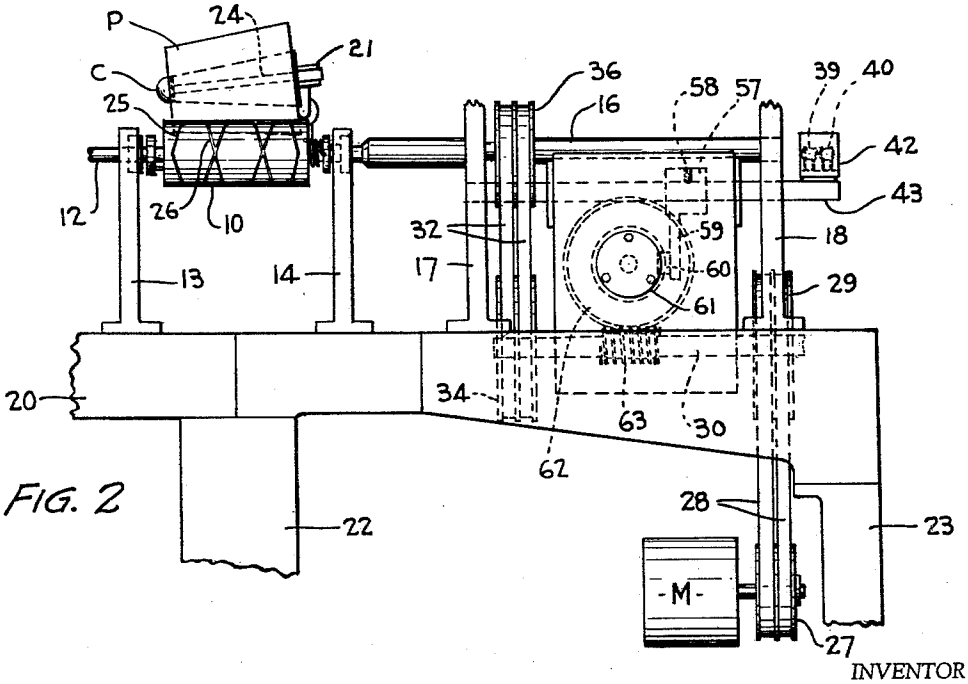


FIG. 2

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WINDING MACHINE

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This invention relates to a yarn winding machine and more particularly to improvements in the rotary traverse roll which customarily rotates in frictional driving engagement with the package being wound to impart rotation thereto and which, in addition, is formed with interconnected grooves of relatively reverse pitch through which the yarn is drawn and traversed in winding onto the package.

In the winding of yarn it has been recognized as desirable to provide some means for controlling the disposition of the turns of winding on the surface of the package to prevent the formation of bands or "ribbons" in which the yarn coils are crowded together or "piled" in contiguous relation. A quite effective means of thus preventing ribboning consists in relatively accelerating and decelerating the rotational speed of the driving traverse roll in a manner to cause slippage between the drive roll and the package. This disrupts the synchronism between the rotation of the package and the traverse of the yarn during the winding. A suitable winding machine incorporating a so-called ribbon breaking or ribbon preventing mechanism is disclosed in the U.S. Patent 2,036,441 of Ernest R. Swanson, granted April 7, 1936. In accordance with this patent and the mechanism therein disclosed, the traverse roll is rotated by power transmitted thereto from an electric motor having automatically operated mechanism for alternately opening and closing the circuit of one or more of its windings to decelerate and accelerate the speed of the motor accordingly.

While the problem of preventing ribboning has thus been successfully resolved, it has been found that the operation of the traverse roll as conventionally employed to shift the yarn back and forth from one end of the package to the other, operates to reverse the pitch of the yarn at identical locations axially of the roll with the result that the reverse portions or knuckles of the yarn tend to pile up on each other to produce a package with hard ends or in other words end portions of greater density than the intermediate portions of the package. This, as well as the aforementioned ribboning, is particularly undesirable in the production of a dye package since the variation in density, whether from ribboning or from the aforementioned formation of dense ends or knuckles, results in unequal dye penetration in the package.

The present invention has been made with the foregoing considerations in mind and accordingly has as its primary object to avoid the formation of a package with the hard ends, as above mentioned, by the expedient of bodily shifting the traverse or drive roll back and forth in the direction of its axis whereby to vary the axial positions of the various knuckles or reversal points of the yarn windings to achieve thereby a more nearly uniform density throughout the package.

Further it has been discovered in accordance with the invention that by thus shifting back and forth the traverse roll which is subjected to a fluctuating or alternately accelerating and decelerating drive, as exemplified in the Swanson patent, the ribbon breaking action may be improved and in adidtion the fluctuating drive itself and the inertia forces resulting therefrom may be utilized to advantage in producing through suitable mechanism the axial shifting of the combined traverse and drive roll.

Moreover the present invention contemplates the provision of a novel and highly useful form of shifting mechanism for the roll, actuated automatically in response to

acceleration and deceleration of the rotational speed of the roll. Thus in carrying out the invention in its preferred embodiment the roll itself is mounted for at least limited angular movement on its supporting and drive shaft and is resiliently yieldingly connected to this shaft for rotation therewith. At the same time resilient means is provided for urging the roll toward one axial extremity of its permissible bodily axial movement, while the roll and its supporting shaft are respectively provided with co-operating cam means actuated in response to the relative angular movement between the roll and the shaft for urging the roll in an opposite axial direction away from its normal position of rest.

Further objects and advantages of the invention are set forth in the following specification which describes a preferred form of construction of the device, merely by way of example, as illustrated by the accompanying drawings. In the drawings:

FIGURE 1 is a front elevaiton of a generally conventional grooved traverse roll and its supporting drive shaft, including the mechanism in accordance with the invention for producing axial bodily displacement of the roll on its shaft incident to changes in rotational speed of the shaft.

FIGURE 2 is a side elevation on a smaller scale than FIGURE 1 showing, in a rather general or diagrammatic manner, the manner in which the roll co-operates with a yarn package when employed in a winding machine.

Referring now in detail to the drawing there is shown in FIGURE 2 a rather general or schematic view of the winding machine having surge producing means for the package rotating and yarn traverse roll such as is disclosed more fully and completely in the U.S. Patent to Swanson, No. 2,036,441.

It will be seen that the winding unit itself basically comprises the traverse roll **10** which is coaxially mounted and supported for rotary movement on a horizontal shaft **12**. Shaft **12** in turn is rotatably supported in upstanding bearing brackets **12** and **14** and is connected to a relatively aligned drive shaft **16** constituting, if desired, an extension thereof, which latter shaft **16** also is rotatably supported between upstanding bearing brackets **17** and **18**. The several brackets **13**, **14**, **17** and **18** herein are supported on the usual machine frame or bed **20** which in turn is supported by the depending vertical legs **22** and **23**.

As is usual in machines of this type, the yarn receiver or cop tube C is rotatably supported on a spindle **24** and the yarn is wound into a package P around the cop tube C by frictional engagement between the package P and the surface of the roll **10** so that the roll imparts rotation to the cop tube C and package P. In passing to the package the yarn will normally extend and move through the alternately or oppositely pitched groove portions **25** and **26** respectively of the traverse roll **10** whereby it is wound axially back and forth along the cop C and the package being wound. The winding spindle **24** is swiveled to the forward end of a weighted arm **21** which is pivotally supported at its rearward end in accordance with usual practice to adapt the surface of the yarn receiver or cop tube C to be urged into contact with the periphery of the drive roll **10**. It will be realized, of course, that as the yarn is built up on the cop tube C it forces the latter upwardly, with the arm **16** swinging on its pivot in a manner common to machines of the present type.

For the purpose of imparting a rotational drive to the roll supporting shaft **12** there is illustrated diagrammatically an electric motor M in FIGURE 2, it being understood that this motor preferably is of the type having a plurality of windings. This motor drives a pulley **27** which transmits rotation through the drive belts **28**

to a multigrooved pulley wheel or sheave 29 keyed on the countershaft 30. Similarly, the belts 32 operatively disposed around sheaves 34 and 36, respectively, keyed on shafts 30 and 16, transmit rotation from the former to the latter. Since the shaft 16 is in driving connection and alignment with the shaft 12 and may be regarded as a portion or extension thereof, it will be seen that the two shafts 12 and 16 are rotated together by power transmitted from the electric motor M.

In accordance with the present invention the rotational or angular velocity of the shaft 12 is caused to constantly fluctuate so that there will be repeated alternate surges or accelerations and interspersed periods of deceleration. The particular means by which this is accomplished is by no means essential to the invention herein claimed, though for purposes of illustration means such as disclosed in U.S. Patent No. 2,036,441 earlier identified, are generally illustrated by way of example.

The means thus employed comprises a pair of mercury switches 39 and 40, respectively, carried in a housing 42 supported on a rock shaft 43. The arrangement is such that rocking back and forth of the shaft 43 will alternately close and open the switches 39 and 40 which are connected respectively in circuit with the windings of the motor M whereby to alternately energize and de-energize these windings with consequent alternate acceleration and deceleration of motor speed and of the angular velocity of the shaft 12. The rotation of the shaft 12 is imparted to the traverse roll 10. Thus due to the momentum and inertia of the package during deceleration and acceleration, respectively, the peripheral speed of the package will be greater or less than the peripheral speed of the drive roll so that the surface of the package will slip or skid on the periphery of the roll and as a result thereof the synchronism between the winding speed and the yarn traverse is disrupted at frequent intervals to prevent the ribbon winding effect, just as in the aforementioned Swanson patent.

In accordance with the invention however the alternate acceleration and deceleration of the rotational speed of the shaft 12 is employed to advantage through the mechanism hereinafter described, to produce an axial bodily shifting back and forth of the traverse roll whereby to vary the axial positions of the reversal points or knuckles of the various windings at the ends of the package.

The preferred arrangement of such mechanism is illustrated specifically in FIGURE 1 of the drawing. As was earlier mentioned the roll 10 is disposed for rotation on and coaxially with the shaft 12. A cam element in the form of a collar 45 is fixed on the shaft 12 as by means of the set screw 46 adjacent one axial end of the roll 10, and is formed with an axially presented generally helical cam surface 48 directed toward the roll 10. It will be seen that the cam surface 48 extends generally rearwardly or in trailing relation from an abrupt shoulder or stop portion 51 disposed at its forward end having regard to the direction of rotation or driven rotary movement of the shaft 12 and roll 10 as indicated by the arrow in FIGURE 1.

Normally the roll 10 is resiliently maintained in a rotary position with the follower 50 abutting against the stop 51 as by means of the spring 52 at the right-hand end of the roll 10 as seen in FIGURE 1. In addition to thus yieldably angularly positioning roll 10, the spring 52 in the present instance is a coil spring transmitting a resilient axial thrust between the adjacent or right-hand end of the roll 10 and a collar 53 on the shaft 12 whereby normally to resiliently urge the roll 10 bodily toward the left as seen in FIGURE 1. In the embodiment shown, the collar 53 is secured against rotation on shaft 12 by the set screw 54 and preferably is provided with a relatively reduced diameter sleeve or bushing 65 fixed integrally thereto or constituting an integral portion thereof, the left-hand end of the sleeve 65 normally being receivable freely in a cylindrical axially opening socket 66 in the adjacent end of roll 10.

The several winds or coils of the spring 52 extend about and are supported on the sleeve 65, and the opposite ends of the spring 52 are connected respectively to the roll 10 and to the collar 53. Thus in accordance with well-known practice said ends 55 and 56 respectively are bent or formed to project in axially parallel directions to be received in axially opening sockets 55' and 56' in the adjoining end portions of the roll 10 and the collar 53.

At this point it should be mentioned that in the embodiment of the invention as illustrated the rock shaft 43 is repeatedly oscillated or rocked back and forth as by means disclosed in the aforesaid Swanson patent. Such means is generally illustrated in the present drawing as comprising a cam follower element 57 secured by set screw 58 on the rock shaft 43 and having a depending arm 59 carrying a follower or roller 60 within the cam groove which extends generally helically on the surface of a cam roll 61. The cam roll 61 has fixed thereto a worm gear 62 which meshes with and is driven by worm 63 fixed on the countershaft 30.

In the operation of the invention as above described it will be readily apparent that the resulting rocking of the shaft 43 and its tilt actuated mercury switches 39 and 40 carried thereby will alternately act through said switches to alternately energize and de-energize the circuits to one or more of the windings of the driving motor M, with resulting alternate acceleration and deceleration of the angular velocity of the shaft 12.

The drive from the shafts 12 is normally imparted to the roll 10 through the spring 52 which yieldably connects these elements. It will be apparent that during driving of the roll 10 at a constant rotational speed, or during periods of deceleration, the spring 52 will maintain the roll 10 in an angular position determined by the abutting engagement of its follower 50 with the end wall or stop shoulder 51 of the cam element 45. At the same time, the spring 52 serves the additional function of urging the traverse roll 10 bodily in an axial direction or to the left in FIGURE 1, to the full extent permitted by the engagement of its follower 15 with the cam surface 48.

During each period of acceleration of the shaft 12, the spring 52 will permit relative angular lagging of the roll 10 with respect to the shaft 12 due to inertia, whereupon the resulting retrogressive movement of the follower 50 along the cam surface 48 will bodily displace the roll 10 axially toward the right in FIGURE 1. As the acceleration decreases and during periods of deceleration the action of the spring 52 will return the roll 10 in an angular direction about the shaft 12 until its pin 50 re-engages the stop shoulder 51 while at the same time the axially compressed spring 52 will return the roll 10 axially to the left in FIGURE 1 to the position shown in that figure.

Thus not only does the surging or alternate acceleration and deceleration of the roll drive cause slippage between the roll and the driven package, with resulting prevention of ribboning, but moreover the ribbon preventing action is even improved by the superimposed axial displacement of the roll 10 with respect to the package P.

Moreover, and of primary importance in connection with the present invention is the attaining of the desired result, namely the relative displacement of the reversal points of different windings of the yarn. Accordingly there is a very substantial reduction of the yarn density at the knuckles or axial ends of the package and the obtaining of a more uniform density of the yarn throughout the package then was heretofore possible, all to the end that the resulting package is susceptible of considerably more uniform dye penetration than heretofore.

In this application I have shown only the preferred embodiment of my invention and it will be readily apparent that obvious changes may be made without departing from the invention.

For example, generally speaking it is immaterial how the surges or alternate acceleration and deceleration of the drive shaft are obtained and that they may be readily produced by mechanisms other than disclosed. Similarly, certain obvious changes may be made in the mechanism for converting or utilizing such surges to produce bodily axial displacement or reciprocation of the traversing roll, all without departing from the invention as defined in the claims hereinafter following.

Having this described by invention, I claim:

1. In a yarn winding machine, a drive shaft, drive means for rotating said shaft and for alternately accelerating and decelerating its speed of rotation, a grooved yarn traverse roll element axially movable on said shaft, a cam element fixed against axial movement on said shaft, one of said elements being relatively rotatable on said shaft incident to said acceleration and deceleration and the other element being secure against rotation, said roll element having a follower operatively engaging said cam element to axially move said roll element in response to said relative rotation between said elements, spring means on said shaft establishing a resiliently yieldable driving connection between said shaft and said rotatable element in one direction of relative rotation, means restricting the relative rotation between said shaft and said rotatable element in the opposite direction, said driving connection yieldably urging said rotatable element in said opposite direction of rotation with respect to the shaft.

2. In a yarn winding machine, a drive shaft, drive means for rotating said shaft and for alternately accelerating and decelerating its speed of rotation, a grooved yarn traverse roll element axially movable on said shaft, a cam element fixed against axial movement on said shaft, one of said elements being relatively rotatable on said shaft incident to said acceleration and deceleration and the other element being secure against rotation, said roll element having a follower operatively engaging said cam element to axially move said roll element in response to said relative rotation between said elements, spring means on said shaft establishing a resiliently yieldable driving connection between said shaft and said rotatable element in one direction of relative rotation, means restricting the relative rotation between said shaft and said rotatable element in the opposite direction, said driving connection yieldably urging said rotatable element in said opposite direction of rotation with respect to the shaft, said cam element comprising a collar on said shaft adjacent one axial end of the roll element and having an axially inclined cam surface directed toward said roll element, the cam follower on said roll element projecting axially into abutting sliding engagement with said surface, a collar fixed on said shaft adjacent the other axial end of said roll element, said cam element and said collar being on opposite axial sides of the roll element, said resiliently yieldable driving element comprising a coil spring disposed about said shaft under compression between said collar and said roll element and resiliently urging said roll element axially toward said cam element.

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